THE CHANGING FACE OF THE GENUS *VIPERA*

By: Twan Leenders, Prof. Bromstraat 59, 6525 AT Nijmegen, The Netherlands.

Contents: Introduction - Systematic review - Characteristics of the different groups: Pelias-group - Rhinaspis-group - Xanthina-complex - Lebetina-group - Russelli-group - Pseudocerastes persicus - Literature - Note added in proof.

English correction by Chris Mattison.

* * *

INTRODUCTION

The systematic division of the genus *Vipera* changes almost constantly. Not only because of the description of several new species, but also because our understanding of the interspecific relationships improves. Sometimes a certain species is thought to be more closely related to another than it was previously, and is granted the subspecies-status but it can also happen the other way around, when a subspecies is granted the species-status.

Nowadays, advanced techniques are being used to establish or rule out kinship. Originally the division of the animal kingdom was entirely based on external characteristics. Later this was combined with internal anatomic characteristics such as hemipenis structure or skeletal features. Currently, relationships are, together with the characteristics already mentioned established by analysis of chromosomes or the chemical composition of venom or tissue.

Because it is very hard to know with any certainty what the relationship between species is and how their evolutionary development occurred, any scientist who is working on the subject has his (or her) own ideas regarding the 'real' development. In systematics (= biological science which is dedicated to the relationship between organisms and their taxonomic placement) two important directions exist: the so-called 'splitters' and 'lumpers'. In broad terms this results in splitters who will easily grant aberrant specimens a species-status, and therefore recognizing many species, while lumpers try to accomplish the opposite. Which of the two is closer to the real situation is impossible to establish. This is why there are often just as many different theories as there are scientists working on the subject.

An example of differing opinions on systematic placement is found in the 'xanthina'-group. Three members of this group (*Vipera albizona, Vipera bornmuelleri, Vipera bulgardaghica*) are only known from a relatively small number of specimens. All three species, however, show a very strong resemblance to *Vipera xanthina*. Therefore it is not unthinkable that this is an example of a single (variable) species. A convinced 'splitter' would probably regard it as 4 separate species, while a 'lumper' would maybe consider it only one.

A natural classification should represent the evolutionary development of the group examined. In the following paragraphs the species are therefore grouped in logical succession; primitive characteristics disappear during evolution and are replaced by more progressive ones. Because this happens gradually, it is impossible to strictly outline each group. That is why in some of the groups specimens or even entire species occur which,

based on scalation or other characteristics, are intermediate between two groups. This shows once again that every division is an artificial one.
I am convinced that some people have different opinions regarding the division of the genus *Vipera*. However, my sole purpose is to present some information on the large number of (sub)species that is currently included in this genus.

SYSTEMATIC REVIEW

Species	**Subspecies**	**Common name**
1. 'Pelias-group' (original European vipers)		
-Vipera ursinii	*-ursinii*	Orsini's viper
	-wettsteini	
	-anatolica	
	-macrops	
	-rakosiensis	
	-eriwanensis	
	-renardi	
-Vipera berus	*-berus*	Common adder
	-sachalinensis	
	-bosniensis	
-Vipera seoanei	*-seoanei*	Iberian viper
	-cantabrica	
-Vipera kaznakovi		
-Vipera darevskii		
-Vipera dinniki		
-Vipera nickolskii		
-Vipera barani		Baran's viper
-Vipera pontica		Pontian viper
2. 'Rhinaspis-group' (more developed European vipers)		
-Vipera aspis	*-aspis*	Asp viper
	-atra	
	-zinnikeri	
	-francisciredi	
	-hugyi	
-Vipera latasti	*-latasti*	Lataste's viper
	-gaditana	
-Vipera ammodytes	*-ammodytes*	Sand viper
	-ruffoi	
	-gregorwallneri	
	-montandoni	

