I	MAJOR RISK	The frequency of envenomation by this snake is high, and the venom is highly toxic.
II	MODERATE RISK	The frequency of envenomation by this snake is moderate, and the venom may be highly toxic to mildly toxic.
III	MINOR RISK	The frequency of envenomation by this snake is low, and the venom may be moderately toxic to mildly toxic.
IV	LITTLE RISK	The frequency of envenomation by this snake is low, and the venom is only slightly toxic.

The major sources used in the production of this section are listed in the bibliography. Where differences of opinion exist between authors (such as the extent of the range of a particular species), both opinions are presented as possibilities.

Finally, the last section consists of a listing of currently available antivenoms. Antivenoms are very effective in reversing the effects of snake poisoning by inactivating the venom. Antivenoms are commercially prepared from horse serum, and are packaged as liquids or freeze-dried powders. For a *monovalent* antivenom, the material has proven effective only against the venom of the species it is named after. For a *polyvalent* antivenom, the poisons of several species (sometimes listed as part of the antivenom's name) will be inactivated. In a particular situation, one or more of these antivenoms may not be available. Thus, alternates are provided. Since manufacturers sometimes discontinue the production of certain antivenoms, they should be contacted prior to anticipated need to insure availability.

Measurement Abbreviations Used in this Study

m = meter
cm = centimeter = 0.01 m
mm = millimeter = 0.001 m
g = gram
kg = kilogram = 1000 g
mg = milligram = 0.001 g
μg = microgram = 0.000001 g

Venomous Snakes in Europe

The snakes described in this volume are those which may be present in some portion of the European continent: the land area bordered by the Ural Mountains on the east, the Caspian Sea, Caucasus Mountains, and Black and Mediterranean Seas on the south, and the Atlantic and Arctic Oceans to the west and north. The British Isles, Iceland, and the Mediterranean Islands are included.

In comparison to the other continents, Europe has both considerably fewer species of venomous snakes and fewer individuals in a species. There are only nine species of venomous snakes, and eight of these are in the genus *Vipera*. It is likely that the geological history, geography, and climate of Europe are responsible for this, as well as centuries of extensive agriculture and subsequent urbanization and industrialization. All these have contributed to a reduction in the number of habitats suitable for venomous as well as nonvenomous snakes. Presumably, the *Vipera* have survived by adapting to a relatively cool climate. Most species spend the winter in hibernation, and therefore show a seasonal variation in activity. *Vipera berus*, for example, may occur north of the arctic circle, up to 70° north latitude in Sweden and Finland.

A number of Atlantic islands are free of venomous snakes: Iceland, Spitsbergen, Ireland, and the Canary Islands. In the Mediterranean Sea, the Balearic Islands, Corsica, Sardinia, Malta, Crete, and the Greek Islands (with the exception of Milos, Kimilos, Polinos, Siphonos, and Euboia) are similarly free of venomous snakes. All smaller islands lack venomous species. The Atlantic Ocean and Mediterranean Sea are completely free of sea snakes.

SNAKE BITE

Section II

Medical Threat

The medical threat that follows a bite by a poisonous snake may be life- threatening, or it may be no more serious than a minor scratch. The determination of threat to life or limb for an individual snakebite case is not easy to make. Medical threat depends on many factors, some of which can be accurately assessed by personnel under field conditions, some of which can require assessment by trained medical personnel, and some of which only the outcome of the case can make clear.

The first factor to be assessed is the toxicity of the particular venom in question. Since snakes of a given species have the same venom, of the same toxicity, the critical aspect is determining the type or species of snake that caused the bite. The toxicity of venom is measured in the laboratory by the amount needed to result in a Lethal Dose in 50 percent of the experimental animals tested (LD_{50}). The venom amount is usually reported in milligrams of venom per gram of body weight of the particular experimental animal, or mg/g. This finding is then extrapolated to man; for an average adult weighing 70 kg, amounts of venom ranging from 50 mg to 500 mg are typically necessary to result in a fatality.

The second important threat factor is determining the amount of venom introduced into the victim by the snake. This varies with the size of the snake, the amount of venom the snake had stored, and the character of the strike. The size of the snake is important, since larger snakes will generally have proportionally larger fangs and venom glands. Consequently, they will *have the capability* to deliver larger amounts of venom than smaller specimens of the same species, and more than a young, immature specimen of that species.

The character of the strike can affect the severity of envenomation by limiting the amount of venom actually delivered. A bite which is only a glancing or scratch-like bite, or one delivered through several layers of clothing (and thus penetrating less deeply into the tissue), or one which is directly over a bone, will often result in a less severe envenomation than would otherwise have occurred.

Finally, there are cases of snakebite with no apparent envenomation. There is no clear explanation for these cases. Unfortunately, this cannot be determined until the ultimate outcome of the bite is known.

Because of these multiple factors which influence the ultimate severity of a given envenomation, the most serious envenomation should be expected and preparations made. When trained medical personnel are available, they *may* be able to determine the risk as being less serious and take appropriate steps. However, if personnel in the field have not taken initial steps, and if the envenomation does turn out to be serious, the subsequent danger will be significantly greater.

Types of Venom

The venom of a given species of snake is a complex mixture of toxins and nontoxic, but physiologically active materials. There are three categories of toxins. *Neurotoxins* affect the nervous system usually by blocking nerve transmission. They have multiple effects, but the immediate threat is their effect on muscle action and coordination, particularly to the breathing muscle, the diaphragm. *Hemotoxins* affect the circulatory system in a variety of complex ways. They may potentiate or interfere with blood clotting and/or cause hemolysis (massive breakdown of blood cells). These actions have many serious secondary results. However, the primary initial danger posed by hemotoxins is their ability to allow leakage of fluid from the blood into the tissue causing edema (localized or generalized swelling) with consequent circulatory collapse (a precipitous loss of blood pressure). This may result in failure of effective heart function. *Necrotoxins* and nontoxic enzymes capable of destroying tissues can interfere with local blood flow and salt balance in a region of the body near the bite. If this destruction is not contained, cell and tissue death will follow.

