ELENA

Experiential Learning and Education for Nature Awareness

Project duration: 2013 - 2016

School activities with living animals based on the Tiere ***live*** approach

ELENA

Educating with living animals

The trans-european project *ELENA* with partners from Georgia, Hungary, Romania and Germany aims to support a sustainable way of living and acting during a human lifetime. Through personal experiences with living animals, the awakened positive emotions can form a link between knowledge an action and motivate children to find ways to live in more harmony with nature. It was funded by the European Comission.

Find more: **www.elena-project.eu**

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Fig. 1. Hermann's tortoise *Testudo hermanni*. Foto: Tibor Sos..

Reptiles

Basic aims of activities

- To develop positive perceptions and attitudes towards reptiles.
- To be familiarised with the types of reptiles.
- To recognise the manner in which the living environment is reflected on reptiles' conformation.
- To recognise the most common reptile species found in Romania's fauna.
- To investigate and recognise habitat elements specific to reptiles, in correlation with their biological requirements.

Reptiles are considered by evolutionists as the first truly terrestrial vertebrates which emerged, after fish, from the first group of quadrupeds (four feet moving animals), namely from amphibians. Reptiles are reproducing by eggs, in which, depending on the species, the embryo can develop on dry land and they can breathe only with the help of lungs. As a result of their physiological characteristics, the formation of a protective layer was possible, which prevents water loss.

The first members of the reptile class (lat. *reptus:* to crawl) were the first evolved vertebrates which had independence of the aquatic environment. Numerous other adaptations to the surrounding environment allowed these animals to simply burst on dry land and to dominate Earth in the Mesozoic Era (Gr. *mesos* – middle, Gr. *zoe* – life or Fr. *mésozoïque*), fact which was documented by means of the impressive high number of species and individuals which were noticed in the diversity of the discovered fossils. The Mesozoic entails three geological periods, namely: Triassic (approx. 250 mill. years - 200 mill. years), Jurassic (approx. 200 mill. years - 145 mill. years) and Cretaceous (approx. 145 mill. years - 65 mill. years).

As shown by the results of paleontological research, the first reptiles (the most primitive) had a fusiform-like body, differentiated in head, neck, torso and tail, supported by two pairs of members, each with five fingers. This type of organisation is still found today, in lizards and crocodiles, whilst the morphology of other reptiles is considered to have changed, as a result of their adaptation to different living environments. Thus, the turtles have acquired bony armour in which they can retract. In other cases, the body was considerably elongated, the body organisation was simplified and the members were reduced, in correlation to the adaptation to environments rich in vegetation, through which such a body shape can move much easier. The reptile species from the Mesozoic were extremely diversified, as such certain reptiles adapted to the aquatic environment, through the elongation of their body, reduction of members and by achieving a hydrodynamic body shape similar to that of sharks and dolphins (Ichthyosaurs). Others adapted to flying and developed a membrane between their body and the posterior members (Pterosaurs). Both reptilian groups mentioned here disappeared in the Mesozoic Era.

Fig. 2. Skin types for some reptiles (top-down): the European pond turtle (*Emys orbicularis*), the sand lizard (*Lacerta agilis*), the Eastern slow worm (*Anguis colchica*)

Biology

Skin

In the case of the majority of reptiles, the skin is covered in epidermal scales with an imbricate disposition (Fr. *imbriqué*, Lat. *imbricatus*) (partially overlapping, just like house weatherboards or roof tiles, each partially covering each other). This horny protection layer (skin protection layer, adapted in order to reduce water loss, relatively thick, consisting of hard horny cells) is periodically replaced. This process is named *shedding* and it is accomplished either in patches (for example in the case of lizards) or in a continuous structures – *exuvia* (e.g. snakes). Here we remind the *femoral glands* of lizards, which carry a role in the adhesion of the two sexes during sexual reproduction and the cloaca glands (or *musk glands*) of crocodiles, which have a role in producing important pheromones, meant to attract sexes. The skin of reptiles has chromatophores (or pigment-containing cells) which are composed of *melanin pigments* (containing melanin) or other types of pigments and these cells play a role in light reflexion. Within these cells, pigments can be dispersed in the cytoplasm or can aggregate around the nucleus, thus leading to dark or light skin-specific shades. Certain lizards, such as the chameleon for example, have chromatophores which contain yellow pigments and guanine crystals, thus providing for a larger diversity of skin colour, depending on the state of the animal and environmental conditions. In the skin of many reptiles, more or less large bone plates are formed, thus leading to the formation in certain groups of a well-developed exoskeleton (e.g. turtles, crocodiles).

Fig. 3 Weaving movement for *Caspian whipsnake Dolichophis caspius*. Foto: Tibor Sos.

Movement

In the case of certain reptiles, locomotion is achieved by means of crawling, in a weaving mode, while the members are more used for griping the sub-layer asperities. Other reptiles have longer and thinner members; the elbow carries out a forward rotation, while the knee is rotated backwards, with the members being maintained near the body. Thus, the body is raised from the

ground, and the animals move around by walking instead of crawling. Many prehistoric reptiles were two-legged, and the importance of such locomotion is the alleviation of anterior members, which could thus be used for capturing pray or for flying.

Fig. 4 Water movements for the European pond turtle *Emys orbicularis*. Foto: Tibor Sos.

The loss of members in the case of snakes during their evolution was accompanied by the increase of the use of the body surface in movement. Thus, snakes either mode in a waeving manner or in a rectilinear manner, through "accordion"-like contractions (from near to nearer). The latter is a slow, sliding movement, generally used by large snakes, but by other snakes as well, when they are hunting. The movement of snakes also involves the scales which are found on the ventral side of the body, and which are attached to mobile ribs. The scales from a certain part of the body are pushed forward, are anchored in the sub-layer, and then the rest of the body is also pulled forward. The body of the snake is thus transversed by waves of contractions, starting from the anterior extremity towards the posterior. Often the two types of movement are combined, for example when passing a bush. On barck land or on mobile land (without asperities), snakes use a lateral wave movement, which allows them to move fast. Each moment, the body is in contact with the ground in at least two points, leaving on the sub-layer a two-parallel-lines shape.

Feeding

The majority of reptiles are carnivorous; certain turtles nonetheless are herbivores or omnivores. Certain lizards have sticky tongues, extremely long, which serve to capture pray (for example the tongue of a chameleon in extended position exceeds the length of its own body). Teeth are in general evenly disposed, except for venomous snakes, whose teeth are, in some cases, longer, and are called venom fangs and serve to inject venom secreted by venom glands present in the oral cavity (modified salivary glands). Turtles do not have teeth; their jaws are covered in horny blades.

Thermoregulation

Reptiles are animals with variable body temperature, also named poikilotherms (Fr. *poïkilotherme*, and Gr. *poikilos* – varied, *thermos* – heat), as well as fish and amphibians. From a physiological point of view they are not able to constant maintain their body temperature (as for example mammals and birds). Unlike animals which live underwater, the terrestrial animals must handle much larger temperature range and as such thermoregulation is extremely important for terrestrial animals. Some reptiles can withstand large air temperature range (for example from - 2°C to + 41°C for certain turtles). In these circumstances, the temperature of the body needs to be maintained between more restricted limits (25-37°C). In order to maintain this temperature, reptiles have developed a series of behaviours. In order to heat themselves, the body is positioned perpendicularly, oriented to the sun rays, laying on a warm substrate, while cooling is achieved by orienting the body in parallel to the light rays or by hiding in shaded areas. In warm regions, the majority of reptiles are nocturnal. The dark colours of reptiles that live in the mountains at high altitudes help gain energy. In temperate

regions, a high number of reptiles enters in a state of somnolence when winter comes, in which the body temperature and metabolic rate decrease. Individuals who usually are solitary, may aggregate in this period in different *hibernacula*. Within these groups, the loss of temperature is diminished by the decrease of the surface/volume ratio. Unlike real hibernation, the temperature of reptiles in this period is not constant, which can determine the death of the animal, if the environment temperature decreases under a certain level and if the shelter is exposed.

Sense organs

The tactile corpuscles (tactile receptors) are spread all over the surface of the body, and are disposed on the edge of the scales.

Olfaction is better developed compared to that of amphibians. The majority of reptiles (with the exception of crocodiles) have on their oral platform two cavities called *Jacobson's organs*, more developed in the case of lizards and snakes, which contain cells playing an essential role in olfaction (olfactory role). The split tongue of lizards and snakes is also adapted to contribute to olfaction. The tongue is exposed in order to capture odorant particles from the air, and then the tips of the tongue are to be inserted in the two orifices found on the oral platform, where the characteristics of said substances will be analysed (smell).

The eye, which is highly developed, has two eyelids and a nictitating membrane (the third eyelid, positioned in the internal corner of the eye). In the case of snakes and certain lizards, the two eyelids are welded together ever since the embryo stage of their development and thus lead to a transparent protective layer, called haw. When moulting, the lower half of the membrane is replaced, which is why during this period snakes do not have good eyesight. The *sanguine* sinus, positioned at the base of the nictitating membrane, is filled with blood, thus pushing the wastes or impurities from the surface of the eye to the internal angle, in order to be discharged. Eyesight is the most important sense for the majority of reptiles. Some reptiles have a third eye developed at the epiphysis level (behind the cerebral hemispheres). In the case of Rhyinchocephals (live fossils from New Zealand), this eye also has an eye lens, a retina and an optic nerve; in other reptiles, it is less developed than this. This eye is covered by a tegument and probably cannot form images, but it can sense the presence of light.

Fig. 5 Adults of the common wall lizard during reproduction *Podarcis muralis*. Foto: Tibor Sos.

Hearing is differently developed in various reptile groups. Snakes can detect the vibrations of the ground but not those remitted via airways, as they cannot hear because they do not have an ear drum. Some snakes have *thermo receptor organs*, which can detect the heat emitted by warm blooded animals.

Reproduction

Reptiles reproduce through eggs (they are oviparous), which can sometimes be retained in the female's body until the egg hatches (i.e. ovoviviparity). The egg of reptiles resembles that of birds and is formed from a gigantic cell filled with *nutritive vitellus* (i.e. yolk), covered in *albumen* (i.e. egg white), *a thin membrane* and *egg case*. The latter is usually membranous, flexible, with the exception of some crocodiles which have calcareous case eggs. In the case of certain snakes and lizards we

see the parthenogenesis phenomenon, which consists in the formation of an egg exclusively by the female (there are no known males). Reptiles often have complex reproductive behaviours. As in the case of other species, courtship works as a signal in order to recognise partners and to stimulate reproduction preparation. Through the head movements of lizard males, coloured spots and tegument portions are highlighted. In the case of snakes, courtship is based firstly on tactile stimuli, through the entwining of bodies. More recent studies show that lizards and snakes also use pheromones in order to attract opposite sex partners. Sound plays an important role only for crocodiles.

Eggs are laid and abandoned in holes dug in the ground, in sand or in vegetal remains, and they are hatched (incubated) by solar heat. There are however approximately 100 reptile species which manifest a certain parental behaviour by taking care of the eggs, sometimes even of the hatchlings, after incubation is finished.

Reptiles and humans

Throughout time, reptiles have been used by man mainly as a food source. Although many of them possess efficient defence mechanisms, as they are poikilothermic animals, they have certain periods when they are slower (they have a slower metabolism) and as such they become vulnerable to natural predators such as birds and mammals. They are still important food sources for a number of isolated tribes in Africa, South America and Australia. Interest towards reptiles does not end here. In developed countries, turtle, crocodile and snake meat is used for a series of exotic dishes, with Asia being the largest market for this type of products. Reptile eggs and especially turtle eggs are also used in alimentation.

These alimentary uses are accompanied by medicinal uses, as numerous species, in full or only certain organs, are considered as having healing characteristics for certain ailments, in traditional medicine. Traditional Chinese medicine uses ingredients that come from rare venomous snakes in a wide range of concoctions, and are used to treat almost any condition. Snake skin was believed to be able to heal, by rubbing it on the affected area, a series of illnesses such as: acne, psoriasis, haemorrhoids, eye infections a.s.o. Snake oil was used by the Romans for hair regeneration and in the 19th century, in Mexico and U.S.A. it was sold as a universal remedy – it was said to cure any disease!

