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A REASSESSMENT OF THE HIGHER TAXONOMY OF THE VIPERIDAE.

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ABSTRACT

This paper reviews recent phylogenetic studies of the Vipers to revisit the higher taxonomy of the group, specifically with reference to the level between family and genus.

Three subfamilies Azemiopine, Crotalinae and Viperinae are recognised.

The various tribes are redefined, diagnosed and named when there are no pre-existing valid names as determined by the ICZN rules current from year 2000.

As a result, a total of 16 tribes are herein formally defined and named, many of them new.

For the Azemiopine, one previously named tribe is identified.

For the Crotalinae a total of 7 tribes are named and defined, 5 new, as well as several new subtribes.

For the Viperinae a total of 8 tribes are named and defined, 5 new, as well as several new subtribes.

Keywords: taxonomy; nomenclature; snake; viper; pitviper; Azemiopine; family; tribe; subtribe; genera; genus; phylogeny; Hoser; Viperidae; Azemiopinae; Azemiopini; Viperinae; Atherini; Bitisini; Causini; Cerastini; Echiini; Proatherini; Pseudocerastini; Pseudocerastina; Eristicophina; Viperini; Maxhoserviperina; Montiviperina; Viperina; Crotalinae; Adelynhoserserpenini; Porthidiumina; Cerrophidionina; Adelynhoserserpenina; Akistrodonini; Calloselasma; Crotalini; Crotalina; Piersonina; Jackyhoserini; Bothropina; Bothropoidina; Rhinocerophiina; Jackyhoserina; Bothrocophiina; Lachesini; Bothriechisina; Lachesina; Trimeresurusini; Tropidolaemusini.

INTRODUCTION

In the period 1975 to present (2012), there have been a large number of studies published in relation to the phylogeny of the extant (living) viperid snakes.

These published studies include the data and findings of Campbell and Lamar (2004), Fenwick, et. al. (2009), Heise, et. al. (1995), Lenk, et. al. (2000), Pyron et. al. (2010) and others, including those cited within these studies.

As of early 2012, the relationships between groups of genera have been consistently placed by various authors as cited above and therefore are not regarded as being in doubt.

Besides the standard taxonomic techniques, relying on morphology and more recently molecular means, ongoing ecological studies (e.g. Ineich, et. al. 2006) have provided alternative means by which to deduce relationships between viperid genera.

Smith et. al. (1977) provided a widely cited, referenced and used classification of all extant snakes down to tribe level.

However the point at where he drew the line between family and tribe was inconsistent.

The best indicator of this is seen by viewing the contrast between his treatment of the elapids with the vipers.

For the former he presented no less than 11 presumed tribes for the Australian elapid snakes alone.

By contrast he identified just five tribes for all the Solenoglyphs, including all the Viperidae from all parts of the world.

Added to this list has been the tribe *Atherini*, erected in the first instance by Groombridge in 1986 and later adopted by Broadley in 1996, leaving other major groups of the true Vipers effectively unnamed at the tribe level until now.

Using the results of numerous recent phylogenetic studies, including Broadley (1996), Kelly, et. al. (2003), Pyron et. al.(2011), those cited within those papers and others, I have herein corrected this anomaly and revisited the taxonomy of the Viperidae defining new groups according to the current ICZN rules (Ride 1999).

Published sources of relevant taxonomic data and opinions relied upon include: Beaman and Hayes (2008), Bryson, et. al. (2011), Campbell and Smith (2000), Castoe and Parkinson (2006), David et. al. (2002), Dawson, et. al. (2008), Fernandes (2005), Garrigues et. al. (2005), Gloyd and Conant (1989), Fernandes et. al. (2004), Grismer et. al. (2006), Gumprecht et. al. (2004), Guo et. al. (1999), Guo et. al. (2007), Guo et. al. (2009), Jadin et. al. (2010), Jadin, et. al. (2011), Klauber, L. M. (1972), Kraus, et. al. (1996), Malhorta and Thorpe (2004), McCranie (2011), McDairmid et. al. (1999), Meik and Pires-daSilva (2009), Pitman (1974), Smith (1941), Vogel (2006), Werman (1984), Werman (1992), Wüster and Bérnils (2011), Zamudio and Green (1997).

In terms of the publications cited herein, I have not accepted all the contents of all as either accurate, or agree with the conclusions. One of these publications has proven lies within it, that being Wüster and Bérnils (2011), see Hoser (2012f), however the paper does contain other relevant information not connected with the false statements in relation to myself and my earlier publications.

In terms of naming tribe contents at the genus level, I have not necessarily included all genus names proposed or actually in usage by herpetologists for the contents of each tribe in that recently erected genera that have not yet been widely accepted may have been omitted. However I have used all those most commonly in use at the present time for the relevant species level taxa.

As a result, where a given taxa is referred to a different genus name, it will as a matter of course be able to be referred back to one of the genus names pre-existing and herein as referring to the same species-level taxon for any given taxon.

As a relevant note, I mention that simultaneous to this publication, *Australasian Journal of Herpetology* Issue 11 has also been published. It contains several relevant papers reclassifying the pitvipers and Vipers, most notably the Rattlesnakes as well as species within Asia, Central America, South America and Africa/Middle East. As a result there are a number of new genus names used here (total four, plus those new for Rattlesnakes as well as various subgenera that may or may not be referred to herein).

It is also worth noting that all new placements have been confirmed by multivariate analysis including morphological studies and comparison of mtDNA between the relevant species level taxa and those within the genera they were formerly placed to confirm the merit and validity of the genera splits undertaken.

The relevant papers are also cited at the rear of this paper or the relevant Hoser papers (Hoser 2012a, 2012b, 2012c, 2012d and 2012e).
Some new genera as diagnosed in the papers (Hoser 2012a, 2012b, 2012c, 2012d and 2012e) are used for the purposes of naming new tribes and subtribes. For nomenclatural purposes, the original descriptions should also be treated as being as part of this paper.

THE ACTUAL FINDINGS AND PLACEMENT OF GROUPS

Authors have in the past had trouble placing the Azemiopine.

Pyron et. al. placed them primitive to the Crotalids and potentially the other Vipers as well.

Because it's not tenable to downgrade the status of the subfamilies Crotaline and Viperinae to that of tribes, Azemiopine therefore is placed in the following list as a subfamily within the Viperidae. Because it is known only from a single genus, the taxon is also assigned a monotypic tribe.

As already mentioned, these lists include several Viperid genera named in papers published simultaneously with this paper in *Australasian Journal of Herpetology* issues 10 and 11 (both journals printed at the same time). The relevant papers are cited at the rear of this paper (Hoser 2012a, Hoser 2012b, Hoser 2012c, Hoser 2012d, Hoser 2012e) and their contents should also be treated as inclusive within this paper for nomenclatural purposes if and when relevant to the Zoological code. The two journals can if need be, be treated as two volumes of the same publication of the same date (8 April 2012).

Within the various levels, each group is placed in alphabetical order (except for the reversal of subfamilies Viperinae and Crotalinae), which as a matter of course may lead to the break up of what would have been more discrete phylogentic units.

This alphabetical ordering of tribes and the like was done after the paper was written meaning that the relevant accounts for each tribe should best be read for close scrutiny with those of other phylogenetically close groups.

At the end of this paper is a list summarizing the current position in terms of tribes and content, which is essentially the same as the paper's actual contents, minus the diagnoses.

FAMILY VIPERIDAE
Diagnosis:

This diagnosis herein acts to separate all three subfamilies of the vipers as a combined diagnosis.
The Vipers are usually thickset snakes with large heads and keeled scales, giving the snakes an unmistakeable appearance. They are further characterized by a pair of long, hollow, venom-injecting fangs attached to movable bones of the upper jaw (the maxillaries) that are folded back in the mouth when not in use. Their eyes usually, but not always, have vertically elliptical pupils and the eyes are relatively large.

No other snakes posess this complete suite of characters.
Vipers are in turn split into two main subfamily groups, namely the pitted (subfamily Viperinae) and pitless vipers (subfamily Crotalinae). The pitless vipers, (viperinae) are those lacking distinctive heat sensitive pits between the eye and the nostril. The pitvipers are those which posess the heat sensitive pits.