All snake venoms are complex mixtures, of varying amounts of these active materials; thus their symptoms of envenomation will be complex. However, the primary effects of envenomation by the more dangerous snakes are known. Hence, symptoms can be anticipated to a great degree if the snake can be identified. (See Section III.) Furthermore, the primary treatment principles described below will eliminate or minimize the damage done by an envenomating bite from virtually all snakes.

Immediate Field Treatment

Snakebite victims will not die immediately. Even massive envenomation by most species of poisonous snakes can be successfully treated one to two hours later; therefore, if other circumstances are more life-threatening, attend to them first.

However, if possible, do one thing before attending to other circumstances:

Identify the Snake.

Unless you are an expert, do this by killing it, ideally without destroying the head. Cut the head off or shoot it behind the head. Do *not* handle the head, as reflex muscle action may cause envenomation. Evacuate the dead snake (head and body) along with the victim.

Arrange for Evacuation.

Do this as soon as the situation will allow. In a medical facility equipped to maintain stable body functions and with antivenom available, no one need die of snakebite. In the field, an untreated victim may die.

Keep the Victim Calm.

This will keep heartbeat and blood pressure at a minimum, and slow absorption and spread of the venom. As most bites are on the arms or legs, a semi-prone position, face up, with the head and shoulders elevated will keep blood flow in and out of the injured extremity at a minimum. A cool, comfortable place further reduces anxiety.

Reduce the Spread of the Venom.

In order to survive, tissue needs some blood supply. It is possible to cut off *all* blood via a tight tourniquet or by packing in ice. Do *not* do so. Instead, reduce the lymphatic flow and the blood flow in the surface blood vessels by mild constriction using compression bands or bandages. These should initially be placed about eight cm above—and, if necessary, below—the wound. Pulse should still be apparent below the band, and it should be possible to slip two fingers between the band and the skin. Compression should not be continued more than two hours without several minutes interruption. Should any swelling or discoloration move beyond the compressed area, move the band to contain it. Ideally, this should be done with a second or third band secured before the bypassed one is released.

Inspect the Site of the Bite.

Look for fang marks. One or two deep puncture wounds 10 to 12 mm apart may be apparent. Other superficial tooth marks in a horseshoe pattern may be visible. Absence of fang marks does *not* mean the victim was not bitten or that the snake was *not* venomous.

Treat for Shock.

Shock can be expected to be an early symptom of envenomation. Its cause may be either the physiological action of the venom, or anxiety on the part of the victim, or, more commonly, a combination of both. Shock should be treated immediately. Early onset or severity of shock is not necessarily an indication of the severity of envenomation. The danger of shock exists for up to 48 hours after envenomation.

Symptoms of shock may include weakness, sweating, thirst, confusion, unconsciousness or semi-consciousness, coldness, cyanosis, absent pulse, or low or unrecordable blood pressure. These may appear within minutes of the bite, or may start as late as two days afterwards. In many instances, the shock is relatively transient, resolving spontaneously within hours. All of these symptoms can be induced or aggravated by fear or hysteria. Evidence of these symptoms of shock should not be taken as positive indicators of envenomation, nor should their severity be used as an index of the severity of envenomation. In all cases, however, the shock must be taken seriously and treated, whether or not envenomation has occurred.

Actions taken to reduce the spread of the venom are also effective for counteracting shock. Keep the victim prone, cool, and reassured. Loosen constricting clothing, and allow the victim to drink water in small amounts.

Symptoms of Snakebite Best Left Untreated.

- Bleeding may occur at the wound, especially in bites from *Viperidae* (vipers or adders). Internal bleeding may result in ecchymosis (black and blue discoloration) spreading from the bite. Bite wounds can be cleaned of blood and debris, and infection is *not* usually a problem.

- Pain and burning sensation may begin soon after envenomation. Lack of pain is no guarantee that envenomation has not occurred. Because most snake venoms have one or more neurotoxins, painkillers such as morphine may do more harm than good. This is the result of morphine's respiratory depression superimposed on a neurotoxin's inhibitory effect on diaphragm function.

- Local swelling usually begins within minutes. Mild constriction of the site should reduce the spread of swelling. Unless it interferes with other vital life processes such as an open airway, nothing more should be done.

- Vomiting is an irregular symptom which may begin as soon as a few minutes after envenomation. Keep the airway clear.

While these symptoms should be untreated, their appearance and progress, as well as the development of shock, should be recorded in as much detail as possible. This information will be helpful in further treatment.

Ineffective or Potentially Dangerous Actions.

- *Incisions* into the skin in an attempt to suction out the venom will often do more harm than good when attempted under field conditions by nonphysicians. There is danger to both blood vessels and nerves, and further opening of blood vessels may actually help spread the venom. The possibility of infection will also be greatly increased. Mechanical suction alone, without incision, will do no harm and may remove small amounts of venom. It also provides something positive to do for the victim. Suction by mouth carries a slight risk if the person doing it has an open sore or cut on the mouth or on the lips.

- *Deep cooling or tight tourniquets* can only hasten the death of tissue on limbs so treated and should be avoided.

- *Medicines* should be avoided unless it is known that they will not aggravate the envenomation symptoms. Potential further depressants of respiratory function, such as morphine, and depressants of blood clotting, such as aspirin, should especially be avoided.

Unlikely Events.

It is possible that the snake cannot be captured or that it is not even seen. If there is any indication of envenomation (fang marks, early symptoms, certainty of the victim), begin initial treatment. In this case, try to obtain the best record possible of symptoms as it may be useful in helping medical personnel to determine which antivenom to use.

