MORPHOLOGICAL STRUCTURES ON THE INTEGUMENT OF *MESONISCUS GRANIGER*

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Abstract. The integument surface of the cavernicolous terrestrial isopod *Mesoniscus graniger* collected in the Magura and Zidita caves, Romania, was investigated using the SEM. Almost the entire body surface is covered by honeycomb-like polygonal scales arranged like a net. Only two fields on both sides of the cephalon have a smoother structure with less pronounced and somewhat morphologically altered scale microstructures. Tricorns, the morphological characteristic for isopod body surfaces, were not observed. The surface granules looking as a ring or chalice of partly elevated scales with a brush or spine-like structures or setae in the center were documented as almost regularly arranged structure on the whole body. Possible functions of these structures are discussed.

Key words: *Mesoniscus graniger*, SEM, integument morphological structures.

1. INTRODUCTION

The biology (GIURGINCA, 2009), historical biogeography (GIURGINCA, 2006, GIURGINCA, 2009) the ecophysiology and the feeding ecology (ŠUSTR ET AL., 2005; GIURGINCA ET AL., 2012) of the species *Mesoniscus graniger* (Frivaldsky, 1863) are well known.

However, the morphological structures on the integument are relatively unknown (GIURGINCA, 2003) although they play an essential role in the body protection including possible water conserving role (SCHMALFUSS, 1978). Our paper represents the first comprehensive description of the morphological structures from the integument of *M. graniger* collected in two caves from the Romanian Carpathians.

For the first time we describe here these integument structures from a cave-dwelling oniscidean, as previous studies have been focused mainly on edaphic species (e.g. SCHMALFUSS, 1978; POWELL & HALCROW, 1982)

MATERIAL AND METHODS

In order to provide the accurate description of the morphological structures in *M. graniger*, detailed investigation of the cuticle structures has been undertaken

using the scanning electron microscopy (JEOL JMS-7401F). Both subspecies of *M. graniger* have been included in the study to evaluate the possible differences: the nominate subspecies *M. graniger graniger* (Frivaldsky, 1863) (Zidita Cave, 05.06.2009, leg. V. Šustr) and *M. graniger dragani* Girginca, 2003 (Magura Cave, 05.09.2000, leg. A. Giurginca).

2. RESULTS AND DISCUSSION

The cephalon, pereion and pleon of *M. graniger* are covered by numerous granules with an irregular distribution on the cephalon surface, while on the tergites of pereion and pleon they form more or less regular rows.

At both subspecies *M. g. graniger* and *M. g. dragani*, there is a continuous row of granules along the frontal line, the occipital furrow and along the entire outline of the dorsal side of the cephalon; which, in fact, represents the sole regular row of granules from the head. Also both subspecies, the two granules are placed precisely in the center of the frontal line and very close to each other.

Two fields, situated on both sides of the cephalon, have morphologically altered scales with a smoother surface then the rest of the cephalon tegument. In both subspecies, these smooth surfaces have a similar oblong shape oriented longitudinally, i.e. parallel to the edges of the cephalon. While at *M. g. graniger*, (Fig. 1A) there is a clear demarcation between the areas with normal structures and the zones with altered scales, at *M. g. dragani*, the margins of these areas are less clearly delineated and their surfaces are rougher (Fig. 1B).

At the nominate subspecies, the granulation from the pereionites forms regular, transversal rows. On the contrary, at *M. g. dragani*, the rows of granules on the pereionites are very irregularly distributed and tend to entwine making difficult the numbering of granules (for details concerning the variation in the number of granules see GIURGINCA, 2003).

Regarding the granulation of the pleonites, *M. g. dragani* presents two rows of granules, while at *M. g. graniger* there is present only one row.

Irrespective of their position, the granules are connected by finer surface structures similar to scales. Scales resemble a honeycomb-like net, which cover almost the entire body surface (Fig. 2 A and B).

The granules represent relatively slight prominences of the body and have an orifice in the center. On each granule there is a structure similar to polygonal chalice with the walls formed by partly elevated scales (Fig. 3 A, B and C). Inside of each such polygon, corresponding with the center of the granule (and the orifice), there is a brush or spine-like structure. The brush represents the secretion of a tegumentary gland. The honeycomb scale net is formed starting from each granule. The walls of each unit of the honeycomb net have a clearly filamentous structure (Fig. 4A and B).

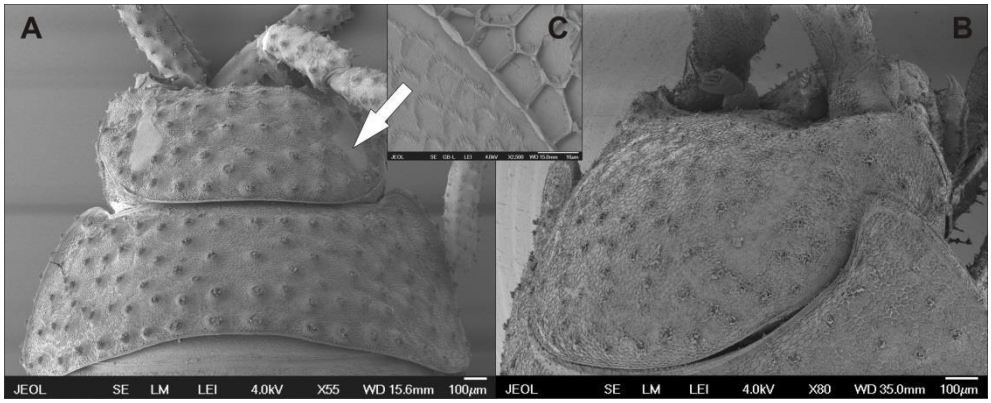

Fig. 1. A. The smooth fiels from both sides on the cephalon of *M. g. graniger*; B. Right side of *M. g. dragani* cephalon with the smooth field; C. Detail of the smooth field with morphologically altered scales at *M. g. graniger*.

