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Aspects Of Studying Snakes In The Fauna Of Uzbekistan

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Abstract: In this article, we have tried to describe our research work on snakes encountered in Uzbekistan. Our main section is devoted to the analysis of the origin, distribution, common and recognizable features of snakes, as well as their comparison with other species of snakes. In the main section, tariffs for snakes are given based on systematic analysis. There is also information about the biochemical composition of snakes, its composition, the scope of action, In the end, we came to our scientific conclusions.

Keywords: *Atractaspis, Boiga blandingi, Coluber ravergieri, Colubridae, Elaphe, in vitro and in vivo, lizards, Oxyuranus scuterratus, Rhabdophis subminatus, snake, Thamnophis sirtalis, Thelotornis kirtlani, Viperidae.*

I. Introduction

Snakes of the *Colubridae* family in Uzbekistan are represented by 10 species. They are characterized by a slender and long body. Within this group of snakes, almost all the main life forms are found above-ground, tree-climbing, digging, leading an underground and semi-aquatic lifestyle [1].

The snakes of the genera *Coluber* u *Elaphe* are quite widespread. Snakes are one of the most widespread groups of snakes ,evolution, which went in the direction of acquiring the ability to quickly move around the earth. Scales are smooth or slightly acidic. The colour is quite diverse ,but usually not bright with a predominance of grey-brown tones. The teeth of the upper and lower jaws significantly increase in the direction deep into the mouth, and the two posterior teeth are separated from the rest by a small toothless gap. In the fauna of the CIS, the genus *Coluber* is represented by 10 species, the genus *Elaphe* by 12 species [7]. In Uzbekistan, 7 species are represented [2, 6,7]. Snakes are also widespread in southern Europe, temperate and tropical Asia, North, East and Central America.

Multi-coloured snake- *Coluber ravergieri Menetries, 1832*. Body length up to 118, tail 35-38 cm. The head is clearly delimited from the neck. The upper side is grey with a greenish or yellowish tinge. Along the back are a series of dark transverse stripes or spots. In the gaps on the sides, there are several brighter spots. The body can be monochrome without any spots and stripes. On the sides of the head from the eye to the corner, there is an oblique dark strip, the other strip is under the eye. Often there are black-headed and almost black snakes. Bright belly, often with small specks.

In Uzbekistan, it lives on the chinks of Ustyurt, in the desert hills and gravelly plains of Central Kyzyl Kum, in the Kanimekh desert, in the Ferghana Valley, in the mountains and foothills. It is found along the loess cliffs of Surkhandarya, Kashkadarya, Zarafshan, Chirchik, the Syr Darya in neighbouring oases.

Typical habitats of this species of the foothills abound with ravines or colonies of rodents, and cliffs bordering the floodplains of rivers, human settlements in the foothills and mountains. Less often, the snake is found in the mountains (up to 2500 m) and the foothill clay desert. This snake is often found in abandoned buildings, in livestock buildings and residential buildings. Sometimes climbed into buildings inside large cities. In case of danger, it hides in the cracks of cliffs, burrows of rodents, cracks in adobe buildings [1, 7].

II. Materials and methods

In spring, these snakes appear in March in the afternoon, in April to August they are active in the morning until 9:00 and in the evening from 16 to 19:00. In September, the midday hours are again mobile. In October they hibernate, climbing into cracks, holes of rodents or birds. The food of the multi-colored snake-bird (rolling rollers, field sparrows, barn swallows, jackdaws, bee-eaters, long-tailed shrikes, gray flycatchers and their chicks), rodents (mole voles, red-tailed gerbils, young yellow gophers, house mice), lizards (colourful lizards), roundheads, steppe agamas). Females in the middle of July - beginning of August lay 5 to 15 eggs 40-50 mm long. Young appear in late August - September. Their length is up to 24 cm. Wintering multi-coloured snake leaves in the month of March. In the southern regions and lowlands, it leaves earlier than in the north or the mountains.

Mating takes place in May. The female lays 10-16 eggs, one at a time with an interval of 3-5 minutes. Young individuals appear in late August-early September. Most females lay their eggs in July, the earliest clutches occur in June. The hibernation snake goes in October.

It feeds on small vertebrates, rodents, birds and lizards, which it eats alive. Larger prey kills with the help of poisonous teeth. In case of danger, it seeks to crawl away, but with an immediate threat, it actively defends itself and bites, while it can bite through the skin and cause poisoning [1]. A multi-coloured snake is one of the widespread species in the Surkhandarya region [1].

