Early mammal varieties declined as flowering plants radiated

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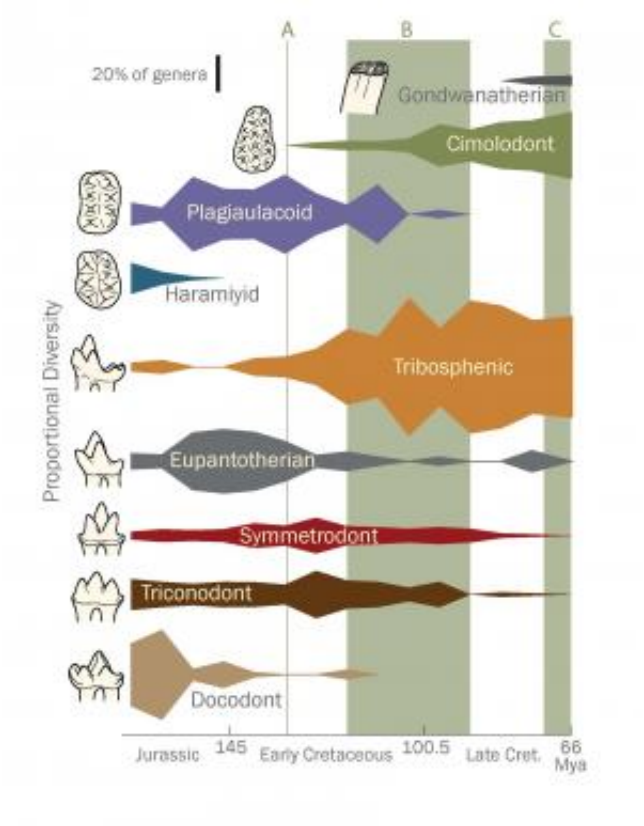

This figure shows a decline in mammal variety by dental type in the mid-Cretaceous. Note the increase, however, in mammals with tribosphenic molars, small insectivores that gave rise to modern-day mammals. Credit: David Grossnickle

The dramatic explosion of flowering plant species that occurred about

100 million years ago was thought to have been good news for evolving mammals, providing them with new options for food and habitat. But research by geologists at Indiana University Bloomington suggests that wasn't necessarily the case.

In a study published in the journal *Proceedings of the Royal Society B*, David Grossnickle and P. David Polly present evidence that mammal varieties declined during the great angiosperm radiation of the mid-Cretaceous, a time when a great diversity of flowering plants appears in the fossil record.

Grossnickle, a former high school biology teacher, conducted the research for a master's degree in geology from IU; he is now a doctoral student at the University of Chicago. Polly is a professor in the Department of Geological Sciences in the College of Arts and Sciences.

The paper, "Mammal disparity decreases during the Cretaceous angiosperm radiation," available online, describes unexpected findings from a painstaking analysis of mammal jaws and teeth.

Fossil discoveries in the past 30 years have provided new insights about mammalian evolution and made the current study possible. It is thought to be the first paleontological examination of its kind, tracking morphological, taxonomic and dietary changes of mammals during the mid-Cretaceous.

"At the middle of the Cretaceous, a time when the early angiosperms are radiating, we find a surprising decrease in the diversity of mammals," Grossnickle said. "It's not until the end of the Cretaceous, close to the time of the extinction of the dinosaurs, that we actually see a rebound in mammalian diversity and the first appearance of purely herbivorous mammals."

Previous literature suggested the spread of angiosperms, along with the evolution of pollinating insects, may have spurred an increase in the diversity of mammals. The idea made sense: The radiation would likely have resulted in more food sources from seeds, fruits, leaves and insects.

Grossnickle and Polly found, however, that while the number of mammal species may have increased, their variety decreased. Most of the mammals that survived were small, insect-eating animals.

"From the fossil record, the time of the angiosperm radiation doesn't look like a very good time for mammals," Grossnickle said. "There's not as much variation as there was before and after that time, and there's not as much as you would expect at a time when angiosperms were radiating."

The study examined mammalian evolution associated with changing diets through a detailed analysis of the size and shape of jaws from the fossil record. The researchers also used dental function and molar size to chart changes in mammal morphology.

They found that one group of mammals, while mostly small and morphologically similar, did well in the mid-Cretaceous. Those were early therians, which gave rise to most modern mammals, including humans.

"Without the ecological changes brought about by the Cretaceous radiation of flowering plants," Grossnickle said, "the world would be a very different place and may not have triggered crucial adaptations of our clever primate ancestors."

More information: rspb.royalsocietypublishing.or … .1098/rspb.2013.2110

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