Although not likely with today's highly mobile armed forces, there may be a situation in which an individual has received a snakebite and reaching a medical facility is not possible. However, antivenom is available but no medically qualified personnel are present. In this case there are three important considerations:

- Antivenom is made form large animal serum, and in a small number of individuals it can cause anaphylactic (allergic) reactions, ranging from mild to life threatening.

- Antivenom will rapidly reverse symptoms and prevent damage even when given up to several hours after envenomation.

- A large number of poisonous snake bites do not result in envenomation.

Therefore, it is very important that antivenom *not* be given immediately after a bite. For European vipers, the best indications of envenomation are local reactions, including severe local pain, swelling, and discoloration. Administration of antivenom by nonmedically qualified personnel would only be indicated if envenomation results in life or limb threatening situations. If the decision to administer antivenom is made, it is important to follow the package insert instructions carefully.

If reaching a medical facility is not possible and no antivenom is available, treat the symptoms to the best of your ability. No specific therapy other than antivenom is known.

It is beyond the scope of this book to discuss advanced medical treatment for poisonous snakebite. As mentioned earlier, this type of treatment (including administration of antivenom) should be left to medically qualified personnel in properly equipped medical facilities.

Prevention of Snakebite

Avoiding the circumstances in which snakebite is likely to occur is much simpler than treating a snakebite. Therefore, it is extremely important to eliminate debris and litter from areas frequented by humans. This attracts rodents and they in turn attract snakes. Further, it is important to make personnel aware of the indigenous snakes and their habits. Finally, it is necessary to monitor the behavior of personnel on post and in the field, to insure that their behavior minimizes snake encounters.

Proper dress in snake-infested areas is important. Combat boots will deflect bites by small and medium-sized snakes. This is particularly important during evening and night hours when the ground cannot be clearly seen.

Natural hiding places for snakes must be treated with caution. These include piles of stones, piles of dry branches and dry leaves, and piles of empty containers of any type (which serve as warm hiding places for snakes at night). Arboreal snakes can be found in trees and bushes, where they are able to search for birds. On warm spring days, snakes may be found emerging from hibernation and basking on rocks or wherever they can find warmth. Desert snakes conceal themselves by covering a portion of their bodies with loose sand. Personnel should be wary of these places, and should avoid reaching or walking into areas that they cannot see clearly. Similarly, they should avoid as much as possible sleeping on the ground. Clothes and shoes, if they were on the ground during the night, should be shaken well before being put on in the morning.

A snakebite in the upper portion of the body (face, neck, shoulders, chest, or back) is more dangerous than a bite in the area of the feet or hands. One must remember this when crawling through areas covered with vegetation or dry grass, in sandy regions, or on rocky slopes, especially during the evening and at night.

Personnel should not sit on piles of stones, piles of boards, or on discarded cans or boxes during breaks. They should avoid moving stones, bricks, concrete blocks, or logs with their bare hands. Instead, a long object (board, shovel, or pole) should be used first. Personnel should not dig with bare hands in concealed places.

Avoid "checking" a live or dead snake. Especially foolish is touching the teeth of a dead snake, since for quite a while after death the venom will retain its potency.

SPECIES

Section III

Vipera Ammodytes

Risk Category II, Moderate Risk. Frequency of envenomation by this snake is moderate, and the venom may be highly toxic to mildly toxic.

Names

Sand viper
Nose-horned viper
Zmije ruzkata (Czech)
Vipera-cu-corn (Rumanian)
Long-nosed viper
Vipera dal corno (Italian)
Pepeljanka (Bulgarian)

Subspecies

Five subspecies occur in Europe:

V. a. ammodytes: Western sand viper
V. a. meridionalis: Eastern sand viper
V. a. montandoni: Transdanubian sand viper
V. a. ruffoi: Sand viper
V. a. transcaucasiana: Transcaucasas sand viper

Identification

The average length of this snake is 0.6 to 0.75 m, with a maximum length of 0.9 m. Males are larger than females. The most distinguishing feature of the sand viper is the snout which looks like there is a horn on the tip of its nose. Both male and female sand vipers have a snout which ends with a strongly upturned appendage formed from soft, small scales. The head is almost triangular and distinct from the neck. The crown is covered by small scales of irregular size except for a single large scale over each eye. Head markings occur, but are not very distinctive, except for a dark line running from each eye to the corner of the mouth, and another spot directly underneath the eye. Occasionally snakes have such subdued colors that these marks are difficult to distinguish. The eyes have vertical pupils. The body is stout, and there is usually a prominent wavy or zigzag dorsal stripe with dark edges in both males and females. Occasionally, this stripe is broken up into a series of rhomboid blotches. The dorsal markings are more vivid and striking in the male. On each flank there is a series of faint spots. Dorsal body color is usually ash grey in males and grey-brown or brick-red in females, but much variation can occur and some specimens may be found with black-brown to yellowish or even pinkish coloration. The belly is yellow, brownish, or pinkish with small dark spots or blotches. The tip of the tail is pink or red.

SPECIES

Range of *Vipera Ammodytes* in Europe

VIPERA AMMODYTES

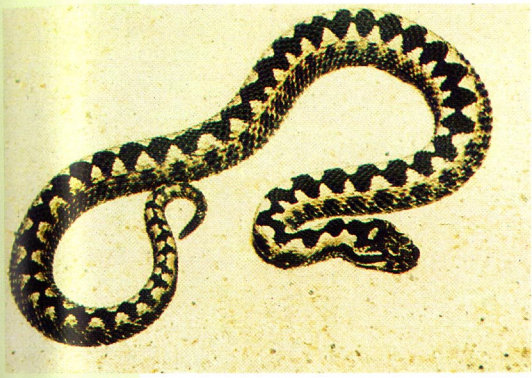


Figure 1. V. a. ammodytes (male). (Photo: Louisiana Purchase Gardens and Zoo, Monroe LA, by John H. Tashjian.)