Spotted snake of *Coluber Tyria* Linnaeus, 1758, medium or large, body length of individual individuals reaches 1.8 m. Intermaxillary scutellum slightly extends to the upper surface of the head. The prefrontal scutes are paired (rarely one) and are separated from the frontal by one (less often two) by a series of small scales. Parietal scutes elongated; their width almost doubles in length. The pupil is round, the eye is surrounded by a continuous ring of scutes, which happens from 6 to 14; the largest in this ring is the superior preorbital. These scutes are separated from the labrum. Upper labial flaps from 10 to 12 in a row, of which the first 7 or 8 scutes are much smaller than the rest of this row. Scales of the body in front of smooth; closer to the tail there are weak ribs. The general colour tone is usually brown, individuals with light grey or light brown tones are found. On the upper surface of the head is a diadem of two transverse dark brown stripes. The first narrow transverse strip runs along the prefrontal scutes, the second, wider, crosses the infraorbital scutes and frontal. In front of the parietal scutes, there are rounded spots, which, like the strips of the diadem, are dark brown in colour. Stripes of the same colour on the sides of the head begin from the upper postorbital shield and pass obliquely to the corner of the oral cavity. Along the midline of the back, there are more or less rhomboid-shaped spots of brown or brown colour, forming a kind of strip along the ridge. On the sides of the body are elongated spots, smaller than the dorsal, and located between the latter. Near them, as well as closer to the abdominal scutes, there are small spots located in disorder. The ventral shields are white, with a yellowish bloom and a characteristic pearly sheen. In young individuals, the colour of the top is much lighter and there are often dark spots on the outer edges of the abdominal shields. Distribution zone Central Asian republics and the southern part of Kazakhstan. The main habitats are sandy and clay deserts. Sometimes the spotted skidder climbs into low desert mountains and lives here in stony deserts. With the development of the area, it disappears. Shelters are burrows of rodents and turtles, where they spend the winter in a state of hypobiosis. They feed on vertebrates, most often lizards, less often rodents, young individuals-insects. Prey of a large size is strangled not by wrapping it around but by pressing its strong body to the ground. The approach of a person or animal usually does not frighten the snake, it tries to actively defend itself. In Central Asia, one of the two subspecies of the spotted creeper Coluber tyria settles [1,].

First, appear in late February, and if the winter is cold, then in March. In April, there are always a lot of them. In September, they are still quite active. Their daily activity varies depending on the ambient temperature. In spring and autumn, they are active all day, in summer - at night and early in the morning, that is, they have two periods of activity - morning and evening. In the middle of summer, it is almost not shown during the day, and in cloudy weather, it can be met at any time of the day. In early June, females begin to lay their eggs. Each clutch contains from 4 to 6 eggs. They leave for wintering in late September - early October [1].

The genus *Elaphe* includes 12 species of fauna of CIS snakes. This is a very large, widespread and prosperous group of snakes. They differ from the snakes in the structure of their teeth: their maxillary teeth are approximately the same size and their row is not interrupted by toothless gaps. Climbing snakes can be considered as a transitional group from purely land snakes to real climbing forms. Many species of this genus spend most of their time on trees, where they find their food, ruining bird's nests. Unlike the snakes of the genus *Coluber*, they avoid true deserts and semi-deserts [8].

They are common in southern and central Europe, temperate and tropical Asia, North and Central America. Their greatest diversity is observed in the countries of Southeast Asia.

Patterned snake - *Elaphe dione Pallas*, 1773. The most widespread species of the genus *Elaphe*. It occurs from the south of Left-Bank Ukraine to the Far East, populating southern Siberia, Central and Central Asia, the Caucasus, Transcaucasia and South Russia. This snake is small, the largest size of large individuals is slightly more than one meter. In Central Asia it is found in many places, it is absent only in sandy deserts, but it is quite common, for example, on the outskirts of Kyzyl-Kumov where there are wells and in the valley of the Syr Darya river [38]. It penetrates the mountains up to 2000-2500 m, and in places, it can rise to 4000 m. This snake selects not too dry places. In the lowlands, it settles in river valleys and hollows with dense and fresh vegetation. In the mountains on grassy slopes, in shrubs and forests, among stones, that is, almost everywhere, preferring areas with mesophilic vegetation. Usually settles near water. He willingly enters the water, even seawater, dives beautifully and can calmly swim a few hundred meters from the embankment, and often, perhaps, he meets on the shore of southern reservoirs in the company of water or ordinary snakes. It is found in the cultural zone along ditches, cemeteries, and also penetrates gardens, kitchen gardens and crops. Shelters are burrows of rodents in hollow trees, voids under stones, dense thickets of reeds and cattail along the banks of reservoirs. The main food of this snake is rodents - from voles to gophers, birds - mainly non-flying chicks of various small passerines and lizards. The snake strangles the caught victim like a boa constrictor, with the rings of its body. Having good ability to quickly and easily move through trees can ruin the nests of birds and eat chicks and eggs of birds. To eat the latter, she developed a special device for crushing them - these are large downward processes on the front vertebrae that push down the eggshell when it passes through the oesophagus of the snake. In an excited state, the patterned snake makes quick movements with the tip of the tail, which strikes the soil and surrounding objects, producing a peculiar intermittent sound, reminiscent of the sound of a rattle.

