Notes on the reproduction of *Rhombophryne* (Anura: Microhylidae) at Nosy Be, northern Madagascar

Jörn KÖHLER*, Frank GLAW* and Miguel VENCES*

Abstract

First observations on the reproduction of the anuran genus *Rhombophryne* are provided. A burrow with two adults and 18 freshly metamorphosed froglets of *R. testudo* was discovered at the end of the dry season at Nosy Be, northern Madagascar. The situation indicates that egg laying and development of the juveniles take place inside the burrow, independent from water bodies. The possibility of parental care by both parents and possible modes of reproduction in *Rhombophryne* are briefly discussed.

Résumé

Notes sur la reproduction de *Rhombophryne testudo* Boettger, 1880 (Anura: Microhylidae) à Nosy Be, Madagascar septentrional.

Les premières observations sur la reproduction d'un Anoure du genre monotypique *Rhombophryne* sont rapportées. Un terrier abritant deux adultes et 18 petites grenouilles fraîchement métamorphosées de *R. testudo* (Rainette tortue) a été découvert à la fin de la saison sèche à Nosy Be, dans le Nord de Madagascar. Cette constatation indique que la ponte et le développement des juvéniles se déroulent très vraisemblablement dans le terrier, affranchis des collections d'eau. D'éventuels soins par les deux parents et les modes de reproduction envisageables chez *Rhombophryne* sont brièvement discutés.

INTRODUCTION

Three subfamilies of microhylids occur at Madagascar. The Scaphiophryninae (*Paradoxophyla* and *Scaphio-phryne*) and the Dyscophinae (*Dyscophus*) deposit numerous small eggs in temporary ponds where the feeding tadpoles develop. In the endemic subfamily Cophylinae different groups can be distinguished. The arboreal genera *Cophyla*, *Platypelis* and some *Anodonthyla* deposite relatively large eggs in water-filled tree-holes or phytotelmes where they hatch into non-feeding tadpoles that develop into small froglets. During the whole embryonic and larval development, the male is present in the tree-hole and guards the rising generation (**Blommers-Schlösser** 1975). Often eggs and tadpoles of two different developmental stages occur in the same tree-hole. This reproductive mode also occurs in the scansorial species *Plethodontohyla notosticta*, and similar repro-duction is known from a still undescribed species (*P.* cf. *notosticta*). However, in this new species the eggs are not single but connected to an egg string, reminding to the European discoglossid genus *Alytes* (see **Glaw** and **Vences** 1994). A somewhat different reproductive mode was described for *Anodonthyla montana*, which deposits the eggs close to small cavities in rocks (**Blommers-Schlösser** et **Blanc** 1991). In the leaf litter dwelling dwarf species of the genus *Stumpffia* the males construct foam nests into which the eggs are deposited. The non-feeding tadpoles complete their development in the nest. *Plethodontohyla tuberata*, a fossorial species, deposits eggs into small cavities in the ground - the non-feeding tadpoles develop in a gelatinous liquid in the hole (**Glaw** and **Vences** 1994).

Rhombophryne testudo is among the most fossorial Malagasy frogs and shows remarkable morphological adaptations which are probably associated with the burrowing life: barbels on the lower lip, small eyes, depressed body, very short and strong extremities (Fig. 1); only some species of *Plethodontohyla* have similar adaptations. Little is known about the life history of *R. testudo*. Calling activity was recognized, especially during heavy rain, from January to April, without concentration around water bodies (**Glaw** and **Vences** 1994). Juvenile specimens captured during rain on the forest floor at Nosy Be in February 1992 had snout-vent lengths (SVL) of 17.8, 18.9 and 23.1 mm. This paper describes the first observations on the reproduction biology of the monotypic genus *Rhombophryne*.