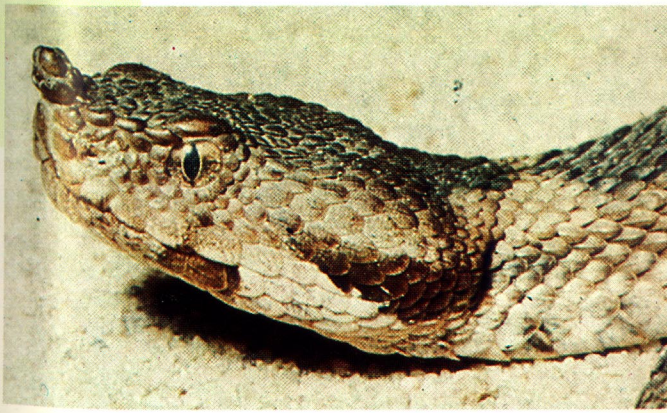
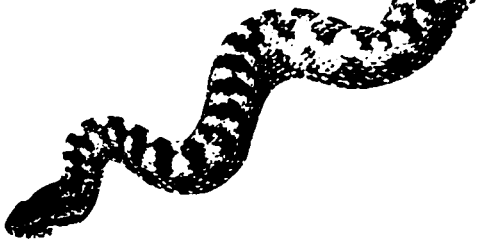


Figure 2. V. a. montandoni. Photo: (Western Zoological Supply, by John H.Tashjian.)

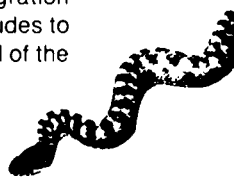


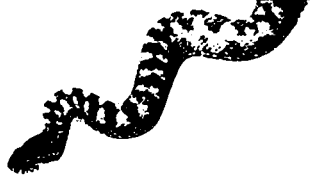
Distribution/Habitat

The range of this snake extends from the Caucasus, in southern Russia, through Turkey, Bulgaria, Albania, Greece, Yugoslavia, southern Romania, southern Hungary, southern Austria, and extreme northeastern Italy. It may also extend into southern Czechoslovakia. *V. a. ruffoi,* the largest of all *V. ammodytes* species, is found near the Swiss-Austrian border. The sand viper can be found in a wide variety of habitats, from the lower plains regions to areas with elevations as high as 2,500 m. It is most often found at moderately high altitudes in dry, sunny terrain with scattered bushes. It seeks gravelly, rocky hills with slopes facing the sun. It is also often found in open areas with few trees and bushes or in rock formations near cultivated fields. It is mainly a ground dweller, although it occasionally climbs into bushes.

Behavior

Vipera ammodytes hibernates from October to April over most of its range. Mating occurs a short time after it emerges from hibernation in late April or early May, and the sand viper can be found in groups during this time. It is a very sluggish and slow-moving snake. During sunny weather, it is apt to be found lying on a branch or rocks or on a pile of wood, sunning itself. The sand viper is not very aggressive. When annoyed it hisses loudly, but it still is not inclined to bite. However, if the disturbance continues, it will bite and it strikes with amazing quickness, considering how slowly it usually moves. It is typically most active in the evening, but this is due to the cooler temperatures rather than the amount of light. During the cooler months, its activity level is greater during the day. *Vipera ammodytes* displays seasonal migration patterns. Reports indicate that in areas of Yugoslavia it moves from high altitudes to the lower plains during the summer, and returns to the higher areas at the end of the summer.



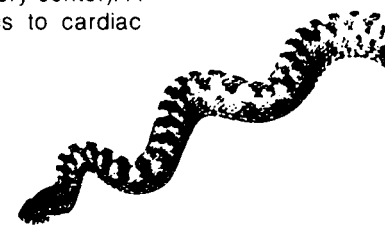


Threat

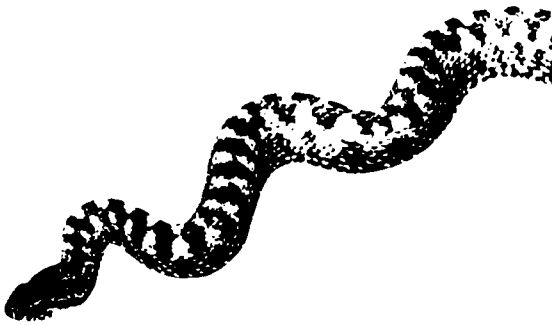
The sand viper has a highly toxic venom, and can inflict serious injury. It is considered by many authors as the most venomous snake in Europe. The LD_{50} of the venom, injected subcutaneously, has been calculated to be 6.59 μg/g; injected intraperitoneally, it has been calculated to be 0.19 to 0.64 μg/g. The venom, therefore, is relatively potent, and is almost as toxic as that of *Vipera russellii*, Sherlock Holmes' famous "speckled band." This, and two other factors, make this a very dangerous snake. The fangs are unusually long; in a large adult they may be up to 12 mm, allowing the snake to inject its venom deeply into the victim. Lastly, this snake tends to be found near cultivated fields, so encounters with humans are common. Fortunately, it is not an aggressive snake, and even when it does bite with venom glands filled, only about ten percent of the venom is typically injected. Nonetheless, deaths are recorded every year, especially in areas where antivenom is not readily available. This snake should be regarded with great caution.

