

## Variation of selected morphological characters of the cave mite *Oribella cavatica* Kunst, 1962 (Acari, Oribatida)

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**Abstract:** Two populations of *Oribella cavatica* were examined. The mites were isolated from bat guano collected in February 2006 in Zbójecka Cave in Mount Łopień and in the cave Czarci Dół, which are situated in the Beskid Wyspowy Mountains, within the Flysch Carpathians in southern Poland. Coefficients of variation of body length and width, lamella length, and sensillus length of this species under stenotopic conditions were compared with those of two eurytopic species. The stable variation of sensillus length of *O. cavatica*, like differences in the variation of *Heminothrus peltifer* in various soil habitats, may have bioindicative significance.

**Keywords:** morphological variation, Oribatida, bioindication, cave

### INTRODUCTION

*Oribella cavatica* is a mite species that was first isolated from the guano of bats living in the cave Čertova diera in northern Slovakia (KUNST 1962). In Poland this species has been found in caves in the vicinity of Ojców (southern Poland) (RAFALSKI 1977). Apart from caves, the species has been found in burrows of marmots (RAFALSKI 1977) and in the soil under mosses near the village of Kryłów, on the river Bug (ŻBIKOWSKA-ZDUN et al. 2006).

Its distribution practically limited to caves allows us to include this oribatid mite among troglaphiles or troglobites. However, the species does not have troglomorphic features, like those noticed in the Brachychtoniidae and the Oppioidea, which occur most frequently in caves and in habitats with similar environmental conditions (e.g. mines) (SKUBAŁA & KŁYS 2002, DUCARME et al. 2000, 2003).

We have found in our research *O. cavatica* to be extremely numerous in guano samples, which seems to indicate that it is a coprophilous or guanophilous species (c.f. KUNST 1962, PALACIOS-VARGAS et al. 1998), and optimal stenotopic ecological conditions favour the development of its large populations. Similar ecological conditions, though not so stable, prevail in the pores of humid soil.

An assessment of variation of a species living in caves under stable stenotopic conditions may be helpful in interpreting the variation of other species living under eurytopic conditions and in answering the question posed in bioindication studies, whether the variation among individuals is a result of genetic or environmental differences (KRZANOWSKA et al. 2002).

The aim of our study was to examine selected morphometric features of *O. cavatica* living in stenotopic conditions and to compare them with the variation of two earlier examined eurytopic species: *Heminothrus peltifer* (C.L. KOCH, 1839) and *Achipteria coleoprata* (LINNAEUS, 1758) (ŻBIKOWSKA-ZDUN & WOŁEK 2006).

#### MATERIAL AND METHODS

The research was carried out in two caves:

(1) Zbójecka Cave in Mount Łopień (20°17'E, 49°42'N) – with 3 entrances situated at the altitude of about 880 m; known corridor about 430 m long, denivelation 16 m;

(2) Czarczi Dół (20°16'E, 49°42'N) – with an entrance situated at an altitude of about 770 m; known corridors about 140 m long, denivelation 14 m.

The described localities lie in southern Poland, in the Beskid Wyspowy Mountains within the Flysch Carpathians, on the northern slope of Mount Łopień. They are typical pseudokarst caves. Climatic conditions in the caves are stable (relative humidity above 90%, air temperature 7–12°C). Organic matter (guano of bats) is found in those caves. Bats stay in caves all the year round. They are large winter quarters of *Rhinolophus hipposideros* in Poland. A winter colony of this species in Zbójecka Cave in Łopień counts about 500 individuals and in Czarczi Dół about 120 individuals (the count surveys were conducted in the middle of the winter seasons i.e. in February). Furthermore, members of other bat species have been observed hibernating in caves, but their numbers have not exceeded several individuals (PIKSA, unpubl. results).

The mites from 10 samples of bat guano collected from the cave floor in February 2006 were isolated with a standard method, using the Tullgren funnel. Each sample was about 220 cm<sup>3</sup> in volume. Among the collected mites, the most numerous was *O. cavatica* (about 1500 specimens in total). Besides, a few oribatid mites from the families Hypochthoiiidae and the Oppiidae were found, as well as the Scutacaridae, which were abundant.

To analyse the variation, the following morphological features were chosen: body length and width, lamella length, and sensillus length. In total, 800 measurements on 200 mature specimens of *O. cavatica* (95 from Zbójecka Cave in Mount Łopień and 105 from cave Czarczi Dół) were made and statistically analysed.