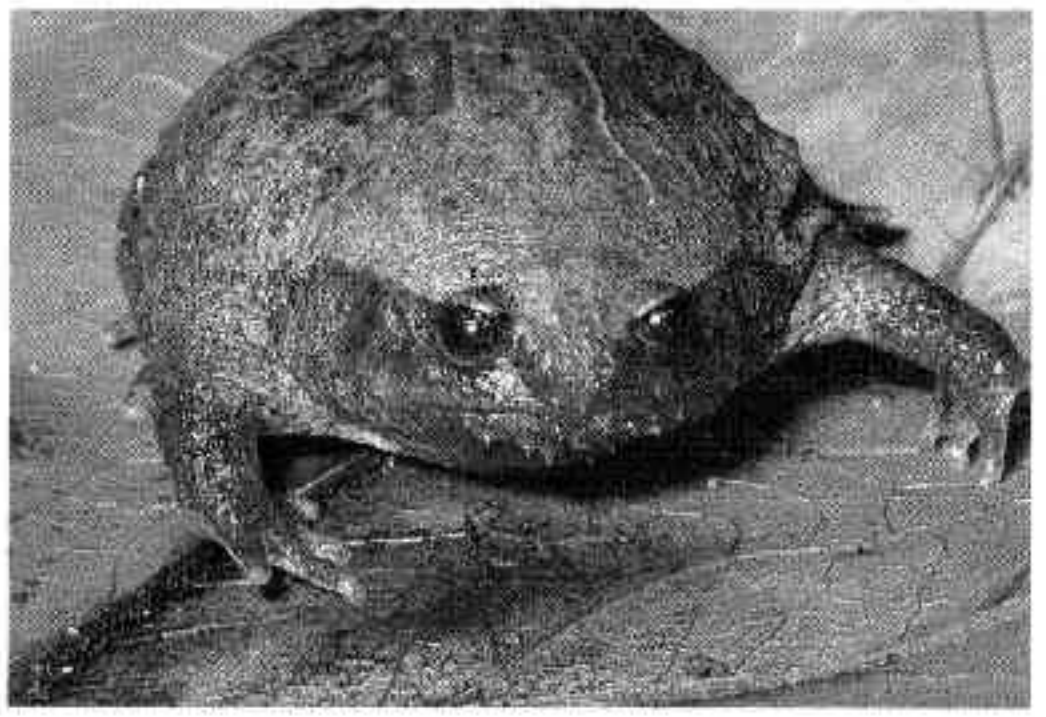

Fig. 1. - Male of *Rhombophryne testudo*, Nosy Be. **F. Glaw**
Mâle de *Rhombophryne testudo*, Nosy Be.

OBSERVATIONS

On the 2nd December 1995 two adults and 18 juveniles of *Rhombophryne* were found under a big stone in a burrow of about 10 cm in diameter (Fig. 2). The burrow, about 15 cm deep in the ground, was situated beside a nearly dry brook (Fig. 3) in primary rain forest at the border of Lokobe reserve, Nosy Be. Humidity at the burrow's wall was higher than humidity of the light soil under the stone.

The adults displayed different colouration: one specimen was dark brown coloured and resembled other males collected several years ago at Nosy Be. The other specimen had greyish-brown reticulations on the dorsum. The dark specimen seemed to have stored water inside its body, whereas the body of the reticulated specimen was emaciated.

* *Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 160, D-53113 Bonn, RFA.*

The juveniles were all in the same developmental stage and measured 9 to 11 mm SVL. These small froglets seemed to have recently finished metamorphosis. Some were bright yellowish, whereas the others showed different gradations of brown colour (but all juveniles were lighter coloured than the adults) (Fig. 4). Tadpoles or eggs were not present in the burrow. After we opened the cavity, the juveniles tried to escape from the nest by jumping.

J. Köhler

Fig. 2. - Burrow with two adults and juveniles of *Rhombophryne*.
Terrier avec deux adultes et des jeunes de *Rhombophryne*.