A third subfamily named Azemiopinae is a monotypic subfamily created for the monotypic genus, *Azemiops*, that contains the venomous viper species *Azemiops feae*, otherwise known as the Fea's viper, which in turn is monotypic for the genus.
It is separated from the other vipers by it's smooth dorsal scales rather than keeled scales.
The snake has a reasonably sturdy body and a short tail.

The head, which is slightly flattened and more elliptical in shape than triangular (like other vipers), is also not covered with numerous small scales like most other vipers, but with large symmetrical head shields like colubrids and the elapids.
This species does, however, have a pair of hollow, retracting fangs, although these are shorter than in true vipers and pitvipers.
The fangs have a ridge at the tip lateral to the discharge orifice, as well as a blade-like structure on the ventral surface otherwise seen only in some opistoglyphous and atractaspid snakes. The venom glands are relatively small (Mebs et. al. 1994). Finally, unlike most vipers, Fea's viper is oviparous. The largest known total maximum length recorded for the taxa is 78 cm (Liem, et.

al. 1971). Long believed to be primitive in terms of the other viperids (Liem et. al. 1971), this position has been confirmed through studies of mitochondrial DNA, (Pyron et. al. 2010).

Vipers range in adult length from less than 25 cm (10 inches) in the Namaqua dwarf viper (*Bitis schneideri*) (a pitless viper) of southern Africa (a true viper) to more than 3 metres (10 feet) in the bushmaster (*Lachesis muta*) (a pitviper) of the Amazon basin and Central America. However it should be noted that both pitvipers and pitless ones average similar sizes and range between similar maximums and minimums.
There are considerably more species of pitvipers than pitless ones.

SUBFAMILY AZEMIOPINAE

Diagnosis: See more detail under family Viperidae.

Vipers with smooth dorsal scales are family Azemiopinae.

Vipers without a pit between the nostril and eye and keeled dorsal scales are family Viperidae.
Vipers with a pit between the nostril and the eye and keeled dorsal scales are family Crotalidae.

Azemiopinae is a monotypic subfamily created for the monotypic genus, *Azemiops*, that contains the venomous viper species *Azemiops feae*, otherwise known as the Fea's viper, which in turn is monotypic for the genus.
The snake has a reasonably sturdy body and a short tail.

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Long believed to be primitive in terms of the other viperids (Liem et. al. 1971), this position has been confirmed through studies of mitochondrial DNA, (Pyron et. al. 2010).
Content: *Azemiops* Boulenger, 1888.
Content of genus is monotypic for *Azemiops feae.*

Tribe Azemiopini Liem, Marx and Rabb 1971.

(Terminal Taxon: *Azemiops feae*)

Diagnosis: Vipers with smooth dorsal scales are family Azemiopinae.

Vipers without a pit between the nostril and eye and keeled dorsal scales are family Viperidae.
Vipers with a pit between the nostril and eye and keeled dorsal scales are family Crotalidae.
The subfamily Azemiopinae, tribe Azemiopini and genus *Azemiops* are monotypic for the single species, *Azemiops feae.*
For further details about this taxon refer to Kardong (1986) and Marx and Olechowski (1970), Orlov (1997), Zhao and Adler (1993) and Zhao and Zhao (1991).
Content: *Azemiops* Boulenger, 1888.
Content of genus is monotypic for the species *Azemiops feae* Boulenger, 1888.

SUBFAMILY VIPERINAE (PITLESS VIPERS)

Diagnosis: See above (under family Viperidae).

Vipers without a pit between the nostril and eye are family Viperidae.
Vipers with a pit between the nostril and eye are family Crotalidae.
Vipers with smooth dorsal scales are family Azemiopinae.

Content: See for each tribe as listed below.

Tribe Atherini Groombridge, 1986

(Terminal Taxon: *Atheris chlorechis*)

Diagnosis: This group of snakes was for many years treated by many authors as being in the single genus *Atheris.*
This tribe is found only in the sub-Saharan Africa, excluding far southern Africa.
The best known genus remains *Atheris*, which is a group of tree-dwelling species.

Three ground-dwelling members of this tribe are now placed in three separate monotypic genera.
These are:

Adenorhinos barbouri (Loveridge, 1930), Uzungwe viper.

Montatheris hindii (Boulenger, 1910), Montane viper.

Proatheris superciliaris (Peters, 1855), Lowland viper.

In any event this tribe is separated from the other vipers within Africa by their their prehensile tails (they are mainly arboreal), that they don't puff their bodies up through the inhalation of air and also their generally smaller adult size.

Adults range in total body length from 40 cm (*Atheris katangensis*) to a maximum of 78 cm. (*A. squamigera*).

All species have a broad, triangular head that is distinct from the neck. The canthus is also distinct and the snout is broad. The crown is covered with small imbricate or smooth scales, none or few of which are enlarged. The eyes are relatively large eyes and have elliptical pupils. The eyes are separated from the supralabials by 1–3 scale rows and from the nasal by 2–3 scales.

The body is slender, tapering and slightly compressed, although slightly more stocky in the ground-dwelling species. The dorsal scales are overlapping, strongly keeled and have apical pits. Laterally these are smaller than the middorsals. Midbody there are 14–36 rows of dorsal scales. There are 133–175 rounded ventral scales. The subcaudal scales are single and number 38–67. In most species, the tail is extremely prehensile and can support the body while suspended from a branch or a twig.

Members of this group come in an amazing variety of colors and patterns, often within a single species. *Atheris ceratophora* and *A. squamigera* are particularly variable.

Content: *Adenorhinos* Marx and Rabb, 1965; *Atheris* Cope, 1862; *Montatheris* Broadley, 1996; *Proatheris* Broadley, 1996.

Tribe Bitisini Tribe nov.

(Terminal Taxon: *Bitis arietans*)

Diagnosis: A group of snakes restricted to Africa and the Arabian Peninsula.

These are the terrestrial Puff Adders (*Bitis arietans*) and relatives. They are separated from all other vipers by the ability of members to use a characteristic threat display that involves inflating and deflating the body to a large degree while hissing and puffing loudly.

Size variation within this (super) genus is extreme, ranging from the very small *B. schneideri*, which grows to a maximum of 28 cm and is perhaps the world's smallest viperid, to the very large *B. gabonica*, which can attain a length of over 2 m and is the heaviest viper in the world.

All have a wide, triangular head with a rounded snout, distinct from the neck and covered in small, keeled, imbricate scales. The canthus is also distinct. A number of species have enlarged rostral or supraorbital scales that resemble horns. Their eyes are relatively small. They have large nostrils that are directed outwards and/or upwards. Up to six rows of small scales separate the rostral and nasal scales. All species have a well-developed supranasal sac. The fronts of the maxillary bones are very short, supporting only one pair of recurved fangs.

These snakes are moderately to extremely stout. Their bodies are covered with keeled scales that are imbricate with apical

pits. They have 21-46 doral mid body scale rows. Laterally, the dorsal scales may be slightly oblique. There are 112-153 large, rounded ventrals sometimes with slight lateral keels. The tails are relatively short. The anal is single. There are 16-37 paired subcaudals.
All are highly venomous.
Content: *Bitis* Gray, 1842 (including all defined subgenera).

Tribe Causini Cope, 1860

(Terminal Taxon: *Causus maculatus*)

Diagnosis: These snakes are fairly stout and small, rarely growing to more than 1 m in length.

In Causini the head is only be slightly distinct from the neck and covered with large symmetrical head shields or alternatively more viperine in appearance, ranging to distinct from the neck. Also, the eyes have pupils that are round, separating them from all other African vipers which have elliptical pupils. The rostral scale may be broad, sometimes pointed or upturned. The nostril is located between 2 nasals and an internasal. The frontal and supraocular scales are long. A loreal scale is ususally present, separating the nasal and preoculars. The suboculars are separated from the supralabials. The mandible has splenial and angular elements.

