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FROGS

Tonkin Bug-eyed Frog

Theloderma corticale

Theloderma corticale is a nocturnal, semi-aquatic frog from the forests of northern Vietnam, Laos and southern China. The warty, green and black-blotched skin resembles moss and lichen so well that the frog almost disappears in the enclosure. It wants cool and wet conditions and does not tolerate heat, but is on the other hand easy to get to breed.

Family: Rhacophoridae Former name: *Rhacophorus corticalis*

KEY FACTS

THE ANIMAL

Adult size	**6-9 cm** snout-vent length
Lifespan	**10-20 years**
Active	**At night**
Lifestyle	**Arboreal and semi-aquatic**
Habitat	**Rainforest, montane forest and rocky terrain**
Skin toxins	**None known**
Difficulty	**Intermediate**

CARE

Min. enclosure	**80 × 50 × 40 cm** L × W × H for 4 adults
Temperature, day	**18-23 °C**
Temperature, night	**15-20 °C**
Humidity	**80-90%**
Water	**Aquaterrarium** depth 5-10 cm
Water temperature	**17-22 °C**
UVB	**Optional** Ferguson zone 1
Winter rest	**13-16 °C** 4-22 weeks
Diet	**Insects**
Kept	**In pairs or in groups**

BREEDING

Reproduction	**Egg-laying**
Development	**Tadpoles in water**
Egg-laying site	**On leaves over water**
Sexually mature	**8-10 months**
Eggs per clutch	**6-47**
Hatching	**9-22 days**
Larval period	**75-180 days** from hatching to metamorphosis
Larval diet	**Complete diet**
Parental care	**None**

PROTECTION AND PAPERWORK

CITES	**Not listed**
IUCN	**Least Concern (LC)**

About the species

Theloderma corticale is one of the most effective camouflage artists among frogs. The skin is covered in warts and tubercles in a mottled pattern of green, brown and blackish grey that breaks up the outline of the body against moss- and lichen-covered bark and rock. The genus name *Theloderma* refers precisely to the warty skin. The eyes are large with an iris flecked in various shades of gold, the toes have large adhesive discs, and the belly is soft.

The snout-vent length is about 6 cm, while females grow the largest and can reach 8-9 cm. Females also have a broader head and shorter snout than males. Weight is not documented.

The species was described by Boulenger in 1903 as *Rhacophorus corticalis*. The Chinese form, formerly regarded as a separate species, *Theloderma kwangsiense*, is today considered the same species, and DNA studies have since shown that the species also lives in Laos and southern China, not only in Vietnam. In captivity the species can live well into its teens and probably reach 20 years.

The frog is calm and relies on its camouflage. If startled, it curls up and plays dead, and even tadpoles just before metamorphosis go rigid when touched. No toxic skin secretion has been described in the species, but the skin is sensitive as in all amphibians, so wash your hands before and after contact. *T. corticale* is easy to get to breed, but it tolerates heat poorly, and that is the most important thing to understand before acquiring it.

Read more: Rearing tadpoles

Distribution and habitat

Theloderma corticale lives in northern Vietnam, in south-central Laos and in southern China, where it is known from Guangdong, Guangxi, Hainan and Yunnan. Several of the Chinese and Laotian records were added after recent DNA studies, and by far most records still come from Vietnam.

The captive population, including in Europe, originates from Tam Dao in northern Vietnam. The species has been collected for the pet trade, but today it is bred regularly in captivity.

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

HABITAT

Theloderma corticale lives in evergreen rainforest and subtropical forest at about 470-1,500 metres elevation. It is tied to water and is found at steep rock faces, in caves and rock crevices in limestone areas, along streams and in water-filled cavities in tree trunks, including hollowed trunks that locals have put out. The eggs are laid in cavities and on surfaces above water, so the tadpoles fall straight down when they hatch.

The climate has a warm rainy season and a cooler, drier winter, when the temperature in the mountains can fall to 4-5 °C. The frog avoids the worst extremes by staying in damp microhabitats near water all year round. The water in the limestone areas is typically hard.

Forest loss threatens the habitat, the species has been collected for the pet trade, and like many amphibians it is susceptible to the chytrid fungus *Batrachochytrium dendrobatidis*. Even so, it is listed as Least Concern (LC) by the IUCN.

Read more: Quarantine and hygiene

Care

THE ENCLOSURE

Theloderma corticale needs an aquaterrarium where a large part of the floor, or the whole floor, stands under water. Allow at least 80 × 50 × 40 cm (length × width × height) for one male and one to three females, or about 38 litres per frog. Two males and one female can be kept in 100 × 60 × 50 cm, fully flooded.

