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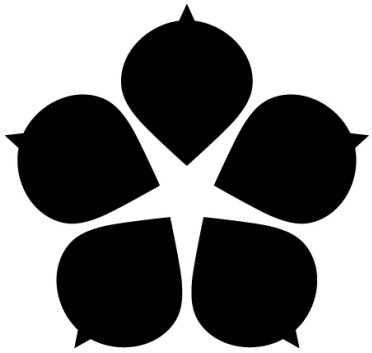

Physiological and biochemical responses to cold and drought in the rock-dwelling pulmonate snail, *Chondrina avenacea*.

RNDr. Thesis

Mgr. Jan Rozsypal

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Annotation

We assessed the capacity of rock-dwelling snail, *Chondrina avenacea* to tolerate environmental stress during seasonal alterations of activity and dormancy. We examined whether hibernation and aestivation share some physiological and biochemical traits, which can underlie potential development of cross-tolerance (i.e., high cold tolerance during estivation or high drought tolerance during hibernation). For this purpose, we recorded seasonal changes in the levels of cold, drought and anoxia tolerance and changes in basic physiological and biochemical parameters which are linked to dormancy and stress tolerance such as supercooling capacity, mass and hydration, rate of exchange of respiratory gases, total amount of proteins, lipids and glycogen, and metabolomic composition.

Declaration [in Czech]:

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Prohlašuji, že se Jan Rozsypal podstatným způsobem podílel na výše uvedené publikaci.

Prof. Ing. Vladimír Košťál, Csc. …….

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ORIGINAL PAPER

Physiological and biochemical responses to cold and drought in the rock-dwelling pulmonate snail, *Chondrina avenacea*

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Abstract The pulmonate snail *Chondrina avenacea* lives on exposed rock walls where it experiences drastic daily and seasonal fluctuations of abiotic conditions and food availability. We found that tolerance to dry conditions was maintained at a very high level throughout the year and was mainly based on the snails' ability to promptly enter into estivation (quiescence) whenever they experienced drying out of their environment. Snails rapidly suppressed their metabolism and minimized their water loss using discontinuous gas exchange pattern. The metabolic suppression probably included periods of tissue hypoxia and anaerobism as indicated by accumulation of typical end products of anaerobic metabolism: lactate, alanine and succinate. Though the drought-induced metabolic suppression was sufficient to stimulate moderate increase of supercooling capacity, the seasonally highest levels of supercooling capacity and the highest tolerance to subzero temperatures were tightly linked to hibernation (diapause). Hibernating snails did not survive freezing of their body fluids and instead relied on supercooling strategy which allowed them to survive when air temperatures dropped to as low as −21 °C. No accumulation of low-molecular weight compounds (potential cryoprotectants) was detected in hibernating snails except for small amounts of the end products of anaerobic metabolism.

Keywords Mollusca · Estivation · Hibernation · Metabolic suppression · Water loss · Supercooling

Abbreviations

r.h.	Relative humidity of the air
SCP	Supercooling point
TFM	Total fresh mass
TDM	Total dry mass
SM	Shell mass
BWM	Body water mass
BDM	Body dry mass
Lt50	Time of exposure lethal to 50 % of a population sample
DGE	Discontinuous gas exchange
PCA	Principal component analysis

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