Unlike other vipers there appears to be no hinge action where the prefrontal bone engages the frontal. However, since the maxillary bones rotate almost as far, the fangs can still be erected. The fangs themselves are relatively short compared to vipers in other tribes. A fine line, or suture, is also present along the length of the fang, representing the vestigial edge where the groove lips meet (from incomplete fang canal closure).

The body is cylindrical or slightly depressed and moderately slender. The dorsal scales are smooth or weakly keeled with apical pits. The ventral scales are rounded and the anal plate single. The tail is short and the subcaudals can be either single or paired. The tail is never prehensile.
In several species the venom glands are not confined to the temporal area as with most vipers, but are exceptionally long and extend well down the neck. These venom glands, located on either side of the spine, may be up to 10 cm in length, with long ducts connecting them to the fangs and the result is that venom tends to ooze out of the fangs rather than squirt.
There are also other internal differences that set the Causini apart: they have unusually long kidneys, a well-developed tracheal lung with two tracheal arteries, and the liver overlaps the tip of the heart.
Unusual for vipers, species within this tribe lay eggs.

They are distributed in sub-Saharan Africa.
Content: *Causus* Wagler, 1830.

Tribe Cerastini Tribe nov.

(Terminal Taxon: *Cerastes cerastes*)

Diagnosis: Separated from others in the similar looking Causini by the following suite of characters: Cerastini, monotypic for the genus *Cerastes* are small snakes, averaging less than 50 cm in length, but are relatively stout in appearance. Pupil elliptical. The head is broad, flat and distinct from the neck. The head is covered with tubercularly keeled scales, which usually number 15 or more across and a supraorbital horn may be present over each eye in some species. The snout is short and wide and the eyes, which are set well forward, are small to moderate in size. The body is short, stout and cylindrically depressed. The tail is short and tapers abruptly behind the vent. The dorsal scales are small, strongly keeled, in 23-35 rows at midbody, with the keels of the oblique lateral row being serrated, similar to seen in Tribe Echiini tribe nov..
Although *Cerastes* are often referred to as horned vipers, only the two larger species, *C. cerastes* and *C. gasperettii*, are known to have horns, and even these do not always have them. Individuals with and without horns occur within the same populations and even within the same litters (see Mallow et. al. 2003).
When present, each horn consists of a single long, spinelike scale that can be folded back into an indentation in the postocular scale. They fold back in response to direct stimulation, thus streamlining the head and easing passage through burrows. Horns occur more often in individuals from sandy deserts as opposed to stony deserts. Specimens without horns have a prominent brow ridge instead (Mallow et. al. 2003).

The purpose of the horns is the subject of much speculation. One theory is that they allow a buildup of sand above the eyes while keeping it out of the eyes themselves.

Another, more recent theory is simply that the horns serve to break up the outline of the head, making them harder for prey animals to spot (Spawls and Branch 1995).

Further detail about this tribe is covered by Schnurrenberger (1959), Sterer (1992) and Werner, et. al. (1991)

Content: *Cerastes* Laurenti, 1768.

Tribe Echiini Tribe nov.

(Terminal Taxon: *Echis carinatus*)

Diagnosis: Members of this tribe can be separated by their distinctive threat display, which involves forming a series of parallel C-shaped coils and rubbing them together to produce a sizzling sound, rather like water on a hot plate. The proper term for this is stridulation. As they become more agitated, this stridulating behavior becomes faster and louder. It is postulated that this display evolved as a means of limiting water loss, such as might occur when hissing. However, some authors describe this display as being accompanied by loud hissing. These snakes can be fierce and will strike from the position described above. When doing so, they may overbalance and end up moving towards their aggressor as a result. Approaching an aggressor is unusual in most other snakes.

These snakes are relatively small in size with adults never larger than about 90 cm (35 in.) in total length.

The head is short, wide, pear-shaped and distinct from the neck. The snout is short and rounded, while the eyes are relatively large and set well forward. The crown is covered with small, irregular, imbricate scales which may be either smooth or keeled.

The body is moderately slender and cylindrical. The dorsal scales are mostly keeled.

However, the scales on the lower flanks stick out at a distinct 45-degree angle and have a central ridge, or keel, that is serrated (hence the common name “saw-scaled vipers”), the serrated keels being uniquely diagnostic for this tribe in terms of all other non-pitted vipers. The tail is short and the subcaudals always single.
Content: *Echis* Merrem, 1820.

Tribe Pseudocerastini Tribe. Nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Diagnosis: A tribe known only from two species, each monotypic for each genus and each quite different from one another and in terms of one another are best diagnosed at the species level.

Both species within this tribe have an elliptical pupil, raised supraocular, in one species forming a very distinct, horn-like projection, but diagnostic for the tribe is that the raised scales or horns are composed of numerous small supraciliary scales as opposed to being made of a single scale seen in other vipers (e.g. *Cerastes cerastes*).

Rarely if ever exceed a metre in total length.

Endemic to West Asia and the Middle East.

Females are the larger sex and male combat is not known.

Egg-layers.
Content: *Eristicophis* Alcock and Finn, 1897; *Pseudocerastes* Boulenger, 1896.

Subtribe Pseudocerastina Subtribe. nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Diagnosis: A monotypic tribe for the species *Pseudocerastes persicus*, monotypic for the genus, in turn comprised of two allopatric subspecies.
Often referred to as the "false horned viper" because of the hornlike structures above the eyes that are made up of numerous small scales. This is in contrast to the "true" horned viper, *Cerastes cerastes*, that has similar supraorbital horns that consist of a single elongated scale. The other member of this tribe *Eristicophis macmahonii*, (subtribe Eristicophina) lacks this well-developed horn-like structure.

The head is broad, flat, distinct from the neck and covered with small, imbricate scales. The snout is short and rounded. The nostrils are positioned dorsolaterally and have valves. The nasal scale is unbroken. The rostral scale is small and wide. The eyes are small to average in size. There are 15-20 interocular scales and 15-20 circumorbitals. The supraorbital hornlike structures above each eye consisting of small, imbricate scales and are also present in juveniles. There are 11-14 supralabials and 13-17 sublabials. 2-4 rows of small scales separate the supralabial scales from the suboculars.

The dorsal body is covered with weakly to strongly keeled scales. On many of these, the keel terminates before the end of the scale and forms a bump. Many others form a point. There are 21-25 mid-body scale rows, none of them oblique. There are 134-163 ventrals and 35-50 divided subcaudals. The tail is short.

Known from the following areas: The Sinai of Egypt, Israel, Jordan, northern Saudi Arabia, the mountains of Oman, northern and northwestern Iraq, possibly southern Syria, extreme southeastern Turkey, northwestern Azerbaijan, Iran and Pakistan to the borders of Afghanistan.

Content: *Pseudocerastes* Boulenger, 1896.

Monotypic for the species: *Pseudocerastes persicus.*

Subtribe Eristicophina Subtribe. nov.

(Terminal Taxon: *Eristicophis macmahonii*)

Diagnosis: Separated from the subtribe *Pseudocerastina* by the lack of a distinct horn-like projection above the eye. The only species within the tribe is known variously as the McMahon's viper, Asian sand viper, Leaf-nosed viper or Whiskered viper.

The head is distinct from the neck and large, broad, flat and wedge-shaped. The eyes are of a moderate size. The crown of the head is covered with small scales. The nostrils are shaped like a pair of small slits. The rostral is wider than it is high, strongly concave and bordered above and to the sides by four much enlarged nasorostral scales arranged in a butterfly shape. There are 14-16 supralabials, which are separated from the suboculars by 3-4 rows of small scales. There are 16-19 sublabials. The circumorbital ring consists of 16-25 scales.

The body is dorsoventrally slightly depressed and appears moderately to markedly stout. The tail is short, tapering abruptly behind the vent. The skin feels soft and loose. The dorsal scales are short and keeled, in 23-29 midbody rows.

The ventrals have lateral keels, numbering 140-144 in males and 142-148 in females. The subcaudals are without keels: males have 33-36, females 29-31.

