

Revolving images and multi-image keys open new horizons in descriptive taxonomy

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This image shows the natural habitat of three of the discovered species in the Châambi National Park, Tunisia. Credit: Pavel Stoev

Only a fraction of the biodiversity on the planet is known to scientists and exploration of new places and habitats continue to yield exciting discoveries and new species to describe by taxonomists. This task is becoming increasingly urgent as a function of the continuous overexploitation of natural resources and destruction of habitats. In fact,

it has recently been estimated that it takes on average 21 years from the discovery of a species in nature to its formal scientific description. The 'shelf life' can sometimes be significantly longer, as for the millipede *Ommatoiulus schubarti* found in Spain in 1863 and just very recently described in 2012.

Illustrations constitute one of the fundamental bases of any taxonomic work, but they could often be misleading and generate problems of synonymy, the Achilles' heel of descriptive taxonomy. Thus, the demand for improving the quality of images and methods of visualization of taxonomic traits has significantly increased in the course of time, catalysed by the recent development of open access publishing. Interactive media illustrating important differences between species have the potential to further accelerate taxonomic works.

A paper, published in the open access journal *ZooKeys*, provides a modern revision of 12 [millipedes](#) of genus *Ommatoiulus*. The authors present an innovative illustration technique that allows the integration of scanning [electron microscope images](#) into an interactive rotatable model (rSEM) to visualize complex morphological features. This allows the structure in question to be seen from multiple angles of view. The development of rSEM is widely accessible, requiring no more than available [scanning electron microscope](#) and a software for image integration (Flash, Java Script based programs, etc.). The new illustrating technique can be viewed [here](#). On the other hand, authors present a highly visual [identification key](#) to serve [species identification](#). The key design prioritizes the visual delivery of taxonomic information via [interactive media](#) including line drawings, photographs and scanning electron micrographs of the most informative taxonomic characters in the studied group.



This image shows *O. chambiensis*, one of the species described with the novel illustration technique Credit: Nesrine Akkari

"Differences between species are often subtle, and the pronouncedly "3D" nature of their anatomy makes recognition of the differences difficult. In many older papers dealing with millipedes, authors have illustrated the copulatory organs as isolated pieces which has led to not only "angle-of-view" problems, but also to difficulties of relating the various components spatially to each other. By using rSEM, we have overcome these problems.", comments the lead author of the study Dr. Nesrine Akkari, Natural History Museum of Denmark.

The slow tempo of incorporating innovative methods in taxonomic research is very likely due to the perception that sophisticated imaging

requires special software, e-infrastructure, and significant funding. The multimedia driven, interactive taxonomic paper by Akkari et al. demonstrates that much can be accomplished using accessible equipment and methodology.

More information: Akkari N, Cheung DK-B, Enghoff H, Stoev P (2013) Revolving SEM images visualising 3D taxonomic characters: application to six species of the millipede genus *Ommatoiulus* Latzel, 1884, with description of seven new species and an interactive key to the Tunisian members of the genus (Diplopoda, Julida, Julidae). *ZooKeys* 328: 5. [DOI: 10.3897/zookeys.328.5763](https://doi.org/10.3897/zookeys.328.5763)

See also:

Cheung DK-B, Brunke AJ, Akkari N, Souza CM, Pape T (2013) Rotational Scanning Electron Micrographs (rSEM): A novel and accessible tool to visualize and communicate complex morphology. *ZooKeys* 328: 47. [DOI: 10.3897/zookeys.328.5768](https://doi.org/10.3897/zookeys.328.5768)

Stoev P, Penev L, Akkari N, Cheung DK-B, Enghoff H, Brunke A, de Souza CM, Pape T, Mietchen D, Erwin T (2013) Revolving images and multi-image keys open new horizons in descriptive taxonomy: ZooKeys working examples. *ZooKeys* 328: 1. [DOI: 10.3897/zookeys.328.6171](https://doi.org/10.3897/zookeys.328.6171)

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