



Venomous Snakes

- By Kedar Bhide

Kedar Bhide is a snake expert from Mumbai. A postgraduate from Mumbai's Haffkine Institute, his work has resulted into first records of 2 snake species for India, Barta (Kaulback's Pit Viper) from Arunachal Pradesh and the Sind Awl-headed snake from Rajasthan.

“ Moments after being bitten, the man feels a live fire germinating in the wound as if red hot tongs contorted his flesh; that which was mortified enlarges to monstrosity, and lividness invades him. The unfortunate victim witnesses his body becoming corpse piece by piece; a chill of death invades all his being, and soon bloody threads fall from his gums; and his eyes, without intending to, will also cry blood, until, beaten by suffering and anguish, he loses the sense of reality. If we then ask the unlucky man something, he may see us through blurred eyes, but we get no response; and perhaps a final sweat of red pearls or a mouthful of blackish blood warns of impending” (This is an introduction of a book written in 1931 by a Costa Rican Biologists and snakebite expert Clodomiro Picado.)

INTRODUCTION

Human fear of snakes is caused almost entirely by those species that can deliver a venomous bite. It is somewhat ironic that such a minority group, like venomous snakes has endangered the whole kingdom of snakes.

Let us start by correcting a frequent misnomer. People often refer to poisonous snakes, and indeed by directory definition, this is not incorrect. But as a student of herpetology we should be more specific in our terminology. A poisonous snake, like poisonous frog or a poisonous plant would make you sick when you eat them. There are no snakes that make you sick when you eat them. In fact, snake meat is considered delicacies in some countries.

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What do you mean by venom and venomous animals?

Biological toxins produced in specialized glands and injected into other organisms by spurs, stingers, spines or teeth is called venom and those animals, which are capable of doing this, are called venomous animals.

Why do snakes have venom?

Snakes ability to produce venom evolved primarily as a means of subduing prey, although at times, they may also use it as a defense mechanism. Venom is formed from modified saliva, a mixture of proteins and enzymes that originally served to aid the digestion of the prey. The stronger these digestive juices, more powerful is the venom, so the distinction between venomous and non-venomous snakes is blurred. Generally, snakes, which are classified as venomous, are those with specialized teeth that deliver venom deep into the body of their prey. However, there are some species without modified teeth that can also produce venom.

Venom apparatus:

The venom injection mechanism of snakes closely resembles a hypodermic syringe in basic design. The syringe has a storage vessel for the fluid to be injected (the barrel), a pump (the plunger), and a delivery channel (the needle). The respective analogue for venom injection in snakes are oral glands for manufacture and storage; jaw musculature for supplying pressure, and teeth for introducing toxin secretions into other organisms. Each of these structures varies in structure and function among venomous snakes.

Venom Glands:

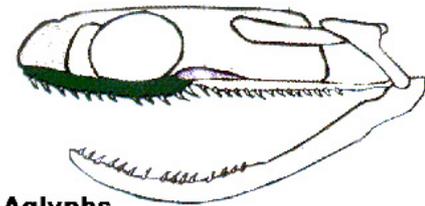
True venom glands, with a thick connective tissue capsule, a lumen, a separate compressor musculature, and a duct connecting to a single fang, are found in elapids and viperids. These glands are evolved from salivary glands. The secreted venom drops in to collecting tubes, where it is stored, there is no specialized storage area.

In most of the colubrids, these glands have derived from some large labial glands, composed of branched out tubules found in a mass of conjunctive tissue. These are called Duvernoy's glands. These glands open by a duct at the base of the grooved teeth.

Venom Fangs:

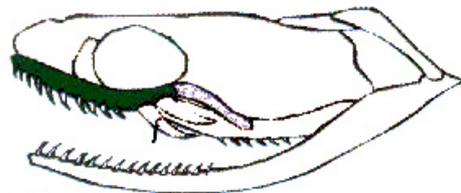
Fangs are larger than other teeth, with a groove that is more or less deep and closed, by which the venom drips and which facilitates it's injection during the bite. These fangs are often separated from the other teeth by a space, the diastema. Snakes are classified in to four groups according to their teeth.

1. Aglyphs (In Greek it means Without groove)– They have no fangs and usually no venom glands, although some colubrids secrete saliva with some toxic properties.



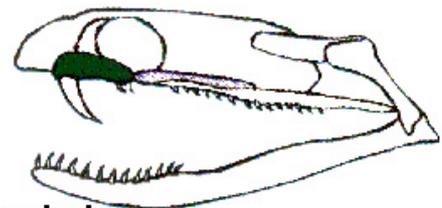
Aglyphs

2. Opisthognathids (In Greek it means groove at the back)– In this group one of the back teeth on each side of the upper jaw is usually larger than others, and it's grooved. The front teeth are small and cone shaped, sometimes grooved, but never connected to venom glands.