Blood collected from certain venomous snakes or from their gall bladder represent, in traditional medicine, miraculous ingredients for longevity and virility. All of these beliefs related to the medicinal properties of reptiles are based on subjective rationales, connected to traditional knowledge. Basically, the rarer a species, the more miraculous properties it seemed to possess.

The skin of reptiles (crocodiles, snakes, lizards) is also used to make certain leather accessories (shoes, bags, belts a.s.o.).

Fig. 6 Horned viper under sun *Vipera ammodytes*. Foto: Tibor Sos.

Snake venom

Snakes use venom to kill their prey and to defend themselves. Not all snakes are venomous. Some suffocate their prey through constriction, while others simply catch and swallow their live prey, without previously killing it.There are two types of venoms, hemotoxic and neurotoxic. Hemotoxic venom affects blood and muscles. It can lead to incapacity of blood coagulation. If it is lethal, it will cause a heart attack to the attacked individual. The neurotoxic venom attacks the nervous cells which stop communicating between themselves and causes paralysis, including that of muscles which play a role in breathing, thus determining the victim's death through asphyxiation. Usually, a species secrets only one type of venom, nonetheless there are snakes whose venom has both a hemotoxic effect and a neurotoxic one.

Also, snake venom has inspired numerous confessions in what concerns its properties of healing various conditions. Beyond these beliefs, scientific research has proven that some components found in snake venom (certain enzymes) have a potential anticoagulant, anti-tumour, anaesthetic, analgesic and hypotensive effect.

Species conservation or fighting to ensure the survival of species

Life of reptiles is difficult to access and many times the existing facts related to these species are based more on popular culture and not that much on scientific information. This can make the attitude of man to generally be oriented in two directions: on one side, exploitation for food or in traditional medicine, and on the other side, manifestation of repulsion and fear associated with avoiding or killing reptiles upon encountering them.

These types of attitudes, together with the destruction of habitats in which reptiles live (for example, deforestation, construction of buildings dedicated for human use and roads, intensive agriculture) or their commercialisation as house pets have led to the downfall of many species. The vulnerability of reptiles is accelerated by a series of aspects related to their biology, such as: reaching sexual maturity in a later stage, low growth rate, relatively small number of laid eggs and high mortality in what concerns hatchlings, elements related to body temperature regulation. Due to the fact that some species have generations of tens of years, they cannot adapt to the rapid environmental changes.

The main threats for reptiles are: [1] loss and modification of habitat due to anthropic activities; [2] exploitation through commercialisation (for example, for food, medicinal applications, leather and accessories industry, as pets or even as souvenirs); [3] pollution; [4] increase of the abundance of certain predators favoured by atrophic changes (for example racoons); [5] viral and bacterial diseases; and [6] unfortunate events triggered by climate changes.

Fig. 7 The spur-thighed tortoise from Dobrogea *Testudo graeca*. Foto: Tibor Sos

Turtles

According to paleontological data, turtles appeared approximately 300 million years ago. They are different from typical reptiles due to their short and flattened bodies, which are covered by a shell. The shell has a posterior side known as the shell per say and a ventral side or a plastron, both being composed of bony plates covered in horny scales. The shell is strong, well developed, in what concerns turtles that live on dry land, and is smaller in what concerns aquatic ones, especially in sea turtles, sometimes up until extinction (the leatherback turtle, *Dermochelys coriacea*).

The jaws, which lack teeth, are covered by a horny layer, similar to that of a bird's beak, which is generally sharp as a blade, but can also be accompanied by thick lips.

Fig. 8 Specific habitats for reptiles in Transylvania. Foto: Tibor Sos.

Biologic cycle

Chelonians are characterised by high longevity. Sexual maturity is usually reached after 7 – 8 years. The giant Galapagos tortoise can live over 100 years. Female turtles dig holes in which they lay from 5 to 100 eggs, which they then cover with dirt. Development lasts usually between 4 weeks and a year. After hatching, the hatchlings are independent from their parents. The reduced develop-

ment rate and the relatively long juvenile period, also taking into consideration the exploitation of certain species' eggs by man, make these animals extremely vulnerable ones, and many species are susceptible to extinction. More than half of the approximately 264 recognised species are in peril of extinction.

Three turtle species live in our country: the spur-thighed tortoise from Dobrogea (*Testudo graeca*), Hermann's tortoise in Banat (*Testudo hermanni*) and the European pond turtle (*Emys orbicularis*), all of are low protected.

Lizards

There are over 3000 species in this group today. All lizards have a long body, rarely can they have four legs, they are considered typical reptiles, and they are most similar to primitive reptiles. Some species may lack legs (for example the slow worm or the glass snake). Their body is covered in simple scales with an imbricate disposition. Nocturnal individuals generally have larger eyes than diurnal ones. The ears are well developed in the majority of species. They live in diverse environments and are abundant especially in warm regions. The environment in which they live and their life styles are also reflected in their conformation. Some are arboreal, they have prehensile tails and legs (chameleons) or they have "wings" which help them jump from one tree to another (flying dragon – *Draco Volans*)

Fig. 9. Common species of lizards for Romania, from left to right): he European green lizard (*Lacerta viridis*), the sand lizard (*Lacerta agilis*), the common wall lizard (*Podarcis muralis*) and the Eastern slow worm (*Anguis colchica*). Foto: Sos Tibor

Others climb walls and have adhesive fingers (gecko lizards) or they dive into the sea in order to feed and have membranes between their fingers (Galapagos iguanas). There are also lizards which remain immobile in the desert in order to catch insects they feed upon, as their aspect is similar to that of a spikey branch.

Their eating diet is varied, as such there are herbivorous, frugivorous, insectivorous and carnivorous species.

Numerous species have in common the self-amputation of the tail phenomenon (autotomy), which appears as a defence mechanism. The lost tail will be regenerated, but the new tail will have a different configuration of the scales and a different colour scheme, and sometimes this regeneration can lead to two or more tails stemming from the same scar tissue.

All 10 lizard species found in our country are protected. The most common species are: the European green lizard (*Lacerta viridis*), the sand lizard (*Lacerta agilis*), the common wall lizard (*Podarcis muralis*) and the Eastern slow worm (*Anguis colchica*).

Snakes

Ophidians are apode animals (they do not have legs); they have a long body, covered in scales, with a particular disposition at head level, for each species. The tail, more or less long, has a narrowed extremity or a massive one or even a prehensile one (it can wrap itself onto branches of trees). They are predators; they eat live animals, which they swallow

Fig. 10. Snake species from Romania (Top-down, left-right) dice snake (*Natrix tessellata*), the grass snake (*Natrix natrix*), the smooth snake (*Coronella austriaca*) the Aesculapian snake (*Zamenis longissimus*) the common European adder or viper (*Vipera berus*), the horned viper (*Vipera ammodytes*) and the meadow viper (*Vipera ursinii*). Foto: Sos Tibor.

Fig. 11 Nile crocodile *Crocodylus niloticus* (Photo Antofie, 2008)

whole. They are adapted to swallowing large preys, with larger diameters than their body. In this sense, they display certain adaptations: their mouth can open very wide, thanks to the mandible dislocation capacity, the body can widen as they do not possess a sternum and their ribs are mobile, teeth are curbed backward in order to prevent prey from slipping from their mouth and the trachea opens in the anterior side of the mount, in order to allow breathing during the swallowing process (sometimes for hours). The digestion of such a prey can last weeks or even months.

Based on the manner in which they kill their prey, snake are classified as non-venomous (some of these are constrictors) or venomous. Except for a single family of lizards which consists of two species (Gila monsters), snakes are the only venomous reptiles.

There are 9 species of snakes in Romania, all of which are protected species. The common non-venomous species are represented by the dice snake (*Natrix tessellata*), the grass snake (*Natrix natrix*), the smooth snake (*Coronella austriaca*) and the Aesculapian snake (*Zamenis longissimus*). Venomous species encountered in our country are: the common European adder or viper (*Vipera berus*), the horned viper (*Vipera ammodytes*) and the meadow viper (*Vipera ursinii*)

Crocodiles

They are among the largest current reptiles; some species actually can reach 5 m in length. There are 23 known species of crocodiles, alligators, caimans, as they are species adapted to a semi-aquatic life style. The majority of today's species live in tropical regions, the sole exceptions being the American alligator (*Alligator mississippiensis*) and the Asian alligator (*Alligator sinensis*); however the latter cannot tolerate colder climates than the temperate one. They live at low altitudes, in fresh water, sometimes brackish water, in the two hemispheres. They are big scale reptiles, with a long body, armed with four members, out of which the anterior ones have five fingers, while the posterior members are provisioned with only four fingers, more or less palmed. Crocodilians have highly developed smell, sight and hearing. Their ears are covered in skin folds which prevent water from going inside during diving. Eyes are immobile, covered by three eyelids. The third eyelid, the nictitating membrane, is transparent, but it protects the eye from water. They have vertical students which dilate to allow them to see in the dark. A layer of drywall is found in the posterior side of the eye, and it also enhances their capacity to see in the dark, at the same time making the eye glow during the night. They do not have very good eyesight underwater. Their teeth are strong, identical, cone-shaped, and can be replaced unlimitedly, when broken. Their stomach is the

most acid one of the vertebrate species, allowing them to digest the bones and shells of their prey as well. Digestion is aided by a muscular stomach (such as the one found in birds), which contains small rocks which play a grinding role.

All crocodilians have strong jaws which allow them to grab and tear apart their prey. They are exclusively carnivorous, the prey is not mashed up in the oral cavity, and the torn piece of meat is swallowed whole. As they consume in large quantities, they do not have to feed often. A research carried out on crocodiles showed that they consume approximately 50 meals per year. While the main food source is represented by fish, large crocodilians hunt mammals and smaller ones can include in their food diet insects, amphibians, gastropods, crustaceans, birds and smaller fish. Also, they can eat snakes, molluscs, turtles and chiropters. They are opportunistic hunters, as they hunt anything within their proximity. Some large crocodiles can even hunt humans.

Excess food is stored as a fat reserve in their tail, back and rest of the body parts, which allows them to survive for long periods of time (even 2 years) without any food. Crocodilians are generally solitary animals; however the existence of bountiful food in certain areas may determine the aggregation of a high number of individuals without any competitiveness manifesting itself.

In our country you can find these species only in zoos.

Myths, folklore and superstitions related to reptiles

The fear of reptiles, the misunderstanding related to them, lack of knowledge, as well as lack of respect towards them has all turned them into mythology and local folklore characters. Starting with the Greeks and Romans, reptiles have been assigned characteristics such as wisdom, fertility and even immortality, and these characteristics, according to beliefs, could be transferred to those who consumed them. They became symbols of mythological characters: Venus for the Romans or Aphrodite for the Greeks, emerges from the sea on a turtle; Athens, the Greek goddess of war, displays a snake on her shield; Asclepius (Esculap), the god of medicine, has as symbol a snake which bears his name. In Egypt, Ra, the god of sun, was represented by a man draped in dark ochre with the head of a cobra, that can destroy enemies just by looking at them, and the crocodile was regarded as a symbol of prosperity which emerges alongside the risen waters of the Nile and of the sunrise. The Aztecs and Toltec saw snakes as the teachers of humans, and Quetzalcoatl, the Mayan demi-god, can be translated as „snake with feathers". Such examples can be found along mankind's history in all civilisations.

Fascination for reptiles has translated in numerous superstitions. Some tribes found on the valley of the Nile believed that crocodile teeth worn around the neck protected the wearer from attacks. In numerous African countries the liver of a killed crocodile is burned in order to protect the village. In South Africa, the killed python is burned, as it is believed that otherwise it will seek vengeance on the one who killed it. Chameleons are granted mystical powers in West Africa, as their capacity to shift colours and to move their eyes independently is translated as the capacity to hypnotise humans. Also, the immobile glare of snakes, caused by the fact that their eye lids are welded together, has led to popular convictions related to their hypnosis capacity. This aspect is also presented in "The Jungle Book" of Kipling.

