Staying one step ahead of their six

The battle of the bugs is never over, it seems. As quickly as entomologists invent a new way to prevent or undo an insect infestation, the little critters come up with a new defense. The latest news from the front – presented this week at the International Congress of Entomology in Vancouver, British Columbia – is the usual mix of dampened hopes for last year's solutions and optimism about more recently spawned approaches.

Insects cause incalculable losses worldwide by spoiling or consuming stored grains and other foods and by inflicting structural damage to buildings. Chemical fumigants such as methyl bromide today constitute the major means of reducing that damage. But with increased public concern about the dangers of these chemicals, and government agencies promulgating ever-stricter controls over their use, scientists are under pressure to find equally effective but safer alternatives.

In recent years, "modified atmospheres" have been touted as substitutes for fumigants. In Australia (where tax incentives favor it) and other countries, many farmers and food distributors seal their filled granaries with plastic coatings and pump them full of carbon dioxide or nitrogen—sometimes bringing oxygen concentrations close to 0.0 percent. At these concentrations most insects stop eating; eventually, they starve and die.

Research by Ezra Donahaye, however, suggests some insects can get accustomed to living with as little as 0.5 percent oxygen (compared with the usual 21 percent in air). Working with the Agricultural Research Organization in Bet Dagan, Israel, Donahaye followed 40 generations of flour beetles, or *Tribolium casteneum* – a four-year endeavor – kept in chambers with modified atmospheres he expected would be insecticidal. While many of the beetles died, enough survived and reproduced so that by the 40th generation the beetles had evolved strong resistance to their particular treatment. Moreover, he took some 13th-generation, resistant beetles and permanently resettled them under normal atmospheric conditions. When he tested their unstressed offspring eight generations later, "only a small decrease in resistance was seen."

Donahaye found resistant beetles have significantly lower respiration rates and consume far less oxygen than their nonresistant counterparts. Moreover, physiological studies show resistant beetles have significantly higher levels of triglycerides in their blood. He hypothesizes they outsurvive others by slowly metabolizing these energy-rich triglycerides during gas-induced fasting. While modified atmospheres may still play a major role in reducing foodstuff infestation, he concludes, "We'll have to be careful to use them in an integrated program with other techniques."

Another new approach, irradiating food with gamma rays (SN: 12/19 & 26/87, p.398), was put in perspective by U.S. Department of Agriculture researcher Judy A. Johnson. She looked at the effect of gamma rays on the Indian meal moth, *Plodia interpunctella*, a common postharvest pest of dried fruits and nuts. She found irradiation with cesium-137 an effective treatment – but only in huge doses, making it non-cost-competitive. After factoring in "very strong consumer reaction against [food] irradiation in the U.S.," she says she is "extremely doubtful that it will ever be used as the sole treatment on a large scale for dried fruit and nuts." But lower doses may prove useful in combination with some modified atmospheres, she adds.

In an attempt to halt structural damage by the drywood termite, *Incisitermas minor*, and to kill other household insect pests without using chemical fumigants, University of California at Los Angeles researcher Walter Ebeling is experimenting with temperature extremes. Earlier tests in which he sprayed liquid nitrogen into wallboards proved impractical, he says. He has since developed a system of blowing hot air into houses wrapped in tarps, raising temperatures – even in the centers of large wooden beams – to 120°F. After 30 minutes at that temperature, he reports, all insect pests lie dead.

"People don't like to have their house treated with a poison gas," he says, adding that he once sat in a test house at 120°F and after 30 minutes watched cockroaches and fleas die at his feet. "I think that was the most thrilling moment I've ever had in pest control," he says.

– R. Weiss

Zinc has roles in learning, immunity

Birth defects, stunted growth and delayed sexual maturation are the most striking problems shown by laboratory rodents fed diets severely deficient in zinc, according to Mari Golub, a behavioral biologist at the University of California's primate research center in Davis. Concerned whether related but less severe problems might occur among moderately zinc-deprived humans, she and her colleagues studied rhesus monkeys, which model many features of human development and metabolism.

While downplaying the likelihood of such severe effects in zinc-deficient humans, their findings, reported in the June AMERICAN JOURNAL OF CLINICAL NUTRITION, do point to other, more subtle problems: impaired immune function and slower learning.

The researchers followed 10 monkeys from birth through their adolescent growth spurt. Half received just 4 parts per million (ppm) zinc in their daily diet, both *in utero* and postpartum – a level the researchers term "marginal zinc deprivation." The other half received 100 ppm zinc in their diet – far more than they required.

Compared with monkeys getting plenty of zinc, monkeys on the deficient diet had blood zinc levels 38 percent lower and immune function depressed 20 to 30 percent. Significant learning impairments also were found. For example, it took zinc-deficient animals two to three times longer to discriminate between a circle and cross.

Effects seen in this "elegant" study mirror those already reported in rodents – especially where zinc deprivation began *in utero*, notes Harold Sandstead at the University of Texas in Galveston. More important, he believes, these findings suggest problems that may be occurring in many developing countries where malnourished people are surviving on low-zinc diets: cereals and no meat.

– J. Raloff

Prolactin a cancer risk?

A Swedish study published in the July 6 JOURNAL OF THE NATIONAL CANCER INSTITUTE supports the theory that elevated blood levels of the hormone prolactin increase the risk of male breast cancer. Some researchers have suggested that prolactin, which maintains milk secretion in women just after they have given birth, might also be a factor in the development of female breast cancer.

In reviewing the records of 95 men with breast cancer and comparing them with patients with other types of cancer, scientists at University Hospital in Lund, Sweden, found that significantly more breast cancer patients either had undergone certain drug treatments or had suffered severe head trauma, both of which can raise blood prolactin levels. A head injury to the hypothalamus, the regulatory area at the base of the brain, could interfere with control of the hormone's production.

Although only about one in 100 breast cancer patients in the United States are men, research on male breast cancer could give clues to the cause of the disease in women. The Swedish scientists say similar studies linking prolactin and breast cancer in women "have given inconsistent results" so far. □