Acreage Living

IOWA STATE UNIVERSITY
Cooperative Extension

Vol. 8, No. 3 http://www.extension.iastate.edu/Pages/communications/acreage/ March 2002

Monarchs and Bt Corn: A Research Update

by Marlin Rice, professor, ISU Department of Entomology
Phone: 515-294-1101 - e-mail:merice@iastate.edu

During the past two years, considerable controversy and debate have surrounded the impact of Bt corn pollen on monarch butterfly survival. A series of scientific studies that address this issue were recently published in the Proceedings of the National Academy of Sciences USA. Rick Hellmich and Les Lewis, USDA-ARS Corn Insects Lab in Ames, conducted some of this research. Listed below are the article titles and a brief summary of the major findings of this research. Complete articles are available online.

Temporal and spatial overlap between monarch larvae and corn pollen.
This study assessed the likelihood that monarch larvae will be exposed to Bt corn pollen in or near cornfields. It was found that monarchs use milkweed in cornfields and insect densities per plant were as high or higher in agricultural habitats as in nonagricultural habitats. There was a temporal overlap between susceptible monarch stages and corn anthesis (pollination) in the northern part of their breeding range. Most of the monarchs produced in the upper Midwest are likely to originate in cornfields and other agricultural habitats.

Corn pollen deposition on milkweeds in and near cornfields.
This study measured naturally occurring corn pollen densities on milkweed. Pollen density was highest in the cornfield and averaged 171 grains/square centimeter and was progressively lower from the field edge outward, falling to 14 grains/square centimeter at 2 meters. The highest pollen density observed was 1,400 grains/square centimeter during a rainless anthesis period. A single rain event can remove 54 to 86 percent of pollen on leaves. Leaves on the upper portion of milkweed plants, where young monarch larvae tend to feed, had only 30 to 50 percent of pollen density of middle leaves.

Monarch larvae sensitivity to Bacillus thuringiensis-purified proteins and pollen.
Laboratory tests established the relative toxicity of Bt toxins and pollen from Bt corn to monarch larvae. Pollen bioassays suggest that pollen contaminants, such as anthers, which are an artifact of pollen processing, can dramatically influence larval survival and weight gains and produce spurious results regarding pollen impacts. The only transgenic corn pollen that consistently affected monarch larvae was from Cry1Ab event 176 hybrids, which is currently less than two percent corn planted and for which reregistration has not been applied. Results from other types of Bt corn suggest that pollen from Cry1Ab (events Bt11 and

Mon810) and Cry1F, and experimental Cry9C hybrids, will have no acute effects on monarch larvae in the field.

Assessing the impact of Cry1Ab-expressing corn pollen on monarch butterfly larvae in field studies.
Survival and growth of monarch larvae after exposure to pollen from three Cry1Ab events were examined in field studies. First-stage larvae exposed to low doses (22 grains/square centimeter) of event 176 pollen gained 18 percent less weight than those exposed to Bt11 or Mon810 pollen after a five-day exposure period. Larvae exposed to 67 pollen grains/square centimeter on milkweed leaves from within an event 176 field exhibited 60 percent lower survival and 42 percent less weight gain compared with those exposed to leaves from outside the field. In contrast, Bt11 pollen had no effect on growth to adulthood or survival of first or third instars exposed for five days to 55 to 97 pollen grains/per square centimeter, respectively. Similarly, no differences in larval survivorship were observed after a four-day exposure period to leaves with 504-586 (within fields) or 18-22 (outside the field) pollen grains/square centimeter collected from Bt11 and non-Bt sweet corn fields. The effects of Bt11 and Mon810 pollen on survivorship of larvae feeding 14 to 22 days on milkweeds in fields were negligible.

Impact of Bt corn pollen on monarch butterfly populations: A risk assessment.
A formal risk assessment was developed for the impact of Bt corn on monarch populations. Expression of Cry proteins, the active toxicant found in Bt corn, differed among hybrids, and especially so in the concentrations found in pollen of different events. In most commercial hybrids, Bt expression in pollen is low, and laboratory and field studies show no acute toxic effects at any pollen density that would be encountered in the field. Other factors mitigating exposure of larvae include the variable and limited overlap between pollen shed and larval activity periods, the fact that only a portion of the monarch population uses milkweed in and near cornfields, and the current adoption rate of Bt corn at 19 percent of corn-growing areas (although it is much higher in many Iowa counties). This two-year study suggests that the impact of Bt corn pollen from current commercial hybrids on monarch populations is negligible.

Backyard Garbage Burning

Air Quality Bureau, Iowa Department of Natural Resources
Phone: 515-281-8852

Burning of household garbage has been, and still is, a common occurrence in rural areas. Iowa rules regarding open burning allow household garbage from dwellings smaller than four family units to be burned on site unless there is a more restrictive local ordinance. However, there are many good reasons not to burn garbage. The following information is supplied by the Iowa Department of Natural Resources, and presents a good case for seeking alternative methods of garbage disposal.

'Backyard burning' of common household trash and garbage emits substantial amounts of toxins into our environment. EPA tests show one burn barrel emits up to 80 times more pollution and up to 11 times the dioxin per pound of garbage burned than a municipal waste incinerator that serves tens of thousands of homes.

You can help keep toxins out of our air, food, water, and soil by finding cleaner waste disposal options.

