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SALAMANDERS AND NEWTS

Ziegler's Crocodile Newt

Tylototriton ziegleri

Tylototriton ziegleri is a small, almost entirely black crocodile newt of 13-16 cm with three rows of large warts along the back and clearly red fingers, toes and tail underside. The species was described in 2013, lives hidden in mountain forests in northern Vietnam and southern China and is easy to keep in an enclosure with a small water section.

Family: Salamandridae Former name: *Yaotriton ziegleri* **Mild skin toxins**

KEY FACTS

THE ANIMAL

Adult size	**13-16 cm** total length incl. tail
Weight	**6-16 g**
Lifespan	**15-25 years**
Active	**At dusk and at night**
Lifestyle	**Terrestrial**
Habitat	**Montane forest**
Skin toxins	**Mild** Wash your hands after contact and keep your fingers away from your eyes and mouth
Difficulty	**Intermediate**

CARE

Min. enclosure	**60 × 40 × 40 cm** L × W × H for 3 adults
Temperature, day	**22-24 °C**
Temperature, night	**20-22 °C**
Humidity	**80-100%**
Water	**Water section** depth 1-5 cm
UVB	**Optional**
Winter rest	**16-18 °C** 12-17 weeks
Diet	**Insects and worms/snails**
Kept	**In pairs or in groups**

BREEDING

Reproduction	**Egg-laying**
Development	**Larvae in water**
Egg-laying site	**On the ground**
Eggs per season	**30-80**
Hatching	**20-36 days** at 20-24 °C
Larval period	**50-110 days** from hatching to metamorphosis
Larval diet	**Other larvae and small aquatic invertebrates (daphnia, mosquito larvae)**
Parental care	**None**

PROTECTION AND PAPERWORK

CITES	**Appendix II**
EU annex	**Annex B**
IUCN	**Vulnerable (VU)**

About the species

Tylototriton ziegleri is a relatively small crocodile newt. Adults are 13-16 cm in total, a little over half of the length is tail, and the weight is 6-16 g, exceptionally up to 23 g. Females have a snout-vent length of 7-10 cm and are clearly sturdier than the males, which usually measure 5-7 cm and at most 9 cm. The head is broader than the body and flat, and the bony ridges at the sides of the back of the head are large and distinct, especially in older animals. Along the middle of the back and on the two sides of the back run three rows of enlarged warts, which give the animal its crocodile-like look; the rows are stronger than in its closest relatives. At the back of the head sit large ear glands (parotoids).

The base colour is black, brown or grey, and darker on land than in water. Fingers and toes are almost always bright red, and so is the underside of the tail. In some animals the rib nodules are faintly orange. After metamorphosis the young are entirely black with the same red toe tips. Females can be recognised by their sturdier build and a smaller, pinpoint cloacal opening; in males the opening is larger and slit-shaped, and the tail is slightly longer in proportion to the body.

T. ziegleri belongs to the *asperrimus* group (subgenus *Yaotriton*) and was described in 2013 by Kanto Nishikawa, Masafumi Matsui and Nguyen Thien Tao. The name honours the German herpetologist Thomas Ziegler. Animals from Vietnam used to be identified as *Tylototriton asperrimus*; studies have shown that this name covers a number of separate species.

The skin is densely covered in glandular warts, and the large ear glands sit behind the head. How strong the secretion is in *T. ziegleri* has not been described. Wash your hands before and after contact and keep your fingers away from your eyes and mouth. Handle the animals only when necessary.

The species can live at least 19 years in captivity and probably reach an age of 23-28 years.

Read more: Rearing tadpoles

Distribution and habitat

Tylototriton ziegleri is known only from a few localities. It occurs in the northern Vietnamese provinces of Ha Giang and Cao Bang and in Jingxi in Guangxi Province in southern China; a photograph suggests that it also occurs in Lao Cai. The range is very small and lies in the border region between Vietnam and China, in limestone and karst landscape. The known sites lie at 885-1,420 m elevation, and a single locality is given at 1,600 m. One of the populations lives in the Pia Oac nature reserve in Cao Bang.

> **Native range:** Vietnam and China.

HABITAT

Tylototriton ziegleri lives in dense, evergreen subtropical mountain forest on calcareous soil, where bamboo dominates and where there are occasional more open, grassy patches. The species depends on forest, but tolerates some disturbance and is not bound to primary forest. The climate is governed by the summer monsoon: the winter half-year is dry and slightly cooler, the summer half-year warm and humid. In the breeding season from April to July the air is saturated with moisture, and the air temperature is 26-34 °C.

The animals live hidden on the forest floor under stones, in leaf litter and other hiding places and are rarely seen. In April and May the animals migrate to the breeding sites, which can be small, permanent pools, temporary rainwater puddles, flooded banks and damp meadows. The waters are 10-200 cm deep with a pH of 6.4-8. The males enter the water first, and the females stay there only briefly. If the rain fails and the pools dry out, the animals continue to live on land.