The Mesozoic – the era of reptiles

The Triassic came after one of the largest extinctions in the history of life on Earth, as it was a time in which life forms which survived started to spread and recolonize the empty space. From the evolutionist point of view, the animals of the Triassic bear the seal of diversified reptiles: ichthyosaurs, sauropterigyan (in the seas), chelonians, crocodilians, dinosaurs and theomorphic reptiles (which will later give birth to mammals). Dinosaurs represent the undisputed group of reptiles with the most evolutionary success, according to specialists, characterised

through a special diversity, impressive dimensions reached by certain representatives and the duration of their domination (over 150 million years). The bipedal position which characterised certain dinosaurs freed the anterior members of the body weight, thus allowing them to be involved in food procurement, in some cases these were even prehensile, while one or more sacral vertebrae are incorporated in the pelvic belt, which enhances its massiveness. The majority of palaeontologists recognise three distinct dinosaur types: theropods, (bipedal, and mainly carnivorous), sauropods (long necks, herbivorous) and ornithschian dinosaurs. Dinosaurs became dominant at the end of the Triassic, and their domination extended throughout the entirety of the Jurassic until the end of the Cretaceous, along with their extinction. Dinosaurs had a remarkable diversity not only in what concerns their size, but also the shape of their body, their food diet, stance, etc. Today there is proof that some dinosaurs were fast, agile and even social animals. Some researchers even claim the existence of certain parental-like behaviour within the group. There is still controversy related to the capacity to maintain body temperature. The Mesozoic climate was a warm one, and the behavioural adaptations were most probably enough to allow these animals to maintain a relatively constant body temperature. Also, numerous dinosaurs had impressive sizes, which granted then a favourable surface/volume ratio in order to avoid overheating.

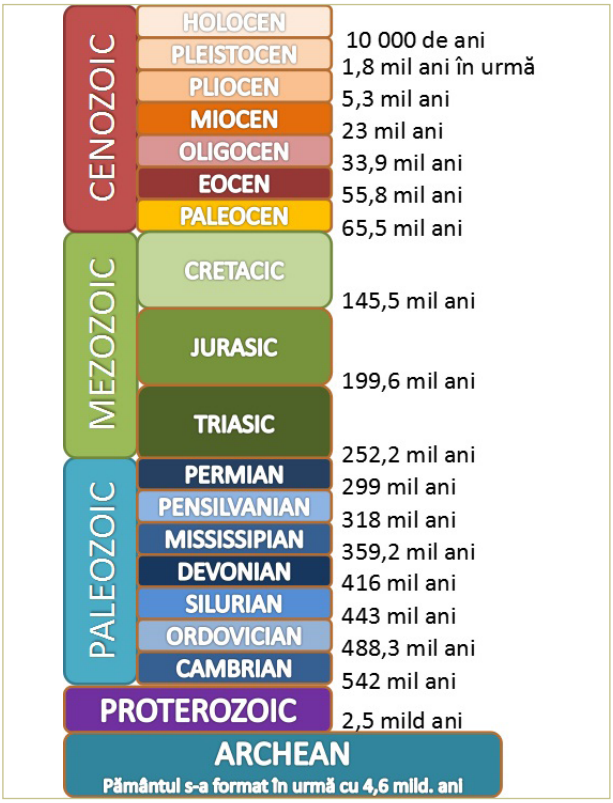

Fig. 12. Geological time scale, adapted scheme after https://en.wikipedia.org/wiki/Geologic_time_scale.

In water, on dry land or in the air

Mesozoic reptiles populated the most diverse environments and developed extremely different species, perfectly adapted to these environments.

Ichthyosaurs were huge marine reptiles, similar to fish and dolphins. The oldest specimens had a long body, flexible and they swam by undulating their body. The advanced specimens had a more compact body, similar to that of fish, with a half-moon-shaped tail.

Dinosaurs dominated the Earth for over 160 million years. The largest fossil discovered in this group belongs to an herbivore, *Diplodocus* and has a length of 27 m; however, there were probably larger specimens. Some species were herbivorous, such as *Brachiosaurus*, *Triceratops*, *Diplosaurus* etc., and others were carnivorous, such as *Megaraptor*, *Oviraptor*, *Tyrannosaurus* and *Velociraptor*.

Another interesting group is represented by flying reptiles. At the beginning, reptiles hovered by using their specialised scales or skin membranes in order to cushion their fall when jumping from tree to tree. At the end of the Triassic, a new group of flying reptiles appeared, which had muscle triggered wings. These were the Pterosaurs, reptiles whose existence lasted for almost 150 million years, leaving behind numerous fossils.

Do you know that?

The Galapagos archipelago houses giant tortoises belonging to the Geochelone (Testudo) elephantopus species. After the Spaniards discovered the archipelago in 1535, the tortoises here were a source of live food for the crews of the great ships that travelled through the Pacific. After 300 years, during his expediti-

on, the naturalist Charles Darwin noticed that the turtle population from the Galapagos was in numeric regression. Subsequently, other scientific expeditions noticed a diversification trend within the isolated tortoise populations. Today there are 14 species or sub-species, differentiated through the shape of their shell. The smallest one registers 65 cm length and weighs 40 kg, and the largest 1.2 m and 300 kg. (The Santa Cruz tortoise).

The leatherback sea turtle (Dermochelys coriacea) is the largest marine turtle (2 m in length and over 600 kg). Perfectly adapted to the aquatic environment, the shell does not have a horny layer and is formed out of a mosaic of small mobile bone plates, covered in a thick skin layer. The posterior members, transformed in fins, are connected to the tail through a fold of skin. The anterior members, more developed, can reach up to 3 m width. It feeds on fish, large scale non-vertebrates and sometimes even algae.

Hatteria or tuatara (Sphenodon punctatus) is the only species to survive from a once thriving group. The true live fossil, this reptile similar to a lizard is still present today on certain small islands around New Zealand. In its adult stage, it can reach up to 70 cm in length. Its body, laterally compressed, is supported by massive members, and its fingers have short membranes at their base. The head and dorsal side of the body present small tubercles, and medially there is a dorsal crest formed out of tubercles which is provisioned with spikes, stretched in the occipital regions until the tail extremity. It lives approximately 100 years, its growth process is quite slow until 50 years and sexual maturity is reached at age 20.

Chameleons are insectivore species extremely adapted to arboreal environments. Their body is compressed laterally, the members are thin, but robust, they have opposable thumbs, by means of which they grab onto branches. The long and often prehensile tail also ensures perfect stability. Their massive head is decorated sometimes with thick bony or horny appendixes which may look like helmets or horns. The representatives of this family are spread all over Africa, the Madagascar Island, the Mediterranean area, and in south-east Asia. One of the most popular characteristic of the group is their change of skin colour (the capacity to modify their colour based on the environment or different stimuli). Their extremely long, sticky and protractile tongue is used to capture prey. It can be projected to a distance equal to the length of the animal. The eyes are protected by inter-grown eyelids which do not leave any central orifice free, but are very mobile and can move independently.

Figure 12 Juvenile of Furcifer pardalis a chameleon species from Madagascar (Antofie M.M., 2008)

Anaconda (Eunectes sp) is considered the largest living snake today; it lives in the swamps and low current rivers from the Amazon and Orinoco rivers in South America. This species beats all records registered by Ophidians, as there are known specimens of 200 kg, 60 cm diameter and over 10 m length. It is the most faintly coloured species from all constrictor snakes, as it is olive coloured, with black and yellow spots, which grants this both aquatic and arboreal animal the perfect camouflage.

Rattle snakes, also named horned rattle snakes, are characteristic to the American continent, but can also be found in tropical Asia. Their main characteristic is the presence of rattles in the top of their tail (fragments of dried skin, residue from previous moulting), which the snake vibrates as a sign of warning. They are ovoviviparous animals, whose females give birth once every two years until it reaches 60 fully developed progenies.

The gharial (Gavialus gangeticus) is a crocodile of up to 6 m length, with the longest muzzle out of all crocodilians. It is considered to be the best adapted at aquatic life, it feeds on fish and amphibians, sometimes small birds and mammals. It rarely leaves the water. The female lays approx. 40 eggs in a hole dug in the sand. The hatching takes place in April, and the hatchlings are approx. 35 cm long. In certain regions it is considered to be a sacred animal, which has not however prevented their numeric decrease. It lives in India, in the ponds of the Gange, Brahmaputra, Koladan, Indus and Mahanadi rivers.

Dinosaurs in Hațeg country, Romania

Some 70 million years ago in the Mesozoic Era, the today Hațeg Country's territory was part of a tropical island in the Tethys Ocean. In a landscape with vines, lakes, rivers, hills and volcanoes, prehistoric animals were living whose fossilized remains are preserved in the former lake rocks. They were discovered fossilized bones of crocodiles, turtles, mammals, flying reptiles, birds and a large number of fossils of dwarf dinosaurs, herbivores and carnivores that are unique in the world. The analysis of nests of petrified dinosaur's eggs support the idea that there were heavy rains and flooding that have covered them for millions of years. All these factors acting now, eroded rocks, unearthing fossilized dinosaurs, which local people called them „Giant bones." Maybe here is the origin of tell stories with dragons, and these legends passed down from generation to generation and retold, over time. We mention tell stories for the dragon of Bucura Lake, about the action of Brave Cîndea cutting the Retezat dragon's head, or about on-site forests full of dragons and monsters. Dacians as an ancient population, whose capital Sarmizegetusa is a few kilometers from Hațeg, had a flag with as a fantastic animal, half dragon, half wolf, what deafening noises when it was held in the chase horses. Bearing in mind all these facts however we wonder if our fascination for dinosaurs comes from ancient times, when our ancestors discovered the first dinosaur bones, or the striking similarity of fossilized dinosaur bones and characters in stories handed down from generation to generation.

Dinosaurs from Țara Hațegului: up - restoration Balaur bondoc - Brian Cooley & Mary Ann, down fossilized eggs of *Telamtosaurus transsylvanicus* (Nopcsa, 1899)

Some worldwide unique species of dinosaurs discovered in Hateg were named Dwarf Dinosaurs. The scientific name of the group of species is dedicated to the many local legends, such names adds a scientific legend to the popular stories. The species Balaur bondoc was a predator with a body of 1.80 - 2 m length and covered with feathers. This predator had a bust up very strong and solid with two sickle-shaped claws, while the wings were still short two claws used for capturing the prey. Old legends are presented in harmony inside the UNESCO Hateg Geological Park that is managed by the University of Bucharest in an permanent exhibition about dragons, giant snakes, dinosaurs hosted in the House of Dwarf Dinosaurs from Sâmpetru. Here you can learn among others about species such a *Magyarosuarus dacus* and *Zalmoxe shqiperorum*. *M. dacus* (sauropod) was a herbivore with a body size estimated to be less than 7 m in length (Nopcsa, 1923), 3-4 m in height the biggest dinosaur in Hateg Country and weighing between 800 and 900 kg. It moved in four legs, the neck and tail were very long. *Z. shqiperorum* (ornithopod) was a herbivore two feet moving dinosaur with a big triangular head, with strong a beck and neck. It measured about 3.5 m in length. These species are representative for the dwarfism for small inland areas known today only in Transylvania. You may discover here another giant species *Hatzegopteryx thambema* (giant azhdarchid). The wing spam is 12 m and the skull length is more the 1 m being the largest flying dinosurs for all times. *Theriosuchus sym-*

piestodon is a primitive crocodile living Hateg Country 70 mil years ago. *T. sympiestodon* is considered today as a real living fossil as members of its family disappeared long time before its time in other European areas. Eggs of *Telmatosaurus transsylvanicus* were discovered in 1895 and is the only dinosaur species from the Maastrichtian faunal assemblage of the Haţeg Basin represented by a complete ontogenetic scale, from embryos and hatchlings to. Very rare was recorded the presence of *Kogaionon ungureanui*, a small mammal only known for Haţeg County. A complete skull was discovered that is extremely rare for mammals living in late Cretacic.