	-meridionalis	
	(-insularis)	
-Vipera transcaucasiana		
-Vipera monticola		Atlas dwarf viper
3. Xanthina-Complex		
'Xanthina-group'		
-Vipera albizona		
-Vipera bornmuelleri		Lìbanon viper
-Vipera bulgardaghica		Taurus viper
-Vipera wagneri		Wagner's viper
-Vipera xanthina		Ottoman viper
'Raddei-group'		
-Vipera raddei	*-raddei*	Radde's rock viper
	-kurdistanica	
-Vipera latifi		
-Vipera albicornuta		
4. 'Lebetina-group'		
-Vipera lebetina	*-lebetina*	Blunt-nosed viper
	-turanica	
	-obtusa	
	-transmediterranea	
	-schweizeri (*)	
-Vipera mauretanica	*-mauretanica*	Atlas mountain-viper
		-deserti
5. 'Russelli-group'		
-Vipera russelli	*-russelli*	Russel's viper
	-siamensis	
	-limitis	
	-formosensis	
-Vipera palaestina		Palestian viper

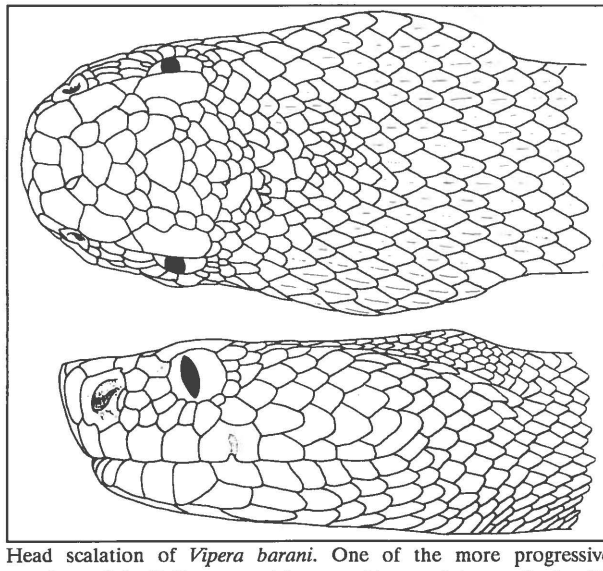
(*) some authors consider *Vipera lebetina schweizeri* a distinct species (groups 3, 4 & 5 are included in the genus *Daboia* by some authors).

'Pelias-group'

The Pelias-group comprises the most primitive representatives of the genus *Vipera*. This means that this group is closest to the original ancestor, which is visible in some 'conservative' features. Because these primitive characteristics gradually change into the more advanced (progressive) features of the higher developed vipers, it is possible to create a division of the genus into developmental groups. Within some groups,

conservative as well as progressive specimens or even species occur. Based on these features, these animals can be considered intermediate forms, which should be placed between two groups. Only in the highest developed groups no more progressive animals can occur, because the highest grade of development is already accomplished here.

The most prominent features can be seen in the head scalation. The division of the vipers in developmental groups is mostly based on the number and type of head scales that are divided. Theoretically, a head scalation as can be found in the Colubridae (nine large plates: 2 parietals, 2 supraoculars, 1 frontal, 2 nasals and 2 infranasals) would have been the most primitive. Such a scalation pattern, however, is not found within the genus *Vipera*. The species that has a scalation pattern that resembles the colubrid pattern the most is *Vipera ursinii*. Therefore this species is considered the most primitive viper. The following large head plates can be found in *Vipera ursinii* and, in a lesser degree, in the other members of the Pelias-group: 2 supraoculars, 1 frontal and 2 parietals. These plates are not keeled, so the upper surface of the head is completely covered with smooth scales.



Head scalation of *Vipera barani*. One of the more progressive members of the Pelias-group (absence of larger plates on the head). (from: Böhme & Joger, 1983; drawing: K. Doering).

A second characteristic of this least developed group is the occurance of only 1 row of suboculars between the eye and the supralabials. Members of the Pelias-group have a rounded snout which is not upturned. The head is only slightly broader then the neck, and the body is relatively slender.

These vipers possess a unique trait which readily distinguishes them from all other *Vipera*: they are capable of flattening their body by spreading the ribs. This is extremely useful in the relatively cold areas where these species occur. By expanding their body surface, these snakes can absorb more solar energy and thus warm up faster. When threatened, the spreading of the ribs is also used to appear bigger.

Several members of the Pelias-group clearly show progressive features. This is particularly the case in e.g. *Vipera seoanei cantabrica* or *Vipera barani*, in which virtually all large head plates are divided (see fig. 1).