The dorsal color pattern consists of a reddish to yellowish brown ground color, overlaid dorso-laterally with a regular series of 20-25 dark spots, bordered partly or entirely with white scales. Posteriorly, these spots become more distinct. The white border areas often extend over the back as bands. The head has a white stripe that runs from the back of the eye to the angle of the mouth. The top of the head may have scattered dark flecks. The labials and throat are white, as is the belly. The tip of the tail is yellow with distinct crossbands.

Mallow et al. (2003) cite the taxon as occurring in Pakistan, Afghanistan, eastern and northwestern Baluchistan, southern Iran and India in the Rajasthan Desert. It is limited to the Dast-i Margo Desert and nearby dune areas, from Seistan in the extreme east of Iran into Afghanistan south of the Helmand River. It also occurs in Baluchistan, between the Chagai Hills and Siahan Range, east to Nushki.
Content: *Eristicophis* Alcock and Finn, 1897.

Monotypic for the genus: *Eristicophis macmahonii.*

Tribe Proatherini Tribe nov.

(Terminal Taxon: *Proatheris superciliaris*)

Diagnosis: The tribe only contains the single genus and species, namely, *Proatheris superciliaris,* commonly known under the following local common names: Lowland Viper, Swamp viper, Lowland Swamp Viper, Eyebrow Viper, Swamp Adder, Peter's Viper, Flood-plain Viper, Mozambique Viper, African Lowland Viper, Domino Viper.
It is separated from all other vipers (all subfamilies, tribes, etc,) by the following suite of characters: A small species that averages 40 to 50 cm in total length with a maximum recorded length of 61 cm. The head has a somewhat elongated appearance, the top of which is covered with small scales except for a pair of very distinct and large supraoculars which are almost twice as long as they are wide.

Physically similar in many respects to the Pseudocerastini, but they differ in having live young instead of laying eggs. While it is a terrerstrial species the tail is somewhat prehensile.

The taxon is found generally in East Africa. More specificially the southern part of its range begins near Beira, in central Mozambique, extends up north over the Mozambique Plain to Quissanga, and through Malawi and as far north as the floodplains of southern Tanzania at the northern end of Lake Malawi. The type locality for the taxon in the original description is given as "Terra Querimba" (Quissanga mainland opposite Ilha, Quirimba, Mozanbique).

Its range it apparently centered around the lower section of the Zambezi River and spreads out into the coastal plain of central Mozambique and the Shire Valley to Lake Chilwa and Malawi. However, other specimens have been found far from this region, such as in Cape Delgado Province, in north-eastern Mozambique, and Mwaya in south-western Tanzania.
The snake is most commonly seen in low-lying marshes, floodplains and land frequently used for grazing cattle (Stevens 1973).
The females are slightly larger than the males.

Content: *Proatheris* Broadley, 1996.

The genus is monotypic for the species: *Proatheris superciliaris.*

Tribe Viperini Laurenti, 1768.

(Terminal Taxon: *Vipera aspis*)

Diagnosis: Separated from other true vipers by the following suite of characters: pupil is elliptical, adults of the snakes are generally small (subtribes Viperina and Montiviperina) to medium or large (subtribe Maxhoserviperina) and more or less stoutly built. The head is distinct from the neck, of triangular shape, and covered with small scales in many species, although some have a few small plates on top. The dorsal scales are strongly keeled, the anal plate is divided, as are the subcaudals. Importantly this group are defined by the characteristic zig-zag pattern running down their back, more-or-less along the dorsal midbody line, this pattern sometimes becoming a series of blotches or spots running longitudinally along the body (as in the genus *Daboia*).

All are viviparous (live bearing).
They are distributed in Eurasia and adjacent parts of North Africa.
Content: *Daboia* Gray 1842; *Maxhoservipera* Hoser, 2012 (see Hoser 2012e); *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999; *Vipera* Laurenti 1768.

Subtribe Maxhoserviperina Subtribe nov.

(Terminal Taxon: *Maxhoservipera palaestinae*)

Diagnosis: Separated from other subtribes by the following suite of characters: Medium to large size as adults, a lack of horns, raised scales or similar projections above the eye or snout.

Separated from the other subtribes by the fact that the snout or nose is noticeably more blunt in appearance, hence their occasional common name, “blunt nosed vipers:.

The head is broad, flat, and very distinct from the neck.
Found in North Africa, the Middle-east and Southern Asia.

Content: *Daboia* Gray, 1842; *Maxhoservipera* Hoser, 2012 (see 2012e).

Subtribe Montiviperina Subtribe nov.

(Terminal Taxon: *Montivipera xanthina*)

Diagnosis: Separated from Viperina by the lack of medium to large scales above the eye. In this subtribe the relevant scales are small.

Separated from the subtribes Maxhoserviperina and Viperina by the fact that in this subtribe the majority of snakes invariably have small horns or raised scales above the eye or snout, not seen in the other subtribes.

Maxhoserviperina is separated from the other subtribes (including Montivipera) by the fact that the snout or nose is noticeably more blunt in appearance, hence their occasional common name, blunt nosed vipers.

Found in Eurasia and the Middle-East

Content: *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999.

Subtribe Viperina Laurenti, 1768.

(Terminal Taxon: *Vipera aspis*)

Diagnosis: Separated from other true vipers by the following suite of characters: as adults these snakes are small and more or less stoutly built. The head is distinct from the neck, of triangular shape, and covered with small scales in many species, although some have a few small plates on top. The dorsal scales are strongly keeled, the anal plate is divided, as are the subcaudals. Importantly this subtribe is defined by the characteristic zig-zag pattern running down their back, more-or-less along the dorsal midbody line, this pattern only being obscured in some melanistic specimens or other aberrant mutations.

The snout is not particularly blunt as seen in the subtribe Maxhoserviperina.

This tribe is separated from specimens within the subtribe Montivipera by the lack of any horns or projections above the eye and the presence of medium sized scales above the eye.

They are distributed in Eurasia only.
Content: *Vipera* Laurenti, 1768.

SUBFAMILY CROTALINAE (PITVIPERS)

Diagnosis: Vipers with an immediately recognisable heat sensitive pit between the nostril and the eye, sometimes called the loreal pit.

This diagnosis herein acts to separate all three subfamilies of the vipers as a combined diagnosis.
The Vipers are usually thickset snakes with large heads and keeled scales, giving the snakes an unmistakeable appearance. They are further characterized by a pair of long, hollow, venom-injecting fangs attached to movable bones of the upper jaw (the maxillaries) that are folded back in the mouth when not in use. Their eyes usually have vertically elliptical pupils and the eyes are relatively large.

No other snakes posess this complete suite of characters. Vipers are in turn split into two main subfamily groups, namely the pitted (subfamily Viperinae) and pitless vipers (family Crotalinae). The pitless vipers (viperinae), are those lacking distinctive heat sensitive pits between the eye and the nostril. The pitvipers are those which posess the heat sensitive pits.

A third subfamily named Azemiopinae is a monotypic subfamily created for the monotypic genus, *Azemiops*, that contains the venomous viper species *Azemiops feae*, otherwise known as the Fea’s viper, which in turn is monotypic for the genus.
It is separated from the other vipers by it’s smooth dorsal scales rather than keeled scales.
The snake has a reasonably sturdy body and a short tail. The head, which is slightly flattened and more elliptical in shape than triangular (like other vipers), is also not covered with numerous small scales like most other vipers, but with large symmetrical head shields like colubrids and the elapids. However this species does have a pair of hollow retracting fangs, although these are shorter than in true vipers and pitvipers.

The fangs have a ridge at the tip lateral to the discharge orifice, as well as a blade-like structure on the ventral surface otherwise seen only in some opistoglyphous and atractaspid snakes. The venom glands are relatively small (Mebs et. Al. 1994). Finally, unlike most vipers, Fea’s viper is oviparous. The largest known total maximum length recorded for the taxa is 78 cm (Liem, et. Al. 1971). Long believed to be primitive in terms of the other viperids (Liem et. al. 1971), this position has been confirmed through studies of mitochondrial DNA, (Pyron et. al. 2010).

Vipers range in adult length from less than 25 cm (10 inches) in the Namaqua dwarf viper (*Bitis schneideri*) (a pitless viper) of southern Africa (a true viper) to more than 3 metres (10 feet) in the bushmaster (*Lachesis muta*) (a pitviper) of the Amazon basin and Central America. However it should be noted that both pitvipers and pitless ones average similar sizes and range between similar maximums and minimums.
There are considerably more species of pitvipers than pitless ones.

