Herpetology Notes, volume 5: 309-310 (2012) (published online on 22 August 2012)

Defensive behaviour of *Kassina maculata* (Anura: Hyperoliidae)

H. Christoph Liedtke[1] and Hendrik Müller[2]

In anurans, defence against predators is achieved through cryptic coloration, behavioural avoidance of predators or through active defences such as fighting, attack or chemical defence (Wells 2007). Behavioural predator avoidance includes an array of responses summarized by Wells (2007), Duellman and Trueb (1994) and more recently by Toledo, Sazima and Haddad (2011). Here we report "shrinking" defensive behaviour (Toledo, Sazima and Haddad, 2010) observed in *Kassina maculata* Duméril, 1853 (Anura: Hyperoliidae) in Southern Malawi.

Cases of anti-predatory behaviour displayed by members of the Hyperoliidae, especially by kassinoid hyperoliids are well documented with records for *Phlyctimantis keithae* (thanatosis; Channing and Howell, 2003), *P. boulengeri* (thanatosis; Rödel and Ernst, 2001), *K. lamottei* (balling behaviour; Rödel et al., 2000). *K. cochranae* (balling behaviour; Rödel et al. 2000), *K. kuvangensis* (balling behaviour; Channing and Howell, 2003), *Paracassina kounhiensis* (balling behaviour; Largen and Spawls, 2010) and *Semnodactylus wealii* (balling behaviour; du Preez and Carruthers, 2009). Rödel and Braun (1999) reported that *K. senegalensis* and *K. fusca* are not usually known for exhibiting anti-predatory behaviour, however in response to ant attacks, the authors recorded one instance of akinetic behaviour by a juvenile *K. fusca*. Here we add *K. maculata* to this list.

The observation described here was made near Thyolo town, Southern Malawi (-16° 4' 47.204", 35° 4' 41.282"; elev. 957m) on 21st February 2012 at approximately 21:00hrs. We discovered an adult *K. maculata* on an unpaved road dividing a tea field from a Eucalyptus plantation. When attempting to capture the individual, the frog tucked its hind and fore limbs tightly onto its body, concealing the bright red markings on the axillary, inguinal and concealed limb regions almost completely (Fig. 1A). The head was also tucked in tightly with the snout facing down and the phalanges covering the tip of the snout (Fig. 1B). The eyes were not protected by the forelimbs and remained open (Fig. 1B). The individual remained in this position for at least one minute and remained tucked and motionless during handling. No

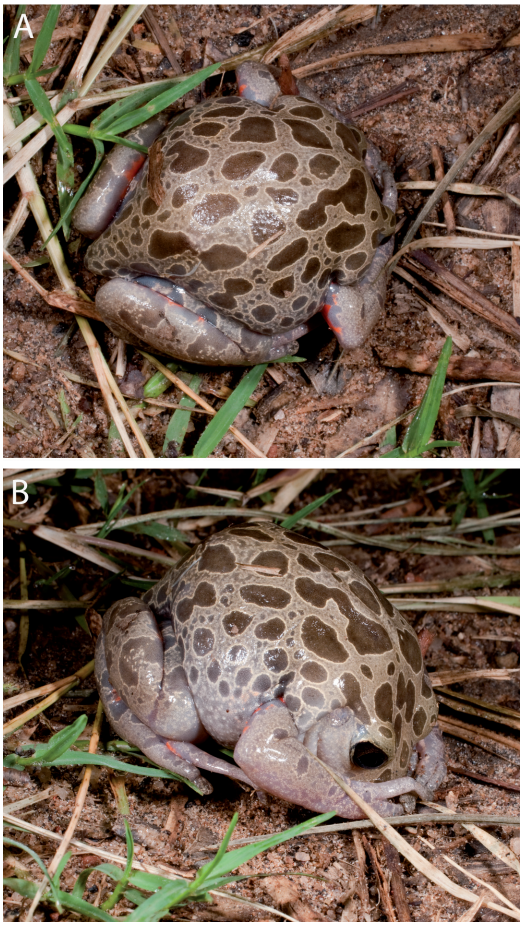

Figure 1. A: dorsal- and B: ventral view of "shrinking" defensive behaviour of *Kassina maculata.*

1 University of Basel, Dept. of Environmental Sciences (Biogeography), Klingelbergstrasse 27, CH-4056 Basel, Switzerland; christoph.liedtke@unibas.ch

2 Institute of Systematic Zoology and Evolutionary Biology with Phyletic Museum, Friedrich-Schiller-University Jena, Erbertstrasse 1, 07743 Jena, Germany

defensive call was emitted. The individual was an adult male with a SVL of 57.3mm. This behaviour was observed in one of ten individuals recorded on this particular field survey. Presumably similar behaviour was seen once before for this species, but no picture or description was provided other than noting a ball-like posture (Channing and Howell, 2003).

