Scientist solves secret of bee bread

A microbiologist has discovered the microbial ingredients honeybees embed in the nutrient-packed pollen derivative known as bee bread.

Martha A. Gilliam of the U.S. Department of Agriculture's Carl Hayden Bee Research Center in Tucson, Ariz., identified 107 molds, 81 yeasts and 29 bacteria in the bread while she and co-workers sifted through the yellow granules for proteins, lipids, vitamins, minerals, amino acids and enzymes.

Worker bees newly emerged from the comb must eat bee bread so their glands produce food for the queen and developing larvae, whereas older worker bees — the foragers — survive primarily on honey.

"We think bee bread is somewhat more nutritious than regular pollen, but until recently, we weren't sure what happened to it [after the bees collected it]," says Elton Herbert, a research entomologist at the Agriculture Department's Beneficial Insects Research Laboratory in Beltsville, Md.

Using standard chemical methods, Gilliam picked apart pollen on its path from plant to hive. She took samples from beeless almond trees, from the carrying basket on the bee's leg and from the combs in the hive.

"We found that as soon as bees touch the pollen on the plant, they are adding glandular secretions, microorganisms and either honey or nectar to make it sticky," Gilliam says. The added microbes produce enzymes that help release nutrients such as amino acids from pollen, and the organisms manufacture antibiotics and fatty acids that prevent spoilage. The bees also remove unwanted microbes from the pollen.

Gilliam aims to do more than satisfy scientific curiosity. "I am looking to give bees a complete diet," says Gilliam, who hopes to make bee bread herself in the next three to five years. Beekeepers today must use artificial supplements to keep bees alive through winters or when plants aren't blooming, and to boost bee populations in the spring when the crops are ready for pollination or honey production. "I'm hoping we can make a diet that is much better for bees — because it's what they are going to eat in nature," she says. Moreover, artificial pollen supplements are expensive and often carry bee diseases. "We haven't found any way to sterilize [the artificial pollen] without knocking out essential nutrients that make the pollen attractive to bees," Gilliam says.

— I. Wickelgren

Global-change study could take decades

Basic understanding of how human activities influence global climate probably will not improve significantly for at least a decade, six U.S. scientists agreed this week. At a briefing in Washington, D.C., for NASA officials on several recent international meetings, they said much information about the Earth first needs to be collected and analyzed. But Robert E. Dickinson of the National Academy of Sciences (NAS) told the administrators, "You should be prepared to [formulate policy] now, so that in 10 years when you do understand the problem, you can do something about it without having to wait another 10 years."

U.S. scientists have joined with colleagues from 40 nations to plan extensive studies of the Earth's atmosphere, biosphere and oceans from space, the air and the ground. These could begin as early as 1990. But until international satellites planned for launch in the mid-1990s return data, predictions about global warming will remain tentative, said the scientists, representing NASA, NAS, the University of New Hampshire in Durham, the University of Wisconsin-Madison and Harvard University.

Many researchers point to gases emitted by automobiles, industry and agriculture — primarily carbon dioxide, chlorofluorocarbons, nitrous oxide and methane — as potential contributors to a recent global warming trend (SN: 7/2/88, p.4; 4/30/88, p.282). Theory holds that a buildup of these gases in the atmosphere would trap heat close to the planet, causing the "greenhouse" effect: higher temperatures at the surface and in the lower atmosphere.

The scientists said they don't fully understand the factors affecting these gases, adding that sources of methane and nitrous oxide still must be identified before policies controlling uses of these chemicals can emerge. They suggested researchers can improve current understanding of global warming by:

- working together on projects encompassing their highly specialized studies
- creating global models incorporating detailed regional data rather than relying on averaged worldwide data, which can obscure important variations
- merging their models to create better ones
- verifying each other's data and interpretations.

Regardless of the effort, tools and time necessary for researchers to quantify humanity's role in climate shifts, global changes already initiated by human activities will persist for centuries, the scientists said.

— C. Knox

Familiar fruit flies emerge in new guise

Scientists studying the genetics of a pesky little fruit fly appear to have settled a century-old dispute about how new species can arise.

Ever since Darwin, conventional wisdom has held that geographic isolation is a key ingredient to speciation: Only when two populations of a given species are separated from each other — by large expanses of water or by mountain ranges, for example — will interbreeding be sufficiently interrupted to allow the gradual development of separate and distinct traits. Over time, these differences may become significant enough to make the two populations incapable of producing fertile offspring when they interbreed. As such, they are deemed separate species.

Since the 1860s, however, a determined handful of scientists have argued for the feasibility of "sympatric speciation" — speciation in the absence of geographic isolation. *Rhagoletis pomonella* — the No. 1 insect pest in U.S. apple orchards — provided scientists the perfect opportunity to test that hypothesis. Once found only in hawthorn trees, many of the fruit-burrowing flies have taken a liking to apple trees since apple seeds were introduced into eastern North America. In recent decades, subpopulations of *Rhagoletis* have developed a clear preference for one kind of tree or the other.

To see whether tree preferences might be leading to truly different species, scientists analyzed the enzymes of flies found on the two types of trees in sites containing both. Although no physical barriers separated the two populations, the researchers found significant and consistent biochemical differences between the two fly populations over several years, indicating that members of the two populations were mating somewhat separately. Laboratory studies show the two races can still interbreed when forced to share a room. But the stable biochemical differences between the two groups in nature strongly suggest they are becoming distinct species.

The scientists conclude that such factors as host-plant preferences and mating-time asynchrony (fruit fly reproductive cycles are coordinated with fruit ripening times, which occur several weeks apart in apples and hawthorns) are sufficient "gene flow barriers" to allow the development of distinct races — and perhaps species — at least in insects.

The research, reported in the Nov. 3 NATURE, was led by Jeffrey L. Feder at Michigan State University in East Lansing; Bruce A. McPheron at the University of Illinois at Urbana-Champaign; and D. Courtney Smith at the University of Utah in Salt Lake City.

— R. Weiss