For wintering, the patterned snake leaves in late October - in the first half of November. Winters usually in the burrows of rodents. In the spring of winter shelters, a patterned snake appears quite early. On the plains, it can be seen already at the end of February, in the foothills - in March, in the mountains - in April. Everywhere these snakes are active day and night. In May and June, they have two periods of activity

- morning and evening. In the daytime, they often bask in the sun, but in the middle of summer, during the hot midday hours, they hide in cool places. Mating begins mainly in the first decade of May. At the end of May, some females are ready to lay eggs. Mass masonry accounts for June ends in July. In the first half of August, only belated individuals are found that have not yet laid eggs. In general, the clutch is strongly stretched, which probably depends on the climatic-geographical zone of a particular region of their settlement. Each female lays from 4 to 16 eggs about 5 cm long. The shape of the eggs is almost cylindrical with equally rounded ends. Newly hatched cubs are 18-19 sm long, and overwintered ones are 25-27 sm long. Moulting occurs once a month [6].

Representatives of snakes of the genera *Coluber* and *Elaphe* are less dangerous to humans than rapids, vipers or rattlesnakes. However, the bites of some of them cause severe poisoning of people, sometimes fatal. The poisonous secret in these snakes is quite toxic and under certain conditions can cause severe poisoning [3]. In the literature, there are data on various methods for producing poisons from these snakes. Thus, using the microaspiration technique, *Vest Darwin* [1] obtained the secret of Duvernois's gland of the garter snake (*Thamnophis elegenus*). The release of gland secretion began with a latent period of about 40 seconds. After the start of suction. The protein content in the fresh glandular extract was 55 mg/ml [3].

From the Duvernois gland, the snakes *Thamnophis sirtalis* [8] caused enhanced secretion of the poison. Other authors [6] from the gland located in the venomous teeth of *Rhabdoptris subminatus* located on the posterior edge of the maxillary bone sucked a secret with a micropipette. The yield of poison was 10-15 µl per tooth, and the protein content in it was -14.34 mg/ml. The LD_{50} value for intravenous administration to mice was 1.29 mg/kg. The poison has phospholipase activity, and phosphodiesterase, fibrinolytic and thrombin-like activity are not registered.

Snake poisons according to some authors possess proteolytic hemorrhagic coagulating fibrinolytic activity in some cases comparable with such poisons of viper and aspid snakes.

The poison *Rhabdophis subminatus*, when administered intravenously, is toxic to mice at a dose of 6.5 mg/kg and has a low caseinolytic, phospholipase and hemolytic activity. The minimum dose for rats (weighing 200 g) was 118 mcg. The poison contains an activator of factor X of the blood coagulation system, which causes fibrinogenemia, and at a sublethal concentration, leukocytopenia and increased platelet aggregation [2].

After that, the tiger snake of ketamines was immobilized (dose 0.2 mg per 100 g of animal mass, intraperitoneal administration) and pilocarpine solution was injected intraperitoneally (0-5 mg / 100 g) to increase the secretion of Duvernois's venous gland [8]. The secretion of the poisonous tooth was taken with a pipette, the yield of which was 0.3 ml per snake or 1-6 mg of dry residue, and when extracting the secretion of the poisonous gland, the yield of whole poison was 2-6 mg per individual. Toxicity (LD50) of the poison obtained firstly, for mice 3, 2 mcg, and in the second, 1, 8 mcg. According to PAGE - electrophoresis ,in both samples there are proteins with a molecular weight of 9, 9-7, 3 kDa. Protein factor with a very strong coagulating action ,molecular weight of 85 kDa and pH 5,25 was isolated from *Thelotornis kirtlani* venom [7]. It should be noted that their poison lacks phospholipase A and oxidase L - amino acids that are commonly found in poisons of other snakes.

III. Results

Histological analysis of the poisonous gland of snakes of the genus *Atractaspis* shows its close resemblance to the Duvernois gland of the posterior grooved snakes. Previously, these snakes belonged to the *Viperidae* family. With the intravenous administration of A. *engaddensis* venom, acetylcholinesterase activity, characteristic for elapids and arginine esterase, inherent in viper venoms, was not found, however, phospholipase and L-amino acid oxidase are present [8].

