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Appendix A from V. Le Bourlot et al., “Interference versus Exploitative Competition in the Regulation of Size-Structured Populations”
(Am. Nat., vol. 184, no. 5, p. 609)

Experimental Support for Physiologically Structured Population Assumptions

Our model relies on basic assumptions regarding resource allocation that can be verified with experimental data collected on isolated individuals of collembolan *Folsomia candida*.

Methods

The collembolans are maintained in the laboratory in polyethylene vials (diameter, 52 mm; height, 65 mm) filled with a 30-mm-wide layer of plaster of Paris mixed with Indian ink to facilitate detection of the individuals. Food is provided weekly in the form of small dried pellets of a mixture of agar and dried yeast in a standardized concentration and volume (Tully and Ferrière 2008). The rearing boxes are maintained in incubators at 21° ± 0.5°C, and the plaster is kept wet to have a constant humidity within the boxes ($\sim$100% relative humidity). We monitored 220 isolated individuals and regularly measured their body size and fecundity (clutch sizes).

Growth Trajectories and Dependence on Resources

The model assumes Von Bertalanffy growth trajectories at a constant food level and that both asymptotic body length and growth rate depend on food level. These three aspects are valid for our experimental species, as shown by figure A1.

Reproduction

Furthermore, the Kooijman and Metz (KM) model predicts that reproduction increases with the food level and scales with the square of body length. Figure A2 shows that both relations are valid for *F. candida*.

Size at Birth

The model assumes that size at birth is independent of food availability. Figure A3 shows the egg diameter as a proxy for body length at birth (Tully and Ferrière 2008) in two different resource conditions. Although the difference is significant, because of very large sample sizes, the difference between the two means is quite low, and we consider verified the assumption that length at birth is almost constant over food availability.

Maturation Length

Finally, our model assumes a constant length at maturity over food availability and population density. Because it is extremely difficult to assess the body length at maturation in populations since *F. candida* is an ametabolous hexapod, we measured body length at first clutch on isolated individuals bred at two different resource conditions. Length at first clutch is longer than the length at maturity but is the closest proxy available in our experimental conditions. Figure A4 shows that the model assumption concerning length at maturity is not supported by our experimental population. Nevertheless, we consider that it is not a primary assumption, and assuming constant length at maturity in the model simplifies it without dramatically changing its behavior.