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Web pages

ADW Animal Diversity Web, http://animaldiversity.ummz.umich.edu/site/index.html

EOL Enciclopedia of Life, http://www.eol.org

Herpetofauna of Europe http://www.hylawerkgroep.be/jeroen/index.php?id=39

Serpentproject http://www.serpentproject.com

Wild animals http://www.animale-salbatice.ro/reptile.html

Facebook group wild animals https://www.facebook.com/animalesalbaticero

Reptiles http://herpetolife.ro

Reptiles http://herpetolife.ro/cele-mai-cunoscute-33-de-mituri-si-superstitii-din-romania

Geopark of Dinosaurs Tara Hategului http://en.hateggeoparc.ro

Experts in reptile education

Milvus Group http://milvus.ro/

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2. Zoo Dragoș Vodă - Vânători Târgu Neamț, jud. Neamț, Tel. 0233/ 790.140, Fax. 0233/ 790.231
3. Zoo „Ion Crișan" Reșița Str. Parcului FN, loc. Reșița, jud. Caraș – Severin, Tel. 0255/ 210.483, 215.035, Fax. 0255/ 212.483, 210.483
4. Zoo Baia Mare, Str. Petofi Sandor, nr. 28, loc. Baia Mare, jud. Maramureș, Tel. 0262/ 276.998
5. Rehabilitation center of wounded wild animals, Milvus Group, and „Vets 4 Wild", http://wildliferescue.ro, Târgu Mureș, Sânsimion, jud. Mureș, Tel. 0722 - 533816
6. Zoo Băneasa, Aleea Vadul Moldovei, nr. 4, sector 1, București Tel. 021/ 269.06.00, Fax. 021/ 269.06.05
7. Zoo Bârlad, loc. Bârlad, Tel. 0235/ 412.952, Fax. 0235/ 416.867
8. Zoo Brașov, Str. Brazilor, nr. 1, loc. Brașov, jud. Brașov, Tel/ Fax. 0268/ 337.787
9. Zoo Bucov, Ploiești,Tel/ Fax. 0244/ 275.972,
10. Zoo Călărași, Str. Parc Dumbrava, nr. 1, loc. Călărași, Tel/ Fax. 0242/ 314.152
11. Zoo Aqua S.R.L. Orțișoara - Băile Călacea, jud. Timiș, Tel. 0256/ 379.612, 0722.338.527, Fax. 0256/ 379.560
12. Zoo Gârboavele Galați, Pădurea Gârboavele, com. Vânători, jud. Galați, Tel. 0236/ 431.961, Fax. 0236/ 414.475
13. Zoo Hunedoara, Str. Pădurii, FN, loc. Hunedoara, jud. Hunedoara, Tel. 0728/ 284.419
14. Zoo Oradea, Str. Matei Basarab, nr. 1, loc. Oradea, jud. Bihor, Tel. 0259/ 434.547, Fax. 0259/ 440.438
15. Zoo Pitești "Pădurea Trivale", Str. Obor, nr. 3, loc. Pitești, jud. Argeș, Tel. 0248/ 223.203, Fax. 0248/ 218.266
16. Zoo Râmnicu Vâlcea, Str. Ostroveni, nr. 95, loc. Râmnicu Vâlcea, jud. Vâlcea, Tel/ Fax. 0250/ 734.271
17. Zoo Sibiu, Calea Dumbrăvii, nr. 142, loc. Sibiu, jud. Sibiu, Tel/ Fax. 0269/ 252.996
18. Zoo Târgoviște, Calea Domnească, nr. 171 B, loc. Târgoviște, jud. Dâmbovița, Tel/ Fax. 0245/ 616.558
19. Zoo Târgu-Mureș, Primăria Municipiului Târgu – Mureș, Str. Verii, nr. 57, loc. Târgu Mureș, jud. Mureș, Tel/ Fax. 0265/ 236.408
20. Zoo Timișoara, B-dul C.D. Loga, nr. 1, loc. Timișoara, Tel. 0256/ 408.300, Fax. 0256/ 408.390
21. Zoo Ilișești, jud. Suceava, Str. Principală, nr. 781, loc. Ilișești Tel. 0721.224.076
22. Zoo Rădăuți, Str. Ștefan cel Mare, nr. 70, loc. Rădăuți, Tel. 0230/ 561.909
23. Zoo „Cozla" Piatra Neamț, Str. Ștefan cel Mare, nr. 6, mun. Piatra Neamț, jud. NeamțTel/ Fax. 0233/ 217.167
24. Zoo Brăila, Șoseaua de centură Brăila, Tel. 0239/ 615.498, Fax. 0239/ 615.499
25. Vivarium Bacău – Complexul Muzeal de Științele Naturii „Ion Borcea" Str. Popa Șapcă, loc. Bacău, Jud. Bacău, Tel/ Fax. 0234/ 535.564
26. Vivarium of Cluj-Napoca Facultu of Biology and Geology University Babeș-Bolyai, http://bioge.ubbcluj.ro, bioge@ubbcluj.ro, Tel.: 0264-431858, Fax.: 0264-431858

Activities

What we need to know when entering the world of reptiles

Protection methods

The ABC of our behaviour in the reptile world

Activities' objectives

- To develop positive attitudes towards reptiles;
- To be familiarised with the types of reptiles;
- To recognise the manner in which the living environment and life style is reflected on reptiles' conformation and behaviour;
- To recognise the most common reptile species found in Romania's fauna;
- To investigate and recognise habitat elements specific to reptiles, in correlation with their biological requirements.

Indoor

Activity 1 Reptiles are invited in school (awareness about the reptiles bodies, differences between reptiles groups, correlation between the reptiles' way of living/environment and their body conformation).

Activity 2 Reptiles in enclosures (visit to a vivarium and reptile behaviour).

Outdoor

Activity 3 Who can I run into? (observing reptiles in their environment).

Activity 4 We understand reptiles (games).

Anexe

A 1_1 Building a terrarium for reptiles
A 1_2 Building a habitat for reptiles
A 1_3 Students woaksheet: external moprhology of a reptile
A 1_4 Students woaksheet: recording the tutles activity in ecnlosers or in nature
A 1_5 Teacher worksheet: biological cycle of turtles
A 1_6 Student verification worksheet: biological cycle of turtles
A 2_1 Snakes in Romania
A 2_2 Lizards in Romania
A 2_3 Turtles in Romania
A 3_1 Teacher worksheet: differences between species and reptiles' morphotypes
A 3_2 Puzzle The spur-thighed tortoise
A 3_3 Puzzle Hermann's tortoise
A 3_4 Puzzle Smooth snake
A 3_5 Puzzle European copper skin
A 4 What reptile do I am?

Reptiles are invited into school

Period:

School stage:

Difficulty:

Activity objectives

- Learning morpho-anatomic characteristcs physiology and behaviour for reptiles;
- Learning the types of reptiles;
- Acknowledging differences between reptiles and amphibians according to the evolutionary theory.

Materials

- Informal material such as posters, key-determinators, movies);
- Conserved exemplasr for reptiles;

Living animals

- At least one turtle, lizard or snake.

The students are announced one hour before that they will be visited by reptiles.

These animals have to come from enclosures because the collecting from the wild of these species is forbidden by low. It is essential that the students understand and acknowledge these rules.

All required measures for students safety will be implemented as well as for animal welfare. It is not recommended to use inside the school venomous or large size species (ex. constrictors snakes of large dimensions).

a) Building a temporary terrarium for reptiles

Activity implementation

The terrarium may be build all year duration.

The activity will be implemented in three stages: [1] preparing; [2] temporary terrarium building; and daily care and observation.

Preparing stage

In a previous class will be discussed the following subjects:

- the species of turtle will be agreed upon, and or it a temporary terrarium will be built to acknowledge that reptiles are endangered species;
- the documentation related to the biological needs of the species will be performed;
- the various steps for building a terrarium considering the needs of the selected species will be explained and discussed;
- responsibilities will be assigned to each student, so as for all of them to contribute to the building of the terrarium and to the animal's accommodation.

Temporary terrarium building

The stages in building up such a terrarium are explained in Appendix 1_1. A graph of activities will be established for each day and each team responsible for feeding and monitoring the species.

Daily care and observations

Every day a team will be responsible for feeding the animal and observing its activity.

Observations will be made in every break and will be recorded in a notebook. Everything that happens in the terrarium will be noted: feeding hours, moulting etc.

At the end of the semester, the results are centralized and discussed.

Period:

School stage:

Difficulty:

Activity objectives

- Developing the responsability attitude;
- Knowledge generation regarding the need for species-specific requirements to be achieved when building up an artificial habitat;
- Observing behavior of attracted reptile in the habitat.

Materials

- A place in the school yard or other facility;
- sand;
- stones;
- wood pieces;
- water jar;
- tasks diagram.

b) Building a reptile's habitat

Implementation period

The habitat may be build up all year and can be coupled with other outdoor activities.

School level and difficulty degree

This module can be performed at all school levels, only the difficulty degree will vary among levels. For example, in primary school the habitat can be built with the help of the parents (here students can only handle the spatial organization of the habitat, respectively the planting of some plants). In middle school and high school, the habitat can be constructed by the students.

Activity implementation

The activity will be performed in three stages:

1.Preparation phase

In a prior meeting, the following aspects will be discussed:

- the location in the school yard or another space in the city will be identified, where the habitat will be constructed;
- the list of species that will be attracted to the habitat area will be determined. Students, locals and experts take part in these discussions, because the habitat will be built where it is most likely to attract reptile species. Moreover, the attracted species can also be other than reptiles;
- Documentation related to the biological requirements of the species of interest will be drafted.

2. The construction of the artificial habitat

After purchasing the needed materials (stones, gravel, pieces of rock, trunks and bark, grass and shrubby plants, water and food dishes) at the beginning of the lesson, a draft of the action flow, with clear responsibilities, shall be drawn on the board according to Appendix 1_2. Teams consisting of 3-5 students will be formed, and they will receive specific responsibilities during the activity.

Each team installs the components in the habitat (sand, stones, pieces of wood etc.) in a well-established order.

The security of the arrangement will be checked, so that the stones cannot be knocked over by the movement of the animals, in order to avoid their possible injury.

An activity chart that establishes the team responsible for the habitat care (watering the plants) and for observing the animals for a definite time will be drafted.

Attention! In this habitat other species may also occur and they also may be studied and observed during classes of biology, ecology.

3. Caring and regular observations

Observations can be made in any break or during the biology classes, which will be recorded in a notebook. The thread of events will be no-

ted: when the attracted animals were first seen, their behaviour etc. After the appearance of the reptiles, activities 2-3 can be also carried out here, in the artificial habitat.

At the end of the semester, the results are centralized and discussed.

c) Morpho-types, anatomy and physiology of reptiles

Activity implementation

The activity takes place in the classroom. The teacher will use the terrarium and the habitat in order to take closer studying.

Any living morph-type presentation in the classroom should preferably be done with the help of a specialist (biologist - herpetologist or reptile expert) for the safe handling of reptiles, but also for students' safety.

We recommend the purchase or borrowing of these species from reptile keepers (reptile experts), such as even from students into the class, or from pet shops, exhibitions, vivarium, zoos, etc. For other morph-types where living animals are not found, the presentation of conserved specimens and pictures, videos etc. is needed.

The students will be explained, that they will observe and record the following aspects:

- The external appearance of the three morph-types of the reptile bodies - common elements;
- The characteristics of each morph-type, associated with the environment and their beaviour;
- Reptile skin characteristics;
- Behavioural aspects of interacting with live reptiles (information necessary to ensure the development of positive emotions).

