Pesticide ingestion: Let us prey

Physically debilitating, even lethal, effects of ingested pesticides on animals have been dramatically demonstrated in laboratories. But evidence is accumulating that pesticides do not need to trigger immediate death or devastating injury to have serious, long-term effects on animals, perhaps on entire species. Several studies have suggested that chronic ingestion of sublethal quantities of various pesticides can influence the behavior of mammals and birds — particularly when they are under attack from predators — and that the predators themselves might suffer harmful or lethal effects.

Among the most recent attempts to investigate this phenomenon is a study of white-footed mice by Ohio State University researchers K.L. Bildstein and D.J. Forsyth. After three months of exposing nine mice to 10 parts per million of the pesticide dieldrin, the scientists tested the mice's laboratory reactions to the overhead flight of the harrier, a medium-sized hawk that is the white-footed mouse's natural predator. While 20 ppm has been shown to "markedly reduce" lifespan, 10 ppm of dieldrin "did not influence adult mortality or result in the tremors or convulsions typical of acute dieldrin poisoning," say Bildstein, now of Winthrop College in Rock Hill, S.C., and Forsyth, now at the Canadian Wildlife Service in Ottawa.

They found that compared with a half-dozen control mice not receiving the pesticide, the experimental mice were generally hyperactive and reacted unusually to the hawk flyovers. In 45 test observations, the dieldrin-fed mice:

- Failed to respond at all to the hawk 9.3 times more often than did the controls.
- Never exhibited a freeze response — one of two behaviors previously shown to help an animal elude a predator.
- Watched the hawk — the other helpful response — just 38 percent of the time, compared with 51 percent for the control mice.
- Ran in response to the flyovers — a behavior that seems to attract the attention of predators — 40 percent of the time, compared with 29 percent among controls.

From their own results and the work of others, Bildstein and Forsyth say dieldrin may have influenced the behavior of the mice by doing any or all of the following: impairing vision, decreasing alertness or depleting nerve hormones associated with behavior patterns.

In any case, they say, "the manner in which white-footed mice in this study responded to an avian predator suggests that, under field conditions, mice ingesting low levels of dieldrin may become more vulnerable to predation than uncontaminated individuals." But perhaps the more important implication involves the predators.

"Predators are likely to catch just those prey they should be avoiding," Bildstein says. "Consequently, predators may augment their dietary intake of pesticides by selecting prey that exhibit abnormal behavior induced by higher than average [pesticide] residual levels. This behavioral complication probably hastens biological accumulation especially in predators hunting flocking prey where increased vulnerability would be especially apparent." The report appeared in THE BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY, Vol. 21. □

Denser fusion fuel crushed by 20 arms

Shiva has 20 arms along which highly energetic laser light is directed to a common target. The target is nuclear-fusion fuel, a mixture of deuterium and tritium, and the object of the experiment is to crush that target and heat it so as to induce fusions. The ultimate object of it all is to produce a fusion reactor someday that would yield useful power. Shiva, which fills a sizable building on the grounds of the Lawrence Livermore Laboratory in California, is the largest experiment of this kind. It has been in operation only a short time, and its first results were reported last week at the 1979 IEEE International Conference on Plasma Science in Montreal by J.A. Glaze and K.R. Manes.

One of the customary ways of comparing experiments of this kind is by the number of neutrons yielded when a target pellet is crushed in a shot. (They tend to represent the number of fusions occurring in the pellet.) The largest such number quoted here is 30 billion (3×10^{10}). That is for a shot with 20 terawatts of laser power delivered in a 90-picosecond pulse to a pellet coated with a special "pusher" that explodes when the light hits it and drives the implosion of the pellet. Other tests were run with pellets in which implosion was driven by the back reaction from the ablation by the light energy of the outer layer of the fuel material itself. These were done at lower energies (7 to 10 kilojoules) and longer duration (0.7 to 1.0 nanoseconds), and they yielded lower numbers of neutrons, the maximum being 100 million.

More important than the raw numbers of fusions produced, even though these are much higher than in previous experiments, are the densities achieved in the crushed fuel. This is the sort of thing that more practical fusion reactions are likely to be built on. Shiva has two instruments that measure a number corresponding to the average product of pellet density and radius. One device measures the time between an emission of X-rays that indicates the light has hit the outside of the pellet and the time that neutrons come from the center of the crushed pellet. The other uses radio chemistry to get the density directly. Glaze says the ablatively driven targets reach high compression — 50 to 100 times the density of liquid deuterium-tritium — but he will not comment on the significance of any comparison with lower-compression targets. The future will see more experiments with higher power aiming at higher neutron yields and higher compressions. □

New Lyme arthritis link

Lyme arthritis — an infectious arthritis discovered in Lyme, Conn., several years ago and since identified in other areas of the United States as well — was attributed last year to the bite of a tick called *Ixodes scapularis* (SN: 6/10/78, p. 375). Now it looks as if another tick — *Ixodes dammini* — is the culprit instead, report Robert Wallis, Stephen Malawista and Allen Steere of Yale University School of Medicine in New Haven, Conn.

Actually *Ixodes dammini* is a newly discovered tick species, and the evidence implicating it as the vector of Lyme arthritis is only circumstantial. Wallis and his co-workers are trying to establish its life cycle, geographic range, host feeding preferences and other details about it and also to isolate any microbe from it that might actually cause Lyme arthritis. □

Galilean satellite maps

The spectacular and extremely distinctive surfaces of Jupiter's Galilean satellites — or at least the portions photographed in March by the Voyager 1 spacecraft — have now been mapped by the Planetary Cartography Section of the U.S. Geological Survey's Branch of Astrogeologic Studies in Flagstaff, Ariz. Using freehand airbrush techniques, guided by coordinate grids applied directly to Voyager's photos, Patricia M. Bridges mapped Io and Callisto, while Jay L. Inge was responsible for Europa and Ganymede. No attempt was made to distinguish between albedo (brightness) and topographic features unless the difference was obvious, says section chief Raymond M. Batson, because of the possibility of misinterpretation. In fact, says Batson, geologic training "is not an overriding consideration" in selecting the artists, since terrestrial experience could conceivably misguide an artist's portrayal of an essentially different extraterrestrial surface. The maps (which appear on p. 396, though with polar regions omitted for reasons of space) will be expanded with the additional photo coverage from Voyager 2's Jupiter encounter in July, after which scientists will get down to the thorny task of naming the host of craters, volcanoes and other features newly visible on what amounts to a whole solar system in miniature. □