Opisthognathids

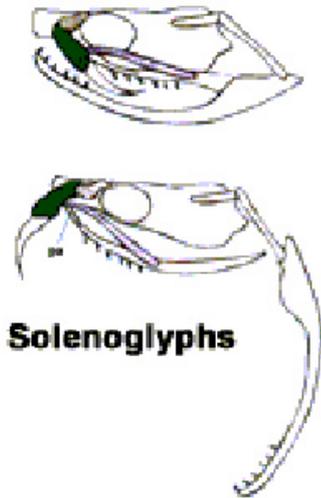
3. Proterognathids (In Greek it means a groove at the front)– Species with one or more fangs towards the front of the maxillary bone are proterognathids.



Proterognathids

These fangs correspond to the jaw's most anterior teeth.

4. Solenoglyphs (In Greek it means a channel or pipe & groove) –



They have the most elaborate system of venom injection. The fang is very long tooth, and the injection groove is closed along its entire length. Furthermore, the maxillary, to which the fang is linked, as well as the replacement tooth, is short and articulated towards the front of the jaw. This allows for deep injection, and for the folding down of the fangs when at rest.

Venom Toxicity:

The potency of venom varies from species to species, the most potent being produced by those that feed on fast moving prey. The venom of some marine elapids for example is among the most toxic in the world, since they eat reef fish, which would elude them if the venom did not act rapidly.

The effects of venom may be neurotoxic – destroying or paralyzing the nervous systems; cytotoxic – causing cellular destruction in the area of bite; cardiotoxic – destroying or paralyzing heart tissue; or hemotoxic – destroying the blood clotting mechanism.

There are three major groups of venomous snakes, the Elapids, the Viperids, and the Atractaspids, which are a primitive group, present in Africa and Middle East. All the venomous snakes are classified in the superfamily Colubroidea.



Elapidae (Cobras, Kraits, Coral Snakes and Sea Snakes and allies):

The elapidae is a diverse family of venomous snakes, and includes some of the largest and most formidable species. Various elapids, such as coral snakes, kraits and some sea snakes, are also among the most spectacularly colored. As a group, more than 60 genera and 300 or so species characterized by enlarged, non-erectile fangs in the front of the mouth, which fits in the groove slot in the lower jaw when the mouth is closed. They have venom that is predominantly neurotoxic. Elapids, also lack a loreal scale (on the side of the snout between the nostril and eye), a feature that otherwise characterizes only the burrowing species and a few small colubrids. They occur in the warmer regions of the world except Madagascar and are particularly well represented in Australia.

Viperidae (Vipers and Pit vipers):

Viperidae is a highly evolved family of snakes with, a rotating fang apparatus that allows development of long fangs that are erected when biting and folded against the palate when the mouth is closed. Viperidae has worldwide distribution and divided in to three subfamilies: Azemiopinae, Crotalinae and Viperinae.

Venomous snakes and human welfare:

The public health impact of venomous snake is very difficult to evaluate because many bites go unreported. Snakebite is one of the most underestimated causes of accidental deaths in modern India. It is a long neglected health issue across the country, even World Health Organization in 2009 added snakebite in the list of 'Neglected tropical diseases' Snakes are the cause of more human deaths and injuries than all encounters and attacks from vertebrate animals in India put together.

The recent 'Million death study' an initiative of the Registrar General of India (RGI) and The Center for Global Health Research (CGHR) at St. Michael's Hospital and University of Toronto, Canada, estimated that the upper limit for snake bite deaths



in India is 45,000 per annum. Loss of limb and other serious disabilities could affect another 200,000 to 250,000 victims of venomous snakebites.

Indian Scenario:

In India, we have 61 species of venomous snakes (Romulus Whitaker & Ashok Captain, 2008), Out of them, 37 are Elapids and 24 are Viperids. The new checklist, which is being updated, will have more species that have been described in last decade.