The water does not need a current. Place cork sheets and half cork tubes in the water as land, hides and egg-laying sites: the frogs readily lay eggs on the inside of partly submerged cork tubes or on the underside of sheets set at about 45 degrees, so the tadpoles fall into the water. Tubes with an inner diameter of at least 7-8 cm are good. Roots, mangrove wood, limestone and clay pots also work well. Plants such as pothos, peace lily, water lettuce and *Anubias* provide cover and thrive in the humid air. A drip wall, where a pump carries water up over cork or artificial rock, imitates the damp rock faces and looks attractive.

A mesh lid provides ventilation, but part of the lid can be covered with glass to retain moisture. Make a root or cork bridge from the water up onto land, so newly metamorphosed froglets can get out. New animals should be quarantined first, ideally for six weeks and with a test for chytrid fungus.

TEMPERATURE

Heat is the species' greatest enemy. By day there should be 18-23 °C and at night 15-20 °C. Down to about 10 °C is fine, while anything above 25 °C is a warning sign, and temperatures above 27 °C can kill the frogs. If you cannot keep the enclosure below 27 °C in summer, you should choose another species.

Measure with a digital thermometer, and keep the enclosure away from south-facing windows and heat sources. Heat lamps do not belong. On warm days misting with cold water, ice cubes of reverse osmosis water in the water section or a cooling element in front of the enclosure with a fan blowing cool air in can help.

A cool winter period imitates nature and gets breeding going. For example, lower the temperature to about 15 °C from September to February, and cut down on misting, food and light (10 hours). During the rest period the frogs stay almost only in the water and eat very little.

HUMIDITY AND MISTING

Humidity must be high: over 80% and never below 60%, otherwise the frogs may dry out. The females lay eggs at 80-90%. The large water surface keeps humidity up by itself, so the frogs do not need misting very often. Two to three times a week is enough to rinse droppings off the furnishings and down into the water.

A misting system is practical, because misting with cold water also cools the enclosure. Make sure the air does not become stagnant. Before the breeding season, misting is increased and the water level raised, so it resembles the start of the rainy season.

Read more: Humidity, misting and ventilation

WATER AND WATER QUALITY

The water section is the species' home. The water should be 5-10 cm deep, and deeper water also works. The frogs must be able to sit in the water and easily climb onto cork or roots.

Preferably use reverse-osmosis water remineralised with a supplement for amphibians, and add tannin with leaves of *Terminalia catappa* (Indian almond), oak leaves or magnolia leaves or a blackwater extract. The water becomes yellowish or tea-brown and gets a slightly lower pH, and this is how the frogs thrive. Still, unfiltered water works well if about two thirds is changed every second to third week, and excessively clean water can cause eye problems. Soft water (GH under 8, KH under 4) gives better rearing, even though the water in the species' limestone areas is hard.

The water should be cool, about 17-22 °C. Amphibians absorb substances through the skin, so rinse your hands free of soap and cream before putting them in the water, and never use cleaning products in the enclosure. Drowned feeder insects are removed at the water change.

LIGHTING AND UVB

The frog is nocturnal and has no documented need for UVB. A low-output UVB tube for shade-dwelling species (Ferguson zone 1) can be used and provides the small UV index that can support the day-night rhythm, but it is optional. Position it so the frogs can always retreat into shade.

Live plants need plant lighting, for example a T8 tube of 6,500 K; the frogs themselves do not need it. A T5 tube with 12 hours of light in the breeding season and 10 hours in winter is suitable. The light must not heat the enclosure. A red night light or a moon lamp, not a heat lamp, makes it possible to see the frogs when they are active.

Read more: Lighting and UVB

FEEDING

T. corticale eats insects: well gut-loaded crickets, dubia roaches, waxworms, black soldier fly larvae and small hornworms. The feeder animals must be no longer than the distance between the frog's eyes and are dusted with a good vitamin and mineral supplement, preferably alternating calcium with D3 and a multivitamin.

Feed just after the light is switched off: within 10 minutes the frogs become active and look for food. The crickets can be placed on the cork or in a small tub floating on the water. Some invariably drown; the tadpoles can eat them, or they are removed at the water change.

The species eats less than many other frogs. Adults get four to six feeder animals every second or third day. Overfeeding makes fat frogs, but breeding females should have a little extra.

Read more: Feeder animals: keeping and breeding Read more: Calcium, vitamins and supplements

BEHAVIOUR AND HANDLING

Theloderma corticale is calm and hides by day in tubes, caves and among plants. A few minutes after the light is switched off, it becomes active. It should not be handled, because the skin is sensitive and the frog has nothing to gain from it. If an animal has to be moved, use a small damp container or wet hands, and be quick.

The males call mostly in the evening and occasionally during the day, a melodic hooting reminiscent of a mechanical owl. Even very young males can call, and the calls can be loud. The frogs are sensitive to disturbance while calling. The species is kept in pairs or groups, and both sexes can live together all year round. Small, peaceful fish such as *Tanichthys albonubes* can be kept with the frogs, but a fish may get eaten.