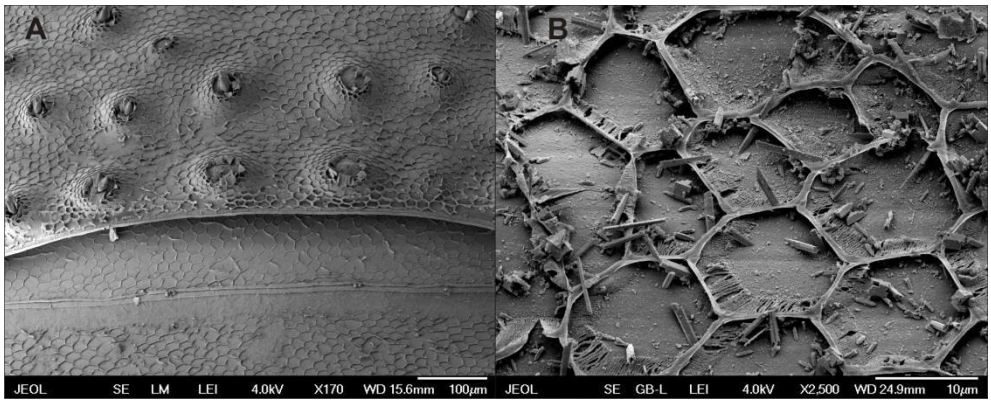

Fig. 2. A. The posterior edge of the first and anterior edge of the second pereionites of *M. g. graniger* showing the position of granules;
B. Microstructure detail of the honeycomb-like net of scales at *M. g. dragani*.

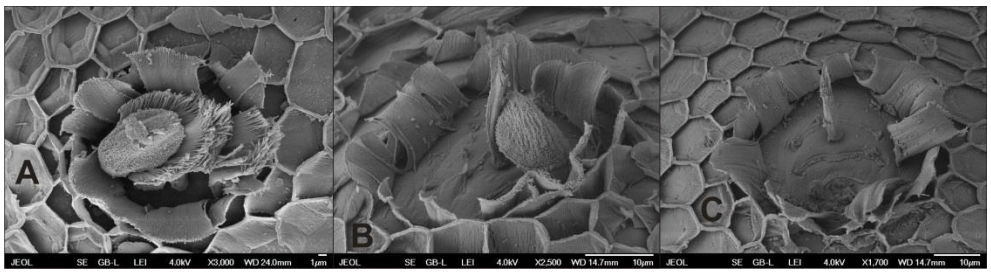

Fig. 3. A, B, C. Details of the structure in the center of a granule at *M. g. graniger*.

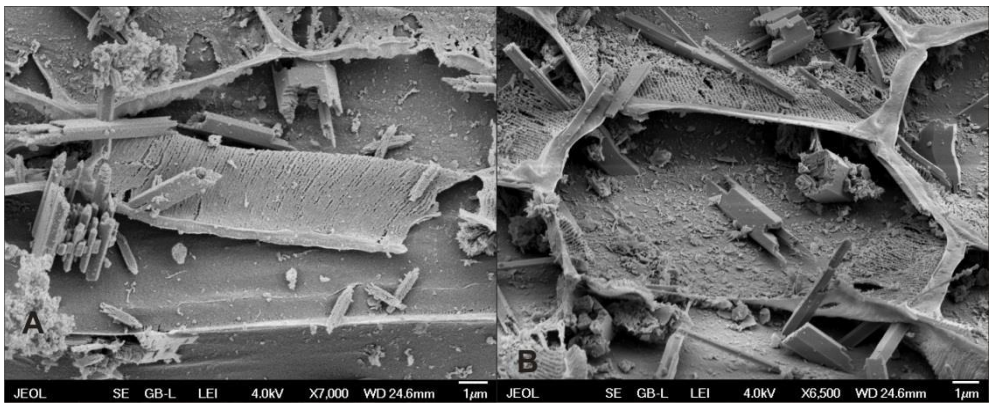

Fig. 4. A, B. Filamentous structure of the walls of a unit of the honeycomb scale net showing various degrees of damage (both from *M. g. dragani*).

Tricorns, recorded by various authors in other species of terrestrial isopods (SCHMALFUSS, 1978; WARBURG, 1993) are completely missing. Tricorns are considered as hygroreceptors (WARBURG, 1993), therefore their absence can be considered as the consequence of the adaptation of *Mesoniscus graniger* to the highly humid environment in caves .

As it has been pointed out by SCHMALFUSS (1977, 1978), the function of the micro-scales and the corresponding structures is considered anti-adhesive: their role is to prevent small, wet particles from sticking to the cuticle by minimizing the possible contact area. Particles of substrate sticking directly to the cuticle of the isopods could hinder the movement and the oxygen and water exchange. Direct contact of substrate particles with the cuticle may cause its damage.

Mesoniscus graniger inhabits the floor and also diverse crevices and other surface structure of diverse size, of a wide altitudinal and latitudinal range of caves (e.g. GIURGINCA, 2009), i.e. generally moist habitats with diverse mineral sediments that might damage its cuticle. We observed several areas of the honeycomb-like net of scales that showed damages due to fine particles of sediments, especially in the case of the *M. g. dragani* collected from the Magura Cave with clastic clay sediments (Fig. 4).

Summarizing, at *Mesoniscus*, the observed integument structures have an important protection function. The water protection role may be reduced or absent as these isopods are living in the highly humid environment of the cave systems.

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