ELAPIDAE

Elapinae

1. *Bungarus andamanensis*, Andaman Krait
2. *Bungarus bungaroides*, Himalayan Krait
3. *Bungarus caeruleus*, Common Indian Krait
4. *Bungarus fasciatus*, Banded Krait
5. *Bungarus lividus*, Black Krait
6. *Bungarus niger*, Black Krait
7. *Bungarus sindanus*, *Bungarus sindanus sindanus*, Common Sind Krait, *Bungarus sindanus walli*, Wall's Krait
8. *Calliophis beddomei*, Beddome's Coral Snake
9. *Calliophis bibroni*, Bibrine's Coral Snake
10. *Sinomicrurus macclellandi*, *Sinomicrurus macclellandi macclellandi*, Mac Clelland's Coral Snake, *Sinomicrurus Macclellandi univirgatus*
11. *Calliophis melanurus*, *Calliophis melanurus melanurus*, Common Slender Coral Snake
12. *Calliophis nigrescens*, Black Slender Coral Snake
13. *Naja kaouthia*, Monocled Cobra
14. *Naja naja*, Spectacled Cobra
15. *Naja oxiana*, Black Cobra
16. *Naja sagittifera*, Andaman Cobra

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17. *Ophiophagus Hannah*, King Cobra

Hydrophiinae

1. *Astrotia stokesii*, Large-headed Sea Snake
2. *Enhydrina schistosa*, Hook-nosed Sea Snake
3. *Hydrophis caeruleus*, Many-toothed Sea Snake
4. *Hydrophis cantoris*, Cantor's Narrow-headed Sea Snake
5. *Hydrophis cyanocinctus*, Annulated Sea Snake.
6. *Hydrophis fasciatus*, *Hydrophis fasciatus fasciatus*, Banded Sea Snake
7. *Hydrophis gracilis*, Common Small-headed Sea Snake
8. *Hydrophis lapemoides*, Persian Gulf Sea Snake
9. *Hydrophis mamillaris*, Bombay Sea Snake
10. *Hydrophis nigrocinctus*, Black-banded Sea Snake
11. *Hydrophis obscura*, Esturine Sea Snake
12. *Hydrophis ornatus*, Cochin Banded Sea Snake,
Hydrophis ornatus ornatus, Ornate Sea Snake
13. *Hydrophis spiralis*, Yellow Sea Snake
14. *Hydrophis stricticollis*, Bengal Sea Snake
15. *Kerilia jerdonii*, Jerdon's Sea Snake, *Kerilia jerdonii jerdonii*
16. *Lapemis curtus*, Short Sea Snake
17. *Laticauda laticaudata*, Common Sea Krait, *Laticauda laticaudata affinis*,
Western Sea Krait
18. *Laticaudata colubrine*, Yellow-lipped Sea Krait
19. *Pelamis platurus*, Pelagic Sea Snake
20. *Praescutata viperina*, Viperine Sea Snake



VIPERIDAE

Crotalinae

1. *Agkistrodon himalayanus*, Himalayan Pit Viper
2. *Hypnale hypnale*, Indian Hump-nosed Pit Viper
3. *Ovophis monticola*, Bloched Pit Viper. *Ovophis monticola monticola*, Western - bloched Pit Viper
4. *Protobothrops jerdonii*, Jerdon's Pit Viper, *Protobothrops jerdonii jerdonii*.
5. *Protobothrops kaulbakii*, Kaulbak's Pit Viper
6. *Protobothrops mucrosquamatus*, Brown Spotted Pit Viper
7. *Pseudocerastes persica*, Persian Horned Viper, *Pseudocerastes persica persica*, Common Persian Horned Viper
8. *Trimeresurus albolabris*, White-lipped Pit Viper
9. *Trimeresurus cantori*, Cantor's Pit Viper
10. *Trimeresurus erythurus*, Spot-tailed Pit Viper
11. *Trimeresurus germineus*, Bamboo Pit Viper
12. *Trimeresurus huttoni*, Hutton's Pit Viper
13. *Trimeresurus labialis*, Nicobar Pit Viper
14. *Trimeresurus macrolepis*, Large-scaled Pit Viper
15. *Trimeresurus malabaricus*, Malabar Pit Viper
16. *Trimeresurus medinensis*, Medo Pit Viper
17. *Trimeresurus poperum*, Pope's Pit Viper
18. *Trimeresurus andersoni*, Anderson's Pit Viper
19. *Trimeresurus stejnegeri*, Stejneger's Pit Viper
20. *Trimeresurus stejnegeri yunnanensis*, Yunnanese Pit Viper
21. *Trimeresurus strigatus*, Horseshoe Pit Viper
22. *Trimeresurus gumprechtii*, Gumprecht's Green Pit Viper



Viperinae

1. *Daboia russelii*, Russel's Viper, *Daboia russelii russelii*, Indian Russel's Viper
2. *Macrovipera lebetina*, Levantine Viper
3. *Echis carinatus*, Indian Saw-scaled Viper, *Echis carinatus carinatus*, South Indian Saw-scaled Viper, *Echis carinatus sochureki*, Sochurek's Saw-scaled Viper

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