The students will draw the reptiles presented in the classroom (living, preserved or presented through images or movies) and with the help of the worksheets, will identify and note the body parts. Students will infer the evolutionary elements of reptiles compared to amphibians, and at the end of the lesson will fill in the information in the evaluation sheet (Appendix 1_3).

Reptile in captivity

Period:

School stage:

Difficulty:

Introductory part

a) Visit to a vivarium

This action is part of a trip to zoo or reptile exhibition legally conserved in captivity.

Zoos may exhibit reptiles in captivity in special enclosures called terrarium. For each species a special enclosure is defined and a specific habitat is restored according to each species needs.

Tortoise, lizards and snakes behaviours may be easily observed by students. Here they may learn about each species morphological and anatomical characteristics, movement, nutrition, world distribution. Moreover, for each species they may learn news regarding food and reproduction.

Also, the students may have the possibility to observe the way they are fed, reactions towards light stimuli or noise with the support of qualified personal and taking care of the animal welfare.

Inside these enclosures you may find rare reptiles for Romania as well as exotic species.

Attention! All reptile species in Romania are protected by low.

Implementation

1. Observing of each type of reptile.
2. Observing the behaviour and body movement.
3. Observing artificial habitat elements and composition for each species such as: dimension, shape, composition, the display to the public.

The students will be stimulated to be creative based on reflection exercise and positive emotions developed towards the reptiles. They may follow an art or literature contest.

Activity objectives

- Observing and interpreting reptile behaviours;
- Recognizing and understanding the self behaviour in the presence of reptiles.

Materials

- Additional material 1_3 Working sheet for students;
- Writing boards, pencils;
- Digit camera with zoom.

Attention for teachers!

Enclosures of reptiles have to comply international standards of animal welfare held in captivity, and teachers ensure this because otherwise the experience can be traumatic for children.

It has obtained the consent of the director of the zoo, the institution before experiencing sound or light effect on reptiles!

Activity is announced and the written consent of parents is compulsory to be obtained. There may be children who have phobias that are medical certificated and, in this context, the possibility exists that they can overcome their difficulties these

Period:

School stage:

Difficulty:

Activity objectives

- Learning the differences in morphology between venomous and non-venomous snakes species, lizards and turtles;
- Observing the behaviour of reptiles in nature and in captivity (pet-shops zoos, terrarium).

Additional materials

- Binocular
- Photo camera
- Key of species
- Note book

b) The reptile behaviour

Implementing period

The activity can be combined with other activities within the module, if possible. If nature observation is the aim that it will be made in the same period as for the 3rd Activity, and if the observation of behavior will be for captive reptiles than it can be done all year.

School stage and difficulty

This module may be implemented in all educational stages the difficulty being easy. Such a module may be prepared for observation also for preschool pupils.

Implementing

In the first stage this activity may be implemented indoor, the second in nature - outdoor followed by the third stage to be coupled with Activity 3.

Also, this activity may be realized for captive reptiles and in this case students will be visiting a vivarium, terrarium a zoo, reptile exhibitions.

The observed behaviour will be recorded.

You may ask the supervisor for vivarium to present the feeding of reptiles.

The reptile behaviour may also be observed looking movies about their life in nature and their biology.

Use the addition information from Appendix A_2.

Who can I meet?

Period:

School stage:

Difficulty:

Implementation period

The phase of observing in nature can be carried out from spring until autumn, more precisely in September. The reptiles' activity is best seen in spring, in the breeding period, when they are more active and the vegetation is not yet very developed.

School level and difficulty degree

This module can be performed at all school levels, as the degree of difficulty is low. The module can also be presented to preschool groups.

Activity implementation

The activity is to be performed in the field. The target area, where it will be carried out, must be known by the teacher before the trip. Thus, to achieve the full objective of this activity, it is important to know if the area is mainly occupied by reptiles and more specifically, what precise area. Frequently meadows, forest margins, bush woods and tall grasses are favourable habitats for reptiles. Also, an area that will be searched with binoculars to observe reptiles will be chosen.

Activity objectives

- Observation of reptile behaviour in nature. Identifying reptile habitats;
- Developing a responsability attitude towards reptile species.

Additional materials

- Binocular
- Photo camera
- Key of species
- Note book.

If a lizard is impaired on the road or in the habitat and disappears under the tall vegetation or in a ground gallery, the group of students will be trained to quietly retreat a few meters and to wait for the reappearance of the lizard, that usually returns after a few minutes. The activity of the lizard can be followed the easiest by using binoculars at a minimum distance of localization (less than 2 m). If after 4-5 min the lizard does not return, the group will continue on its way. Usually, snakes later return to where they were bothered or not at all.

Semi-aquatic reptiles can be seen on the shore of aquatic habitats.

A sunny day will be chosen for the trip. In spring, the best observation time is at noon and in summer, due to the heat at mid-day, in the morning or evening. On the meadows and in the wood sides the following can be seen: the sand lizard, the slow worm (legless lizard), and the smooth snake. On the hills exposed to the south, the green lizard and the Aesculapius snake can be found. In aquatic habitats and at their limit, the grass or water snake or even the water turtle may be encountered and, in mountain areas, even the common adder. This species can be observed from afar, without the risk of being attacked.

Note! *Capturing all seen reptiles is prohibited by law, so only observing with binoculars, photography and filming is permitted!*

The students will determine the observed species by using the determination key in the Appendix and will make notes about the behaviour of the reptiles. The easiest behaviour to observe is their running away from the predator (also they run away from humans) and from the heat of the sun. Less frequently in nature, the courtship, the battle for territory and partner, mating, oviposition, hunting, feeding etc. can be seen. Students will also learn to recognize the reptiles' specific habitats and factors affecting these habitats, for example: intensive logging, overgrazing, the shift of use from grass to arable land, using the land for construction of houses and roads, air, water and soil pollution.

The protection status of these species will be explained. The law will be transmitted considering the students' level of understanding

According to Government Emergency Ordinance no. 57/2007 on the regime of protected natural areas, the conservation of natural habitats, wild flora and fauna, approved with amendments by Law no. 49/2011, art. 33 (1) „for the (...) species, terrestrial, aquatic and underground wildlife, (...) including those set out in Appendixes 4 A and 4 B, as well as the species included in the National Red List, living both in natural protected areas and outside, the following activities are prohibited:

a) any form of harvesting, capturing, killing, destruction or injury of specimens found in their natural environment, in any of their biological cycle stages;

b) the deliberate disturbance during breeding, rearing, hibernation and migration;

c) any damage, destruction and / or intentional collection of nests and / or eggs from the wild;

d) any damage and / or destruction of breeding or resting sites; (...)

f) the possession, transport, trade or exchange, with any purpose of the specimens taken from the wild, in any of their biological cycle stages.

A list of encountered species will be drawn up and the results of the observations will be discussed in class.

b) Non-venomous and venomous snakes: how to react?

Implementation period

It can be done in class, after the first activity. It can be combined with other activities.

School level and difficulty degree

This module can be performed at all school levels, as the degree of difficulty is low.

Activity implementation

b1) First part is implemented in the classroom, and starts with a presentation regarding the venomous and non-venomous snakes. The manner in which we should dress / what footwear to have when going in the wild and how to react in the presence of snakes will be highlighted. An emphasis will be put on the recommendation that students will be instructed not to interact with snakes, but only to observe them from a distance. Note! Most bites are due to the human intention to catch the snakes.

The presentation can be focused on the following text, modified according to the level of understanding and knowledge of the target group.

„How to avoid viper bites?

Most bites occur during handling of the vipers, so do not play with snakes! Wear sturdy shoes on the ground, as soil vibrations caused by your steps warn the snakes in a timely manner, which generally retreat. Please wear long pants that cover your ankles. Before lifting something from the ground, before sitting down, study the area carefully to check if there aren't any snakes. What do we do in case of a bite? We remain calm, not all snakes are venomous! The adder's bite can be distinguished by the fact that there are one or two stings as compared to the multiple, U-shaped form bites of the non-venomous snakes. Deaths caused by snake bites are very rare and can be avoided if the doctor is immediately reached. Not all bites inoculate venom! The state of shock symptoms may be confused with the ones of a real bite. The effects vary depending on the victim's age, physical condition and health. The elderly, the sick or allergic and children are more sensitive to the venom, but also to the anti-venom! Do not capture snakes for identification; the anti-venom used in the country is for all indigenous species of vipers! Immobilize the bitten member, but do not use the tourniquet! Do not cut or suck the wound, do not apply ice! The victim will be exempt from physical effort! Do not drink alcohol or take supplements!"

Period:

School stage:

Difficulty:

Activity objectives

- Developing the right attitudes in relation snakes;
- Developing the appropriate behaviour when encountering snakes in nature.
- Developing the competency for correctly behaving when encounters any reptile in nature.

Required materials

- Snakes of plastic/wood/textile;
- Movies.

b2) Part II is an out-door activity in the school yard or in nature to perform games for the identification of sckae species.

Models, with the characteristic zigzag of vipers, but also without it (i.e. black vipers) or with the specific characters of non-venomous reptiles (the stripe on the smooth snake head, the yellow ear of the water snake, etc.) can be used. It is important to never capture a snake.

The teaching materials that mimic snakes will be well hidden in the bushes, under branches, boards, etc. and children will be encouraged to look for them. When a child finds a snake he should identify it and present what he has learned in class (Appendix 3).

We understand reptiles

The purpose of this activity is to fixing through games the knowledge related to reptiles, develop skills related to teamwork, boosting growth and wellbeing of pupils.

These activities can be implemented in the classroom and outdoors.

Recommended age: primary and secondary classes

Duration of game: 5-10 minutes.

Number of participants: teams of 10-15.

Period:

School stage:

Difficulty:

Activity objectives

- Developing team spirit;
- Theoretical background information establishment regarding the main characteristics the reptile types;
- Developing curiosity.

Additional materials

- Scarf;
- Twine;
- A4 cartons;
- Tape.

a) The head of the serpent

This is a game to strengthen the relationship between members of a team, establishment and operation of teams, boosting the students.

The goal

This game is for the development of empathy, trust, understanding fully the role of the sense organs, confrontation and overcoming discomfort or tension caused by fear. Students also understand how snake's muscles work when moving.

Implementation

The teacher divides the students into teams of seven, choose a team leader, that will lead the others. Each team forms a snake, which is why participants are caught by hand in front of the next shoulders. The forehead is the team leader, others are blindfolded (or eyes closed). Snake on a certain predetermined route forward, „head" must take care of the body, to lead them on a path where all are safe. The trail team leader may choose or be chosen by the teacher. The foreman requires speed, skill displacement aware of teammates. It is important that the snake does not break. Will win the team that will arrived unharmed at the end of the route in the shortest time. The route can be represented by a long string of several tens of meters (20-50 m), which sits in a sinus. In the end it is recommended reflection on the feelings they had as blindfolded students (if they trusted leader, how to be blindfolded etc.) and the student head of the serpent. Develop empathy towards people with eye problems.

b) What reptile am I?

This game is for fixing and knowledge about reptiles, it is a creative classroom or outside.

The goal: to develop the spirit of communication, knowledge related to reptiles.

Implementation

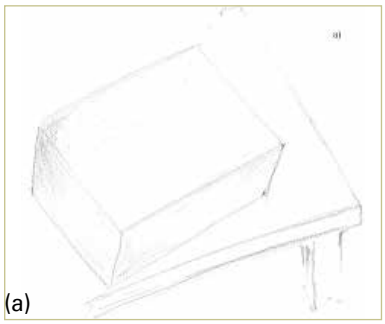
Each participant sticks a label with a species image as listed in Appendix 7 on the back of her or him, without showing this image species.

