



# Phenotypic plasticity in *Daphnia cucullata* from two riverine pools: when do they produce helmets?

Eva Volemanová<sup>1</sup>, Adam Petrusek<sup>1</sup>, Christian Laforsch<sup>2</sup>

<sup>1</sup>Department of Ecology, Faculty of Science, Charles University in Prague, Viničná 7, 128 44 Praha 2  
<sup>2</sup>Evolutionary Biology, Dept. Biologie II, LMU München, Großhaderner Str. 2 D-82152 Planegg-Martinsried  
eva.volemanova@gmail.com

## Introduction:

The seasonal change in helmet size in *Daphnia cucullata* is a typical example of cyclomorphosis. It may be induced both by predator-released kairomones or small-scale turbulence. In field conditions, such turbulence may be caused by movement of aquatic animals; particularly strong vortexes are created by a large predatory cladoceran *Leptodora kindtii*.

*D. cucullata* is common in riverine pools close to the Elbe River in Czechia; in most of them it produces helmets. In a small pool Bezednice, however, daphnids lack helmets despite the presence of predatory phantom midge larvae *Chaoborus flavicans*.

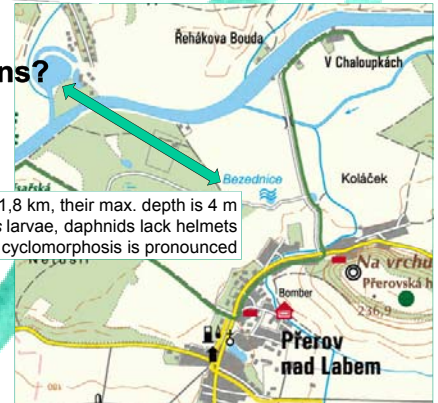
## Questions:

Will the daphnids from Bezednice react by helmet enlargement to *Chaoborus* kairomones or turbulence under laboratory conditions?

Will their reaction be different from clones from a nearby large pool Řehačka, where the cyclomorphosis is pronounced?

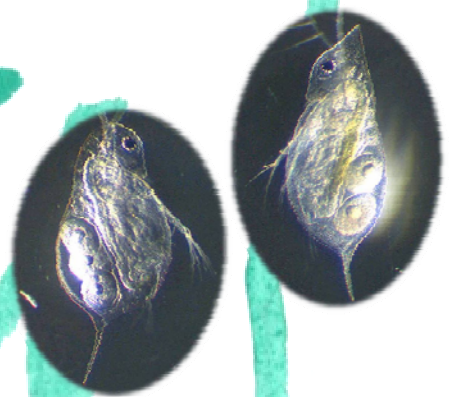


distance between pools is 1,8 km, their max. depth is 4 m  
Bezednice – predators: *Chaoborus* larvae, daphnids lack helmets  
Řehačka – *Leptodora kindtii* as main predator, cyclomorphosis is pronounced



## Methods:

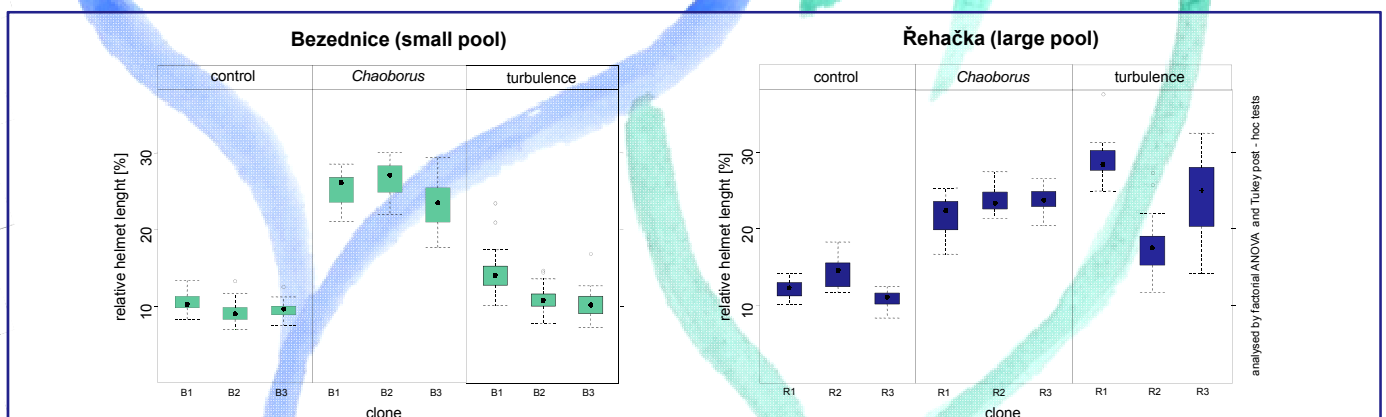
Three different *D. cucullata* clones from each pool were exposed to kairomones of phantom midge larvae *Chaoborus flavicans* and to turbulences in three replicates for each clone. *Chaoborus* larvae were separated from daphnids by a fine net allowing chemical communication. Turbulences were produced mechanically (fig. on the left). A relative helmet length was measured in the third generation and compared with control animals.



**Results:** Clones from the small pool Bezednice reacted by significant helmet elongation in *Chaoborus* treatment ( $p < 0.001$ ), the reaction to turbulence was not significant ( $p = 0.28$ ).

Clones from the large pool Řehačka showed significant reaction of a similar magnitude in both treatments (both  $p < 0.001$ ).

Despite apparent interclonal variation, relative helmet length in *Chaoborus* treatments did not differ between clones from both pools ( $p = 0.58$ ).



Clones from the small pool Bezednice did not lose the ability to respond to *Chaoborus* kairomones. *Chaoborus* density in this pool is probably too low to induce this morphological defense or there is a large amount of alternative prey.

Differences in reaction to turbulence suggest that selection pressures towards reaction to mechanical stimuli substantially differ between the two localities. The large pool has abundant population of *Leptodora*, which is absent from the small pool. The presence of this invertebrate predator in the large pool may be the factor responsible for sensitivity of local clones to turbulence and maintenance of cyclomorphosis.