Resting metabolic rate and costs of pit construction in the ant lion species *Euroleon nostras* (Fourcroy) [Planipennia]

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Larva of *Euroleon nostras*, original size approx. 1.2 cm

Euroleon nostras **is one of over 200 species of Myrmeleontidae, whose larvae (called ant lions) construct pitfall traps to catch mobile prey (e. g. ants, spiders and beetles). The pit construction or reconstruction takes place after soil drift, when the ant lion has moved to another place or after a prey has been caught. Larvae (third-instar) of *E. nostras* need 25 min in average for constructing a pit with a mean diameter of 3.7 cm in dry sand. They transport up to the 150-fold of their own body mass in doing this. Ant lions wait for prey at the ground of their pits. Thus, ant lions are typical sit and wait predators. The scope of energetic costs for pit construction and the resting metabolic rate determine important parameters regarding feeding ecology and behaviour in the live cycle of ant lions: (1) the amount of prey, which must be captured to compensate the energetic costs of the pit building, (2) the time period until the energetic gain of a prey is lost and (3) the decision of the ant lion, if it is worthy to construct a new pit elsewhere in the case of absence of prey.**

Therefore, the objective of our investigation was to assess the energetic costs of pit construction and resting metabolism in relation to the energetic gain by capturing a prey.

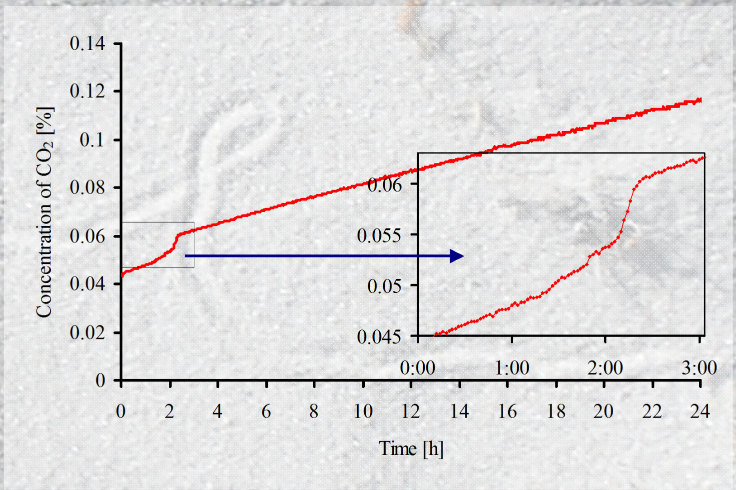

Fig. 1: Carbon dioxide release of an ant lion (22.6 mg ww) during pit construction (steep increase, magnification in the box) and waiting for prey (slow increase)

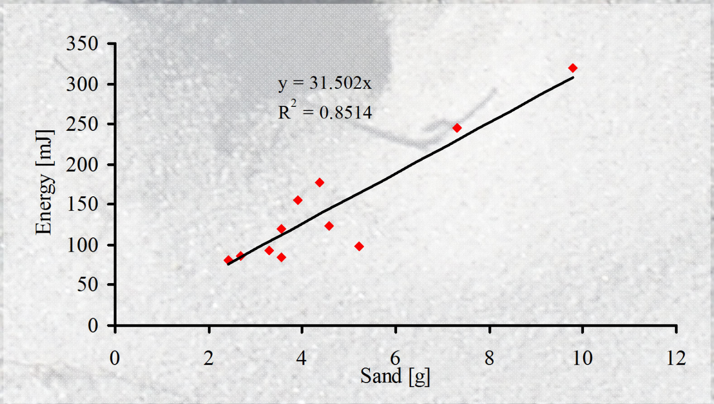

Fig. 2: Relation between metabolic costs and amount of transported sand during the pit construction of larval ant lions (*E. nostras*, third-instar).

We measured the carbon dioxide release of *E. nostras* larvae while building pits and during resting state continuously. These measurements were carried out by using a respirometer which was equipped with a carbon dioxide sensor from Zirox (Greifswald, Germany). Calculations were performed directly in carbon units and converted into energy units by using a conversion factor of 43.1 kJ g^{-1} C, based on the energy content of ingested food and the carbon content of the prey (*Formica polyctena* (Först.)).

The amount of released carbon dioxide during pit construction and resting state was calculated from the increase of carbon dioxide concentration during the measurement and the volume of the apparatus. Phases of pit construction and resting at the bottom of the pit were clearly distinguishable by the different slopes of the carbon dioxide concentration in the line chart (Fig. 1). Results were corrected by subtracting the carbon dioxide release of a chamber with sand but without ant lion. Excavated sand was weighed after finishing the measure. The energy content of the prey was measured by direct calorimetry with a Paar semimicro bomb calorimeter, model 1425. The carbon content of of the prey was determined using a NC-Analyser NC2500 from CE Instruments.

Our results indicate that an ant lion larva with a wet weight (ww) of approx. 21 mg releases 0.62 µg carbon h-1 (1.3 J g^{-1} ww h^{-1}) within periods without activity and 4.9 µg carbon h^{-1} (10.8 J g^{-1} ww h^{-1}) during construction of a pit. Considering a measured extraction efficiency of 68.7 % at feeding on *F. polyctena*, one prey of this kind compensates the loss of carbon or energy originated by the resting metabolic rate of the larva for 47 days.

Larvae of *E. nostras* need a very short time (approximately 25 min) for constructing a pitfall trap in relation to the time at resting metabolic rate (several days). Therefore, the energetic costs of the pit construction are of minor importance in spite of the 8-fold higher metabolic rate needed. The relation between energetic costs for pit construction and resting metabolism over a whole day is also demonstrated by Fig. 1. However, it has been taken into account that the energetic costs increased exponential with increasing pit diameters (Fig. 3).

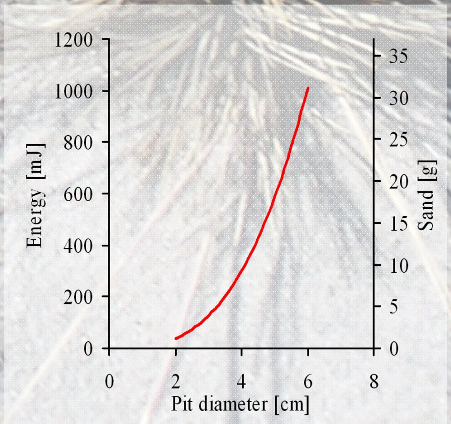

Fig. 3: Calculated relation between pit diameter, metabolic costs and amount of transported sand during pit construction of larval ant lions (*E. nostras*, third-instar).

The background picture of this poster shows several creeper lanes, a pit and a pit during construction (spiral) of ant lions

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