Breeding

SEXUAL MATURITY AND SEXING

Females grow larger than males and have a broader head and shorter snout. Males have well-developed nuptial pads on the thumbs, which are red and swollen in the breeding season, but females can have faintly developed pads, so take care when sexing. Calling reveals a male. In most species in the genus the animals are sexually mature at 8-10 months; the exact age for *T. corticale* is not known.

The sex ratio in captivity is often skewed, with up to 99% males. Cool tadpole water apparently produces more females: at 17-19 °C about 70% become females, at 13-16 °C about one female for every four males, and at room temperature almost only males. Temperature-dependent sex determination has not, however, been proven for the species. Buy animals from a breeder who rears them cool, and preferably buy more animals than you expect to use.

Read more: Incubating eggs

MATING

Breeding is typically triggered by a cool period followed by rising temperature and humidity and a higher water level. After the winter the temperature can be raised gradually to 20-25 °C from February, misting increased, the water level raised from just under 6 to 7 cm and the day length extended to 12 hours. The first eggs can come in early March, and further temperature rises can bring more clutches from July to September.

Egg-laying can also happen all year round under stable conditions, but a few weeks of cooling in winter or at least separating the sexes for a few months is still a good idea, so the females can regain strength. It can also be enough to give a little extra food and change the water with cooler water every week; the pair are then often seen in amplexus within a few days. If breeding continues for more than four to five months, the sexes should be separated.

Mating takes place in the water. The male grasps the female behind the front legs, and the pair may be seen in amplexus the day before egg-laying.

EGGS AND TADPOLES

The eggs are stuck in rows above the water: on the underside of half bamboo tubes, cork tubes or cork plates, on vertical surfaces such as mangrove wood or the back wall, or on stones and plants. The eggs are 4-5 mm, half white and half grey, in a clear jelly. A clutch typically numbers 6-47 eggs and rarely up to 70. Clutches come at intervals of one to four weeks, but several months can also pass without eggs.

Leave the eggs where they are laid, and keep them moist. Eggs that fall into the water develop less well: they may hatch a couple of days earlier, give smaller larvae and survive less well, and in unoxygenated, unfiltered water development may fail altogether. One of the adults often sits close to the eggs, but actual brood care is not known.

The tadpoles are not cannibals under normal conditions and can stay with the parents, where they eat excrement and drowned crickets. They are, however, most often moved to their own tubs: an aquarium or a plastic box with 10-25 cm of water, sand, stones or pieces of tube as hides and leaves of *Terminalia catappa*. A tub of 60 × 40 × 20 cm with about 15 cm of water, a filter with a nylon stocking over the intake and 20 °C works well. Give fish flakes, spirulina flakes, bloodworms or tadpole pellets, but no more than is eaten, and change half of the water every week. Large clutches should be divided, so that there is room for all.

METAMORPHOSIS

The eggs hatch after 9-22 days depending on temperature and whether they lie on land or in water. The larval period is long, typically two and a half to three months, but it can last six and up to eight months. At 20 °C it takes about 137 days from egg-laying to completed metamorphosis; at 23-26 °C it goes faster.

In cool rearing the front legs appear about 118 days after egg-laying, and from about day 125 the froglets crawl onto land with a tail stub. When the front legs show, there must be an easy way up: roots, cork or floating plants, and the water must be shallow, at most 5 cm. The froglets can be moved to an enclosure with 2-5 cm of water, floating cork sheets and a couple of pothos cuttings, or to an enclosure with a water section and damp leaf litter and moss on land. The froglets begin to eat once they have been on land for about a week.

REARING THE YOUNG

The newly metamorphosed young are relatively large and go into a small, simple enclosure where it is easy to see that all are eating and growing: shallow water, floating cork and plants, or leaves and moss on land and a shallow water area. Leave out tubes at the start, so that the young do not hide from you. Keep the temperature cool, about 20 °C.

First food is small crickets from about 2 mm, and many young can take 6 mm crickets straight away. Feed every other day, and always dust with calcium and vitamins. After two to four months the young can move to a larger enclosure. Remember that tadpoles from warm water most often become males.

Health and common mistakes

Theloderma corticale is hardy when the temperature is right. The typical problems are:

- Too high a temperature: above 25 °C is a warning sign, and above 27 °C the frogs can die. Cool immediately.
- Air that is too dry. Below 60% the frogs may dry out.
- Poor water quality or excessively clean water, which can cause eye problems. Change water regularly, and use tannin.
- Lack of calcium and vitamins, especially in breeding females and juveniles. Dust the food.
- Chytrid fungus and other infections. Quarantine new animals.
- Obesity in overfed animals.
- White spots and frayed tail fins in tadpoles usually do not harm development; the cause is unknown.

See a vet with amphibian experience if a frog loses weight, stops eating, develops sores, discoloured skin or cloudy eyes.

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.