Human has been fascinated with venomous animals for ages. The first attempts to use their venoms in treatment had been done in Ancient Times. Sometimes people ascribed to them magical properties. Some of venomous animals, like snakes in Ancient Egypt, were even the subject of worship. Some of them were suspected to be evil children, because of the characteristic symptoms that were observed after their bites.

Interest in venomous animals increased recently, especially because of the possibility of using their venoms in medicine and pharmacology. It was widely known that many species of insects, arachnids, amphibians or reptiles are venomous. However, for a long time people ignored reports of venom mammals. Just modern methods of venom separation and reports of the discoveries of the first fossil venomous mammals, especially insectivores, contributed to the increased interest in this group of animals.

So far, venomous mammals have been found in two orders: monotremes, with the only one venomous animal, i.e. the Australian platypus, and shrews. The most of extant venomous mammals belong to the latter. Venomous are two endemic species of solenodons from the Caribbean, i.e. the Cuban solenodon and the Hispaniolan solenodon, four species of short-tailed shrews from North America and two species of water shrews from Europe and Asia: the Eurasian water shrew and the Mediterranean water shrew. Venomous are probably also the Transcaucasian water shrew and the Canarian shrew. Recent studies indicate that venomous may also be three species of vampire bats from Central and South America and three species of the genus loris from Asia: the Sunda slow loris, the pygmy slow loris and the Bengal slow loris.

So far, the venom of the platypus has been investigated thoroughly. In turn, the Japanese scientists have identified the main components of the venom of one species of the short-tailed shrews. However, there is still nothing known about the composition and mechanisms of action of venoms of our native water shrew species. The first attempts to study properties of venoms of these small mammals have been taken already in the 50s and 60s of last century by Michalina Pucek. She applied these venoms to the laboratory animals, such as mice, rabbits and voles. To the main reactions observed in these animals after venom injection she included the hind-limb paralysis and the paralysis of the entire hind part of the body, muscle cramps and convulsions, breathing disorders, increased urination and death. Similar reactions were observed by Pearson after application of the venom of short-tailed shrew to mice and rabbits. However, it should be noted, that the statements were made with a mixture of the venom itself and gland tissue, so observed responses were also partly the immune responses to foreign tissue.

The main aim of my project is to obtain preliminary information about the composition and properties of the venom produced by water shrew, and to compare its effects on potential prey of this small mammal. It is assumed that water shrew uses venom contained in its saliva to hunt for its prey. It can thus overpower prey much larger from itself (e.g. up to 8 times heavier fish). Similarly to the American short-tailed shrew, the water shrew produces its venom in the submandibular salivary glands, which is then discharged by special ducts to the base of the lower incisors. It has been observed that water shrew can attack its prey by biting its head as close as possible. It is believed that this way venom enters into the prey's brain, causing rapid paralysis of the nervous and muscular system. Furthermore, paralyzed prey is suitable to make fresh food storage for a longer time. The phenomenon of food hoarding has been observed in water shrews, and usually large, not small, prey were hoarded.

I predict that venom of water shrew possess mainly paralytic properties and will cause the paralysis of limbs, muscle spasms or convulsions of its prey. I do not expect any strong impact of its venom on heart of prey, which could result in rapid death of prey.

My project involves testing individual protein fractions, and not the whole salivary gland extracts, as it has been made in the 50th of the last century. Therefore, the observed responses will not be the result of an immune response to foreign tissue, but the response to toxic substances contained in the venom of water shrew. My planned tests will also allow to identify the specific responses of different organs and systems, rather than the general reaction of the body.

The second aim of my research is to know hunting strategies of water shrew and the use of venom in response to the prey with different size and difficulty in manipulating (fly larvae, small and large earthworms, frogs). I predict that smaller prey like fly larvae and small earthworms will be eaten by water shrews immediately, whereas large earthworms and frogs at first will be bitten and paralyzed by water shrews. Only after immobilization they will be eaten or transported to shelter by water shrews.

This project has the opportunity to fit into this modern, dynamically developing research trend related to the recognition and utilization of venoms and toxins of animals and plants. The use of modern methodology will allow to perform preliminary identification and learn about the properties of the individual components of the water shrew's venom. Obtained information about the properties and the mechanisms of action of the water shrew's venom may be useful for further research in its use in medicine and pharmacology.