

PROTO-PATTERNS IN FIRE-BELLIED TOADS AND EUROPEAN TREEFROGS

COLIN J.O. HARRISON

48 Earl's Crescent, Harrow, Middlesex HA1 1XN

Through the kindness of Julian Bentley I had the opportunity this year to rear and observe a number of frog and toad tadpoles of different species. It was a useful occasion for comparative study and raised a few queries without immediate answers.

One group that I reared together were mainly Oriental Fire-bellied Toad, *Bombina orientalis*, but with a few Fire-bellied Toad, *B. bombina*, and some which appeared to originate from hybridisation of the former with the Yellow-bellied Toad, *B. variegata*. There was little evidence of specific differences in these tadpoles and it was not until metamorphosis that variation became apparent.

The small tadpoles were at first blackish with a pale yellow-buff eye rim and a pale line along each side, which together with a pale line bordering the tail-base produced a variegated pattern. Later they became plain and blackish; but at about the time that the bulges for forelimbs first appeared the back became greyer, with the darker markings of the adults beginning to show. They tended to become a little paler, and by the time that the forelegs were about to emerge they showed on the back a pattern of four pale green spots. A pair of rounded spots were fairly close together on the upper back, and lower down were a pair of larger spots, more longitudinally elongated.

A number of the metamorphosed young appeared to be hybrids. In shape and behaviour they were like *B. orientalis* and the underside had the same colour and pattern, the background being the yellow of captive-bred *orientalis*. On the upper side, however, they were a kind of drab khaki, turning blackish in darker situations and with some greyish-white speckling on the flanks. Some showed variable small green patches on the nose and limbs. More strikingly, the green spots persisted as bold markings on the back, even in older individuals, the hinder pair tending to diverge posteriorly, and being fainter at times, and absent in at least one individual.

I could find no evidence of this pattern of spots on the back as a character of adult *Bombina* species; although in the European fieldguide (Arnold & Burton 1978) Ovenden shows the Yellow-bellied Toad with a similar pattern of four pale buff patches on the back. This does not seem to be apparent in photographs or on the few adults I have seen.

I checked tadpoles of the latter species and found that the four pale green spots appeared just as the fore-arms were developing; but within a matter of days, as they left the water and absorbed the tail, these became pale buff markings that were faint or barely detectable in most individuals. The situation would seem to be similar in the European Fire-bellied Toads in which the spots disappeared soon after they left the water.

I have not been able to check the Giant Fire-bellied Toad, *B. maxima*, but the pattern may be present on newly-metamorphosed young since Bray (1987) says that "The young toads resembled the adults closely but had many green markings on the back".

The young Oriental Fire-bellies also show a strong pattern and may have been the main influence on the hybrid pattern. They had four bold green spots, the lower pair tending to taper and diverge posteriorly. However, since the back rapidly turned green soon after metamorphosis the spotted pattern, which appeared to be still present and which fitted between the typical black markings, was concealed by a background of similar colour.

The overall occurrence suggests a protopattern; an ancestral pattern common to the genus and still genetically present, now disused except for its temporary occurrence at metamorphosis when it might possibly have a cryptic function in aiding the concealment of tiny toads at a very vulnerable stage.

I am intrigued by an apparent parallel with a study I once made of a pattern component in bird plumage. Paired green neck streaks are present on the males of many species of ducks, they occur in some hybrids even when the parent species show no visible evidence of them, they are important as part of the display plumage of a few species, and also occur on the head of the Mallard, *Anas platyrhynchos*, where they are lost in a background of similar colour but revealed by differential feather fluffing in some epigamic displays.

Another pattern noted during tadpole-rearing was that of the European Treefrog, *Hyla arborea*. Here the tadpoles, just prior to metamorphosis, showed a lighter brown back with a sparse scattering of irregular black spots. After metamorphosis these spots tended to persist for a while after the frogs had turned green, varying between individuals but becoming smaller and less distinct with growth. In frogs of 2-3 cm body and head length they were still apparent on some individuals.

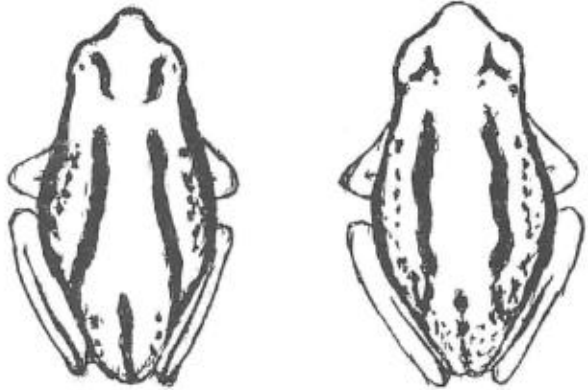


FIG. 1. Markings on treefrogs, *Hyla arborea*. See Addendum below, for explanation.

Arnold and Burton (1978) mention and illustrate the presence of dark spots on adults of the subspecies *H. a. sarda* from some western Mediterranean islands. They also state the Stripeless Treefrog, *H. meridionalis*, of southern Europe may have small dark spots.

As with the markings on juvenile *Bombina* it could be suggested that they had a function in increasing crypsis at the stage when the young might be on the ground or among lower and more mixed herbage. However, although these markings may appear random at first sight they tend to be aligned along tracts from the hinder edge of the orbit to the groin on either side of the body, and a few may be along the mid-line. This arrangement suggests the possibility that they are relics of an earlier striped pattern.

In their present occurrence these patterns may be of some interest to keepers of amphibians as something they may observe that is rarely commented upon in publications, but might also be of greater interest in that they appear to be inherent characters with some degree of individual variation that might give rise to more boldly-marked strains during captive breeding.

ADDENDUM

After completing the above comments on pattern, and sending them off, I was delighted to find in a shop some treefrogs that appeared to back up my hypothesis. They were described as of Portuguese origin, apparently an Iberian population of *Hyla arborea*. Although shown to similar scale the one on the left in the diagram is c. 2.5 cm head and body length, the right-hand one c. 1.5 cm. Both were in a dull brown colour phase with blackish striping. There are paired stripes from above the eyes to the hind-flank, interrupted on the neck. There is a short stripe on the lower mid-back. Within a few days the larger frog turned bright green, the stripes becoming dark green and increasingly indistinct. However, the row of small spots on each side, which look as though they might have made a short stripe, persisted in the green phase as black spots above the irregular black line along the side of the body that is typical of the species.

REFERENCES

- Arnold, E.N. & Burton, J.A. 1978. *A field Guide to the Reptiles and Amphibians of British Europe*. pp. 272. Collins: London.
- Bray, R.J. 1987. Care and breeding of *Bombina maxima*. *Reptiles: Proceedings of the 1986 U.K. Herpetological Societies Symposium on captive breeding*: 5-10.