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DATA ON THE OXIGEN CONSUMPTION OF ISOPODA AND DIPLOPODA SPECIES

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Abstract

Examining the dependence of respiration of *Trachelipus nodulosus* C. L. KOCH, *Porcellio scaber* LATR. Isopods and of *Chromatoiulus unilineatus* L. Diplopod species on temperature related to body size with Warburg's technique can be determined that the rise of temperature (between 15—30 °C, $\mu l\ mg^{-1}\ h^{-1}$) — in accordance with the ecological demands of species—affects the respiration of *Ch. unilineatus* the least.

The respiration of *Tr. nodulosus* is also adapted to the environmental circumstances with higher temperature, while that of *P. scaber* is changing mostly with the temperature. The connection of body weight and individual oxygen comsumption is described by a so called "saturation curve" (Fig. 1b).

Introduction

The knowledge of energy emitted by the respiration is necessary to the explanation of ecological role, production relations of living organisms. Such investigations were carried out by SAITO (1965, 1967, 1969) at the macrodecomposer Isopod and Diplopod groups in the species *Japonaria laminata armigera* (Diplopoda), *Ligidium japonicum, Armadillidium vulgare, Porcellio scaber* (Isopoda). The body size of individuals and the environmental temperature were considered using Warburg's technique. REICHLE (1967) proved with isotope technique, that the value of oxygen consumption measured in laboratory is about 1,4 times lower than that of the animals moving in their natural environment. STACHURSKY (1974) examining the Isopod *Ligidium hypnorum* stated, that the quantity of oxygen respired is in exponential relation to the living weight of the individuals. NEWELL et al. (1974) examined the factors influencing the oxygen consumption of *Porcellio scaber* Isopod species using Gilson Differential Respirometer at different temperatures, considering the activity of the animals.

The aim of this work was to examine the fundamental relations to body size and to temperature among the factors influencing the respiration at three species common in our country.

Materials and Methods

Manometric calibrated Warburg respirometer was applied for respiration measures. The volumes of manometric chambers were about 15 ml. 20 per cent KOH served for occlusion of CO_2 expired by the animals. The chambers were kept in waterbath with constant temperature. Control chambers without animals were used for correction the possible temperature fluctuations. 1—1 animal was placed in every chamber on wet filter papers. So it was attainable that the animals stayed in rest and their activity didn't influence their oxygen consumption. As physiological condition has also influence on respiration, adult individuals of intercasting state were used for measurements. They had been kept previously in laboratory at least for one week. The species used for the measures were *Trachelipus nodulosus* C. L. KOCH, *Porcellio scaber* LATR. Isopods and *Chromatoiulus unilineatus* L. *Diplopod* species. The period of measures was 3—4 hours, within of which the oxygen consumption was recorded in every 20 minutes. 120 measurements were made, using 5—10 parallels with 80 animals of different weights. The living and dry weight of the investigated animals was measured before and after the experiments. The results are given in $\mu l\ h^{-1}\ mg^{-1}$ dry weight.

Results and discussion

The respiration measurements of populations can not be measured in field conditions, but the data determined in laboratory can not be extended to natural circumstances. The daily activity, the relation of activity and respiration, the relation between respiration and temperature, sex have to be taken into consideration. Respiration is reciprocally proportional to the body weight. The respiration rate related to the body weight is a hyperbolic function (Fig. 1). The constant parameters and the forms of these curves depend also on the temperature. The data of functions with form $y=a+b\frac{1}{x}$, can be seen in tables 1. 2. 3.

Table 1. Trachelipus nodulosus

°C	a	b	r	p
15	−0.022	2.0223	0.916	<0.02
20	0.0538	6.328	0.929	<0.1
25	0.12	29.63	0.956	<0.001
30	0.278	10.499	0.965	<0.01

Table 2. Porcellio scaber

°C	a	b	r	p
15	−0.099	6.076	0.946	<0.02
25	0.403	5.314	0.631	>0.1
30	2.609	16.651	0.536	>0.1

Table 3. Chromatoiulus unilineatus

°C	a	b	r	p
20	0.0216	0.473	0.856	<0.1
25	0.0248	1.254	0.781	<0.1
30	0.18	1.21	0.441	$=0.1$

The rise of respiratory curve of the two investigated Isopod species is higher than that of the Diplopod species. The consumption plotted against temperature results exponential curves (Fig. 2. 3.4). The figures show the oxygen consumption of individuals with the same body weight as a function of temperature.