Clinical Symptoms

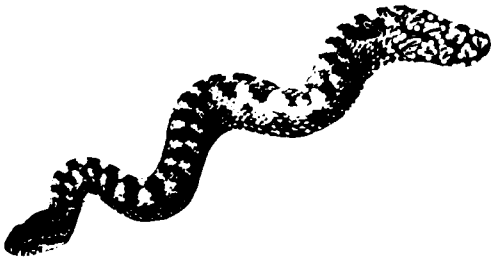
The venom of *Vipera ammodytes* is considered to have thrombinolytic and proteolytic activities. There is little or no clotting activity, and there is no direct hemolysis of red blood cells. A neurotoxic fraction has been found, but there appears to be no effect on the central nervous system. Two basic protein toxins have been isolated with phospholipase A activity, which produce effects similar to the whole venom. In addition to the typical viper symptoms, an intravenous injection produces a rapid fall in arterial blood pressure. This is believed to be due to the reaction with cellular membranes altering their permeability, but it is different than that produced by the release of histamine. Swelling then occurs, and this is followed by decreased muscular tension and coma (probably due to inhibition of the respiratory center). A respirator at this point is very helpful. Severe envenomation leads to cardiac disturbances and respiratory failure.



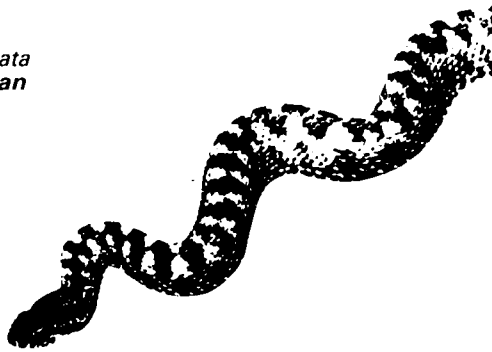
Kufi
Arabic



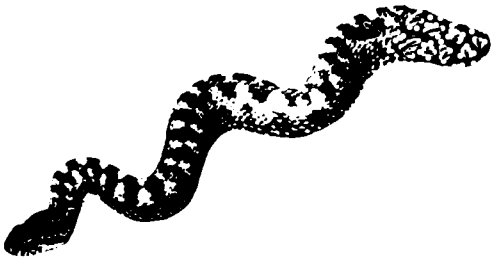
Berghuggorm
Swedish



Zmija Zygzakowata
Czechoslovakian



Levantadder
Dutch



Vipera-Cu-Corn
Romanian

Vipera Lebetina

Risk Category II, Moderate Risk. Frequency of envenomation by this snake is moderate, and the venom may be highly toxic to mildly toxic.

Names

Levantine viper
Blunt-nosed viper
Levantadder (Dutch)
Kufi (Arabic)
Lebetine viper
Levante-Otter (German)
Vipere lebetine (French)

Subspecies

Two subspecies occur in Europe:

V. l. obtusa: West-Asian blunt-nosed viper
V. l. schweizeri: Cyclades blunt-nosed viper

Identification

This is a large, robust snake with an average length of 0.75 to 1.15 m, and a maximum length of 1.8 m. It is the largest venomous snake found in Europe, and it can weigh as much as 3,000 g. Males are larger than females. The head is broad, triangular, and distinct from the neck. The sides of the head are almost at a right angle with the top of the head. The snout is rounded. The eyes are rather forward on the head; the pupils are vertical. The crown is covered with small, keeled scales, and there are no large scales, even over the eyes. The tail is short, about one sixth to one eighth of the total length, and it tapers abruptly. There is a dark line from each eye to the corner of the mouth, and usually a dark spot or blotch under each eye. There may also be found converging lines on top of the head, forming a V-mark. From the head to the tail along the back there is a double row of dark spots which may oppose or alternate with each other. The spots may be separate or joined to form a variety of patterns. On each flank there is a series of smaller spots. Both the dorsal spots and the flank spots are sometimes very faint and indistinct. All of these markings may be difficult to see on snakes with light coloration. The dorsal color can be quite variable and may range from light grey to khaki to reddish-brown. The belly is light grey to yellow, with small dark brown spots. The underside of the tail tip is yellow. Males usually have a different coloration and greater contrast than females. Females tend to be dark brownish, while males are lighter in color. In general, the coloration of the Levantine viper is not very vivid. Drab browns and light greys predominate. In sandy areas, this snake is almost uniformly dusty grey to khaki and with no markings. Young specimens are more striking and are often blue grey or even pinkish.

Distribution/Habitat

Principally an Asiatic snake, *Vipera lebetina* is found in Europe only in the Caucasus area and on a few islands in the Cyclade Archipelago (Milos, Kimolos, Polinos, and Siphonos). It occurs over a wide variety of habitats from marshes and plains at sea level to mountainous areas at elevations up to 2,100 m. In the northwest part of the Caucasus area and by the Caspian Sea its range extends even to semi-desert areas. In the Caucasus area it prefers rocky, hilly country at moderate elevations, with scattered bushes and adequate water supply. In the islands, it is found mostly in rocky river valleys with enough protection from the sun, often near cultivated fields. It is principally a ground dweller, but it can climb bushes and small trees.

Behavior

Since the Levantine viper is found in warmer regions, it is primarily a nocturnal snake. But in cooler months, it is often found during the daytime basking in the sunshine. It is very lethargic when encountered during the day, and it seems almost oblivious to stimuli. Local descriptions refer to this snake as "the deaf one" and "the blind one." It is more active in the evening and night, but it still appears sluggish. However, even though it appears unresponsive, it may strike quickly and savagely at any time. It will bite if molested.

Threat

The venom of the Levantine viper is only moderately potent, but its bite is considered to be very dangerous, mostly because of the size of the snake and its yield of venom. The $LD_{99.100}$ is 5.0 to 6.0 μg/g by subcutaneous injection; the LD_{50} is 0.8 μg/g by intravenous injection. Compared to other venomous snakes, these figures indicate only a moderate toxicity. However, the snake's large size results in a proportionally large yield of this venom, which is typically from 75 to 150 mg per snake. The lethal dose per average adult human has been estimated to be in the range of 70 to 75 mg. Therefore, the bite is potentially fatal, even when half of its venom supply is injected. Rats, which are this snake's major food source, die within seconds after being bitten.

