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Will the Insects Survive this Winter?

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Abstract
It is not easy for insects to survive Iowa winters. Some literally can't - they freeze to death (corn earworm, black cutworm) or migrate to warmer climates (potato leafhopper). Insects are unlike mammals and birds because they must generate their own heat (called ectotherms). Insects die when they are exposed to temperatures below the melting point of their body fluids, termed the lower lethal temperature. Over time, insects have developed several strategies to survive cold temperatures and none of them involve wearing fleece. Many insects have adapted to cold temperatures by entering diapause, which is like hibernation. Diapause is a developmental arrest to survive adverse seasons where individuals slow down metabolic activity.

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In preparation for diapause, insects store energy reserves and move to protected sites (e.g., in the soil, under leaf litter or inside plants). Some species aggregate together, such as multicolored Asian lady beetle. Aggregation in the winter happens for many reasons but usually masses form as a result of chemical communication within the species. Diapause is specific to a certain life stage for insects. For example, European corn borer overwinter as 5^{th} instars, bean leaf beetle overwinter as adults, and soybean aphid overwinter as eggs.

Insects can employ two survival strategies for cold temperatures: freeze avoidance or freeze tolerance. Freeze-avoidant insects keep their bodily fluids liquid and freeze tolerant insects can handle the formation of internal ice. Insects in Iowa generally avoid freezing because the winter lasts for a long time. Some freeze-avoidant species acclimate for winter by creating cryoprotectants, or antifreeze proteins, in their body (usually 20-30% of fresh body weight!).

Generally speaking, warmer winters mean more insects are likely to survive because they aren't exposed to lower lethal temperatures. A winter with widely fluctuating temperatures can be difficult for insects. Insects need time to gradually prepare for winter, and repeated cold and warm cycles can eventually burn up all their stored

energy reserves. The "polar vortex" of 2019 produced extremely harsh air temperatures and wind chill factors. This winter certainly killed those insects susceptible to cold temperatures. But those insects overwintering in the soil will be insulated from air temperatures; snow and crop residue can add layers of protection, too. No matter the overwintering strategy, all insects will eventually die if it gets cold enough. I anticipate a drop in field crop pest activity, but we will know more as spring approaches.

Sources: Encyclopedia of Insects and Wikipedia.

Category: Crop Production Insects and Mites

Crops:

Corn Minor crops Soybean

Tags: Insects overwintering insects

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Dr. Erin Hodgson started working in the Department of Entomology at Iowa State University in 2009. She is an associate professor with extension and research responsibilities in corn and soybeans. She has a general background in integrated pest management (IPM) for field crops. Dr. Hodgson's curre...