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The influence of constant temperature on the embryonic growth of Asellus aquaticus L. (Crustacea).

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It is known that an adequately large amount of work has been devoted to investigations on the influence of temperature on the growth period of aquatic invertebrates. However, the action of the given factors on the basic biological characteristics of embryonic growth in crustaceans is virtually unknown. An experimental study of the effectiveness of the transformation of matter and energy during the period of embryogenesis in the isopod Asellus aquaticus L. under different constant temperatures was carried out.

Living material was collected in the quarry lakes of the Kurasovshchin zone (city-Minsk). The adults were kept in containers with constant temperatures of 10.3 $\pm$ 0.3 and 18.8 $\pm$ 0.3 °C. After depositing the eggs in the pouch the females were transferred into containers with constant temperatures (7.1, 10.3, 14.5, 18.8, 22.1, 23.6, 25.9 °C with deviation of not more than $\pm$ 0.3 °C) and with idenitical illumination. The completion of embryonic growth was taken as being the moment of emergence of the young from the pouch of the adult. In animals of age up to 4 h, for each temperature, the rate of oxygen consumption, the wet and dry body mass, and the specific energy capacity were determined. The rate of oxygen consumption was measured by the manometric method with electrolytic compensation; the remaining parameters - according to methods standard in hydrobiological studies.

Investigation of the connection of the studied characteristics with temperature allows one to determine, sufficiently accurately, the range of temperature favourable for growth. Thus, analysis of the data for the duration and rate of growth (fig. 1a), the rate of oxygen consumption, and the total oxygen consumption during the growth period (fig 1b), the rate of exchange (fig. 1c), and the dry body mass (fig. 1d) in relation to temperature makes it possible to determine an interval of 10-22°C.

Within this range is maintained a specified sum of the temperatures (almost 220 degree hours when t_o = 4.7°C). At the lowest temperatures the rate of growth is relatively increased, and at the highest temperatures is retarded (fig. 1a). The dependence of the rate of oxygen consumption on temperature in the range 10–22°C complies with a linear relationship (fig. 1b). Of much importance is the fact that the rate of exchange in a given interval is close to the curve (fig. 1c). It is important to note that the amount of oxygen consumed in the growth period, in the produced unit of mass* in an isolated zone of temperature, is practically constant (fig. 1c) and equal to 280–290 $\mu l\ mg^{-1}$. The maximum specific energy capacity and the energetic equivalent is representative for young which were born at temperatures of 14.5 and 18.8°C (fig. 1e). During this time, at these temperatures, the minimum expenditure of energy, on growth, is recorded (fig. 1f).

In this way the quantitative analysis of the basic energetic properties of animals during one of the physiological stages at different constant temperatures, allows one to determine the temperature range in which the expenditure of energy, at a given instance during embryonic growth, is minimised. For A. aquaticus this range is represented by the limits 10–22°C, during which the least expenditure of energy is observed between 14.5 and 18.8°C.

Литература

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* this is a literal translation of the phrase "na edinitsu obrazovannoi massy" edinitsu maccy = unit of mass, obrazovannyi = produced, formed evolved.

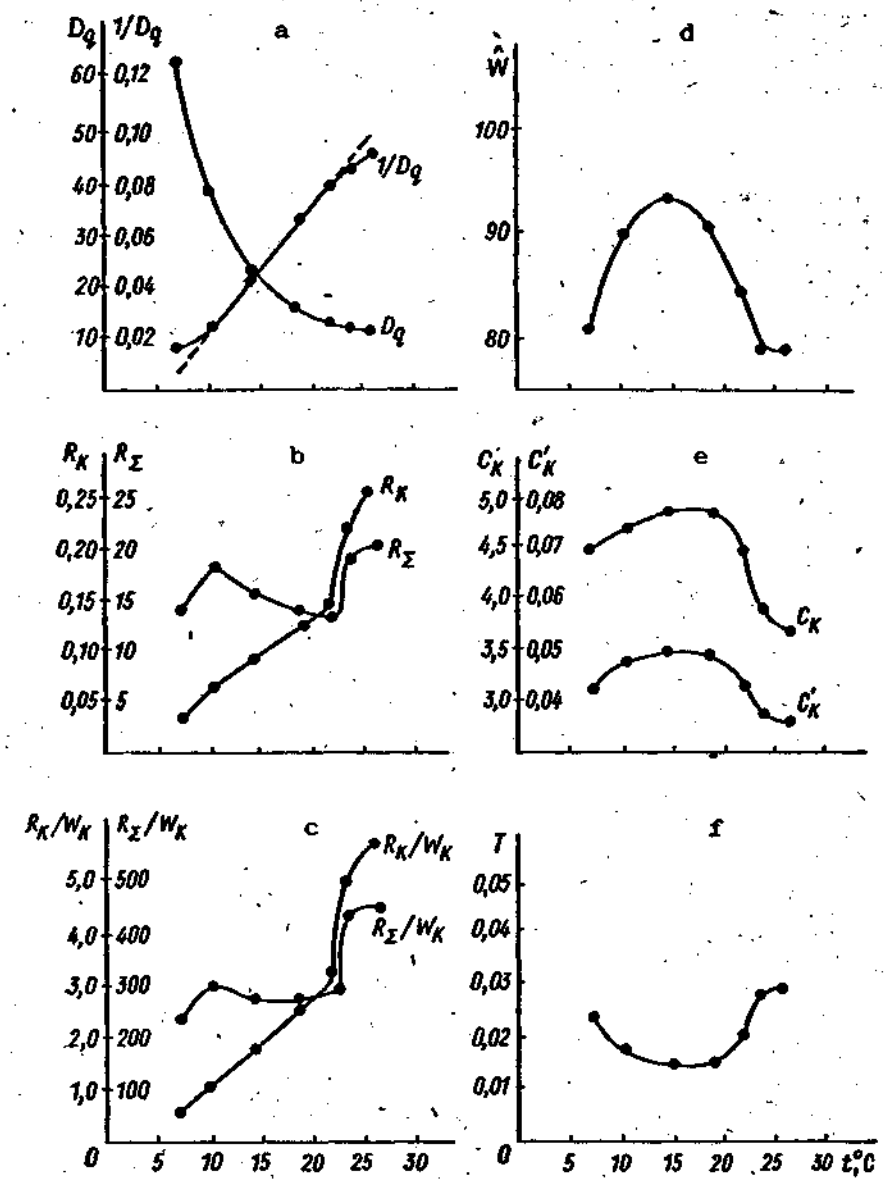

Fig. 1. The dependence of the basic biological properties of the young of Asellus aquaticus during emergence from the pouch on temperature:

a – duration of embryonic growth, h. (Dq) and the rate of growth, h^{-1} (1/Dq);

b – rate of oxygen consumption, µl h^{-1} for each specimen (Rk) and the total oxygen consumption during the growth period, µl (R_Σ);

c – rate of exchange, µl mg^{-1} h^{-1} (R_k/W_k) and the amount of oxygen consumed in the produced unit of mass* µl mg^{-1} (R_Σ/W_k);

d – dry mass, mg 10^{-4} (W);

e – specific energy capacity, cal. mg^{-1} (C_k) and energetic equivalent, cal. per specimen (C'_k);

f – expenditure of energy during the period of embryogenesis given by the difference of energetic equivalent between the egg and the young, cal. (T).

* see footnote to text.

Notice

Please note that these translations were produced to assist the scientific staff of the FBA (Freshwater Biological Association) in their research. These translations were done by scientific staff with relevant language skills and not by professional translators.