Novel Body Structure Likely Tied to Mating in New Extinct Insect Species

Insects, widely distributed across the world, is the most diverse group of animals on earth (more than one million species) and accounts for more than 50% of all living species. They are divided into over 30 orders, such as Coleoptera, Lepidoptera, Hymenoptera, etc.

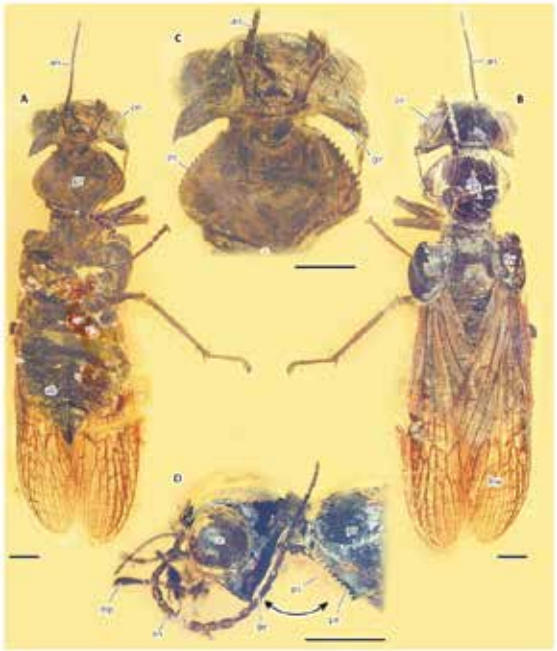
Usually, insects use different parts of their bodies—mostly the mouthparts or legs—to cling to their mating partners, catch prey or defend themselves. After 400 million years of evolution, specialized appendages were independently acquired in several groups to perform these tasks. They included modified legs in mantids, assassin bugs and stick insects, and clasping antennae of the globular springtails. However, no species was known to use their neck (the part between head and thorax) to perform any of these functions.

In early 2016, a new and unusual extinct insect order was discovered in approximately 100 million-year-old Burmese amber by a team of German and Chinese scientists. All specimens were scanned with different μ-Ct devices at the CAS Institute of Zoology, the Beijing Synchrotron Radiation Facility, or the Shanghai Synchrotron Radiation Facility. Based on 2D and 3D data covering several morphological features, researchers concluded that this species lived in the foliage of trees or bushes.

The most striking morphological feature of the species, named Caputoraptor, is a jack-knife mechanism with sharp edges of the posterior head meshing with toothed ridges on the anterior prothorax. Such a configuration was not known from any other fossil or extant species. Although the musculature involved in the mechanism was not preserved in the specimens of Caputoraptor, it is likely that the two ridges interacted like the blades of a scissors when the head was lowered.

Since the position of the eyes suggested that the field of vision of Caputoraptor did not include the space between the ridges, sensory hairs most likely functioned as a trigger causing the cephalo-thoracic scissors to close. It is difficult to determine how and why Caputoraptor used this unique mechanism.

Based on the structure of the apparatus, researchers proposed that the cephalo-thoracic device was a sexual-dimorphic structure of the female, used to cling to the male during copulation. A defensive or prey-catching function appears less likely. A similar mechanism did not evolve in any other known group of extant or extinct insects.



Caputoraptor elegans: photographs of the specimens embedded in Burmese amber.

Females mounting males are known from several groups of insects including grasshoppers, mayflies and roaches. The spread forewings of the males would fit perfectly with the cephalo-thoracic scissors of the females.

These short and sclerotized structures would not be mechanically damaged between the ridges and would provide stable anchorage. Once the female achieved such a fixed position, copulation could take place with the female on top of the male.

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