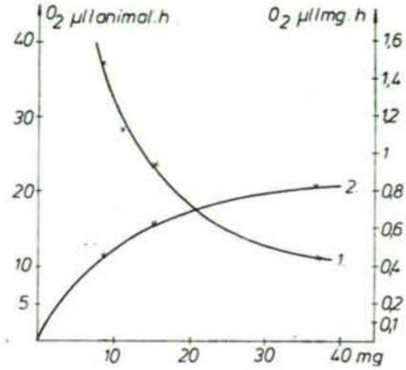

Fig. 1. (a) The dependence of oxigen consumption on body weight of individuals investigated ($\mu l \times mg^{-1} \times h^{-1}$) and
(b) the oxygen consumption of the animals of different weights (μl/animal$\times$h)
(*Trachelipus nodulosus*, 30 °C).

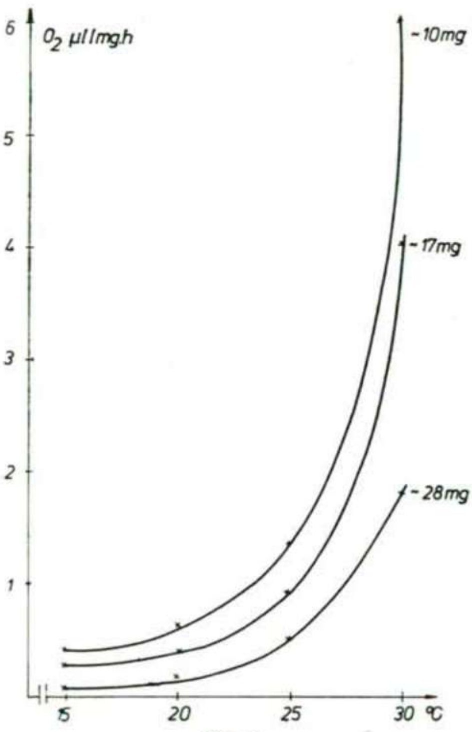

Fig. 2

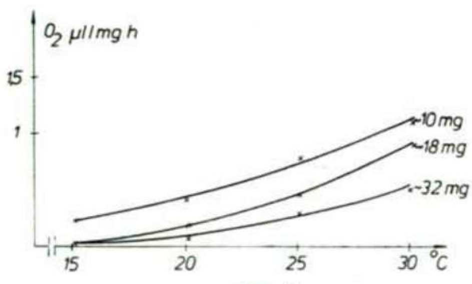

Fig. 3

Fig. 2—4. The oxygen consumption of individuals with same weights at different temperatures:
Porcellio scaber (Fig. 2)
Trachelipus nodulosus (Fig. 3)
Chromatoiulus unilineatus (Fig. 4).

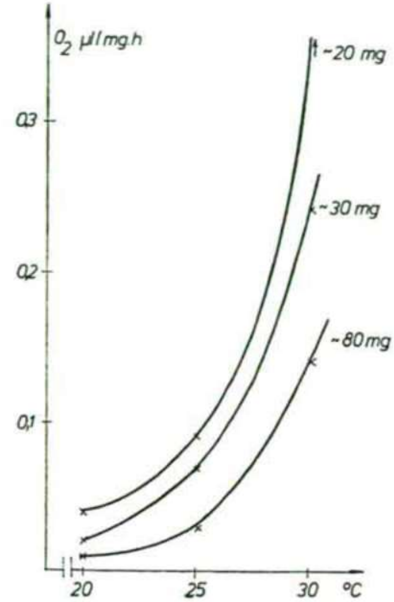

Fig. 4

Comparing the respiration of the species *P. scaber* and *Tr. nodulosus* it turns out that the respiration intensity of the latter one depends on the environmental temperature much less and it's respiration curve is considerable plattened. This can be explained with the different habitats and ecological demands of the above mentioned species. While the *P. scaber* generally lives in cellars, glass-houses, gardens, open woodlands, under stones, the *Tr. nodulosus* can be found on open grasslands. It is a xerophil species exposing to great temperature fluctuations. The respiration of *Ch. unilineatus* is even less influenced by the rise of temperature that can be explained with its ecological demands. It lives on dry grasslands, in acacia groves and is generally distributed, wide spead in the Great Hungarian Plain.

JENSEN and NIELSEN (1975) got exponential functions similar to the 2—4. figures also for poikilotherm insect imagos. The form of their equation:

$$\lg y_w = 0{,}0491t - 0{,}9111.$$

It is supposed, that these exponential curves are saturated and so form Verhulst logistic curves at higher temperature values as it was established by GALLÉ (1978) on ants and CSOKNYA and HALASY (1975) on *Palingenia longicauda* OLIV. (Ephemeroptera). NEWELL et al. (1974) wrote also about such curves at extrem high temperatures examining *P. scaber*. The temperature values that are felt extrem by the single species adapted to divergent conditions can be different. For instance the respiration rate of *P. scaber* is strongly raised by the temperature at 20—25 °C, which — since it doesn't mean physiological threshold of temperature to increase the rate of metabolism — causes much less increase in the oxygen consumption rate of *Tr. nodulosus* and *Ch. unilineatus* having thermophile niche center.

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