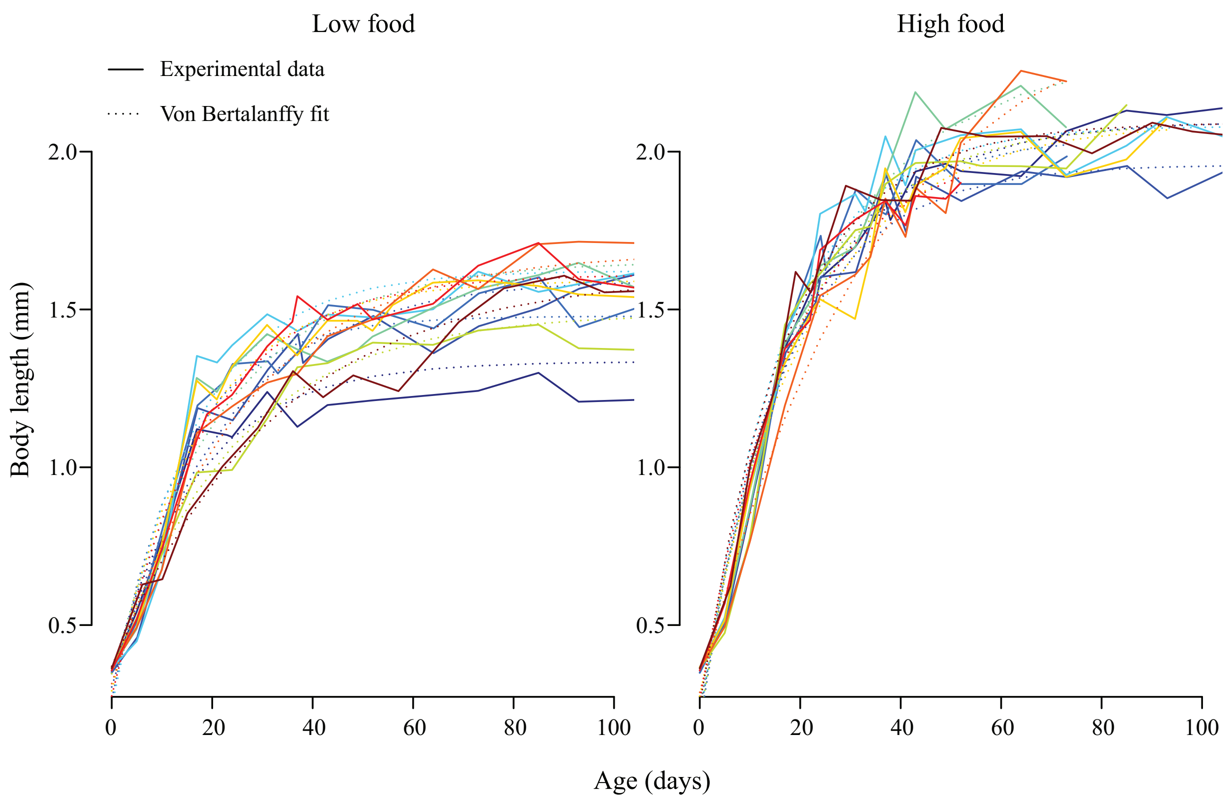

Figure A1: Growth trajectories (solid lines) and corresponding Von Bertalanffy fit (dotted lines) in two different resource conditions.

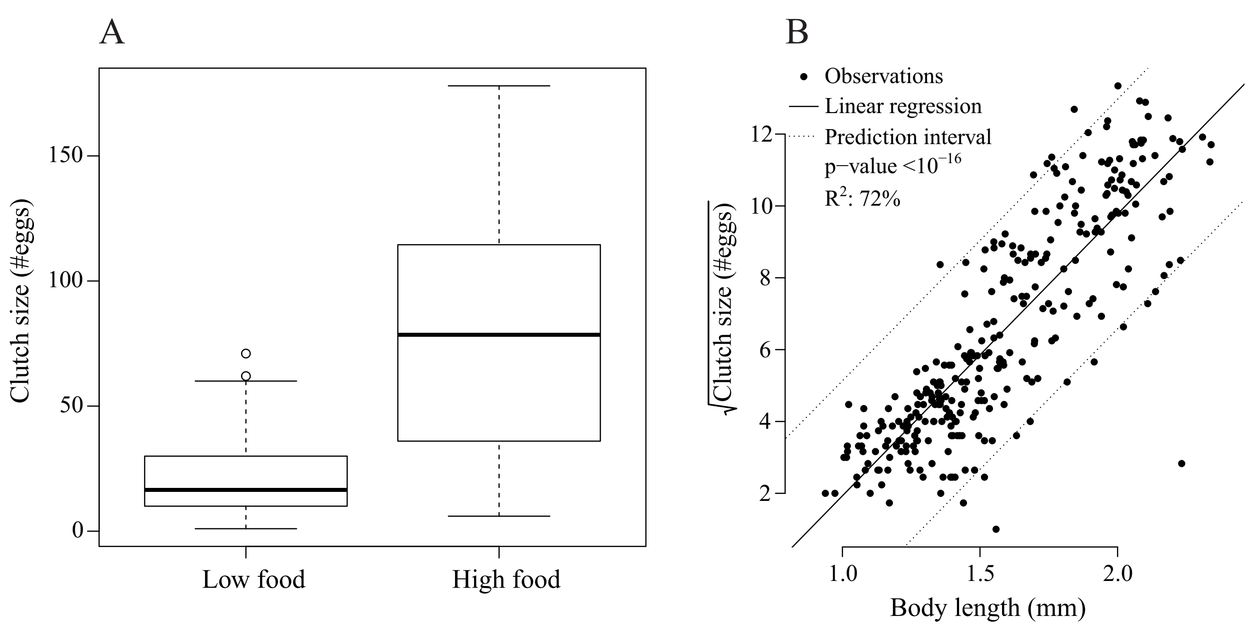

Figure A2: Reproduction (clutch size) in two different resource conditions and square root of clutch size against body length. Regression statistics for the latter are extremely significant.