All pitvipers have a vertically elliptical pupil in the eye.

Pitvipers found in the New World as well as most Asia, from the edge of the Caspian Sea, eastward.

Tribe Adelynhoserserpenini Tribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Diagnosis: Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided, the head is not covered with about nine large plates (and occasionally a few smaller scales as well).

Content: *Adelynhoserserpenae* Hoser, 2012 (see Hoser 2012a); *Atropoides* Werman, 1992; *Cerrophodion* Campbell and Lamar, 1992; *Porthidium* Cope, 1871.

Subtribe Porthidiumina Subtribe nov.

(Terminal Taxon: *Porthidium ophryomegas*)

Diagnosis: Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided, the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern of a pale mid dorsal line offset by alternate or opposite blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated (Genus *Porthidium*).

Content: *Porthidium* Cope, 1871.

Subtribe Cerrophidionina Subtribe nov.

(Terminal Taxon: *Cerraphodion godmanni*)

Diagnosis: The diagnosis for this tribe is incorporated here as a diagnosis for both subtribes Adelynhoserserpenina subtribe nov. and Cerrophidionina subtribe nov. as it separates all of the component genera in the single diagnosis.

Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided.

If the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern is of a pale mid-dorsal line offset by alternate or opposte blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated the snake is in the genus *Porthidium* and subtribe Porthidiumina.

To be within this tribe (Cerrophidionina) the chinshields and preventrals are separated by 4 or more gulars, the dorsal pattern is of mid-dorsal blotches or crossbands (sometimes only extending to the mid-dorsum, but no pale mid-dorsal line present), rostral variable, usually broader than high or only slightly higher than wide, snout unelevated, the head is not covered with about nine large plates (sometimes with a few smaller scales as well), if there are more than 138 ventrals the snake is in this subtribe. If there are less than 138 ventrals the snake is in the subtribe Adelynhoserserpenina Subtribe nov..

Content: *Cerraphodion* Campbell and Lamar, 1992; *Atropoides* Werman, 1992.

Subtribe Adelynhoserserpenina Subtribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Diagnosis: The species within this subtribe used to be placed in the genus *Atropoides*.

The diagnosis for this tribe is incorporated here as a diagnosis for all both subtribes Adelynhoserserpenina subtribe nov. and Cerrophidionina subtribe nov. as it separates all of the component genera in the single diagnosis.

Separated from all other pitvipers in the Western hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided.

If the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern is of a pale mid dorsal line offset by alternate or opposte blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated the snake is in the genus *Porthidium* and subtribe Porthidiumina.

To be within this tribe the chinshields and preventrals are separated by 4 or more gulars, dorsal pattern of mid-dorsal blotches or crossbands (sometimes only extending to the mid-dorsum, but no pale mid-dorsal line present), rostral variable, usually broader than high or only slightly higher than wide, snout unelevated, the head is not covered with about nine large plates (sometimes with a few smaller scales as well), if there are more than 138 ventrals the snake is in the subtribe Cerrophidionina. If there are less than 138 ventrals the snake is in the subtribe Adelynhoserserpenina subtribe nov..

Content: *Adelynhoserserpenae* Hoser, 2012 (See Hoser 2012a).

Tribe Agkistrodonini Tribe Nov.

(Terminal Taxon *Agkistrodon contortrix*)

Diagnosis: Known as the Moccasins, including the Cantils, Copperhead and Cottonmouth, these snakes are separated from all other vipers in the Western Hemisphere by the following suite of characters: The tail does not terminate in a rattle or button, the tail is not strongly prehensile, the distal portion is not curving strongly down in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are single or paired, usually fewer than 200 ventrals and 31 dorsal mid-body rows, most or all subcaudals are undivided.

If the chinshields and preventrals are separated by only 2-3 gulars (as opposed to four or more), the dorsal pattern of a pale mid dorsal line offset by alternate or opposte blotches on either side (rarely pattenless); rostral usually distinctly higher than wide; snout may or may not be elevated the snake is in the genus *Porthidium* and subtribe Porthidiumina (see above). To be within this tribe the chinshields and preventrals are separated by 4 or more gulars, dorsal pattern is of mid-dorsal blotches or crossbands (sometimes only extending to the mid-dorsum, but no pale mid-dorsal line present), rostral variable, usually broader than high or only slightly higher than wide, snout unelevated, the head is covered with about nine large plates (sometimes with a few smaller scales as well), the dorsal colour consists of crossbands or may be uniformly coloured, lacunolabial is present.

Content: *Agkistrodon* Palisot de Beauvois, 1799.

Tribe Calloselasma Tribe Nov.

(Terminal taxon: *Calloselasma rhodostoma*)

Diagnosis: The tribe consists of two distinct genera and they are defined herein separately as a composite diagnosis for the tribe and it's contents.

The species taxon, *Calloselasma rhodostoma*, monotypic for the genus is the only Asian pit viper with large crown scales and smooth dorsal scales.

There are three species within the genus *Hypnale*. All are readily identified by their more-or-less upturned snouts that produce a sort of hump-nosed effect (hence the common name "Hump-nosed Vipers"). This separates them from all other vipers.

All taxon within this group are moderately stout snakes.

The Malayan Pitviper, *Calloselasma rhodostoma* is found in Southeast Asia from Thailand to northern Malaysia and on the island of Java. Attains an average total body length of 76 cm, with females being slightly larger than males. The largest recorded length is 91 cm. The species is oviparous (lays eggs).

The three species of *Hypnale* occur in South-west India and island Sri Lanka. Members of this genus grow to a maximum total length of 55 cm (for *H. hypnale*). The tail length accounts for 14-18% of the total body length in males, 11-16% in females.

The snout is more or less upturned, with two species having a wart-like protuberance at the tip that is covered with tiny scales. The anterior head shields are strongly fragmented, but the frontal scale, supraoculars and parietals are complete and quite large. The nasal scale is single, but it may have a groove that extends towards its upper edge. There are two preoculars and 2-4 postoculars. The loreal scale is single, but extends across the canthus rostralis so that it can be seen from above. The supralabials and sublabials both number 7-9. Bordering the supralabials are 3-4 enlarged temporal scales, above which are 3-5 irregular rows of temporal scales. There is one pair of chin shields, each of which is slightly longer than it is wide.

There are 17 dorsal mid-body scale rows, which are weakly keeled. Apical pits are present, but very difficult to see. The keels are lacking or may be entirely absent on the first two scale rows bordering the ventrals. There are 120-158 ventrals and 28-48 mainly divided subcaudals.

Content: *Calloselasma* Cope, 1860; *Hypnale* Fitzinger, 1843.

Tribe Crotalini Gray, 1825

(Terminal Taxon *Crotalus horridus*)

Diagnosis: Separated from all other snakes on the planet, including other vipers, by the posession of a rattle on an unbroken tail, or in the case of one species and neonates an obvious pre-button.

They are generally medium to large species with strongly keeled scales, stout build and a large head distinct from the neck.

This tribe is herein restricted to include only the true Rattlesnakes and no other pit vipers.

Content: *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus Linnaeus*, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Piersonus* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.
Note: There are now also 8 named and defined subgenera within this group (see Hoser 2012b). These are: *Cottonus* Hoser, 2009; *Crutchfieldus* Hoser, 2009; *Edwardsus* Hoser, 2009; *Mullinsus* Hoser, 2009; *Pillotus* Hoser, 2009; *Rattlewellsus* Hoser, 2012; *Sayersus* Hoser, 2009; *Smythus* Hoser, 2009.

Subtribe Crotalina Subtribe nov.

