

### Which are the most tolerant aquarium fishes to hypoxia?

<sup>1,2</sup>I. Valentin Petrescu-Mag, and <sup>3</sup>Dan Rasiga

<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania, EU;

<sup>2</sup> SC Bioflux SRL (Research Society), Cluj-Napoca, Romania, EU,

<sup>3</sup> Babeş-Bolyai University, Cluj-Napoca, Romania, EU.

Corresponding author: I. V. Petrescu-Mag: zoobiomag2004@yahoo.com

**Abstract.** In the current paper we report on the ecophysiological adaptation of the lyretail panchax (*Aphyosemion australe*) and Gardner's killifish (*Fundulopanchax gardneri*) to hypoxia. Their adaptation to hypoxia is real and different from that of Osphronemidae or Callichthyidae which is based on breathing atmospheric air.

**Key words:** ecophysiological adaptations, lyretail panchax, Gardner's killi, extreme environment, hypoxia.

**Rezumat.** În această lucrare se relateaza despre adaptarea ecofiziologica a ciprinodontidelor cap lopez (*Aphyosemion australe*) și afiosemion gardneri (*Fundulopanchax gardneri*) la hipoxie. Adaptările lor sunt reale, spre deosebire de familiile Osphronemidae și Callichthyidae ale căror adaptări se bazează pe inspirarea aerului atmosferic.

**Cuvinte cheie:** adaptări ecofiziologice, cap lopez, afiosemion gardneri, condiții extreme, hipoxie.

**Letter.** Species of fish raised in aquaria illustrate all types of breathing common in the wild (branchial, intestinal, at skin surface, or using a pseudolung). Many fish species are very tolerant to hypoxia (e.g. *Betta splendens*, *Trichogaster trichopterus*, *Macropodus opercularis*, *Corydoras aeneus*, *Corydoras paleatus*, *Poecilia reticulata* etc). Some of them are able to breathe atmospheric air, some of them are not. Families such as Osphronemidae use a specialized organ (known as maze, or pseudolung) for breathing atmospheric air, while others such as Callichthyidae breathe through the intestine. Certainly, fish with morphological adaptations and alternatives are the most tolerant to hypoxia and anoxia. However, there are species that cannot breathe atmospheric air and still have developed an amazing tolerance to hypoxia due to high affinity towards dissolved oxygen, behavioral sequences and metabolic particularities: most of the killifishes, especially *Fundulus spp.* (see also Virani & Rees 2000; Love & Rees 2002; Martinez et al 2006; Richards et al 2008).



Figure 1. *Fundulopanchax gardneri* and *Aphyosemion australe* (photo by Dan Rasiga, original).

In addition, in aquariums there are other cultivated killifish species tolerant to hypoxia. Two well-known fish species by aquarists are the lyretail panchax (*Aphyosemion australe* (Rachow, 1921), Figure 1, right) and Gardner's killifish (*Fundulopanchax gardneri* (Boulenger, 1911), Figure 1, left). Our experiments demonstrated that values between 3 and 4 mg l<sup>-1</sup> of the oxygen content ensure the normal development of these two species in aquarium. Less than 1% of the aquarium fish species tolerate such low oxygen levels (if we exclude species which breathe free air).

## References

- Love J. W., Rees B. B., 2002 Seasonal differences in hypoxia tolerance in gulf killifish, *Fundulus grandis* (Fundulidae). *Environmental Biology of Fishes* **63**(1):103-115.
- Martínez M. L., Landry C., Boehm R., Manning S., Oliver Cheek Ann, Rees B. B., 2006 Effects of long-term hypoxia on enzymes of carbohydrate metabolism in the Gulf killifish, *Fundulus grandis*. *Journal of Experimental Biology* **209**:3851-3861.
- Richards J. G., Sardella B. A., Schulte P. M., 2008 Regulation of pyruvate dehydrogenase in the common killifish, *Fundulus heteroclitus*, during hypoxia exposure. *Am J Physiol Regul Integr Comp Physiol* **295**:R979-R990.
- Virani N. A., Rees B. B., 2000 Oxygen consumption, blood lactate and inter-individual variation in the gulf killifish, *Fundulus grandis*, during hypoxia and recovery. *Comparative Biochemistry and Physiology - Part A: Molecular & Integrative Physiology* **126**(3):397-405.

Received: 09 December 2009. Accepted: 30 December 2009. Published online: 30 December 2009.

Authors:

Ioan Valentin Petrescu-Mag, University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, 3-5 Calea Mănăştur Street, Cluj-Napoca 400372, Cluj County, Romania, European Union.

Second adress: Bioflux SRL, 54 Ceahlău Street, Cluj-Napoca 400488, Cluj County, Romania, European Union, e-mail: zoobiomag2004@yahoo.com or scientific.bioflux@gmail.com

Dan Rasiga, Babeş-Bolyai University, "Alexandru Borza" Botanic Garden, Republicii street no 42, Cluj-Napoca 400015, Cluj County, Romania, EU, e-mail: dagisar@yahoo.com or rasiga\_dan@yahoo.com

How to cite this article:

Petrescu-Mag I. V., Rasiga D., 2009 Which are the most tolerant aquarium fishes to hypoxia? *ELBA Bioflux* **1**(2):51-52.