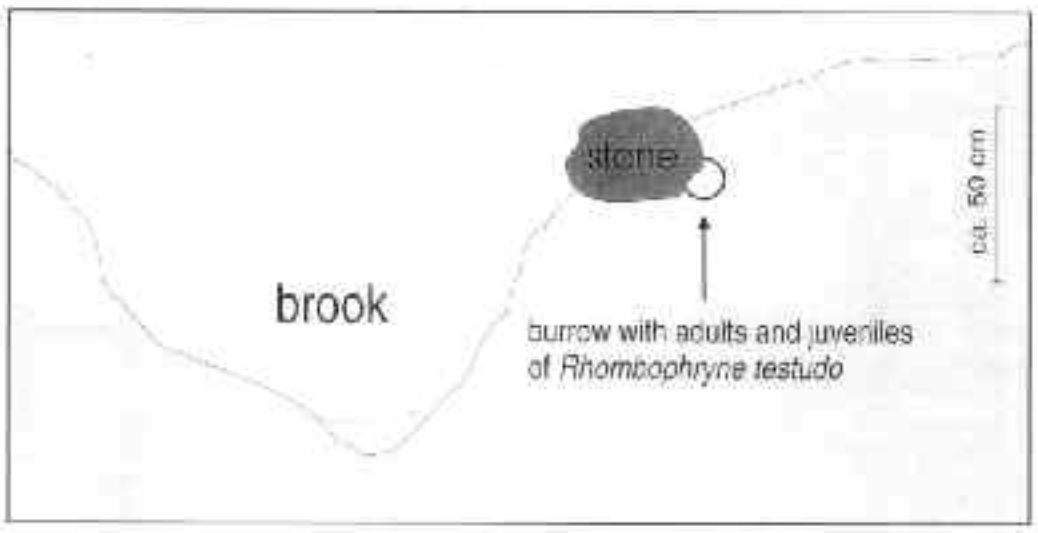

Fig. 3. - Schematic cross-section of burrow locality, showing the situation beside the brook in primary rain forest.
Coupe transversale de l'emplacement du terrier montrant sa situation entre le ruisseau et la forêt primaire.

J. Köhler

Fig. 4. - Close up view of the nest, with notable differences in juvenile colouration.
Vue rapprochée du nid, avec des différences notables dans la coloration des juvéniles.

DISCUSSION

The observations described above indicate that mating and egg laying of *Rhombophryne testudo* can occur before the rainy season, and that egg laying and development of the juveniles very probably take place inside the burrow.

In other cophyline species, eggs and tadpoles are known to be guarded by a single male. Only **Guibé** (1952) stated that the eggs of *Plethodontohyla tuberata* were shielded by the female. In the case of *Rhombophryne* we found two adults together with freshly metamorphosed froglets. Unfortunately, we could not collect the adult specimens (lack of permission) to verify their sex (secondary sexual characters are not known in *Rhombophryne*), but it is very probable that these adults were the parents of the young. If so, the eggs, tadpoles (?) and juveniles of *R. testudo* might be guarded and maybe also moistured by the remaining parents inside the burrow until they emerge from the chamber by themselves.

Regardless of numerous observations of male guarding in cophylines, the observations of **Guibé** (1952) on *P. tuberata* and ours on *Rhombophryne* indicate that additional modes of parental care exist within this subfamily.

However, the complete mode of reproduction in *Rhombophryne* remains unknown. Direct development of terrestrial eggs was reported for the microhylid subfamilies Asterophryinae, Cienyophryninae and some members of the Microhylinae (**Duellman** and **Trueb** 1986), but is still unknown for Malagasy microhylids. The reproduction of *Rhombophryne* might more likely resemble that of *Plethodontohyla tuberata*, where the non-feeding tadpoles develop in a gelatinous liquid in the nest in the ground.

ACKNOWLEDGEMENTS

The senior author thanks **Jochen Steinbrecher** (Aachen), who discovered the described burrow including the frogs, for his enthusiastic help in the field. We are further indepted to Prof. Dr. **Bruno Condé** (Nancy) who kindly translated the abstract.

BIBLIOGRAPHY

Blommers-Schlösser (R.M.A.), 1975. - Observations on the larval development of some Malagasy frogs, with notes on their ecology and biology (Anura: Dyscophinae, Scaphiophryninae and Cophylinae). *Beaufortia*, **24** (309): 7-26.

Blommers-Schlösser (R.M.A) et **C.P. Blanc,** 1991. - Amphibiens (première partie). *Faune de Madagascar*, **75** (1): 1-379.

Duellman (W.E.) and **L. Trueb,** 1986. - Biology of amphibians. *McGraw-Hill Book Company*: 1-670.

Glaw (F.) and **M. Vences,** 1994. - A fieldguide to the amphibians and reptiles of Madagascar, Second edition, including mammals and freshwater fish. *Vences and Glaw Verlags GbR*, Köln: 1-480.

Guibé (J.), 1952. - Recherches sur les Batraciens de Madagascar. *Mém. Inst. sci. Madagascar*, **5** (1, A): 109-116.