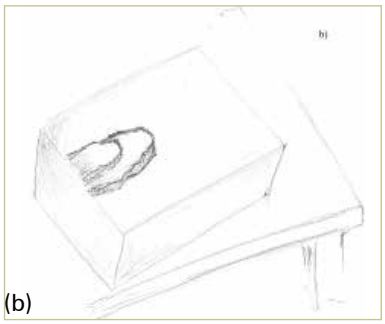
The teacher will form pairs face to face. The first player – the one that has to guess – returns and shows to his chosen pair the image of the reptile. Now his pair is asking questiions to guess the category of reptiles and then species. The partner game only answer questions with „yes" or „no" to the series being very careful questions asked. If questions are not logical based on information provided in the characteris-

tics of the species to a guess, they will lose the contest. When finished they change their roles. If, species is guessed correctly, the player is allowed to catch the label on the chest.

The teacher can assess strengthen knowledge about reptiles in the classroom.

It is recommended to reflect the difficulty guessing species and found to be justified.


(a)


(b)


(c)

Building a terraium for reptiles

Upon the natural material aquisition, that are native for the School in order to better aknowledge the importance of natural resources (stones, gravel, sand, tree bark, plants, bushes, dish water, etc.) at the beginning of the lesson the teacher draws on the board actions flow (fig.).

Compliance by students strictly to this flow will impact the development of organizational skills.

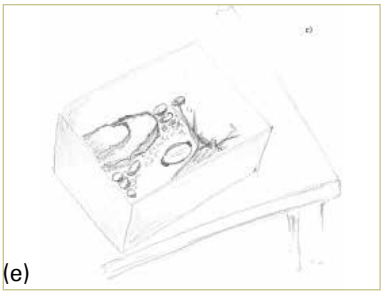
Teams of 3-5 students who will receive specific responsibilities in running the activity.

Each team installs terrarium after a well-defined plan, the components: large rocks, sand, stones, pieces of wood, water bowl for food and space.

They will check the stability of the terrarium building to prevent injury to the animal after traveling stones.

Terrarium finished in carefully insert the new tenant, reptile class that derives from the pet store.


(d)


(e)


(f)

Fig. 15. Stages in building a terarrium

Materials

- Materials
- Enclosure of glass for terrarium;
- Sand;
- Stones;
- Tree barks;
- Light source (lamp);
- Water jar;
- Foor for reptiles;
- Tasks diagram.


(a)


(b)


(c)

Building a habitat for reptiles

Reptiles of Romania being protected species can not be invited to study in the classroom, but can be invited in the schoolyard. It is important to have a school yard in the vicinity of nature. Once identified the right place, we must organize its demarcation so that, in terms of landscape, the following actions should be integrated in nature.

It will collect and store larger and smaller stones to build a mound. Rocks in the region are preferred taht beongs to the site of school. Add gravel and sand into hill interface with the ground. The gaps between the stones will helps reptiles to take shelter.

It will bring fragments of branches or tree trunks from the perimeter of the village, facing extend heap of stones.

You need a source of water that you will fix into the natural vegetation of the habitat in the schoolyard.


(d)


(e)

Fig. 16 Habitat building up in a place of the school yard near nature (a), in which you will bring stones from the neighbouring of the place (b), branches fragments (c), place a water jar (d) and from the morning to the noon time you may have visitors (e).

Materials

- Materials
- Place the schoolyard or another edifice;
- Sand;
- Stones;
- Pieces of wood;
- Water jar;
- Tasks diagram.

Studnets worksheets

External morphology of a reptile

1. What is the systematic position of reptiles? (Family, order and class they belong)

Fam. _____ Order _____ Class _____

2. Present 5 qualities for reptiles assumed by popular culture

1 _____
2 _____
3 _____
4 _____
5 _____

3. Define 5 antonyms for the qualities of reptiles

1 _____
2 _____
3 _____
4 _____
5 _____

4. Draw the body of a reptile on a separate sheet of paper. Define the components of a reptile (one of the three tyes)

_____
_____
_____

5. With what did you analyse the body of a reptile in class?

□ magnifying glass;

□ stereomicroscope;

□ naked eye;

□ photo / design analysis.

6. Present a couple of reptile species found in our country

_____
_____
_____

7. Place the reptiles in the trophic pyramid using a clear example

Producer _____ Primary consumer _____
Reptile _____ Tertiary consumer _____

Student worksheet no. 2

Sheet for recording the activity of captive reptiles in the schoolyard

Reptiles can be examined as of setting up of the terrarium or natural habitat for at least 2 weeks or for the entire period, from spring to winter. We note that reptiles are very active during spring.

Note:

[1] ground and water movement;

[2] favourite places to sit in the sun and preferred sub-layer;

[3] favourite places for shelter;

[4] interaction with other animal species;

[5] laying eggs;

[6] hatching;

[7] how it nourishes and protects its offspring;

[8] the dynamic of the daily activity correlated with temperature, lighting or weather for outside school activities;

[9] preference for certain food sources; [10] make morph-metric measurements with a rangefinder in order not to hurt or touch the reptiles and observe how fast they grow their offspring. An alternative is to photograph the individual in the same spot for a long time, making sure that you have a measuring ruler nearby.

At the end of two weeks of daily observations, please compare the results and draw the conclusions.

Each time take 5 min for reflection regarding emotions and feelings towards the reptiles.

Teacher worksheet: biological cycle of turtles

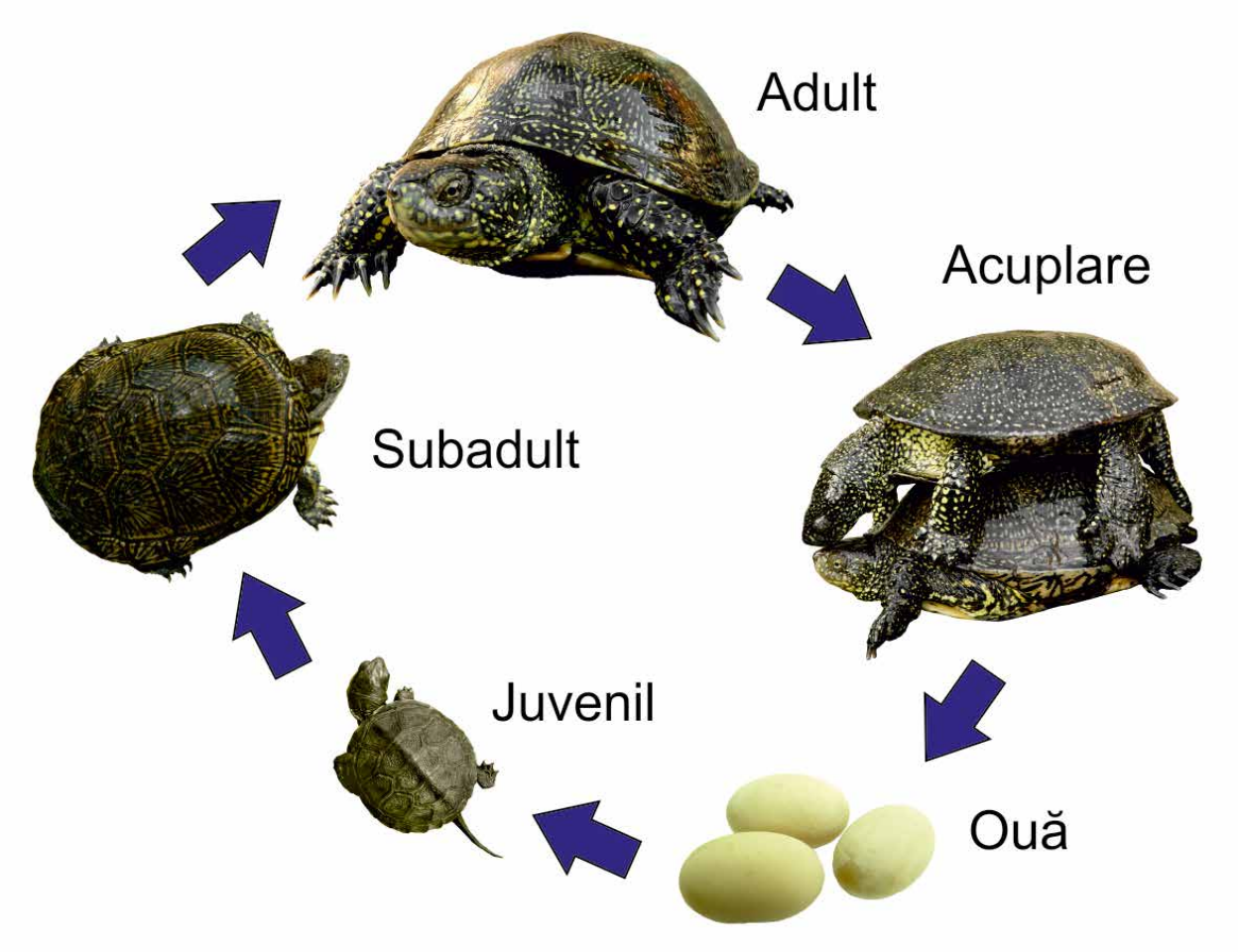


Fig. 17 The biological development cycle for turtles
Example European pond terrapin Emys orbicularis
Foto: Tibor Sos

Student verification worksheet: biological cycle of turtles

Students will fill in the empty spaces

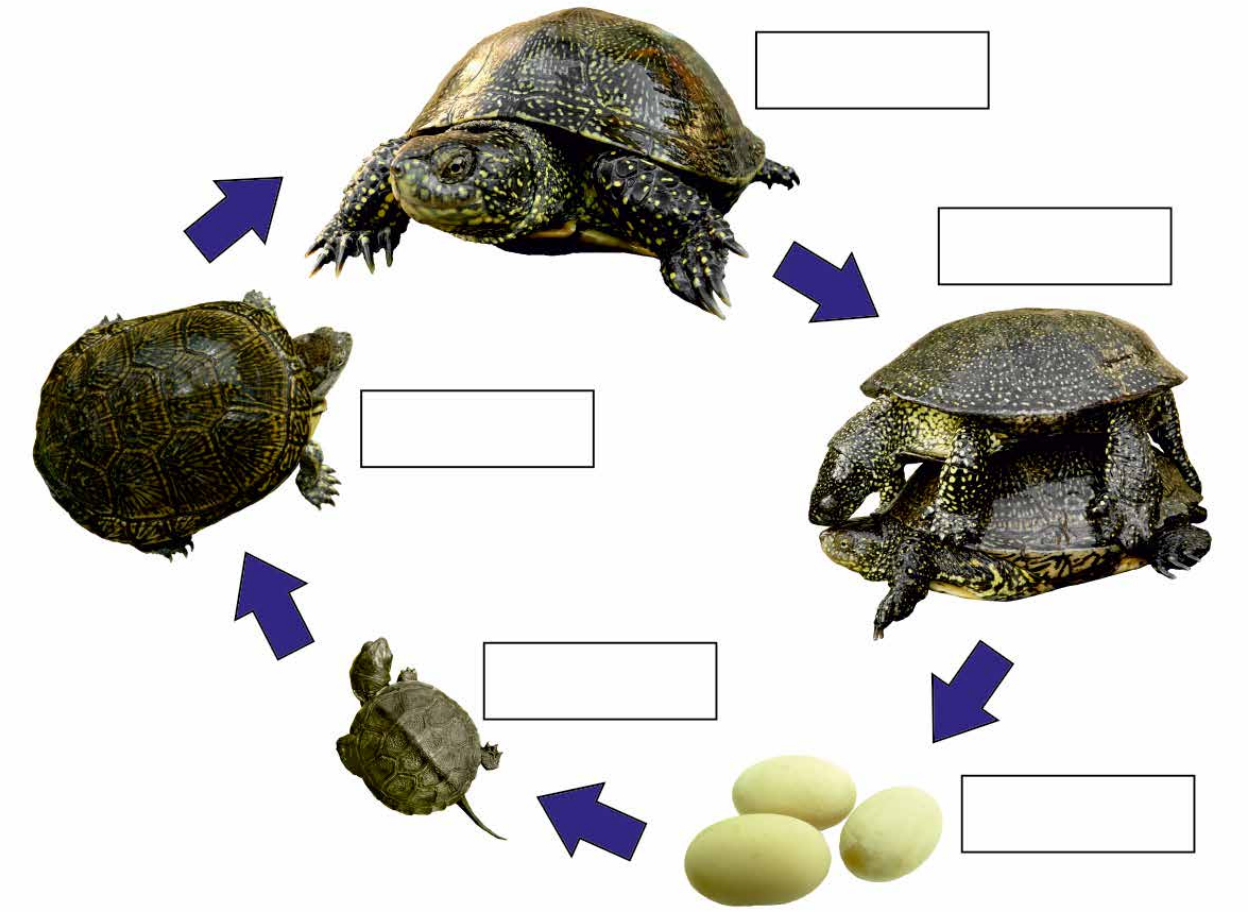


Fig. 18 The biological development cycle for turtles. Example European pond terrapin *Emys orbicularis* Foto: Tibor Sos

Snakes in Romania

Fig. 19 Șerpi din România - partea A
Foto: Tibor Sos

Snakes in Romania

Snakes in Romania - Part B Foto: Tibor Sos.