A number of non-European representatives of the Pelias-group (*Vipera barani, Vipera darevskii, Vipera dinniki, Vipera kaznakovi* and some subspecies of *Vipera ursinii: anatolica, eriwanensis* and *renardi*) are sometimes placed in a group of their own, the 'Kaznakovi'-group.

'Rhinaspis-group'

The members of this group all share as a common feature a more or less upturned snout. This can range from slightly upturned in e.g. *Vipera aspis* to a real horn like e.g. *Vipera ammodytes*. Other characteristics are the two rows of suboculars which separate the eye from the supralabials and the fact that all head scales except for the supraoculars are divided. Still, many 'conservative' animals, which possess large plates on top of the head, like the members of the Pelias-group, occur in this group. Progressive animals do not occur in this group because it is the climax-group in this branch of the developmental tree of the vipers. The head scales are keeled until the area where normally the parietals would have been. The rest of the head scales is smooth. Body shape in these vipers is somewhat more stocky than in the previous group.

Vipera transcaucasiana (until recently a subspecies of *Vipera ammodytes*) has been granted the full species status based on immunological data (Hermann *et al.*, 1987). Additionally, this species differs from *Vipera ammodytes* in having an aberrant pattern and a heavier built body. (In *Vipera transcaucasiana*, the original zig-zag or diamond shaped pattern of *Vipera ammodytes* is replaced by a pattern of alternating dark stripes on a brown or gray background, reminiscent of some *Vipera aspis*. See fig. 2).

'Xanthina-complex'

Obst (1983) placed the vipers that are assigned to this group and the following ones in a different genus: *Daboia*, the Asian vipers. Indeed, several reasons to separate the genera *Vipera* and *Daboia* exist, although this division is still not generally accepted.

These heavy bodied snakes have large, broad heads which are clearly broader than the neck. All have a rounded snout which is not upturned. All head scales, except for the supraoculars, are divided and keeled.

The Xanthina-complex is subdivided into two groups: The 'Xanthina-group'(1) and the 'Raddei-group'(2). These groups are distinguished by the shape of the supraocular plate: (1) a flat, rounded plate (*Vipera albizona*, *Vipera bornmuelleri*, *Vipera bulgardaghica*, *Vipera wagneri* and *Vipera xanthina*) and (2) a pointed plate or one with an angle (*Vipera albicornuta*, *Vipera latifi* and *Vipera raddei*). Additionally, the latter group differs from the former because its members possess a complete ring of supraoculars which separates the supraocular plate from the eye.

Vipera xanthina inhabits Western Turkey, extreme Northeastern Greece, and some Greek and Turkish islands. The other representatives of the Xanthina-group are inhabitants of mountainous regions and have very limited distribution areas.

A number of species from the Xanthina-complex has been known for only a couple of years. *Vipera albizona*, for example, was described for the first time in 1990 (Nilson *et al.*). The first specimens *Vipera wagneri* and *Vipera bulgardaghica* were collected in 1846 and 1898, respectively. Only in 1984 was *Vipera wagneri* rediscovered and news of its existence published. The same happened for *Vipera bulgardaghica* in 1985. Publication of the type-locality of *Vipera wagneri* led to a massive overcollection of specimens by foreign and local snake catchers. This resulted in an almost complete extermination of the recently rediscovered population in a very short period of time. For this reason, type-localities of newly discovered viper species were no longer published or even deliberately published wrong, to mislead collectors. Unfortunately this has not worked yet, and all over Europe captive specimens of viper species which are only known from a few

specimens in the wild, appear. Fortunately, most species reproduce in captivity so import of new animals from the wild is unnecessary and hopefully stopped.

'Lebetina-group'

This group constitutes the climax in development of the subfamily Viperinae. Finally, in the members of the Lebetina-group, the supra-oculars are divided as well. The eyes are separated from the supralabials by 2-3 rows of suboculars. The body is encircled by 23-27 dorsal scale rows.
These vipers can be very large and possess long fangs. The venom is relatively strong and is secreted in large amounts.

