1096
doi:10.1017/S1431927619006214
Microsc. Microanal. 25 (Suppl 2), 2019

Investigation of Morphology and Surface Structure of *Stenocara eburnea*, Namib Desert Beetle

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Fog harvesting Namib Desert beetles such as *Onymacris unguicularis* have recently inspired various synthetic designs to collect water droplets in the dry, arid conditions [1]. To our best of knowledge, first scanning electron microscopy (SEM) microstructure of hydrophobic textured patterns on the dorsal surface of elytra of *Stenocara* sp. has been reported in 2001 and been attributed to its high efficiency for fog condensations [2]. While their explanation of its efficacy for the water collection is valid, it has widely confirmed that the specimen investigated in the aforementioned paper is not *Stenocara* sp. but *Physosterna cribripes* [3]. Therefore, it was only in 2010 that an actual SEM picture of the apex of the elytra of *Stenocara gracilipes* has appeared, revealing irregularly lined, jagged bumps [4].

This study reports first known SEM micrographs of *Stenocara eburnea*, characterized by its white-colored elytra shell. While *S. eburnea* shares many characteristics with *S. gracilipes* and *P. cribripes*, peer-reviewed scientific reports on the *S. eburnea* are quite limited: brief details reported in 1970s on the physical attributes of the beetle such as body temperature regulation [5] and UV reflectivity [6].

Figure 1 represents a female specimen as observed with a Leica Zoom 2000 light microscope. The horizontal length of the female elytron is approximately 0.6 cm. The elytra portion of the beetle is characterized by uneven bumps formed in straight vertical bands down the dorsal view of the elytra, with relatively smooth grooves in-between likewise in *S. gracilipes* [4]. Unlike its white elytra, its head as well as all of its legs are dark colored as *S. gracilipes*. The sites of interests has been marked from A to D.

Figure 2 is a collection of corresponding SEM images taken of same specimen with a FEI Quanta 200 3D. In Figure 2(A), groups of microsetae were seen connecting its pronotum to its elytra. While their exact function is unknown, it may hinder any dew formation between pronotum and elytra. Figure 2(B) shows a series of bumps formed on the surface of upper right elytron. It is also noted that small bumps randomly exist between straight vertical lines observed in the Figure 1 as previously reported in [4]. Likewise in in *P. cribripes* [2], textured hexagonal array of hydrophobic region can be seen. These wax structures are believed to reduce dehydration of the insect in the arid area [7]. A bird eye close-up view of a bump (Figure 2(C)) in the upper left elytra reveals that the tip surface of the bump is not covered hexagonal structures while it is unclear if the tip of the bump is still covered wax or not. Further chemical analysis on the tip is necessary as previous Red O [2] or Sudan III [4] staining experiments reported contradicting results. As seen in Figure 2 (A-C), the regular hexagonal pattern of surface wax texture was observed in the lower part of a left elytron in the Figure 2(D). From this electron micrograph, the periodicity of the pattern was determined to be approximately 5 μm, comparable value to 6 μm [7] reported for *P. cribripes*.

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[8] The authors acknowledge general funding from Bergen County Technical School District. Dr. David Reeves is thanked for his help to assist SEM work for this work.

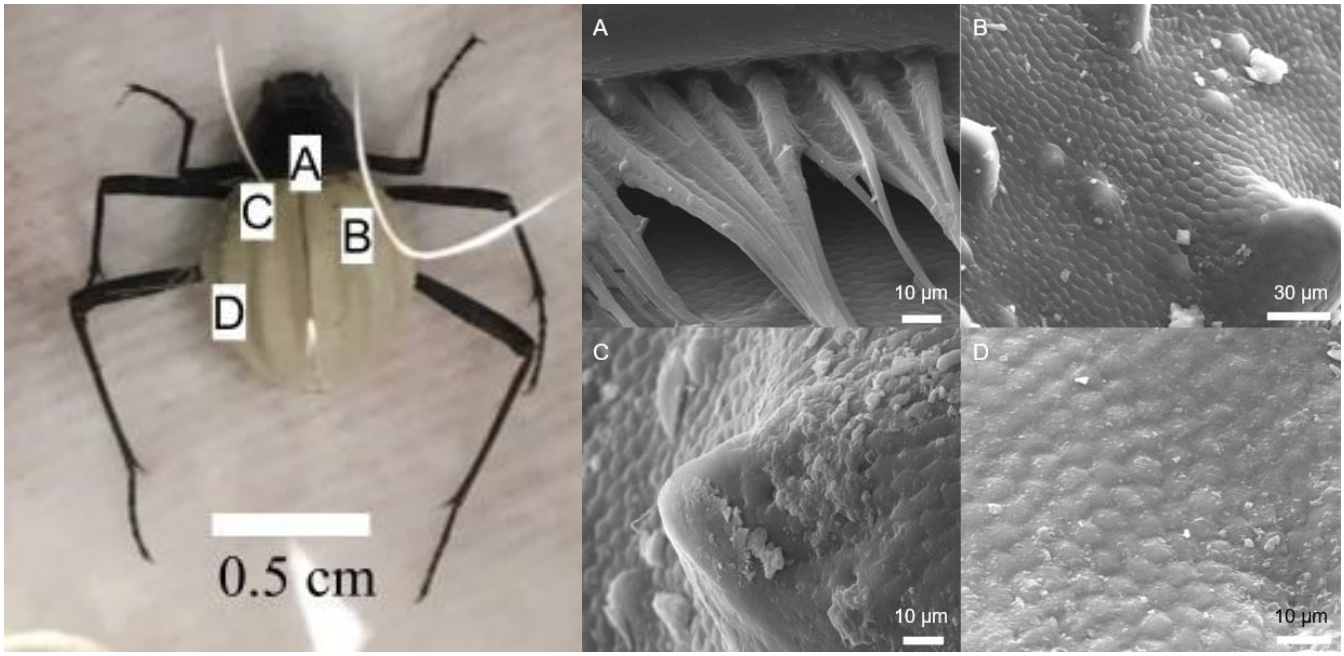

Figure 1 (Left). Light microscope image of a female *Stenocara eburena.* Namibia, Erongo Reg., 300m E. Swakopmund city, 7.12.2015, leg. Dementiev S: (A) lower region of the pronotum, (B, C, D) separate regions of elytron (dorsal view).

Figure 2 (Right). SEM imaging of indicated regions from Figure 1: (A) group of microsetae structures out of pronotum, touching down on its elytron, (B) morphology of upper right elytron, (C) close-up view of a bump in the upper left elytron, (D) close-up view of textured surface in the lower left elytron.

https://doi.org/10.1017/S1431927619006214 Published online by Cambridge University Press