Lizards in Romania

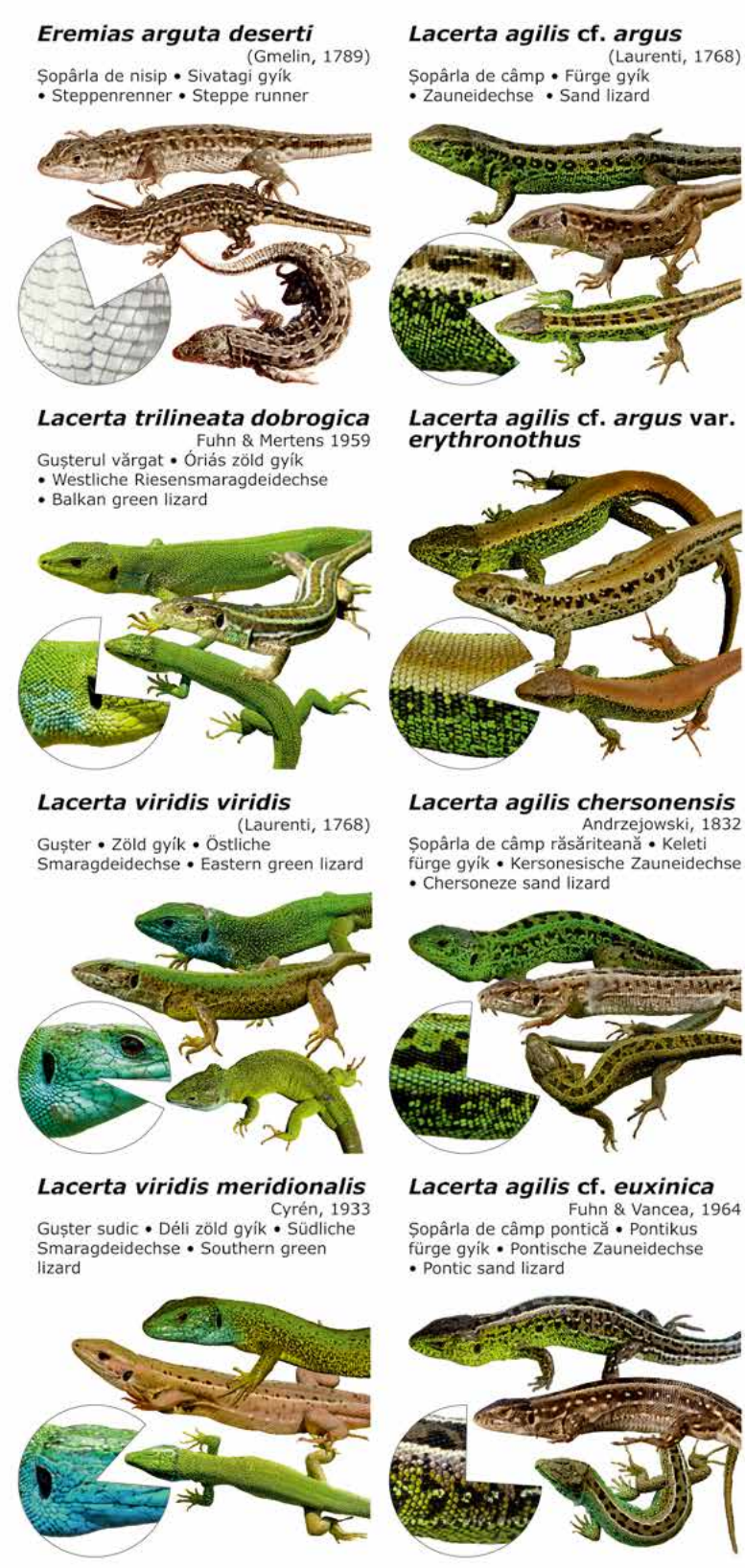


Fig. 21 Lizards in Romania - part A
Foto: Tibor Sos

Lizards in Romania

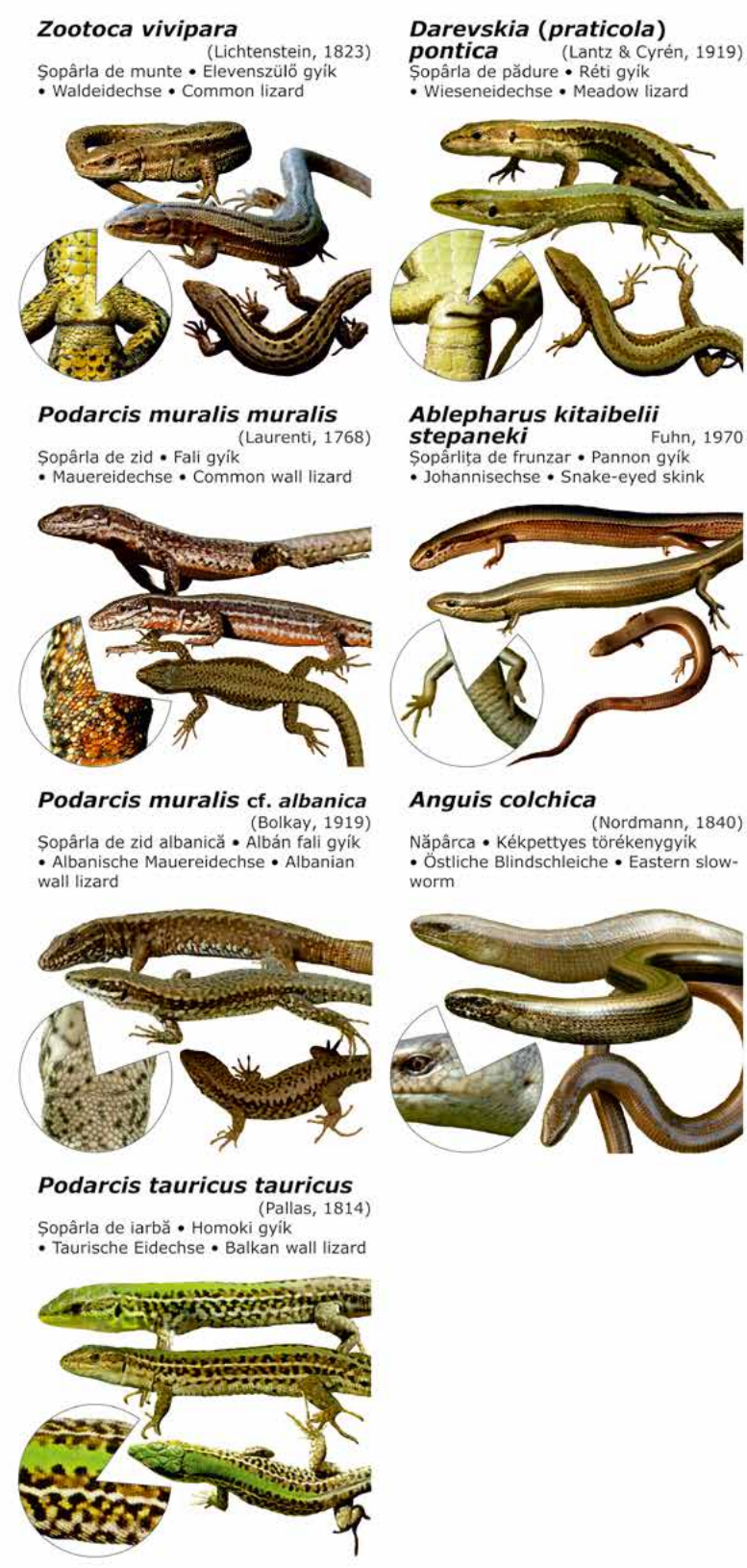


Fig. 22 Lizards in Romania - Part B
Foto: Tibor Sos

Turtles in Romania

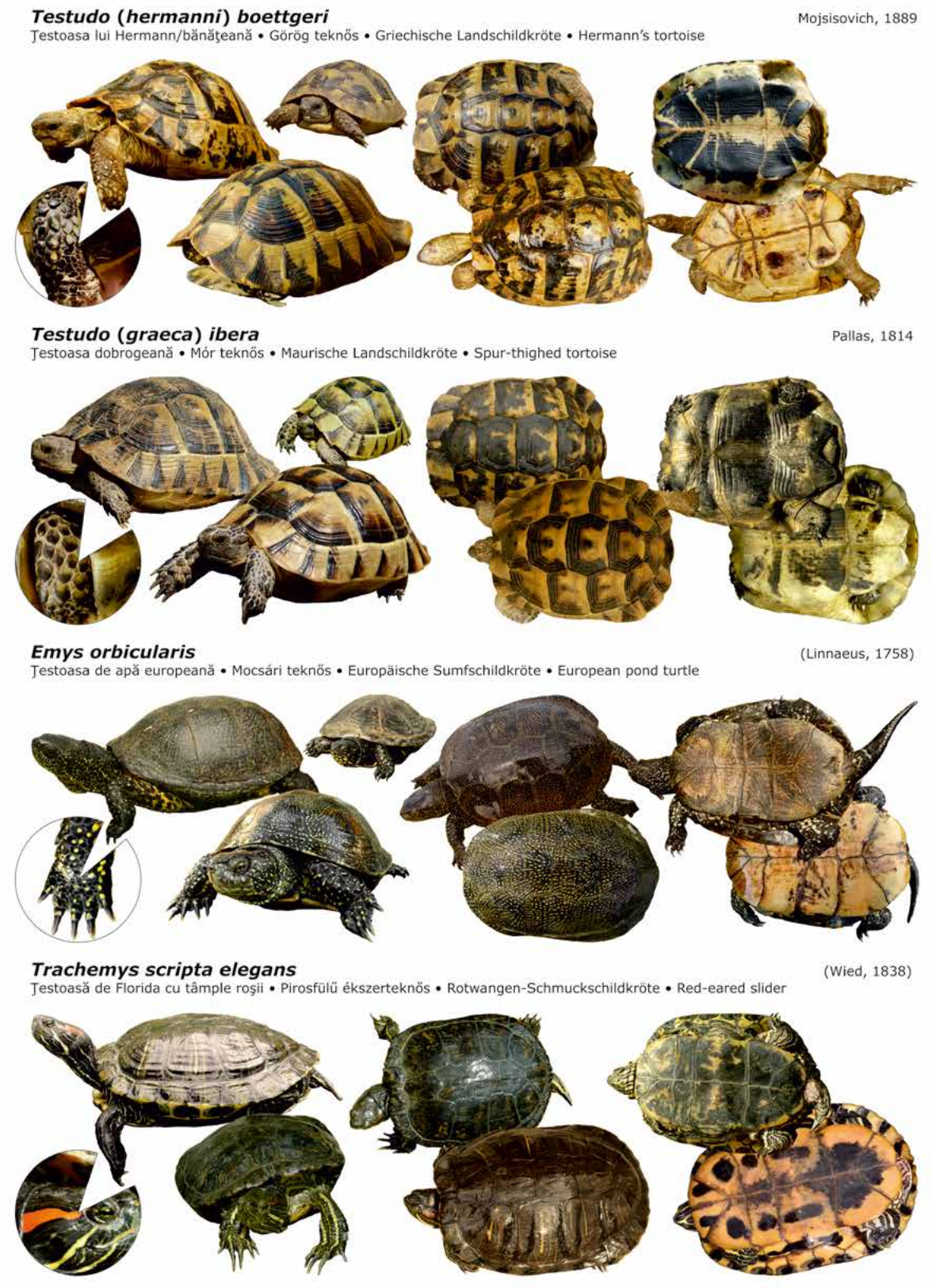


Fig. 23 Turtles in Romania
Foto: Tibor Sos

Teacher worksheet: differences between species and reptiles' morphotypes

a) differences between the The spur-thighed tortoise and the Herman turtle (they can be easily confused by the ignorant).