(Terminal Taxon *Crotalus horridus*)
Diagnosis: Includes all rattlesnake taxa excluding *Piersonus ravus*, which is placed in the monotypic subtribe *Piersonina.*

Piersonus (subtribe Piersonina subtribe nov.) is separated from all other rattlesnakes (this tribe) by the following suite of characteristics. In common with the two species in the genus *Sistrurus*, it has nine (usually) large head plates. The other rattlesnakes all have smaller and irregular head shields. *Piersonina* is separated from the the genus *Sistrurus* by the fact that the upper preocular is not in contact with the postnasal, the rostral is curved over the snout; canthus rostralis is rounded, dorsal body blotches are longer than wide unless the snake is melanistic (black) and often in distinct diamond shapes; body pattern commences from the neck; by contrast in *Sistrurus*, the upper preocular is in contact with the postnasal; rostral is not curved over the snout; the canthus rostralis is sharply angled and the dorsal body blotches are square or wider than long, body pattern commences from the head proper.

In all rattlesnakes of the genus *Sistrurus* (the two species being *S. catenatus* and *S. milliarius*), the hemipenis has a gradual transition from spines to calyces. However in all other rattlesnakes including in the subtribe Piersonina the hemipenis has an abrupt transition from spines to fringes at the point of bifircation of the lobes.

Content: *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus* Linnaeus, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.

Note: There are now also 8 named and defined subgenera within this group (see Hoser 2012b). These are: *Cottonus* Hoser, 2009; *Crutchfieldus* Hoser, 2009; *Edwardsus* Hoser, 2009; *Mullinsus* Hoser, 2009; *Pillotus* Hoser, 2009; *Rattlewellsus* Hoser, 2012; *Sayersus* Hoser, 2009; *Smythus* Hoser, 2009.
Subtribe Piersonina Subtribe nov.

(Terminal Taxon *Piersonus ravus*)

Diagnosis: This subtribe is monotypic for the genus and species *Piersonus ravus.*

This is separated from all other rattlesnakes by the following suite of characteristics. In common with the two species in the genus *Sistrurus*, it has (usually) nine large head plates. The other rattlesnakes all have smaller and irregular head shields.

Piersonina is separated from the the genus *Sistrurus* by the fact that the upper preocular is not in contact with the postnasal, the rostral is curved over the snout; canthus rostralis is rounded, dorsal body blotches are longer than wide unless the snake is melanistic (black) and often in distinct diamond shapes; body pattern commences from the neck; by contrast in *Sistrurus*, the upper preocular is in contact with the postnasal; rostral is not curved over the snout; the canthus rostralis is sharply angled and the dorsal body blotches are square or wider than long, body pattern commences from the head proper.

In all rattlesnakes of the genus *Sistrurus* (the two species being *S. catenatus* and *S. milliarius*), the hemipenis has a gradual transition from spines to calyces. However in all other rattlesnakes including in the subtribe Piersonina the hemipenis has an abrupt transition from spines to fringes at the point of bifircation of the lobes.

Piersonus ravus is only found in the mountains of central and southern Mexico, like the highlands of Morelos, Puebla and Oaxaca. Vertical distribution is estimated between 1500 – 3000m above sea level. Rarely does it exceed 70 cm in total body length.

P. ravus inhabits primarily forests of the temperate zones, especially pine-oak forests. They can also be found in temperate grasslands, cloud forest, high altitude thorn scrub and tropical deciduous forest.

Its common name is the Mexican Pygmy Rattlesnake.

Content: *Piersonus* Hoser, 2009.

Tribe Jackyhoserini tribe nov.

(Terminal Taxon: *Jackyhoserea pictus*)

Diagnosis: A large tribe of live-bearing pitvipers found in the New World whose centre of distribution is South America.

Separated from all other pitvipers by the following suite of characteristics: Live bearing. No rattle or similar unbroken pre-button on the end of the unbroken tail. The tail is not prehensile, the rostral is wider than high, the supracephalic scales are either small and keeled although in some species there may be some smallish platelike scales, no supraocular spines, the supracephalic scales may be either mostly flat, with small keels or sometimes srtongly keeled, the rostral is wider than high to slightly higher than wide, 21-29 dorsal mid-body rows, 124-254 ventrals, 30-91 usually divided subcaudals, tail may or may not be prehensile, the tail spine is relatively long, the body may be slender to moderately stout, the distal portion of the heimpenes have proximal calcyes, papillate or spinulate, usually smooth distally.

Content: *Bothriopsis* Peters, 1861; *Bothrocophias* Cutberlet and Cambell, 2001; *Bothropoides* Fenwick, et. al., 2009; *Bothrops* Wagler, 1824; *Jackyhoserea* Hoser, 2012 (See Hoser 2012c); *Rhinocerophis* Garman, 1881.

Subtribe Bothropina Subtribe nov.

(Terminal Taxon: *Bothrops lanceolatus*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*): if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spots or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern consisting of dark vertebral rhomboids bordered by paler lines (genus *Bothrops*); Jackyhoserina Subtribe nov. (see below) are separated from all species within the genus *Bothrops* (defined above and forming a part of this description), by the following suite of characters: The canthus does not curve upwards, there is a dorsal pattern of small blotches, many of

which are located mid-dorsally or fused to form a zig-zag stripe, occasionally trapezoidal or triangular that alternate or meet mid-dorsally; 3-10 intersupraoculars; 8-11 supralabials with the second, third or none fused with the prelacanul; 10-12 infralabials; 21-25 (usually 23) dorsal mid body rows, 157-186 ventrals in males, 165-186 ventrals in females, 37-63 all divided subcaudals in males and 33-58 all or mostly divided subcaudals in females.

Content: *Bothriopsis* Peters, 1861; *Bothrops* Wagler, 1824.

Subtribe Bothropoidina Subtribe nov.

(Terminal Taxon: *Bothropoides neuwiedi*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*)(see above subtribe Bothropina): if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spts or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern not consisting of dark kidney-shapes, Dorsal head lacking a well-defined pattern *(Bothropoides*).

Content: *Bothropoides* Fenwick, et. al. 2009.

Subtribe Rhinocerophiina Subtribe nov.

(Terminal Taxon: *Rhinocerophis nasus*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*)(see above subtribe Bothropina); if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spts or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern consisting of large brown kidney-shapes; Dorsal head with well-defined pattern. Mostly dark with four or five large brown patches separated by very thin pale lines (Genus: *Rhinocerophis*).

Content: *Rhinocerophis* Garman, 1881.

Subtribe Jackyhoserina Subtribe nov.

(Terminal Taxon: *Jackyhoserea pictus*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*) (see above subtribe Bothropina): if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there's no distinct series of pale spts or bars on the infralabials; dorsals are often strongly keeled but not tubercular; intersupraoculars are usually keeled, skull narrow, distance across frontal bones are less than the width of the skull at the anterior end of the supratemporals; Dorsal pattern consisting of dark vertebral rhomboids bordered by paler lines (genus *Bothrops*); Jackyhoserina Subtribe nov. are separated from all species within the genus *Bothrops* (defined above and forming a part of this description), by the following suite of characters: The canthus does not curve upwards, there is a dorsal pattern of small blotches, many of which are located mid-dorsally or fused to form a zig-zag stripe, occasionally trapezoidal or triangular that alternate or meet mid-dorsally; 3-10 intersupraoculars; 8-11 supralabials with the second, third or none fused with the prelacanul; 10-12 infralabials; 21-25 (usually 23) dorsal mid body rows, 157-186 ventrals in males, 165-186 ventrals in females, 37-63 all divided subcaudals in males and 33-58 all or mostly divided subcaudals in females.

Content: *Jackyhoserea* Hoser, 2012 (See Hoser 2012c).

Genus content: *J. pictus* (type species), *J. andianus, J. barnetti, J. lojanus, J. roedingeri.*

Note: Subgenus *Daraninus* Hoser 2012 is monotypic for the species taxon, *J. andianus.*

Subtribe Bothrocophiina Subtribe nov.

