

99-million-year-old beetle trapped in amber served as pollinator to evergreen cycads

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This illustration is an ecological reconstruction of the mid-Cretaceous beetle *Cretoparacucujus burmiticus*. Credit: Chenyang Cai

Flowering plants are well known for their special relationship to the insects and other animals that serve as their pollinators. But, before the rise of angiosperms, another group of unusual evergreen gymnosperms,

known as cycads, may have been the first insect-pollinated plants. Now, researchers reporting in the journal *Current Biology* on August 16 have uncovered the earliest definitive fossil evidence of that intimate relationship between cycads and insects.

The discovery came in the form of an ancient boganiid beetle preserved in Burmese amber for an estimated 99 million years along with grains of cycad [pollen](#). The beetle also shows special adaptations, including mandibular patches, for the transport of cycad pollen.

"Boganiid beetles have been ancient pollinators for [cycads](#) since the Age of Cycads and Dinosaurs," says Chenyang Cai, now a research fellow at the University of Bristol. "Our find indicates a probable ancient origin of beetle pollination of cycads at least in the Early Jurassic, long before angiosperm dominance and the radiation of flowering-plant pollinators, such as bees, later in the Cretaceous."

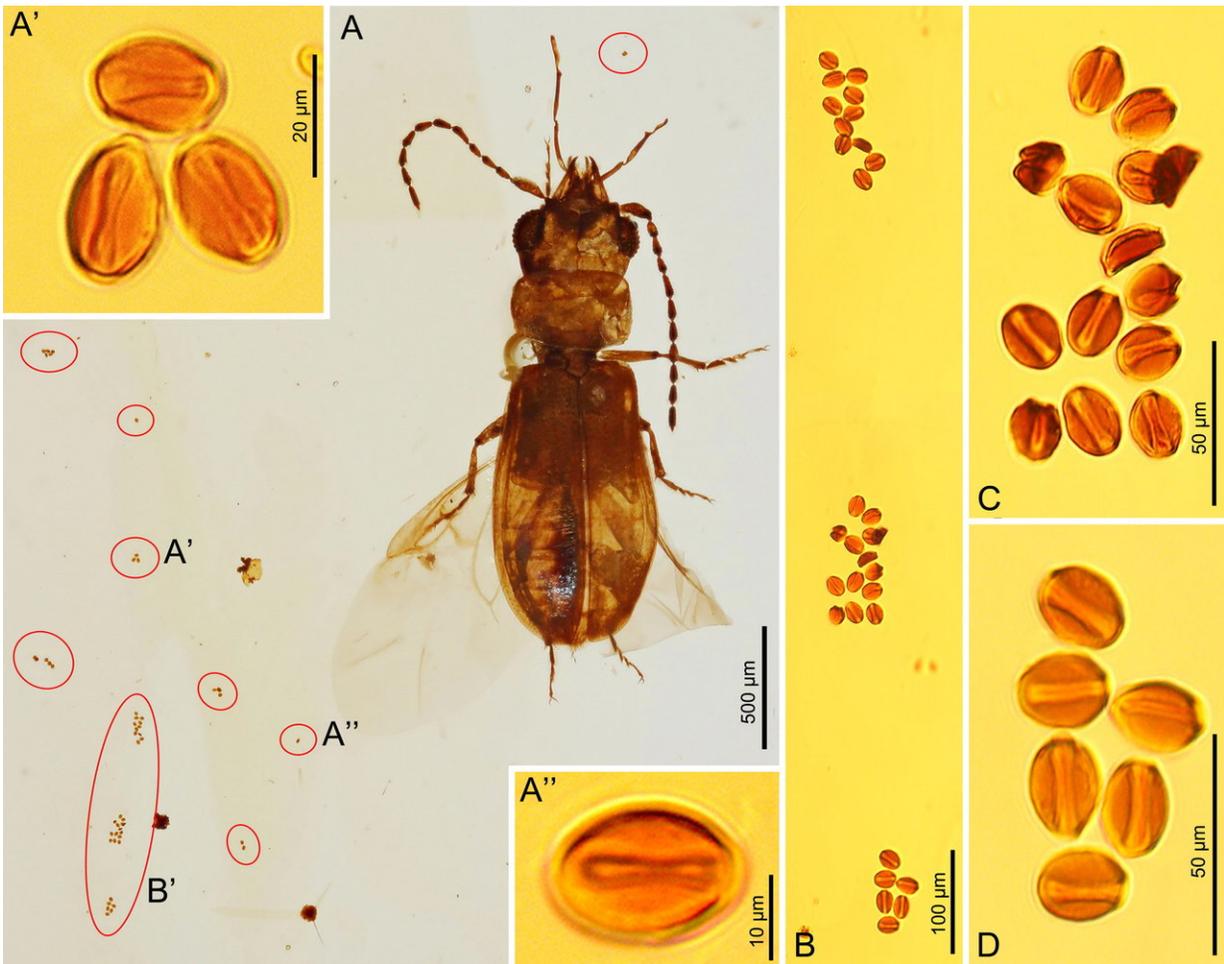
When Cai's supervisor Diying Huang at the Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, first showed him the beetle trapped in amber, he was immediately intrigued. He recognized that its large mandibles with bristly cavities might suggest the beetle was a pollinator of cycads.

After cutting, trimming, and polishing the specimen to get a better look under a microscope, Cai's excitement only grew. The beetle carried several clumps of tiny pollen grains. Cai consulted Liqin Li, an expert in ancient pollen at the Chinese Academy of Sciences, who confirmed that the pollen grains belonged to a cycad.



A dorsal view of the mid-Cretaceous beetle *Cretoparacucujus cycadophilus*, including the mandibular cavities it likely used for pollination. Credit: Chenyang Cai

The researchers also conducted an extensive phylogenetic analysis to explore the beetle's family tree. Their analysis indicates the fossilized beetle belonged to a sister group to the extant Australian *Paracucujus*, which pollinate the relic cycad *Macrozamia riedlei*. The finding, along with the current disjunct distribution of related beetle-herbivore and cycad-host pairs in South Africa and Australia, support an ancient origin of beetle pollination of cycads, the researchers say.



Cycad pollen grains associated with *C. cycadophilus* Credit: NIGPAS

Cai notes that the findings together with the distribution of modern boganiid beetles lead him to suspect that similar beetle pollinators of cycads are yet to be found. He's been looking for them for the last five years. The challenge, he says, is that older Jurassic [beetles](#) are generally found as compression fossils not trapped in amber.



A dorsal view of the mid-Cretaceous beetle *Cretoparacucujus cycadophilus* with a 1mm scale bar. Credit: Chenyang Cai

More information: Current Biology, Cai et al.: "Beetle Pollination of Cycads in the Mesozoic" [www.cell.com/current-biology/f...](http://www.cell.com/current-biology/fulltext/S0960-9822(18)30827-3)
[0960-9822\(18\)30827-3](http://www.cell.com/current-biology/fulltext/S0960-9822(18)30827-3) , DOI: [10.1016/j.cub.2018.06.036](https://doi.org/10.1016/j.cub.2018.06.036)

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