By puzzles game and using the following questions, students can learn the differences between the two species.

	Testudo graeca	*Hermann's tortoise*
1	Ribs relatively flat.	Relatively tiny ribs
2	Last rib wider than the other.	The last rib is of the same size like the others.
3	With horny nail on the tip of the tail.	Without horny nail towards the tip of the tail.
4	Large and small scales on the forelimb.	Large scales on the forelimb
5	Without spurs.	Obvious spurs on each thigh.

b) the differneces between turtles, snakes and lizards.

We propose you 8 characteristics that can be taken from the general part of the module and the Appendix 2 following the model:

- General shape of the body;
- Skin structure;
- Movement;
- Temperature regulation;
- Feeding;
- Sense organs;
- Reproduction;
- Non venomous versus venomous species.

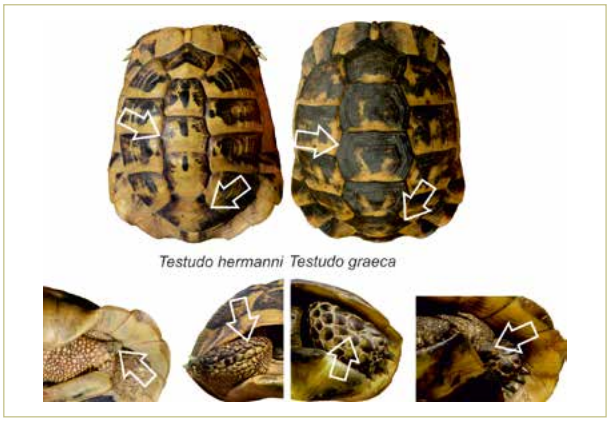


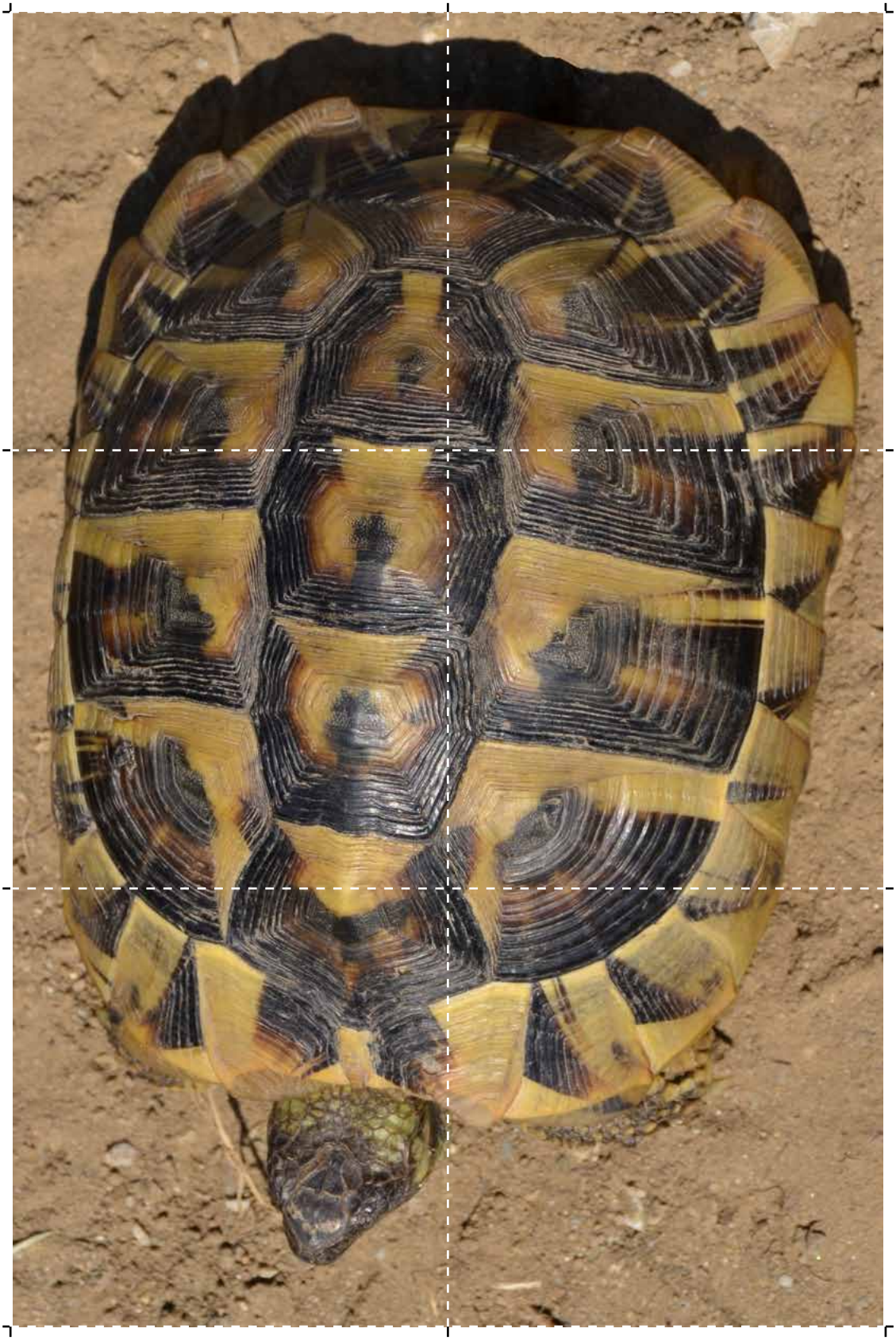
Fig. 24 Morphological diferences among the land turtles species from Romania: the Herman turtle (left) and the spur-thighed tortoise (right)

Puzzle The spur-thighed tortoise

(Fig. 25. Tibor Sos)

Puzzle Hermann's tortoise

(Fig. 26. Tibor Sos)



Puzzle Smooth snake

(Fig. 27. Tibor Sos)

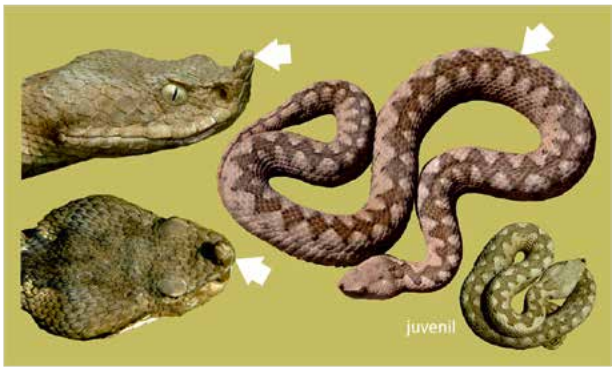
Puzzle European copper skin

(Fig. 28. Tibor Sos)

What reptile do I am?

Horned viper, *Vipera ammodytes*

On the back there is a zigzag pattern. With horned appendage. Only in South- Western Transylvania. Venomous species! It may be gray to reddish-brown or yellowish. It lives in warm rocky valleys, on scree. It feeds mainly on rodents like rats. Food is murdered with poison. Attacks only if surprised or caught!



(Fig. 29. Tibor Sos)

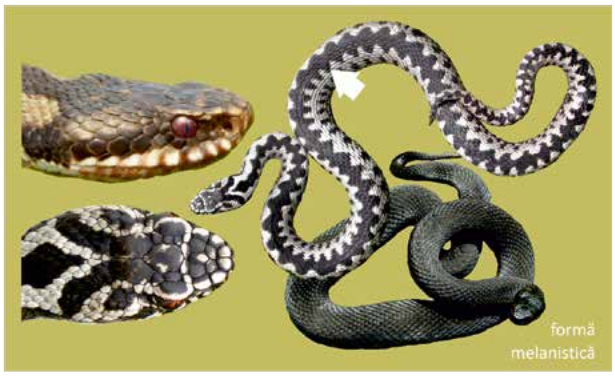
Meadow viper, *Vipera ursinii rakosiensis*

On the back there is a zigzag design with rounded corners. Rare, only in steppe grasslands lives of Mures Valley and Somes. There has nasal appendage. Venomous species, but are insectivores (feeds mostly crickets and locusts) its venom is weak! Is a species hardly noticed. Often may occur in the morning or after a longer period of cold to sunshine. Her colours range from gray to brown.

(Fig. 30. Tibor Sos)

The common European adder, *Vipera berus*

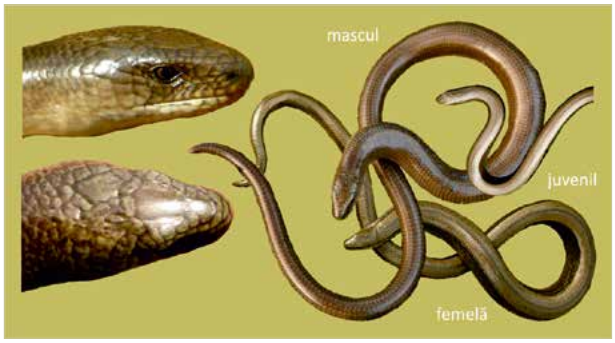
On the back there is a zigzag pattern with sharp corners. It is typical of mountain areas, less for the hilly areas. There has nasal appendage. Venomous species, attacking only when bothered! Males are gray brown females usually visible. Living in valleys with favorable exhibition: south, southeast. It feeds mainly on rodents. Crowds of vipers may occur during breeding.



(Fig. 31. Tibor Sos)

The Eastern Slow-worm, *Anguis colchica*

Without drawing zigzagging back. Body shiny as glass. It's a legless lizard. It is non venomous species as all native lizards in Romania. Tail longer than body, in case of danger can „break" into pieces. Have mobile pupils (their snakes overgrown). Females have dark sides. It feeds on earthworms and slugs.



(Fig. 32. Tibor Sos)

The smooth snake, *Coronella austriaca*

Without drawing zigzagging on its back. Body scales easily distinguishable. Continuous stripe on the sides of the head. Adults reach a maximum length of 60-80 cm. Non venomous species. It is often being considered viper killed due coloring. It appears with colors from gray, yellow, reddish-brown. It lives in grasslands on the edge of forests. Prefer as food lizards and rodents. Food is killed by twisting.

(Fig. 33. Tibor Sos)

The Aesculapian snake, *Zamenis longissimus*

Without drawing zigzagging on its back. Body scales easily distinguishable. With streak only from the eye to the corner of mouth and two „ears" open, yellowish. Adults reach up to 130-160 cm in length. Rare species in central Transylvania. Non venomous species. It prefers warm valleys, woodlands and thickets. It climbs easily and often feeds on bird chicks in nests when surprised. Usually it feeds on rodents. Can attack biting when surprised. The juveniles are spotted.

(Fig. 34. Tibor Sos)

The ringed snake or water snake, *Natrix natrix*

Without drawing zigzagging on its back. Body scales easily distinguishable. Semi-aquatic species. It lives in wetlands (swamps in the area, ponds, meadows) and in dry areas (lowland thickets). It is diurnal and night retreats into the wilderness. It is a good swimmer and always keeps head above water. It is the best climber in trees or bushes. Natural predators are hedgehogs, foxes, wild cats, birds of prey. Consume amphibians (frogs, newts), smaller lizards, and rodents, fish, birds and sometimes, chicken or eggs.

(Fig. 35. Tibor Sos)