Care

THE ENCLOSURE

Tylototriton ziegleri is kept in a rainforest enclosure with a small water section. Three adults need an enclosure of at least 60 × 40 × 40 cm. Two animals manage with a floor area of 50 × 30 cm, and each animal beyond three needs about 25 % more floor space. Bigger is better, e.g. 120 × 60 × 60 cm for five animals. The enclosure can be made of glass or plastic and needs good ventilation in the lid or sides.

The substrate is filled 8-15 cm deep with a mixture of clay, woodland soil and grit over a drainage layer of clay pebbles, so that there are both drier and moister zones. Shape the substrate into small hills. The water section takes up a fifth to a quarter of the area and is separated by a glass edge of at most 10 cm or made as a lower part of the floor. The water is at most 5 cm deep, and access must be easy, with a gently sloping, wide bank of stones or gravel so that the animals can always get out. The water section is used mostly in the breeding season; the males may stay in it for several weeks.

The animals live in hiding, so there must be plenty of hides in both the moist and the dry part: half bamboo tubes, cork bark, clay dishes, caves in a back wall and a layer of oak, beech or bamboo leaves. Moss retains moisture and suits as an egg-laying site. Plants such as *Pilea cadierei*, *Radermachera sinica* and ferns thrive in the same climate. Springtails, earthworms and isopods in the enclosure eat waste and are also food. Isopods can fall into the water section and drown, so it must be cleaned regularly. Larger groups can be kept together if there is enough space and cover.

Read more: Terrarium construction and bioactive substrate Read more: Feeder animals: keeping and breeding

TEMPERATURE

From March to October the enclosure is kept at 22-24 °C by day and 20-22 °C at night. The animals tolerate higher temperatures for a short time, but longer periods above about 25 °C should be avoided, and there must be cool spots in the enclosure. From November to February the animals are kept at 16-18 °C; brief drops to lower temperatures are not a problem.

The cool, dry winter followed by a simulated rainy season is the most important trigger for breeding. The young thrive at 19-21 °C.

HUMIDITY AND MISTING

Humidity is 80-100 %. The enclosure is misted daily with a plant sprayer or a rain system, and the amount is adjusted to the size and ventilation of the enclosure so that the substrate does not become stagnantly wet. There must be both damper and drier zones.

From October only a little misting is done, in only a few places (moss pads), and the water level in the water section is lowered until it is almost emptied. When the males enter the water, or the rainy season is to begin, mist heavily several times a day and raise the water level. The transition should preferably coincide with a low-pressure system.

Read more: Humidity, misting and ventilation

WATER AND WATER QUALITY

The water section must have soft, slightly acidic water with a pH of 6.4-6.8; for example rainwater that has stood for a while. The water is at most 5 cm deep. Never use tap water without removing the chlorine. Amphibians absorb substances through the skin, so cleaning agents, soap and chemicals must not come near. Change the water regularly and remove visible impurities. If gravel is used as substrate, it is rinsed regularly; soil and clay mixtures seldom need replacing.

LIGHTING AND UVB

Light is not particularly important to the animals, which do not like strong light. It is set to suit the plants: LED strips or fluorescent tubes for 12 hours in summer and 10-11 hours in winter. Indirect room light is also enough. UVB is not necessary for this hidden-living species.

Read more: Lighting and UVB

FEEDING

Adults are given food that is usual for newts: wax worms, crickets, house crickets, waxworm larvae, earthworms and isopods of suitable size. Adults are fed about twice a week; in winter they eat irregularly and much less. Females eat more before mating and egg-laying, and males also eat in the water.

The feeder animals must be well nourished and dusted with a vitamin and mineral supplement. Young that have just gone onto land are fed every day and given small crickets, small earthworms, fire-bellied bristle worms, fruit flies, bloodworms and tubifex in a dish or on a small plate. Feeding is gradually scaled down as they grow. Young that will not eat can be tempted with live food held in front of them with tweezers.

BEHAVIOUR AND HANDLING

The animals are hidden and quiet and are seen mostly when they are fed or when the males are in the water. Aggression between adults is normally not a problem, and pairs or small groups can be kept together if the enclosure is large enough. The species is best kept in a clean single-species enclosure without other amphibians; earthworms, isopods and aquatic snails can be added. Grown young are not placed with the parents.

The animals are handled as little as possible. If they have to be moved, use wet hands or a small tray, and wash your hands afterwards. Newly acquired animals are quarantined, and a swab test is taken for the fungi *Batrachochytrium dendrobatidis* and *Batrachochytrium salamandrivorans* before they are put together with other amphibians.

Breeding

SEXUAL MATURITY AND SEXING

Females grow larger and are sturdier than males, and in the breeding season they are clearly broader, while males develop stronger legs. The sex can also be seen by gently opening the vent: the female has a smaller, point-shaped opening, the male a larger, slit-shaped one. Age and size at sexual maturity are not documented. Towards the end of summer the females become clearly rounder. To be sure of getting a pair, keep a small group together.