#### RESULTS AND DISCUSSION

*Oribella cavatica* belongs to the suborder Brachypylina and its cerotegument is light brown, fairly strongly sclerotized, with lamellae strengthening it on the prodorsum. These are not features typical for troglobionts. Mites of this species living

in caves differ from those living in the soil in their morphometric features, such as body length and width, leg length, as well as the shape and length of various setae and the sensillus. Troglomorphic features of cave mite species include larger body size and longer sensilli (DUCARME et al. 2004). Those authors, however, did not study the variability of the above-mentioned features for particular species. It is well known that the mites living in humid soil have longer sensilli (AOKI 1973). The investigated populations of *O. cavatica* were fairly uniform and similar to each other (Tables 1 and 2). According to the literature, its body length is 420-500  $\mu\text{m}$  (WEIGMANN 2006), but the mites examined in this study were slightly smaller, 372-453  $\mu\text{m}$  long (Tables 1 and 2). Only 30% of the examined mites were over 420  $\mu\text{m}$  long. This seems to be connected with the size dynamics of the studied population, with nearly unlimited access to the nutrients from bat guano. The mean length of a specimen from Zbójecka Cave in Łopień was 411.60  $\mu\text{m}$ , whereas at Czarci Dół it was 408.05  $\mu\text{m}$ . Other statistics also show great similarity of both populations. Additionally, the variation of body size (length and width) in both caves was similar (Tables 1 and 2).

Table 1. Arithmetic mean, standard deviation (SD), minimum (Min.) and maximum value (Max.), and coefficient of variation (CV) of selected morphological features of adults of *Oribella cavatica* collected in Zbójecka Cave in Łopień

Feature	Mean ( $\mu\text{m}$ )	SD ( $\mu\text{m}$ )	Min. ( $\mu\text{m}$ )	Max. ( $\mu\text{m}$ )	CV
Body length	411.60	18.52	372.3	452.9	0.045
Body width	248.97	16.93	209.1	290.7	0.068
Sensillus length	74.43	7.89	56.1	107.1	0.106
Lamella length	76.94	7.54	56.1	91.8	0.098

Table 2. Arithmetic mean, standard deviation (SD), minimum (Min.) and maximum value (Max.), and coefficient of variation (CV) of selected morphological features of adults of *Oribella cavatica* collected in Czarci Dół

Feature	Mean ( $\mu\text{m}$ )	SD ( $\mu\text{m}$ )	Min. ( $\mu\text{m}$ )	Max. ( $\mu\text{m}$ )	CV
Body length	408.05	16.24	336.6	453.9	0.039
Body width	244.00	14.64	204.0	280.5	0.060
Sensillus length	75.37	8.14	51.0	112.2	0.108
Lamella length	75.05	6.98	56.1	91.8	0.093

Coefficients of variation of the measurable features of *O. cavatica* living under stenotopic conditions and two eurytopic species *Heminothrus peltifer* and *Achiapteria coleoprata* (ŻBIKOWSKA-ZDUN & WOLEK 2006) are compared in Table 3. The varia-

Table 3. Coefficients of variation of selected measurable characters of adults of *Oribella cavatica* in this study, compared to those of *Heminothrus peltifer* and *Achipteria coleoptrata* (ŻBIKOWSKA-ZDUN & WOLEK 2006)

Species and site	Coefficient of variation			
	body length	body width	sensillus length	lamella length
<i>Oribella cavatica</i> Zbójecka Cave	0.05	0.07	0.11	0.10
<i>Oribella cavatica</i> Czarci Dół	0.04	0.06	0.11	0.09
<i>Heminothrus peltifer</i> Meadow	0.03	0.04	0.18	ND
<i>Heminothrus peltifer</i> Dump	0.04	0.06	0.29	ND
<i>Achipteria coleoptrata</i> Meadow	0.05	0.08	ND	ND
<i>Achipteria coleoptrata</i> Dump	0.05	0.07	ND	ND

ND = difficult to measure or lack of feature

tion in body length and width is similar in all the species, irrespective of the type of habitat. Sensilli and lamellae in *O. cavatica* are characterised by relatively high variation, nearly identical in both caves. The eurytopic *H. peltifer* is characterised by the largest variation of the sensillus; a large difference in coefficient of variation between individuals living in soil and in a dump has also been noticed.

The compared results indicate that the only morphological feature whose variation may have a bioindicative significance is sensillus length. The variation of the sclerotized lamellae may also have bioindicative significance, but to prove it is necessary to compare the variation of the lamellae in eurytopic soil species. DUBININA & ALEKSEEV (1994) and FUJIKAWA (1995, 1999) found in their studies on the eurytopic species *Tectocephus velatus* (MICHAEL, 1880) and *Oppiella nova* (OUDEMANS, 1902) an effect of various environmental factors, including anthropogenic ones, on the length variation of the sensillus and sclerotized lamellae on the body. Those authors observed differences in the shape of the sensillus and the sclerotized lamellae on the prodorsum in populations inhabiting different habitats.

The species *O. cavatica* and the earlier examined *H. peltifer* have sensilli in the shape of straight setae, which are easy to measure. The stable variation of sensillus length in *O. cavatica* from different caves and significant variation of the same feature of the *H. peltifer* from various soils displays a bioindicative value.

Research on the bioindicative role of Oribatida is focused mainly on changes in the species diversity and dominance structure of oribatid mite communities (SENICZAK 1979, SKUBALA 1997, STRAALLEN 1998). The results of our research show that the variation of selected morphometric features may play a similar role.

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