Kassina maculata are relatively large frogs and secrete toxins through dorsal skin (Chen et al., 2011). In an effort to classify this defensive pose, we conclude that *K. maculata* displays "shrinking" behaviour, a subcategory of thanatosis, or death feigning proposed by Toledo, Sazima and Haddad (2010), which maximizes the exposure of the unpalatable dorsal region and reduces damage during subjugation by predators (Toledo, Sazima Haddad, 2010). This is most likely the same or similar behaviour sometimes referred to as "balling". It is interesting to note that this frog takes a defensive posture that conceals its bright colour patches rather than displaying them as is often the case in distasteful species (Wells, 2007). One could therefore speculate that the coloured axillary and thigh regions may serve as flash colours in flight behaviour following initial "shrinking" rather than purely classical aposematic signalling. This idea was proposed before by Cott (1940), but was received sceptically by Passmore and Carruthers (1995) due to the fact that this is a relatively slow-moving, walking species. Alternatively, aposematic signalling is most effective against visual predators and hence, *K. maculata* might display a repertoire of predator-dependent defensive behaviour, although this is largely speculative at this point.

As thanatosis appears to be widespread in this genus and possibly also in closely related taxa, it is likely that this is a synapomorphic trait and its association to toxic secretions warrants further attention.

Acknowledgement. We would like to thank the Swiss National Science Foundation (31003A- 133067) and the Mohammed bin Zayed Species Conservation Fund (project No. 10051494) for financial support. Research permits were granted by the National Commission for Science and Technology of Malawi (permit No. 2012/01). The Museums of Malawi, in particular Lovemore Mazibuko, Yankho Chapeta and Evelyn Mkandawire, are gratefully acknowledged for facilitating our research in Malawi. We would also like to thank Stefan Leiser and Mark Wilkinson for their great company in the field and Simon Loader and Alan Channing for comments on a draft version of this note.

References

Channing, A., Howell, K. (2003). *Phlyctimantis keithae* (Wot-wot) defensive behavior. Herpetological Review. **34**:51-52.

Chen, H., Wang, L., Zeller, M., Hornshaw, M., Wu, Y., Zhou, M., Li, J., Hang, X., Caid, J., Chen, T., Shaw, C. (2011). Kassorins: novel innate immune system peptides from skin secretions of the African hyperoliid frogs, *Kassina maculata* and *Kassina senegalensis*. Molecular Immunology. **48**:442–451

Cott, H. B. (1940). Adaptive coloration in animals. Oxford University Press. 540 pp.

Duellman, W. E., Trueb, L. (1994). Biology of amphibians. The Johns Hopkins University Press, Baltimore and London. 670 pp.

du Preez L. H., Carruthers, V. (2009). A complete guide to the frogs of Southern Africa. Struik Nature, Cape Town. 488 pp.

Largen, M., Spawls, S. (2010). The amphibians and reptiles of Ethiopia and Eritrea. Edition Chimaira, Frankfurt am Main. 693 pp.

Passmore, N. I., Carruthers, V. (1995). South African frogs: a complete guide. Southern Book Publishers. 322 pp.

Rödel, M.-O., Braun, U. (1999). Associations between anurans and ants in a west African savanna (Anura: Microhyliidae, Hyperoliidae, and Hymenoptera: Formicidae). Biotropica. **31**:178-183

Rödel, M.-O., Ernst, R., Leistener, G., Fahr, J. (2000). Zum Totstellverhalten einiger westafrikanischer Frösche. Salamandra. **36**:125-130.

Rödel, M.-O., Ernst, R. (2001). Redescription of the tadpole of *Phlyctimantis boulengeri* Perret, 1986, (Anura: Hyperoliidae) with preliminary comments on the biology of the species. Alytes. **18**:178-186.

Toledo, L. F., Sazima, I., Haddad, C. F. B. (2010). Is it all death feigning? Case in anurans. Journal of Natural History. **44**:1979–1988.

Toledo, L. F., Sazima, I., Haddad, C. F. B. (2011). Behavioural defences of anurans: an overview. Ethology Ecology & Evolution. **23**:1–25.

Wells, K. D. (2007). The ecology and behaviour of amphibians. University of Chicago Press, Chicago, IL. 1400 pp.

Accepted by Zoltan T. Nagy