Vipera libetina also has the unfortunate tendency to be found near farms and grazing areas, and it is feared by farmers and shepherds. In the small area of Europe that it is found, it is responsible for most of the serious snakebites which occur. It causes not only human fatalities, but also kills many sheep, goats, horses, cows, and camels.

Range of *Vipera Lebetina* in Europe

Figure 4. V. 1. schweitzeri (female). (Photo: Dallas Zoo, by David G. Barker.)

VIPERA LEBETINA

Figure 5. V. 1. lebetina (Photo: San Diego Zoo, by John H. Tashjian.)

Clinical Symptoms

The venom is hemolytic with proteolytic enzymes, phosphodiesterase activity, and coagulant and anticoagulant components. It also has some DNAse activity: the venom causes a fall in the nucleic acid content in the blood, spleen, and liver. The venom causes considerable hemolysis of red blood cells in humans. Envenomation causes sharp pain at the site of the bite, followed by local swelling and necrosis. Hemoptysis can appear 15 to 30 minutes after envenomation. This is followed by dizziness, weakness, a cold sweat, and a loss in blood pressure. In severe envenomation, the hemorrhaging spreads and this leads to hypovolemic shock. The shock can become irreversible, and death ensues.

Vipera Xanthina

Risk Category II, Moderate Risk. Frequency of envenomation by this snake is moderate, and the venom may be highly toxic to mildly toxic.

Names

Ottoman viper
Coastal viper
Berghuggorm (Swedish)
Near-East viper
Bergotter (German)

Identification

This is a large, robust snake with an average length of 0.7 to 0.95 m, and a maximum length of 1.35 m. It can attain a weight of as much as 1,500 g. It is similar to *Vipera lebetina*, and is considered by some authors as a subspecies of that snake. The head is large, slightly flattened, and distinct from the neck. The head is a little shorter than that of the Levantine viper. The crown is covered with small, keeled scales except for a single large scale over each eye. The nose is rounded and blunt, and lacks the nose horn seen in some of the other European vipers. The eyes have vertical pupils. The tail is slender and short, comprising about one eighth of the snake's total length. There are several bold, distinctive markings on the head region. Two dark lines extend from eye to the mouth. One drops vertically to the edge of the mouth, and the other extends backwards and diagonally to the corner of the mouth. There may also be two prominant converging stripes on the top of the head forming a V-mark with the vertex between the eyes. From the head to the tail, down the middle of the back, there is a series of irregular blotches which are often connected to form a wavy line. On each flank there is a series of dark circular or rectangular spots which sometimes alternate. There is often another row of smaller spots above the larger flank markings. The flanks appear darker than the top of the back. The pattern is more vivid in males than in females. Its dorsal color may be yellow, olive, or reddish brown. The belly is greyish in the male and yellowish with black or dark grey mottling in the female. The underside of the tail tip is often yellow or orange.

Distribution/Habitat

This predominantly Asian snake's range extends only slightly into Europe. It occupies a fringe of land along the coast of Eastern European Turkey around Istanbul. Reports indicate that it is also found in the southern Sporades Islands of Leros and Patmos, in the Aegean Sea off the west coast of Turkey. Its range may even extend into the Caucasus mountains. It is found in a variety of habitats, including swamps, rocky hillsides, and open grassy areas with few bushes or trees. It is most often found in areas with ample water, moisture, and vegetation. It is not found in sandy or desert regions.

The Ottoman viper can exist in large numbers around stream valleys and coastal areas. Places with a large rodent population attract this snake, and it is often found around populated areas in yards, fields, irrigation ditches, and gardens. It is mostly a ground dweller, but it can climb into small trees and bushes.

Behavior

The Ottoman viper is mostly nocturnal, since it occupies the warmer regions. It can be active in the day during the cooler months. It is similar in behavior to the Levantine viper in that it is lethargic and slow moving. It can, however, move rapidly when necessary, and it does strike quickly. It feeds on mice, birds, and lizards; usually it does not attack larger animals. It is not aggressive and avoids human confrontation, but reports indicate that it can have a rather short temper if disturbed or stepped on. When defending itself, it tends to roll up into a coil and emit a whisper-like sound. When this snake is encountered, the individual should walk away as quickly as possible.

Threat

Even though this snake is not unusually aggressive, numerous human encounters have been reported in areas it occupies, and in these regions it is a major cause of serious snakebite. The venom is only moderately potent, with an $LD_{99\text{-}100}$ of 2.2 to 6.7 μg/g (subcutaneous injection), an LD_{50} of 0.5 μg/g (intravenous injection), and an LD_{50} of 2.6 μg/g (intraperitoneal injection). Although these figures fail to indicate any unusual risk, the venom yield is very high, with between 50 and 200 mg typically carried by the adult snake. The lethal dose for man has been estimated to be about 75 mg, and this amount can be easily delivered by an adult Ottoman viper. Fortunately, in any single bite, this snake seldom injects more than a small amount of its stored venom. In experiments done with a subspecies, not found in Europe, *Viper xanthina palestinae*, the viper never injected more than 50 percent of its stored venom; the average amount injected was 11 percent. It also required several weeks to restore its venom supply. Nonetheless, deaths occur rather frequently, and the mortality rate has been determined to be approximately five percent. This snake should be treated with great caution.