(Terminal Taxon: *Bothrocophias hyopora*)

Diagnosis: Separated from all other pitvipers in the tribe Jackyhoserini tribe nov. and all other pitvipers in the Western Hemisphere by the following suite of characters: Tail does not terminate in a button or rattle; if the tail is strongly prehensile, the distal portion curves strongly downward in life or preservative, with a relatively long tail spine and usually divided subcaudals (Genus *Bothriopsis*) (see above subtribe Bothropina): if the tail is not prehensile, the distal portion does not curve strongly downward in life or preservative, there is no conspicuous supraocular spine or horn, the distal subcaudals are either single or paired, there are usually fewer than 200 ventrals and 31 dorsal mid-body scale rows; most or all subcaudals are divided, there is a distinct series of pale spots or bars on the infralabials; dorsal keels are tubercular; intersupraoculars are smooth or keeled, skull is broad, distance across the frontal bones equals the width of the skull at the anterior end of the supratemporals (Genus: *Bothrocophias*).

Content: *Bothrocophias* Cutberlet and Cambell, 2001,

Tribe Lachesini Cope, 1900.

(Terminal Taxon *Lachesis muta*)

Diagnosis: The following diagnosis can be also used to separate the two subtribes, namely Bothriechisina subtribe nov. and Lachesina subtribe nov. These snakes are diagnosed and separated from all other vipers in the Western Hemisphere by the following characteristics: Tail does not end in a button or rattle, if the tail is strongly prehensile where the distal portion curves down in life or in preservative, then it will have a short and blunt spine and the subcaudals will be undivided (Genus *Bothriechis*, subtribe Bothriechisina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is a conspicuous supraocular spine or horn, then the genus is *Ophryacus* (within subtribe Lachesina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is not a conspicuous supraocular spine or horn and the distal subcaudals are divided into more than 2 scales, there's 200 or more ventrals, 31-39 dorsal mid-body scale rows then the snake is of the genus *Lachesis* (within subtribe Lachesina subtribe nov.).

Content: *Bothriechis* Peters, 1859; *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.

Subtribe Bothriechisina Subtribe nov.

(Terminal Taxon *Bothriechis nigroviridis*)

Diagnosis: The following diagnosis can be also used to separate the two subtribes within tribe Lachesini tribe nov., namely Bothriechisina subtribe nov. and Lachesina subtribe nov. These snakes are diagnosed and separated from all other vipers in the Western Hemisphere by the following characteristics: Tail does not end in a button or rattle, if the tail is strongly prehensile where the distal portion curves down in life or in preservative, then it will have a short and blunt spine and the subcaudals will be undivided (Genus *Bothriechis*, subtribe Bothriechisina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is a conspicuous supraocular spine or horn, then the genus is *Ophryacus* (within subtribe Lachesina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is not a conspicuous supraocular spine or horn and the distal subcaudals are divided into more than 2 scales, there's 200 or more ventrals, 31-39 dorsal mid-body scale rows then the snake is of the genus *Lachesis* (within subtribe Lachesina subtribe nov.).

Content: *Bothriechis* Peters, 1859.

Tribe Lachesina Cope, 1900.

(Terminal Taxon *Lachesis muta*)

Diagnosis: The following diagnosis can be also used to separate the two subtribes within tribe Lachesini tribe nov., namely Bothriechisina subtribe nov. and Lachesina subtribe nov. These snakes are diagnosed and separated from all other vipers in the Western Hemisphere by the following characteristics: Tail does not end in a button or rattle, if the tail is strongly prehensile where the distal portion curves down in life or in preservative, then it will have a short and blunt spine and the subcaudals will be undivided (Genus *Bothriechis*, subtribe Bothriechisina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is a conspicuous supraocular spine or horn, then the genus is *Ophryacus* (within subtribe Lachesina subtribe nov.). If the tail is not strongly prehensile and the distal portion does not curve strongly downward in life or preservative and there is not a conspicuous supraocular spine or horn and the distal subcaudals are divided into more than 2 scales, there's 200 or more ventrals, 31-39 dorsal mid-body scale rows then the snake is of the genus *Lachesis* (within subtribe Lachesina subtribe nov.).

Content: *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.

Tribe Trimeresurusini Tribe Nov.

(Terminal Taxon: *Trimeresurus gramineus*)

Diagnosis: An Asian tribe of pitvipers, it includes all species from Asia and ajacent areas, except those from the genera *Calloselasma* and *Hypnale*, defined under their elsewhere in this account.

In terms of the pitvipers outside this tribe they are as follows:

The species taxon, *Calloselasma rhodostoma*, monotypic for the genus is the only Asian pit viper with large crown scales and smooth dorsal scales.

There are three species within the genus *Hypnale*. All are readily identified by their more-or-less upturned snouts that produce a sort of hump-nosed effect (hence the common name Hump-nosed Vipers). This separates them from all other vipers.

The size and shape of the vipers in the tribe Trimeresurusini Tribe nov. varies, but the greatest number are smallish and arboreal. The greatest degree of diversity is in the region of continental south-east Asia.

In the period between 1990 and 2012, numerous new genera have been described and generally recognised, the majority of species taxa being formerly assigned to the genus *Trimererusus*. 12 genera are listed as being the content of this tribe below, although further generic names have been proposed.

Coincident with this taxonomic work at the genus level, has been the descriptions of numerous species taxa, most restricted in known distribution to small areas, often associated with mountains or other "island" habitats.

Content: *Cryptelytrops* Cope, 1860; *Gloydius* Hoge and Romano-Hoge, 1981; *Himalayophis* Malhorta and Thorpe, 2004; *Ovophis* Burger, 1981; *Oxyus* Hoser, 2012; *Parias* Gray, 1849; *Popeia* Malhorta and Thorpe, 2004; *Protobothrops* Hoge and Romano-Hoge, 1983; *Triceratolepidophis* Ziegler et al., 2000; *Trimeresurus* Lacépède, 1804; *Viridovipera* Malhorta and Thorpe, 2004; *Zhaoermia* Zhang, 1993.

Tribe Tropidolaemusini Tribe Nov.

(Terminal taxon: *Tropidolaemus wagleri*)

Diagnosis: A tribe of Asian pitvipers consisting of three genera and herein defined by each genus.

Deinagkistrodon is a monotypic genus for the species *D. acutus*, found in in southern China (Chekiang, Fukien, Hunan, Hupeh, Kwantung), Taiwan, northern Vietnam, and possibly Laos. It's commonly known as the Sharp-nosed Viper.
It is separated from other Asian pitvipers by the following suite of characters:

The back is light brown or greyish brown, with a series of dark brown lateral triangles on each side. The two pointed tops of the two opposite triangles meet each other at the mid-line, forming a series of about twenty light brown, squarish blotches on the back. A row of large black spots extends along each side near the belly. The top and upper sides of the head are uniformly black, with a black streak from the eye to the angle of the mouth; yellowish below, spotted with dark brown. The young are much lighter than the adults with essentially the same pattern. The head is large, triangular, with an upturned snout. The body is very stout. The tail is short, ending in a compressed, pointed slightly curved cornified scale. The top of the head is covered with nine large plates. Dorsal scales are strongly and tubercularly keeled. Subcaudals mainly divided, some anterior are single. Ranges from 0.8 to 1.0 metre (2.6 and 3.3 ft) in total length, with the longest recorded length being a male of 61 inches or 1.549 metres (5.08 ft).

Garthius is monotypic for the species *chaseni*, known as *Chasen's mountain pit viper.*

It's a small, stocky terrestrial pitviper, not exceeding a metre. Dorsally it's brownish with irregular blackish, light-edged blotches which become transverse bands posteriorly. The belly is yellow with grey specks. There's an oblique black stripe behind the eye bordered below with white.

Currently known only from Mt. Kinabalu, Borneo (Indonesia).

Garthius is separated from other Asian Pitvipers by the following suite of characters: Scalation includes 15-19 dorsal mid-body scale rows, 130-143 ventrals, 20-30 divided subcaudals and 6 supralabials with the third being the highest.

Tropidolaemus is a genus of five currently described species, commonly known as the Temple Vipers. The genus is separated from other Asian pitvipers including the superficially similar *Trimeresurus* by the following suite of characters: absence of a nasal pore, the upper surfaces of the snout and head are covered with distinctly covered small scales, strongly keeled gular scales, second supralabial not bordering the anterior margin of the loreal pit and topped by a prefoveal, and a green colour in juveniles that may or may not change with age.

