Biology

Rick Weiss reports from San Antonio, Tex., at the annual meeting of the Entomological Society of America

Ants get a transforming charge

Red fire ants, infamous for their nasty bites, have gained added notoriety for their habit of invading outdoor electrical equipment such as traffic signal control boxes, household electric meters and airport runway lights. The insects especially enjoy gathering around tiny electrical switches called relays, where they congregate by the hundreds, disrupting current flow and permanently damaging surrounding circuitry.

While the electricity itself rarely kills the ants, their affinity for these devices apparently overwhelms their usual drive to eat and drink, leaving masses of the insects dead of starvation and thirst. But an incomplete understanding of exactly what the ants really like about these highly charged environs has left engineers and entomologists uncertain how to deal with the problem.

Experiments at Texas A&M University in College Station now confirm that electrical fields are the draw. The researchers ruled out other candidate attractants, including magnetic fields, vibration and the ozone generated by such devices.

Scientists still don't know why ants find electrical fields so attractive. But since electrical relays by definition generate these fields, the simplest anti-ant strategy amounts to sealing the affected components in plastic boxes and applying insecticides around surrounding wires, concludes William P. MacKay, who led the study. For those inclined toward a more punitive approach, he adds, preliminary experiments indicate that circuits adapted to deliver a whopping 550 volts across relay points neatly eliminate ants caught lingering in the vicinity.

Who says ants are airheads?

Suppose you had a large head and you learned that a lunatic was decapitating big-headed people who walked to work during the day. Would you start working the night shift? That seems the approach taken by some *Atta cephalotes*, tropical ants subject to decapitation by parasitic flies of the genus *Neodohrniphora*.

After mating, female flies sneak up on ants foraging for leaf litter and inject a tiny fly egg into the skull of each ant. As the egg develops into a larva, or maggot, it consumes the ant's head from the inside out.

Research by Donald H. Feener Jr. of the University of California, Los Angeles, and his colleagues indicates that these flies – which only fly by day – require ant heads at least 1.6 millimeters in diameter. And the scientists report another intriguing observation: Call it evolutionary necessity rather than intelligence if you choose, but a disproportionate number of the *A. cephalotes* whose heads exceed 1.6 mm put off their foraging until after dark.

Current advances: When aphids suck

It's been 25 years since two University of California, Berkeley, entomologists described the world's first insect feeding monitor – an electrical device that could detect when an aphid jammed its piercing, sucking mouthparts into plant tissues. While such an accomplishment might leave average citizens yawning, it revolutionized the study of piercing, sucking insects, which every year cause incalculable crop damage by transmitting viruses from plant to plant. Now a new generation of computerized feeding monitors provides details about insect feeding with unprecedented ease, sending millivolts of electricity through a plant and through a gold wire – thinner than a human hair – glued to an aphid. When the insect pierces plant tissues, the circuit is completed, allowing researchers to study the dynamics of insect feeding and virus transmission and to compare the effectiveness of newly developed, insect-resistant plants.

Food Science

Land of the midnight melons?

Though fresh produce can be flown in to grace Arctic dinner tables this time of year, the costs are high. Indeed, imported $5 cucumbers are not uncommon in Canada's remote north, observes Dennis R. St. George at the University of Alberta in Edmonton. And the high cost of supplying high-latitude greenhouses and artificially lit growth chambers with heat and/or electricity renders their yields comparably expensive. So St. George is now investigating what he hopes will prove a money-saving alternative: fiber-optic transmission of rays from the sun or from growth lamps to Arctic crops nurtured in heavily insulated indoor gardens.

At a meeting of the American Society of Agricultural Engineers in New Orleans last week, he and colleague John J.R. Feddes reported initial data on their prototype lighting system. To maximize the collection of natural light, its two solar panels track the sun across the sky. Each of the 96 Fresnel lenses on these panels concentrates the sun's light and delivers it to the 15-meter-long, silica-core optical fiber with which the lens is paired. In field tests conducted Nov. 29, the system "operated as designed," the researchers say, though the transmission efficiency of photosynthetically active wavelengths was only 16.4 percent – far below the 70 percent suggested possible with optical-fiber systems tested by other researchers for different applications.

The Canadian team suspects problems in the prototype's solar tracking led to its initial weak showing. But if overall efficiency can be substantially upgraded, they maintain, the approach holds promise for year-round lighting control in indoor gardens. In the depths of winter, high-latitude gardeners might pipe in artificial lighting to counter the 24-hour-per-day darkness, they say. And in the perpetual daylight of summer's peak, the system could allow growers to parcel out natural rays in doses that permit normal growth.

Another dietary advantage to fiber

High-fiber breakfasts may help the weight-conscious moderate their appetites, two new studies suggest. Because the high-fiber cereals used in these studies contained fewer calories per serving than the low- or no-fiber cereals selected for comparison, one might expect people who breakfast on them to compensate by eating more at lunch, note Allen S. Levine and his co-workers at the University of Minnesota and at the Veterans Administration Medical Center in Minneapolis. Instead, they found "a significant inverse correlation" between a cereal's fiber content and the number of calories needed to sate an individual's appetite at breakfast and lunch, according to their report in the December AMERICAN JOURNAL OF CLINICAL NUTRITION.

The team fed 7:30 breakfasts of orange juice and a cold cereal with milk to healthy adults. Each person returned to the cafeteria 3½ hours later to select a buffet lunch. In the first of two one-day studies, 14 subjects were randomly assigned one of five breakfast cereals, differing primarily in fiber content. Post Toasties had 0 grams fiber per 100 grams of cereal, Shredded Wheat had 11, Bran Chex had 18, All Bran had 35 and Fiber One had 39. The 19 subjects in the second study randomly received either Post Toasties or Fiber One for breakfast.

Overall, those breakfasting on the highest-fiber cereal consumed fewer calories than those receiving the lowest-fiber cereal – roughly 100 calories less at breakfast and another 50 calories less at lunch. Such a reduction "could result in substantial weight loss if continued long-term," Levine and his colleagues say. Moreover, they note, a survey of participants in the second study indicated the caloric differences did not affect subjects' perceptions of fullness after either meal, suggesting calorie intake can be reduced without increasing hunger.