According to some authors the subspecies *Vipera lebetina schweizeri*, which is endemic on the Cyclades islands, should be regarded as a valid species (Nilson & Andrén,1988; Schätti & Sigg, 1989; Schätti *et al.*, 1991). The same would apply to *Vipera lebetina transmediterranea* (Nilson & Andrén, 1988).

'Russelli-group'

The systematic position of this group is still somewhat insecure. Possibly these snakes can be incorporated in the previous group. The most important distinguishing feature between both groups is their distribution (Lebetina-group: Southeast Europe, Middle-East, North Africa; Russelli-group: Middle-East, Asia).

In the Russelli-group, all head scales are divided and keeled as well. There are several (2-4) rows of suboculars which separate the eye from the supralabials.

The shape of the head is allmost triangular with a blunt snout. Especially in *Vipera russelli* there is a very large nasal, with an extremely large nostril placed in a depression. This is used by the snake to produce a loud hissing sound.

Just like the members of the Lebetina-group, these snakes are very large and possess large amounts of potent venom.

Pseudocerastes persicus

Although this viper from the Middle East hardly seems to have any affinity with the aforementioned vipers, it was included in the genus *Vipera* by Marx and Raab (1965), based on similarities in skull structure. According to Obst (1983) this species should be incorporated in the genus *Daboia*. It would then be named either *Vipera persica* or *Daboia persica*, respectively.

LITERATURE

Böhme, W. & Joger, U. (1983), Eine neue Art des *Vipera berus*-Komplexes aus der Türkei. Amphibia-Reptilia 4: 265-271.

Brodmann, P. (1987), Die Giftschlangen Europas und die Gattung *Vipera* in Afrika und Asien. Kümmerly & Frey, Bern. 148 pp.

Hermann, H.W., Joger, U., Nilson, G. & Sibley, C.G. (1987), First step towards a biochemically based reconstruction of the phylogeny of the genus *Vipera*. Proc. 4th ord. Gen. Meet. S.E.H., Nijmegen. 195-200.

Marx, H. & Raab, G. (1965), Relationships and zoogeography of the viperine snakes. Fieldiana, Zool., Chicago. 44: 161-206.

Nilson, G. & Andrén, C. (1988), *Vipera lebetina transmediterranea*, a new subspecies of of viper from North Africa, with remarks of the taxonomy of *Vipera lebetina* and *Vipera mauretanica*. Bonn. zool. Beitr. 39: 371-379.

Nilson, G., Andrén, C. & Flärdh, B. (1990), *Vipera albizona*, a new mountain viper from central Turkey, with comments on isolating effects of the Anatolian 'Diagonal'. Amphibia-Reptilia 11: 285-294.

Obst, F.J. (1983), Zur kenntnis der Schlangengattung *Vipera*. Zool. Abh. Mus. Tierk., Dresden. 38(13): 229-235.

Schätti, B. & Sigg, B. (1989), Die Herpetofauna der Insel Zypern, Teil 2. Schildkröten, Echsen und Schlangen. Herpetofauna 11: 17-25.

Schätti, B., Baran, I. & Sigg, H. (1991), Rediscovery of the Bolkar viper: morphological variation and systematic implications on the '*Vipera xanthina* complex'. Amphibia-Reptilia 12: 305-327.

Foto 1: *Vipera transcaucasiana*.
Foto: Jan Bergman.

Note added in proof

Four species have recently been placed in a new genus *Macrovipera*:

Macrovipera lebetina. Near and Middle East (Turkey to Kashmir), northern Algeria and northern Tunisia.

Macrovipera schweizeri. Previously *Vipera lebetina schweizeri.* Cyclades Islands, Greece (Milos, Sifnos, Kimilos).

Macrovipera mauretanica. Previously *Vipera mauretanica mauretanica*. Northwest Africa (Moraccoc, Algeria).

Macrovipera deserti. Previously *Vipera mauretanica deserti*. North Africa (Algeria?, Tunisia and Libya).

The reference for this information is Herrmann, Joger and Nilson (1992). Phylogeny and systematics of viperine snakes. III: resurrection of the genus *Macrovipera* (Reuss, 1927) as suggested by biochemical evidence. *Amphibia-Reptilia* 13 (1992): 375-392.