16 fractions were obtained from the dried secretion of Duvernois's gland of the snake *Boiga irreqularis* ,lethal activity was detected in three of them. The large lethal fraction contained 12.5% of the secretion proteins, its toxicity for marine fish was LD_{50} 7.3 mg/kg. The small lethal fraction had two peaks that included 9.4% of the secretion proteins and had an average proteolytic activity that caused myoglobinuria in mice. The main lethal fraction contains three 12.5-18 kDa and 52 kDa fractions and a myotoxin fraction comprising two peaks with a molecular weight of 14.5 and 17 kDa. The Duvernois gland secretion contains a myotoxin fraction with average lethal activity [5]. A neurotoxic fraction with a molecular mass of about 8 kDa, with a postsynaptic action, which, like whole poison, blocks neuromuscular transmission was isolated from *Boiga blandingi* venom [4].

To clarify the structural and molecular organization of biological membranes and the principles of their functioning, natural and synthetic, selectively acting biologically compounds are widely used: protein neurotoxins, enzymes, low molecular weight blockers and modifiers of various biosystems. In recent years, animal and plant toxins have been widely used to study the specific functions of excitable membranes, which made it possible to successfully use neurotoxins of postsynaptic action to isolate and study the structure of the acetylcholine receptor [6].

The poison of snakes of the *Colubridae* family is characterized by the content of various enzymes (phospholipase A, hyaluronidase, phosphatase, protease, acetylcholinesterase) and toxic polypeptides. It is believed that the toxic properties of snake venoms are mainly determined by the properties of toxic neuropeptides. Currently, the polypeptides that make up the toxins according to the mechanism of their action are divided into presynaptic, postsynaptic neurotoxins and membrane-active polypeptides.

The presynaptic neurotoxin was first isolated from the cobra venom *Bungarus multicinctus* and was called β - bungarotoxin [6]. It has a molecular weight of 6767 and consists of 61 amino acid residues [7].

Later it was discovered that the poison toxin consists of two subunits, interconnected, at least one disulfide bridge. ɑ - bungarotoxin, specifically binding to nicotinic cholinergic receptors, was isolated from the venom of the striped edge of *Bungarus multicinetus* [8]. Due to the high means of acetylcholine receptor, toxins of this type are widely used in the study of the molecular organization of postsynaptic membranes [6,8]. Using ɑ - bungarotoxin, it was possible to isolate in a pure form and characterize a cholinergic receptor, which is a glycoprotein with a molecular weight of about 230-400 kDa [7]. Labelled radioactive drugs - analogues of these toxins are successfully used to assess the distribution of acetylcholine receptors [6]. A polypeptide called taipotoxin has been isolated from the poison of the Australian taipan Oxyuranus scuterratus. It is structurally composed of three subunits, each of which is formed by 120 amino acid residues connected by 7 disulfide bridges [6,7]. Taipotoxin subunits taken separately are much less toxic than in the complex, but the phospholipase activity of individual subunits is higher [5,8]. Of the three subunits, only the main ɑ subunit acts neuro-toxically, it is responsible for the phospholipase activity of the whole complex. After recombination, the ɑ - subunit with β - and γ - subunits of the lethal complex increases by 500 times. The presynaptic neurotoxin was also isolated from the venom of the Brazilian rattlesnake *C.durissis terrficus* and was named [3,7]. This toxin is formed by ɑ and β - protein components, the latter having phospholipase activity, as well as β - bungarotoxin. Crotoxin has neither toxic nor enzymatic properties. However, when combined with phospho-lipase, the toxicity of the complex increases by an order of magnitude in comparison with the starting ingredients.

