Biology

The mystery of seeds' speedy passage

Birds and fruit-bearing trees work well together. Birds derive nutrients and energy from the fruit, which they eat seeds and all, and the trees benefit from having their seeds, which pass intact through the animals' digestive systems, dispersed widely.

Some researchers have suggested that the plants manipulate birds by lacing the fruit with laxatives. This strategy would make seeds move quickly through the bird's digestive juices, thus avoiding damage, K. Greg Murray and his colleagues at Hope College in Holland, Mich., reported in 1994.

In their experiments, Murray and his colleagues fed tropical thrush a meal of seeds from a Costa Rican shrub, *Witheringia solanacea*, mixed into bird food. When the scientists added juice from the shrub's fruit to the mixture, the birds passed the seeds twice as quickly.

A new study disputes that finding.

The juice's concentration of sugar—not any laxative chemicals—determines the seeds' speed through the digestive tract, suggests biologist Mark C. Witmer of the University of Wyoming in Laramie in the September ECOLOGY.

Sugar, an important nutrient for birds, accounted for 5 percent of *W. solanacea* juice and 13 percent of the bird food. So the feed with the juice had a lower sugar concentration than the feed without it, says Witmer.

Decreasing the sugar content of other birds' diets consistently speeds up the rate at which they pass food, Witmer's experiments show. Like most other species, birds digest low-nutrient diets faster than more nourishing fare.

Murray responds that seeds move more quickly through birds only when they receive a steady diet of the low-sugar food. In recent experiments, he found no difference in passage time among birds fed single meals of varying sugar concentrations.

Migrants seek out berry, berry rich food

For songbirds on the move, berries appear to be more important than researchers had thought.

From 1993 to 1995, investigators determined the diet of migratory songbirds making their autumn visit to Block Island, R.I., by analyzing more than 1,500 droppings, reports ecologist Jeffrey D. Parrish.

During their autumn trek, most of the 69 species bound for the island switched from an insect-rich diet to one based on fruit, he explains in a report accepted for publication in THE CONDOR. For several of the breeds, including the hermit thrush, red-eyed vireo, and yellow-rumped warbler, fruit made up 80 percent of their diet, notes Parrish, now with the American Association for the Advancement of Science in Washington, D.C.

A few species, including the American redstart, continued to dine exclusively on insects. However, the insect eaters put on less weight than the others, and the bigger the role fruit played in a species' diet, the greater its weight gain, he asserts.

Fruit has advantages over insects beyond providing lots of energy. Since it is more abundant and easier to grab than insects, hunting it down takes less work, Parrish notes in a separate report accepted for publication in STUDIES IN AVIAN BIOLOGY.

Researchers have known that many songbirds make stops at coastal shrublands, rich with fruit-bearing bushes, during their autumn migration. To test whether the birds select the shrublands for the fruit, Parrish monitored how many birds landed in an area where his group had picked all the berries. Compared to a similar but berry-filled spot, only a third as many birds visited the depleted area, he reports.

Bird-loving landowners should plant shrubs such as northern arrowwood, bayberry, and pokeweed, which produce berries that birds like, he recommends.

Materials Science

Ice resists melting in warm conditions

What seemed to be a straightforward material synthesis took an unexpected turn for scientists at the U.S. Geological Survey (USGS) in Menlo Park, Calif. They were testing a new way of making samples of methane clathrate so they could measure its mechanical properties. The researchers combined tiny grains of ice with gaseous methane at a low temperature, then allowed the mixture to warm slowly and react to form the clathrate, a solid in which water molecules form cages that trap a gas.

As the mixture crept above 0°C, however, the ice didn't melt. Even when the reaction reached completion, at temperatures near 16°C, grains of pure ice lingered in the vessel. "The full reaction to form the clathrate took about 8 hours, and we never saw wholesale melting of the seed ice," says Laura A. Stern, a USGS geophysicist. Stern and her colleagues report their findings in the Sept. 27 SCIENCE.

At first, the researchers thought they had measured incorrectly or that something was wrong with their apparatus, Stern says. However, a control experiment using neon gas, which does not form a clathrate, ruled out those possibilities. "All the ice melted in about 30 minutes," she notes.

Jeffrey Kargel, a geologist with USGS in Flagstaff, Ariz., struggled to accept the results but came to believe that the researchers "are basically on the right track." A similar effect has been seen in gold-plated silver grains, he says, where the gold forms a layer that protects the silver from melting. The clathrate probably does the same for the ice.

Although the effect lasted for many hours, this phenomenon is no ice-nine—the fictitious substance that turns the whole Earth solid in Kurt Vonnegut Jr.'s novel *Cat's Cradle*. The ice, Stern says, won't survive indefinitely at high temperatures. Left out on a tabletop, methane clathrate dissociates into its constituents, leaving nothing but a puddle of water. Still, Kargel says, "if [the results] can be verified, they will be full of insights into the dynamics of melt nucleation."

Et tu, clean room filter?

During a computer chip's manufacturing process, even minuscule amounts of dust or organic chemicals drifting through the air can spell ruin. That's why chips are assembled in clean rooms, where the air is filtered and everyone entering must, like surgeons, don protective caps, gowns, and booties. But now, according to a report in the September JOURNAL OF THE ELECTROCHEMICAL SOCIETY, it seems that even the filters—whose job it is to keep the bad stuff out—can be a potential source of contamination.

Researchers at Eastman Kodak Co. in Rochester, N.Y., discovered that phosphorus was contaminating their chips somewhere along the 200-step manufacturing process. They narrowed the problem down to a few stages in one clean room, then realized that the contamination had begun after the installation of some new, high-performance filters.

Sure enough, the polyurethane coating used to attach the paper filters to their metal frames gave off a phosphorus-containing substance. "Phosphorus shouldn't be in polyurethane," says John A. Lebens, a research scientist at Kodak and coauthor of the report. It turned out that the contaminant was in a flame retardant added to the coating. It doesn't take much phosphorus to wreak havoc, Lebens points out. It evaporates easily and settles on chips left in the open, altering their electrical properties.

It took the group 3 months to isolate the source of the contamination. The filters pull so much air through them, Lebens says, that "if it goes on for years, it can ruin your whole clean room." Luckily, only a few of the new filters were in use and the filter manufacturer corrected the problem readily. "We look at our filters very carefully now," Lebens says.