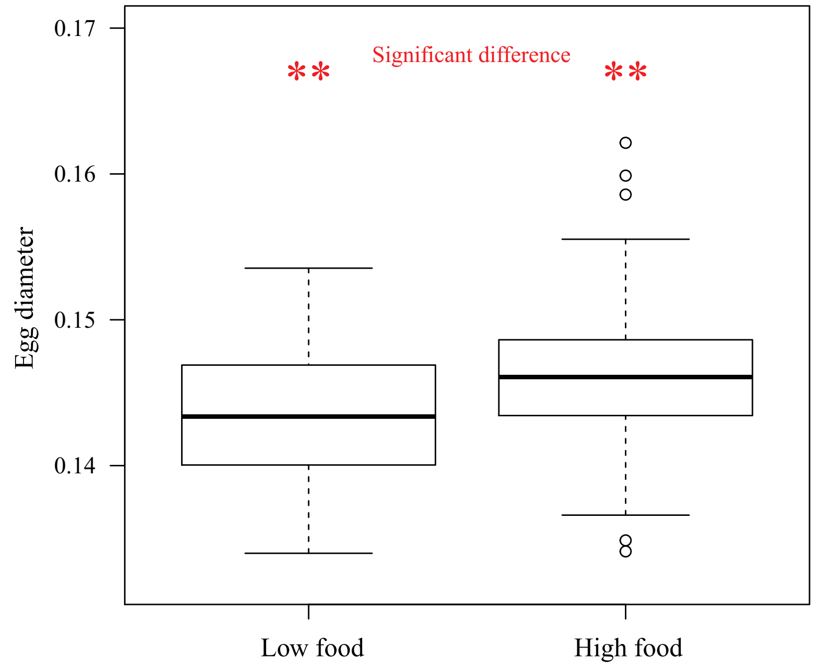

Figure A3: Egg diameter as a proxy for size at birth in two different resource conditions.

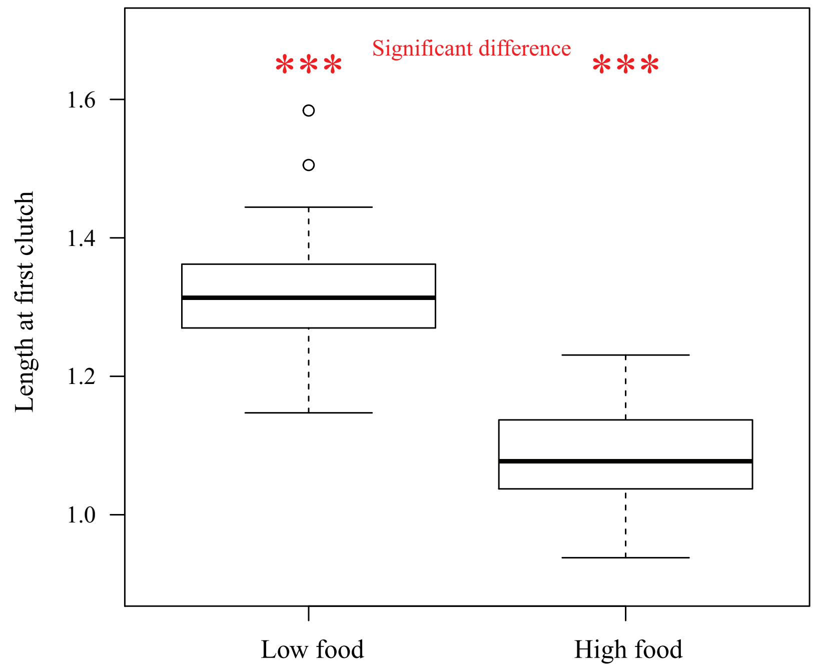

Figure A4: Length at first clutch in two different resource conditions.