Burning household garbage in piles, barrels, pits, and fireplaces is a poor combustion method with low temperatures, poor oxygen flow, and lack of emission controls unlike municipal incinerators. Plus it is a filthy hassle to deal with leftover ash and soot.

Common household trash such as synthetics, plastics, metals, and packaging release potent chemicals when burned. Even common paper products such as junk mail, cardboard, newsprint, and magazines contain chemical dyes, coatings, pigments, and chlorine.

Emissions include particulate matter, carbon monoxide, acids and toxins such as vinyl chloride, heavy metals, dioxins, and furans to name a few.

Inhalation may cause irritation, asthmatic attacks, or increase the long-term health risks for respiratory problems, cancers, birth defects, developmental abnormalities, and other serious health problems for burners and persons downwind.

Several toxic chemicals emitted are PBTs-persistent, bioaccumulative toxins. They take many decades to break down and are slowly building up in the environment and some food chains, posing additional risks when consumed.

Please learn not to burn. Sanitary disposal and recycling are safe, clean, and convenient options. For materials, contacts, and resources for cleaner waste disposal, check out the Waste Management Assistance Division (WMAD) website. http://www.state.ia.us/dnr/organiza/wmad/index.html

Information in this article was supplied by the Iowa Department of Natural Resources at the following web site:
http://www.state.ia.us/government/dnr/organiza/epd/air/citizen/burn/garbage.htm

Elbows, Hips, and Orthopedic Surgery

Center for Companion Animal Health, UC Davis, CCAH Update, Fall 1999

The elbow is one of the most complex joints in the body–three bones have to fit together perfectly," says Kurt Schulz, assistant professor of surgical and radiological sciences at UC Davis. "The hip joint is, alternatively, a relatively simple joint that has only two bones–but still they must glide perfectly as a ball and socket."

Sometimes the bones don't fit or articulate well due to injury or disease, says Dr. Schulz, who is an expert in orthopedic surgery and the biomechanics of natural and prosthetic joints.

Cats have no common developmental orthopedic diseases, and rarely develop joint infections. By far the most common problem for feline hips and elbows is accidental fracture.

In dogs, it's a different story.

Several breeds, including golden retriever, Labrador retriever, German shepherd, Newfoundland, Bernese mountain dog, rottweiler, border collie, and mixed breeds–both large and small–can develop hip and elbow "dysplasia."

For instance, in the disease called FCP (fragmented coronoid process), a small portion of the bone in the elbow joint breaks off, which causes swelling, arthritis, mild to severe pain, lameness, and exercise intolerance.

Elbow diseases such as fragmentation or disunity in the joint create great difficulties for dogs, who carry more weight on their forelimbs than on their hind limbs.

Developmental hip problems can begin at any age, while almost all elbow diseases affect young

dogs. Signs begin to show up from about six months to two years of age. Osteoarthritis, the end result of joint diseases, can become apparent at any age.

Dr. Schulz and his colleagues carry out CCAH supported research to better understand the biomechanics and pathophysiology, or underlying causes, of developmental joint diseases.

Some of their studies of elbows and hips include analysis of the surface contact of bones and load transmission when an animal walks. They also use technology such as quantitative computed tomography, otherwise known as "CAT scanning," to devise methods for screening and to develop preventive measures.

Clinical Treatments

The Veterinary Medical Teaching Hospital has a very high caseload of dogs with elbow dysplasia. Dr. Schulz may see five or more cases a week. Orthopedic treatments to relieve the condition include debridement–cleaning out the diseased tissue using a tiny power grinder such as those used in dentistry–and microfracture, a technique to cause cells in the diseased tissue to be replenished with healthy cells. Both of these surgical approaches require postoperative management that includes intensive physical therapy and antiarthritic medications for about four weeks.

Total Hip Replacement

UC Davis has the largest program anywhere in the world for the study of total hip replacement (THR) in dogs. THR is done for dogs with previous hip trauma, and most commonly, for dogs with hip dysplasia. A dog becomes a candidate for THR when medical management—control of body weight, appropriate exercise and treatment with pain medication–fails.

Dr. Schulz says, "We are working to optimize implant design and procedure to ensure that an artificial hip joint will function properly throughout a dog's life. We are primarily interested in cemented total hip replacements that have been used successfully in humans for more than 20 years. We are also investigating the use of a joint designed in Switzerland that is 'cementless.' There are advantages to both cemented and cementless artificial joints; it's important to have the option of either technique."

Ninety-six percent of hip replacements in dogs are successful, but surgical complications can include dislocation of the joint (the ball pops out of the socket), infection (more a concern with cemented joints) and aseptic (not caused by infection) loosening, which can show up with either the cemented or non-cemented variety of artificial joints.

"In order to eliminate complications and give more dogs an opportunity for relief, we continue to research the most effective procedures in orthopedic surgery, and to share our findings with the veterinary profession," says Dr. Schulz.

For more information from the CCAH, check the CCAH Update web site at http://www.vetmed.ucdavis.edu/ccah/Update.html

Acreage Living is published monthly. For more information, contact your local county ISU Extension office.

Editor:
Shawn Shouse
ISU Extension FS/Ag Engineering
SW Area Extension
53020 Hitchcock Avenue
Lewis, Iowa 51544
PH: 712-769-2600

Layout & Design:
Paulette Cambridge
Office Assistant
SW Area Extension
53020 Hitchcock Avenue
Lewis, Iowa 51544
PH: 712-769-2600