IV. Discussions

The amino acid sequence data indicate that the phospholipase component is homologous to other phospholipases from rattlesnake venoms [6,5]. From the venom of the Australian tiger snake *Notechis* *scultatus*, a presynaptic neurotoxin, notexin, was isolated. The toxin is the first of phospholipase neurotoxins for which an amino acid sequence has been established [7,8]. Its molecule is a single polypeptide chain of 119 residues, organized using 7 disulfide bridges. Along with toxic activity, it has a strong myotoxic effect. Notexin II-5 was isolated from the same poison. According to the amino acid sequence, it differs from notexin only in seven positions [7,8], and its lethal activity is 1/3 of the activity of notexin. It is 5-10 times less myotoxic than notexin. Myotoxin VI-5 is a strongly myotoxic phospholipase from the venom of the sea snake *Enhydrina schistosa*. Its molecule consists of one main peptide chain including 120 residues stabilized by 7 disulfide bridges. Analysis of the amino acid sequence shows that this toxin is a homologue of the other phospholipases already described. Postsynaptic neurotoxins with the ability to selectively block receptors of the postsynaptic membrane are isolated from the venom of several species of cobras [5]. The polypeptide isolated from the Taiwanese cobra venom *Naja naja atra* received cobrotoxin. In its structure, it is a polypeptide chain, consisting of 69 amino acid residues with a molecular weight of 6949 [1,2,5]. In recent years, highly purified phospholipase A2, a polypeptide chain, consisting of 120 amino acid residues and stabilized by 14 disulfide bridges, has been isolated from this poison. Cardiotoxins isolated from cobra venom *Bungarus sasciatus* can be an example of membrane-active polypeptides. Structurally, they are a polypeptide chain consisting of 117-118 amino acid residues .

Under the influence of snake venoms, changes in the structure and function of the mitochondria of various animal organs are shown *in vitro* and *in vivo* [4,6,7,8]. In this case, there is a swelling of mitochondria and their destruction. A study of the action of the venom of various snakes on the functioning of mitochondria showed that generally low concentrations of poisons cause respiratory dissociation and oxidative phosphorylation, while large ones inhibit the respiratory function of mitochondria.

Gyurza poison used *in vivo* in rat liver mitochondria ,increases respiration rate in state 4, without significantly affecting state 3. Cobra venom differs in that by activating respiration in state 4 ,it suppresses it in state 3 by 30%. These changes in mitochondrial respiration are accompanied by a decrease in respiratory control and ADP / O ratio, limiting the breathing process from the phosphorylation process. The following results were obtained on turtles using the parameters described above. Mitochondria of the turtle liver under the influence of gyurza venom undergo inhibition in state 3 and 4 almost twice, the intensity of phosphorylated respiration is suppressed. But under the action of cobra venom, in parallel experiments, a strong inhibition of the respiratory activity of the liver mitochondria with a complete loss of ATP-synthesizing respiration in state 3 was shown. The obtained data showed that the use of gyurza and cobra venoms *in vivo* is accompanied by respiratory activation in state 4 in rats and blocking this breath in steppe turtles. This circumstance can be explained by the fact that rats die more quickly from exposure to toxins, small low-energy shifts in the tissue, and, apparently, from shallow damage to the mitochondrial energy. In turtles, more pronounced changes in mitochondria also reflect greater endurance to low-energy shifts in tissues. It should also be noted that of the two types of poisons used, cobra venom, which in rats and turtles at the level of mitochondria, in addition to dissociation, also causes respiratory inhibition was more effective.

V. Conclusion

Thus, snake venoms primarily affect the ATP-synthesizing function of mitochondria, and then the electron transfer from oxidation substrates along the respiratory chain to molecular oxygen.

Currently, it is well known that dysfunction of biomembranes under the action of snake venoms is determined by the activity of phospholipase A and membrane-active polypeptides. Membrane-active polypeptides are described under various names: cardiotoxins, factors, depolarizing skeletal muscle, toxin - as a direct lytic factor and cytotoxins. A significant violation of bilayer lipid and cell membranes occurs with the simultaneous action of membrane-active polypeptides and phospholipase [6]. Membrane-active polypeptides are not only modifiers of membranes, but they also act as a mediator that binds an enzyme to membrane structures [6]. The cobra venom cytotoxin, a membrane-active polypeptide consisting of 60 amino acid residues in one chain with 4 disulfide bonds, has a molecular weight of 6500 Da [6,7] The sizes and shape of the cytotoxin molecules in the solution and membrane environment were determined [3,6]. Cytotoxin increases the permeability of bilayer lipid membranes for monovalent cations, while in the presence of phospholipase A it shortens the lifetime of these membranes [4]. Cytotoxin causes skeletal muscle contracture, which develops against the background of irreversible depolarization of muscle cell membranes and showed that under the action of cytotoxin, phase separation of lipids occurs in liposome membranes. Ksenzhek et al. [3] established that the cytotoxin from cobra venom at the interface can be in two conformational states.

Xenzhek [4] and Krasilnikov [3] found that when interacting with BLM, cytotoxin increases their anionic conductivity and forms single ion channels. The channel conductivity varied widely, and the average conductivity at 100 mM KCI (pH-7.5) was close to 50 ps.

Thus, despite the numerous snakes compared to others, a significant part of their representatives remains unstudied, there is practically no information on the biochemical composition and mechanism of action of whole poisons and their components on biological structures, including bio-membranes.

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