MATING

Mating is triggered by a winter temperature of about 16-18 °C together with dry care and little food, followed by a simulated rainy season. The animals react to changes in air pressure, so the rainy season is best started when a low-pressure system is approaching: mist heavily several times a day, raise the water level in the water section and let the temperature rise. The males enter the water within 1-2 days and wait for the females; they become paler and develop a different skin texture. The females enter the water for one or more days.

The pair form a circling dance in which the male butts the female with his head and waves his tail. He deposits spermatophores and guides the female over them; this can take several hours. The water temperature during mating is 18-19 °C in the morning and 21-22 °C by day. If mating fails to occur despite the rainy season, it can help to lower the water level again and raise it after a dry period. The urge to mate is less tied to the season than in *Tylototriton vietnamensis*.

EGGS AND LARVAE

The female lays the eggs the day after mating, sometimes over two days, on land in a damp, moss-covered spot close to the water section, often hidden under leaves or bark. The eggs sit together in clumps with a clear jelly. In the wild the female lays 10-109 eggs in a clump and then withdraws further into the forest. In enclosures 30-80 eggs are most often laid and at most 134 in a season. Each egg is 7-11 mm in diameter. In the wild the eggs are laid in April and May; in the enclosure it can happen from January to September.

The eggs are removed from the enclosure because the parents may eat eggs and larvae. They are placed on slightly damp kitchen paper on a wire grid in a closed plastic box with a little water in the bottom, so that the eggs lie above the water and in very high humidity. The box is opened once or twice a day for inspection and airing, dead eggs are removed, and the paper is changed once or twice during development. Damaged eggs with live larvae can be placed in the water in the box; they hatch early, cannot swim yet and can be moved to a Petri dish until they swim.

METAMORPHOSIS

The eggs hatch after 20-36 days at 22-24 °C by day and 20-22 °C by night. The larvae are up to 22 mm long when they hatch and have small front legs. When the first larvae hatch, the water level in the box is raised, which makes the rest hatch. The larvae metamorphose 81-130 days (11-18 weeks) after egg-laying and are then 5-6 cm long. Before that they turn black, the gills and tail fin disappear, and the skin gradually becomes rough.

The larvae must be able to leave the water at any time. Make an easily accessible transition with sloping gravel, cork, roots or stones, or move them to a land container. Around the move onto land the animals shed their skin; those that have already gone onto land return to the water once more to shed. Mortality during metamorphosis is 35-40 %.

REARING THE YOUNG

The larvae are very aggressive towards each other, and cannibalism is common. The fewer larvae together, the better the survival and the larger the young. The safest way is to keep them singly or at most 5 together in plastic boxes of 10 litres; sort them by size and provide many hiding places in the form of plants and PVC pipes. The water must be still, for example rainwater with an extract of boiled oak leaves, with sand from an established aquarium, aquatic plants (Java fern, Java moss) and large pond snails, which eat uneaten food. Let the box mature for a few days beforehand.

The larvae eat immediately after hatching and must practically swim in food. Start with artemia, very small daphnia and copepods 2-3 times a day, later 6-8 times. From 25 mm pieces of tubifex are added, from 35 mm pieces of earthworms, whole tubifex and white worms, and the largest take bloodworms and young shrimp. Change the water one to three times a day, at most about 15 % at a time and with still water. An excess of fresh water causes gas build-up in the belly, and water that is too hard damages the gills. *Hydra* polyps harm the larvae and must be removed.

Newly metamorphosed young are entirely black with orange fingers and toes and remnants of the gills, which disappear after a few days. They are moved to the rearing enclosure only after their first skin shed. They are kept in boxes of 40 × 30 cm in groups of 5-12 animals on sloping gravel with a small puddle in the lowest part, with moss, stones, baked oak leaves and cork bark. Temperature and light as for the adults; 19-21 °C is well tolerated and may be an advantage. The young are smaller and more delicate than those of *Tylototriton vietnamensis*. Check them daily, change the leaves weekly and rinse the gravel.

Health and common mistakes

Typical problems in the care of *Tylototriton ziegleri* and its relatives:

- Stagnant air and excessive heat: keep the enclosure airy, and provide cool places.
- Poor larval water: water that is too hard causes breakdown of the gills, too much fresh water causes gas in the belly.
- Bsal and Bd: fungi that can be fatal to salamanders. Asian salamanders can carry them without symptoms. Quarantine, hygiene (separate equipment for each enclosure, no mixing of animals from different sources) and swab tests are the best prevention.
- Damaged larvae and young: loss of the tail tip, tail fin or toes after bites from other larvae. Keep the larvae apart and sorted by size.
- Snail and polyp problems in the rearing tank.
- See a vet with amphibian expertise at signs of illness, for example sores, swellings, refusal of food or death without visible cause.

Read more: Quarantine and hygiene

Always ask someone who knows

This guide is a good place to start, but it cannot replace experience. Animals differ, and much of what matters most is learned from people who have kept the species for years. Talk to a breeder, an experienced keeper or a vet who knows reptiles and amphibians before you get the animal - and again if anything looks wrong.