Content: *Deinagkistrodon* Gloyd, 1979; *Garthius* Malhorta and Thorpe, 2004; *Tropidolaemus* Wagler, 1830.

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SUMMARY OF CURRENT VIPER CLASSIFICATION (HOSER 2012)

FAMILY VIPERIDAE

SUBFAMILY AZEMIOPINAE

Content: *Azemiops* Boulenger, 1888.

Tribe Azemiopini Liem, Marx and Rabb 1971.

(Terminal Taxon: *Azemiops feae*)

Content: *Azemiops* Boulenger, 1888.

SUBFAMILY VIPERINAE (PITLESS VIPERS)

Content: See for each tribe.

Tribe Atherini Groombridge 1986

(Terminal Taxon: *Atheris chlorechis*)

Content: *Adenorhinos* Marx and Rabb, 1965; *Atheris* Cope, 1862; *Montatheris* Broadley, 1996; *Proatheris* Broadley, 1996.

Tribe Bitisini Tribe nov.

(Terminal Taxon: *Bitis arietans*)

Content: *Bitis* Gray, 1842 (including all defined subgenera).

Tribe Causini Cope 1860

(Terminal Taxon: *Causus maculatus*)

Content: *Causus* Wagler, 1830.

Tribe Cerastini Tribe nov.

(Terminal Taxon: *Cerastes cerastes*)

Content: *Cerastes* Laurenti, 1768.

Tribe Echiini Tribe nov.

(Terminal Taxon: *Echis carinatus*)

Content: *Echis* Merrem, 1820.

Tribe Proatherini Tribe nov.

(Terminal Taxon: *Proatheris superciliaris*)

Content: *Proatheris* Broadley, 1996.

The genus is monotypic for the species: *Proatheris superciliaris.*

Tribe Pseudocerastini Tribe. Nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Content: *Eristicophis* Alcock and Finn, 1897; *Pseudocerastes* Boulenger, 1896.

Subtribe Pseudocerastina Subtribe. nov.

(Terminal Taxon: *Pseudocerastes persicus*)

Content: *Pseudocerastes* Boulenger, 1896.

Subtribe Eristicophina Subtribe. nov.

(Terminal Taxon: *Eristicophis macmahonii*)

Content: *Eristicophis* Alcock and Finn, 1897.

Tribe Viperini Laurenti, 1768.

(Terminal Taxon: *Vipera aspis*)

Content: *Daboia* Gray 1842; *Maxhoservipera* Hoser, 2012 (see Hoser 2012e); *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999; *Vipera* Laurenti 1768.

Subtribe Maxhoserviperina Subtribe nov.

(Terminal Taxon: *Maxhoservipera palaestinae*)

Content: *Daboia* Gray, 1842; *Maxhoservipera* Hoser, 2012 (see Hoser 2012e).

Subtribe Montiviperina Subtribe nov.

(Terminal Taxon: *Montivipera xanthina*)

Content: *Macrovipera* Reuss, 1927; *Montivipera* Nilson et. al., 1999.

Subtribe Viperina Laurenti, 1768.

(Terminal Taxon: *Vipera aspis*)

Content: *Vipera* Laurenti 1768.

SUBFAMILY – CROTALINAE (PITVIPERS)

Content: See for each tribe.

Tribe Adelynhoserserpenini Tribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Content: *Adelynhoserserpenae* Hoser, 2012 (See Hoser 2012a); *Atropoides* Werman, 1992; *Cerrophodion* Campbell and Lamar, 1992; *Porthidium* Cope, 1871.

Subtribe Porthidiumina Subtribe nov.

(Terminal Taxon: *Porthidium ophryomegas*)

Content: *Porthidium* Cope, 1871.

Subtribe Cerrophidionina Subtribe nov.

(Terminal Taxon: *Cerraphodion godmanni*)

Content: *Cerraphodion* Campbell and Lamar, 1992; *Atropoides* Werman, 1992.

Subtribe Adelynhoserserpenina Subtribe nov.

(Terminal Taxon: *Adelynhoserserpenae nummifer*)

Content: *Adelynhoserserpenae* Hoser, 2012 (See Hoser 2012a).

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Tribe Akistrodonini Tribe Nov.

(Terminal Taxon *Agkistrodon contortrix*)

Content: *Agkistrodon* Palisot de Beauvois, 1799.

Tribe Calloselasma Tribe Nov.

(Terminal taxon: *Calloselasma rhodostoma*)

Content: *Calloselasma* Cope, 1860; *Hypnale* Fitzinger, 1843.

Tribe Crotalini Gray, 1825

(Terminal Taxon *Crotalus horridus*)

Content: *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus* Linnaeus, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Piersonus* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.

Subtribe Crotalina Subtribe nov.

(Terminal Taxon *Crotalus horridus*)

Content: *Aechmophrys* Coues, 1875; *Caudisona* Laurenti, 1768; *Crotalus Linnaeus*, 1758; *Cummingea*, Hoser 2009; *Hoserea* Hoser, 2009; *Matteoa* Hoser, 2009; *Sistrurus* Garman, 1883; *Uropsophus* Wagler, 1830.

Subtribe Piersonina Subtribe nov.

(Terminal Taxon *Piersonus ravus*)

Content: *Piersonus* Hoser, 2009.

Tribe Jackyhoserini tribe nov.

(Terminal Taxon: *Jackyhoserea pictus*)

Content: *Bothriopsis* Peters, 1861; *Bothrocophias* Cutberlet and Cambell, 2001; *Bothropoides* Fenwick, et. al., 2009; *Bothrops* Wagler, 1824; *Jackyhoserea* Hoser, 2012 (See Hoser 2012c); *Rhinocerophis* Garman, 1881.

Subtribe Bothropina Subtribe nov.

(Terminal Taxon: *Bothrops lanceolatus*)

Content: *Bothriopsis* Peters, 1861; *Bothrops* Wagler, 1824.

Subtribe Bothropoidina Subtribe nov.

(Terminal Taxon: *Bothropoides neuwiedi*)

Content: *Bothropoides* Fenwick, et. al. 2009.

Subtribe Rhinocerophiina Subtribe nov.

(Terminal Taxon: *Rhinocerophis nasus*)

Content: *Rhinocerophis* Garman, 1881.

Subtribe Jackyhoserina Subtribe nov.

(Terminal Taxon: *Jackyhoserea pictus*)

Content: *Jackyhoserea* Hoser, 2012 (See Hoser 2012c).

Subtribe Bothrocophiina Subtribe nov.

(Terminal Taxon: *Bothrocophias hyopora*)

Content: *Bothrocophias* Cutberlet and Cambell, 2001.

Tribe Lachesini Cope, 1900.

(Terminal Taxon *Lachesis muta*)

Content: *Bothriechis* Peters, 1859; *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.

Subtribe Bothriechisina Subtribe nov.

(Terminal Taxon *Bothriechis nigroviridis*)

Content: *Bothriechis* Peters, 1859.

Tribe Lachesina Cope 1900.

(Terminal Taxon *Lachesis muta*)

Content: *Lachesis* Daudin, 1803; *Ophryacus* Cope, 1887.

Tribe Trimeresurusini Tribe Nov.

(Terminal Taxon: *Trimeresurus gramineus*)

Content: *Cryptelytrops* Cope, 1860; *Gloydius* Hoge and Romano-Hoge, 1981; *Himalayophis* Malhorta and Thorpe, 2004; *Ovophis* Burger, 1981; *Oxyus* Hoser, 2012 (see Hoser 2012d); *Parias* Gray, 1849; *Popeia* Malhorta and Thorpe, 2004; *Protobothrops* Hoge and Romano-Hoge, 1983; *Triceratolepidophis* Ziegler et al., 2000; *Trimeresurus* Lacépède, 1804; *Viridovipera* Malhorta and Thorpe, 2004; *Zhaoermia* Zhang, 1993.

Tribe Tropidolaemusini Tribe Nov.

(Terminal taxon: *Tropidolaemus wagleri*)

Content: *Deinagkistrodon* Gloyd, 1979; *Garthius* Malhorta and Thorpe, 2004; *Tropidolaemus* Wagler, 1830.