The mind-blowing Diogenes lacewing: How to store remains to survival 110 million years ago

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An image of the mind-blowing Diogenes green lacewing (Hallucinochrysa diogenesi).

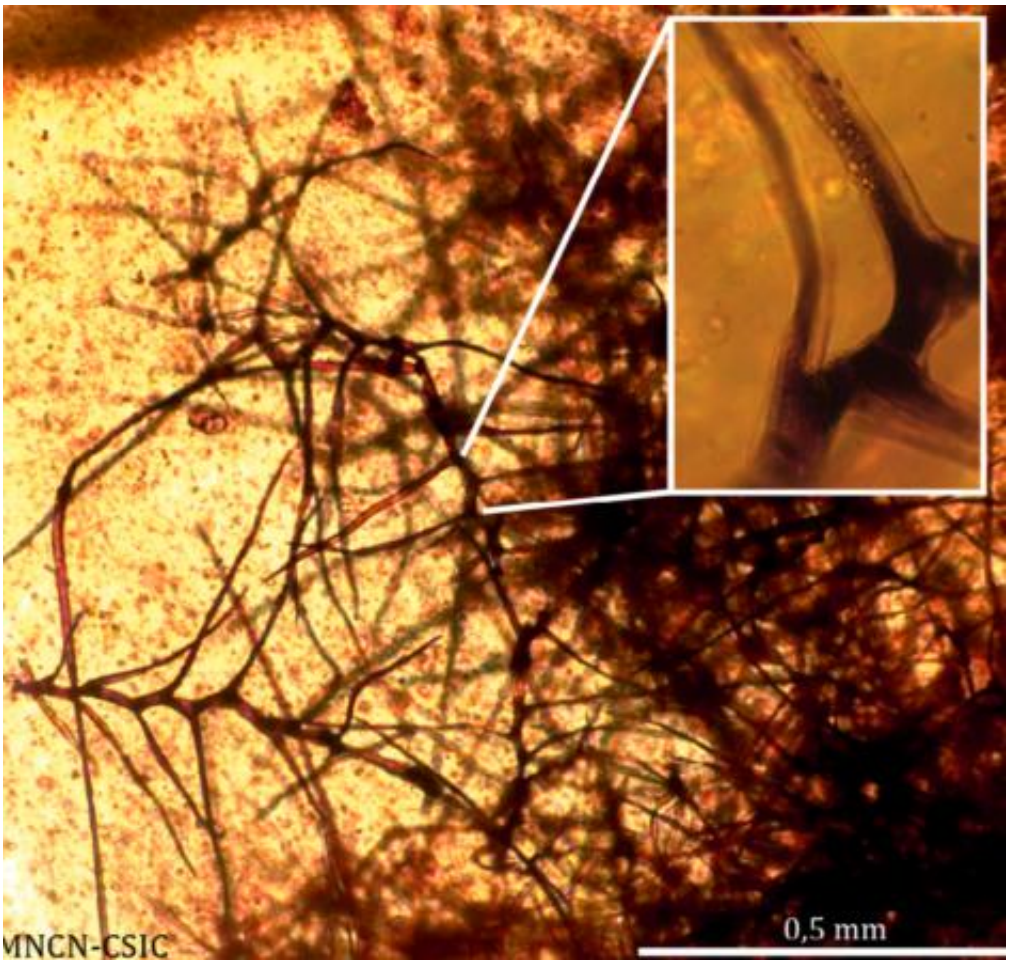
An insect larva covered by plant remains that lived in the Early Cretaceous, about 110 million years ago, evidences the most ancient

known insect camouflage, according to a paper published in the last edition of the journal *Proceedings of the National Academy of Sciences* (*PNAS*). The paper is based on the study of an amber piece found in 2008 in El Soplao outcrop (Cantabria, Northern Spain), the Mesozoic's richest and largest amber site in Europe.

The researchers who participated in the study are: Ricardo Pérez-de la Fuente and Xavier Delclòs, from the Department of Stratigraphy, Paleontology and Marine Geosciences at the University of Barcelona (Spain); Enrique Peñalver, from the Geominer Museum of the Spanish Geological and Miner Institute; Mariela Speranza, Carmen Ascaso and Jacek Wierzchos, from the National Museum of Natural Sciences, of the Spanish National Research Council, and Michael S. Engel, from the Division of Entomology of the University of Kansas (USA).

To cover the body with detritus to camouflage

The fossil, about four millimetres long, is a predatory larva of the order Neuroptera. It is covered by a tangle of filamentous plant remains that it collected with its jaws to form a defensive shield and camouflage itself. This kind of behaviour, the trash-carrying, is a survival strategy observed in current species to render them nearly undetectable to predators and preys. The fossil, related to current green lacewings, represents a new genus and species designated Hallucinochrysa diogenesi, alluding to its mind-blowing appearance and resemblance to Diogenes syndrome, a human behavioural disorder characterized by compulsive hoarding of trash.



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According to the study, the filamentous plant remains composing the larval trash packet are recognised as trichomes, that is, plant hairs with diverse shapes and functions. Observing the morphology, micro-structure and composition of these trichomes, researchers were able to state that they belonged to ferns.

Today green lacewing larvae harvest plant materials or even detritus and arthropod remains and carry them on their backs, nestled among small tubercles with hairs. On the contrary, Hallucinochrysa diogenesi

possessed a bizarre, unique morphology; it showed extremely elongated tubercles, with hairs that had trumpet-shaped endings acting as anchoring points. All this structure, completely unknown until now, formed a dorsal basket that retained the trash and prevented it from sliding when the insect moved.

The most ancient insect camouflage

In the authors' opinion "Hallucinochrysa diogenesi proved that camouflage strategy and its necessary morphological adaptations early appeared in insects; they already existed in the era of the dinosaurs. In the case of green lacewings, it can be stated that this complex behaviour has not changed for at least 110 million years. This fact constitutes a relevant piece of information for evolution studies about animal behaviour and the adaptation strategies of organisms throughout Earth's history".

The study also shows, providing then an outstanding data, a close ancient plant-insect interaction —possibly an example of mutualism—; the predatory larvae saved ferns from plagues, whereas ferns provides larvae with a habitat and protecting remains; in other words, both organisms profited from each other. In a Cretaceous scenery where resin forests in the ancient Iberian Peninsula were razed by wildfires, this larva collected remains from a fern that grew abundantly after wildfires.

Provided by University of Barcelona