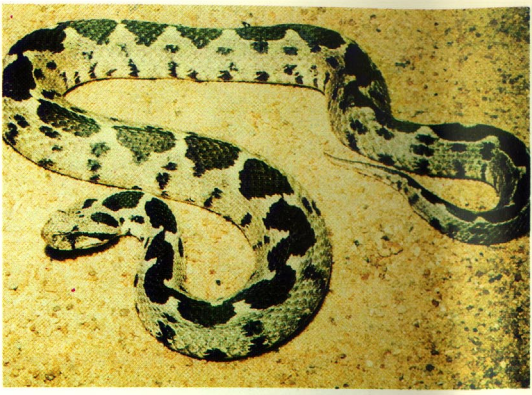
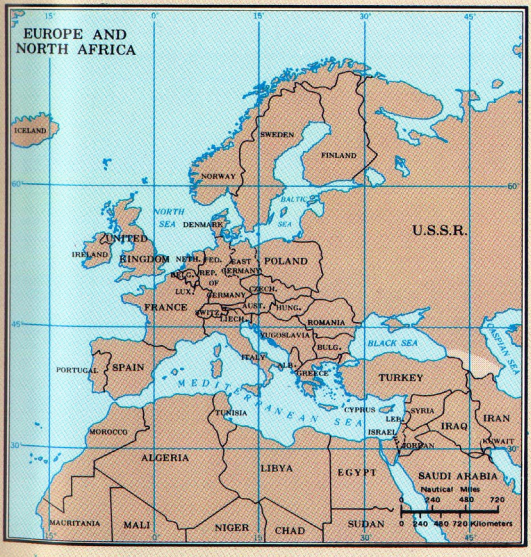


Figure 7. V. xanthina. (Photo: San Antonio Zoo, by John H. Tashjian.)

Figure 8. V. xanthina (female). (Photo: Dallas Zoo, by David G. Barker.)

VIPERA XANTHINA

Figure 9. V. xanthina. (Photo: Richard Schneider.)



Range of *Vipera Xanthina* in Europe

Clinical Symptoms

The venom of the Ottoman viper is hemolytic with proteolytic enzymes, phospholipase, hyaluronidase (all factors which modify blood coagulation), and an active neurotoxin. Envenomation causes sharp pain and local swelling which expands in all directions. The area can become discolored from internal bleeding and blisters, or pimples with pus can develop several hours after the swelling starts. Without treatment, the swelling can progress for days. The local lymph glands can enlarge and are painful to touch. Fifteen to thirty minutes after envenomation, the victim will feel dizzy and weak; he is likely to have cold sweats, and may want to vomit. Initially, shock may be observed which is due to a depression of the central autonomic regulatory mechanism, due to the neurotoxin component of the venom, and causing a fall in the blood pressure. With time, local hemorrhaging spreads, and the decrease in blood volume causes hypovolemic shock. In severe envenomation, this shock becomes irreversible, and death ensues. A good indicator of severe envenomation is that if thrombocytopenia occurs (with a platelet count below 5,000), the diagnosis is poor. A second cause of death may be hemorrhage which eventually causes irreversible damage to vital organs.

Vipera Aspis

Risk Category III, Minor Risk. Frequency of envenomation by this snake is low, and the venom may be moderately toxic to mildly toxic.

Names

Asp viper
Aspis-Otter (German)
Vipera aspide (Italian)
European viper
Vipere commune (French)
Vibora aspid (Spanish)

Subspecies

Six subspecies occur in Europe:

V. a. aspis: Asp viper
V. a. atra: Asp viper
*V. a. franciscired*i: Asp viper
V. a. hugyi: South Italian asp viper
V. a. montecristi: Monte Cristo asp viper
V. a. zinnikeri: Gascony asp viper

Identification

The asp viper, in all of its subspecies, is a small, robust viper with an average length of 0.45 to 0.6 m, and a maximum length of 0.75 m. Males are larger than females. *V. a. hugyi*, from southern France and Italy, is larger and heavier. In all subspecies, the head is triangular and distinct from the neck. The back of this snake's head is broader than that of *V. berus*. (This is an important, although somewhat fine, point of comparison, since these two species are approximately the same size, and have considerable overlap in their ranges.) The shields on the crown are fragmented with only two or three of them enlarged. Head marks are not well defined. The snout is distinctly upturned, but lacks the prominant nose-horn seen in *Vipera ammodytes*. The eyes have vertical pupils, and the upper half of the iris is gold or yellowish in color, while the lower part is a dark orange color. From the neck to the tail, down the middle of the back, there is a series of elongated rectangular blotches which cross the back and almost reach the middle of the flank. These blotches are sometimes joined by a narrow streak to form an exaggerated zigzag line. In southern Europe these markings often appear as a series of oval blotches. On each flank there is a row of dark spots or short bars which alternate with the dorsal markings. Its dorsal color may be grey, yellowish, light brown, or reddish brown. In the Alpine region completely black specimens (*V. a. atra*) are found, especially at altitudes over 1,000 m. The belly may be light grey, yellowish, or dark grey with lighter flecks. The underside of the tail tip is often yellow or orange.

Distribution/Habitat

This species of *Vipera* is found only in Europe. Its range extends from the Pyrenees through Switzerland, Italy, Sicily, central and southern France, extreme southern Germany, southern Austria, and western Yugoslavia. The asp viper can tolerate very cold weather and has been observed to move about in temperatures as low as 5°C. It can also tolerate high, wet mountainous regions and in the Alps it has been found at elevations up to 3,000 m. It tends, however, to occupy warmer regions and is found most often in dry, hilly habitats at lower elevations. It seeks open rocky hillsides exposed to the sun. Some reports indicate that it is prevalent on chalk hills or in limestone areas.

Figure 11. V. a. zinnikeri. (Photo: San Antonio Zoo, by John H. Tashjian.)

Figure 12. V. a. aspis. (Photo: San Antonio Zoo, by John H. Tashjian.)

Figure 13. V. aspis. (Photo: Richard Schneider.)

