Scientists upset insect orthodoxies

A new study on insect evolution has set scientists buzzing. Its findings challenge the conventional wisdom that insect diversity exploded about 125 million years ago in response to the rapid spread of flowering plants. "This is going to be a hotly discussed paper, the opening shot in a good contention," asserts Leo J. Hickey, a paleobotanist at Yale University.

Insect diversity preceded that of flowering plants, called angiosperms, by 120 million years, according to the report. In fact, "insects may have spurred angiosperm diversity rather than the other way around," says coauthor Conrad C. Labandeira, a paleoentomologist at the Smithsonian Institution in Washington, D.C. He and J. John Sepkoski Jr., a paleontologist at the University of Chicago, report on this and other new twists in insect evolution in the July 16 SCIENCE.

Labandeira and Sepkoski traced the evolution of 1,263 insect families based on data gleaned from published studies around the world. The picture they assembled begins 390 million years ago with the first wingless insects. Then, about 325 million years ago, insect evolution took off. Winged groups evolved rapidly, as did insect families with other innovative body parts and the ability to metamorphose. These insects were evolving along with the primitive flora that predated flowering plants, says Labandeira. But the process was cut off 240 million years ago, at the end of the Permian period, by the worst mass extinction in Earth's history. It wiped out eight of 27 major orders of insects.

Following the crisis, however, the remaining insect groups "took off like compound interest in the bank" and continued to diversify exponentially until 125 million years ago, says Sepkoski. At that time, when flowering plants began to multiply, insect diversity slowed down. "That's what was so surprising," he says.

Furthermore, the scientists conclude that today's remarkable diversity of insects results from low extinction rates and not, as generally thought, from high evolution rates.

The two researchers also examined the history of how insects feed. The scientists grouped insect mouthparts into 34 classes, such as rasping, hooking, and sucking. They discovered that insects were poised to exploit the new food sources provided by angiosperms: 85 percent of the mouthpart types had evolved prior to the advance of flowering plants.

The view that the coevolution of insects and plants began with the proliferation of angiosperms 120 million years ago needs to be revised, Labandeira says. "The basic building blocks of coevolution go back at least to the Permian extinction," he contends.

Some scientists see even deeper implications in the study. To Hickey, the study implies that the driving force of insect diversity was "a simple increase in the number of species, controlled by a slow rate of extinction relative to evolution. They increased exponentially through time until coming to saturation. The appearance of flowering plants was incidental." This contrasts with the view that diversity is the result "of the complexity of the entire [system] of organisms present," he says.

The new data "should encourage everyone to rethink the implications of coevolution," argues David M. Raup, a paleontologist at the University of Chicago. It may be that "many of the larger patterns in evolution are due to chance" rather than to specific interactions between organisms, he adds.

Some take issue with this view, in part because of the study's design. They point out that the research analyzed diversity at the family level, a more general taxonomic grouping than species. "Families are a systematic convention invented for human convenience. But in nature, species interact with other species," says May R. Berenbaum, an entomologist at the University of Illinois at Urbana-Champaign.

Smithsonian Institution

Study examined fossil insects like this caddis fly embedded in Baltic amber.

Steven M. Stanley, a paleobiologist at Johns Hopkins University in Baltimore, is not surprised that the spread of flowering plants failed to produce new insect families. "What it undoubtedly produced was large numbers of species on a global scale. No one should extrapolate this pattern to the species level," he says.

Sepkoski says the question is not whether coevolution occurred, but "whether it has been of fundamental influence in the overall diversification of insects." — *B. Wuethrich*

Fish oil sharpens young preemies' focus

Babies born quite prematurely enter the world almost fat free. And that poses a double liability: They lack not only a valuable reserve of stored energy, but also the high levels of one fatty acid essential for normal visual development. Researchers now report they can improve the early visual acuity of preemies by fortifying their formula with this nutrient, one of the primary bioactive constituents of fish oil.

In the July AMERICAN JOURNAL OF CLINICAL NUTRITION, Susan E. Carlson and her co-workers at the University of Tennessee in Memphis report a year's worth of visual-acuity measurements for 67 infants, each born about two months early. Though docosahexaenoic acid (DHA) normally accounts for more than one-third of all fatty acids in the brain's gray matter and the eye's retina, a fetus begins to acquire large amounts of it only during the last trimester of pregnancy. Compared to preemies receiving standard preterm infant formula, those drinking fish-oil-fortified formula registered visual-acuity gains for about four months.

In a study published last October, Eileen E. Birch and her colleagues at the University of Texas Southwestern Medical Center in Dallas, also observed early visual benefits among fish-oil-supplemented preemies. Though a more limited investigation than Carlson's, it showed that preemies on a fish-oil-fortified formula had visual acuity similar to that of term and preterm infants receiving breastmilk. This was true at 57 weeks after conception (17 weeks after birth for term babies and up to 30 weeks after birth for preemies). Preterm infants on standard, DHA-free preemie formula exhibited notably poorer acuity.

Because early restrictions in visual inputs can permanently alter the development and organization of the brain's visual cortex, even temporary decreases in visual function may warrant correcting, maintains vision expert Martha Neuringer of the Oregon Regional Primate Research Center in Beaverton. Moreover, she notes, such impairments may not show up in acuity tests.

Humans can make DHA from another fatty acid in the diet. However, because this system operates inefficiently in infants, it may take preemies months to make up their initial deficit. That's why Carlson now argues that DHA should be considered "a conditionally essential nutrient for the preterm baby."

However, her data also indicate preemies might need another fatty acid (arachidonic acid). And unless the ratio between the two nutrients is balanced, she warns, a baby might encounter subtle, unnecessary side effects. — *J. Raloff*