Range of *Vipera Aspis* in Europe

VIPERA ASPIS

Behavior

The asp viper hibernates during the winter months and emerges during April through October. It is diurnal during the cooler months in the spring and autumn, but becomes nocturnal during the hot summer months. Its activity is greatly dependent on the surrounding temperature. In cooler weather it hunts during the day, and at night, when it becomes too cold, it retreats to a concealed shelter until the morning. Like other vipers, it takes advantage of sunny days and spends a great deal of time in a rather motionless state, basking in the sun. In warm weather, the daytime is too hot for the asp viper, and it hunts mostly in the evening. The maximum temperature it can tolerate is 37°C. During the day, it remains under cover, usually beneath plant growth or under other protection. Individual snakes do not range very far, but tend to stay in the same area. The same snake can be found in the same locale even for several years. Especially in the hot summer months, it will not move about unless there is sufficient plant protection. It is solitary in habit, and is usually found in the company of other asp vipers only during the mating season, which occurs during April and May. The asp viper is not an aggressive snake; on the contrary, it frequently appears rather sluggish. When approached, it tends to stop and freeze. It usually does not attack, and the best policy when confronted by this snake is to walk slowly away. If an individual does not notice the snake and advances to a point where he threatens or disturbes the snake, *Vipera aspis* will bite.

Threat

The venom of Vipera aspis is considered to be moderately potent. The $LD_{99\text{-}100}$ is 3.0 to 6.0 μg/g by subcutaneous injection. This is slightly more potent than *V. berus*, but less so than *V. ammodytes*. The LD_{50} by intravenous injection is 1.0 μg/g, and 4.1 μg/g by intramuscular injection. The venom yield per snake is typically very small compared to other venomous snakes. And since only a fraction of the venom is injected at one time, the bite is not likely to present a serious threat to a healthy adult. It is painful, and it may take several weeks for a bitten individual to recover, but a bite is normally not fatal. Still, this snake should be treated with caution. It is responsible for many bites over its range, and fatalities have been recorded. Death can result if the venom is introduced directly into a vein.

Clinical Symptoms

The venom of the asp viper is hemorrhagic, with phospholipase, hyaluronidase, and protease activity. It also contains factors that modify blood coagulation. It does not appear to have any neurotoxin activity. Envenomation results in a sharp pain which can spread over the entire part of the body where the bite occurred. Swelling and discoloration often follow, leading to a hemorrhagic necrosis. After a few hours there can be vomiting, a dazed sensation, a weakening pulse, and subnormal body temperatures. These symptoms will subside in a mild case of envenomation, but will continue for several days in severe envenomation. Further complications can occur later, and jaundice, renal impairment, and liver damage may develop.

Vipera Berus

Risk Category III, Minor Risk. Frequency of envenomation by this snake is low, and the venom may be moderately toxic to mildly toxic.

Names

Adder
European viper
Cross adder
Vipere Peliade (French)
Common adder
Northern viper
Kreuzotter (German)
Vipera rossa (Italian)

Subspecies

Three subspieces occur in Europe:

V. b. berus: Adder
V. b. bosniensis: Balkan cross adder
V. b. seoanei: Iberian cross adder

Identification

The average length of this snake is 0.5 to 0.6 m, with a maximum length of 0.9 m. Females are larger than males. *V. berus* has a characteristic stout body that is slightly flattened, making it longer in width than in height. The head is ovoid in shape, and only slightly broadened toward the rear. The top of the head has five large smooth shields. The snout is broadly rounded and lightly overhanging, but it is not clearly upturned as in some other European vipers. The eyes have brown irises. Beneath the eye is a row of small scales. (This is important in distinguishing this poisonous snake from the nonpoisonous look-alike, the Ringelnatter. The nonpoisonous Ringelnatter has round pupils, and several (2 to 3) large scales beneath the eye.) There are two dark curved lines at the top of the head between the eyes that look like V-marks and which start in front of the eyes and extend backwards. These marks tend to merge to form a single X-mark. There is a distinct dark zigzag mark running down the back of the head to the tail, with a series of spots on each flank opposite the indentations of the stripe. The tail is sharply tapered about 100 to 150 mm from the tip of the tail. In the Iberian cross adder (*V. b. seoanel*) the flank spots sometimes fuse to form three parallel bands. The basic coloration is grey in males and brown in females. However, the color can be quite variable and usually depends on local environment. The dorsal color will range from grey through copper to brown or uniformly black. *V. b. seoanei*, in particular, are commonly found as black specimens. The belly may be grey, grey-brown, or black, and is sometimes marked with white spots. The tail tip is yellow, orange, or reddish orange. Males have more vivid and contrasting patterns. Females tend to be darker; they frequently are dark brown and, in mountainous regions and in swampy areas, are almost black.

Range of *Vipera Berus* in Europe

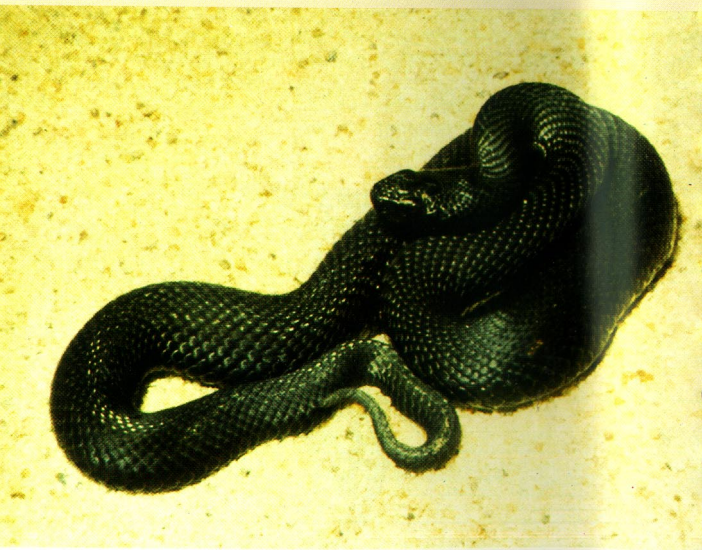


Figure 15. V. b. seoanei. (Photo: Louisiana Purchase Gardens and Zoo, by John H. Tashjian.)

Figure 16. V. b. berus (male). (Photo: Richard Schneider.)

VIPERA BERUS