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Insects & Winter

More than any other group of animals, insects demonstrate a bewildering diversity of adaptations to everything this planet can throw at them. Be it their shape, colour, size, social organization, powers of flight, sensory capabilities or ability to withstand extremes of climate, insects are a wonderful testament to evolution. This amazing ability to adapt has allowed them to exploit a variety of different options for winter survival.

No one strategy is best in the winter world of insects. Some species freeze solid, either as eggs, larvae, pupae or adults; others seek special shelter to avoid freezing temperatures; a tiny number migrate south and one species remains relatively active. This multitude of responses to the demands of winter makes sense since each type of insect has evolved under a different set of conditions and pressures.

Among the insects that overwinter as eggs, we find the eastern tent caterpillar, most grasshoppers and crickets, most mosquitoes and the praying mantis. Most of us are familiar with tent caterpillars. In the late summer, the adult (eastern tent caterpillar moth) lays her eggs in a 2 cm long ring encircling a cherry or apple twig. The eggs are encased in a shiny, hard foam that almost looks to have been varnished. As with some frogs and turtles, the eggs are protected by glycerol, an antifreeze chemical that was often used in car radiators. The glycerol inhibits ice crystals from forming within the egg cells. Tent caterpillar antifreeze continues to provide protection at frigid temperatures that would kill hibernating frogs. In the early spring, the glycerol breaks down and the eggs hatch, unleashing an army of leaf-eating larvae. After a month or so of devouring tasty new cherry leaves, the caterpillars form light yellow cocoons from which the brownish tent caterpillar moths emerge.

Other lepidoptera (moths and butterflies) have opted to deal with the cold and famine of winter by sleeping it out in the larval form. This is also the option chosen by many flies. Woolly bears, for example, the furry, black and brown caterpillars so common in the fall, overwinter in the larval/caterpillar stage by simply curling up in some protected place on the ground. Once again, glycerol antifreeze comes to the rescue of these hibernating fur balls, restricting freezing to body cavities outside of the cells - even at temperatures below -30C!

Woolly bears have actually evolved to survive multiple freezings. Bernd Heinrich, a biology professor at the University of Vermont, did a simple experiment where he took two woolly bears, just out of hibernation in April, and put them in his freezer at -14C. Two hours later they were frozen solid. Amazingly, when the caterpillars thawed out an hour later, they were alive and well. He repeated the experiment with the same two caterpillars and the results were the same. This probably explains how woolly bears can become active in mid-winter - I've seen them walking on the snow on mild days - and then presumably survive the return of cold weather until spring.

In April, the woolly bears come out of hibernation and resume eating leaves. They soon pupate within a cocoon composed of most of the caterpillar's hair held together with silk. Two weeks later, the adult emerges in the form an attractive white moth known as the isabella moth. The adults, which are active in early summer, lay eggs on the various plants the caterpillars eat. Within four to five days, the eggs hatch and the caterpillars emerge. They continue to feed and molt until the early fall when they begin to look for a suitable place to overwinter.

Other species of insects have gone with the pupal stage as their means of surviving until spring. This is the option chosen by giant silk moths like the cecropia. In the fall, the cecropia caterpillar will spend several days spinning a tough, brown, weather-resistant home, fastening it securely to a small branch. It goes back and forth with its strong silk until the shell (cocoon) assumes the proper shape and proportion. The shell material is impenetrable by most birds and affords excellent camouflage. It is about three inches long and an inch in diameter. Inside the cocoon the caterpillar will pupate and prepare itself for winter by producing chemicals to prevent death by freezing. A miraculous metamorphosis occurs in late May or early June when the beautiful adult moth emerges. Tiger swallowtail butterflies also overwinter in the pupal stage.

A surprising number of insects actually survive winter as adults. Among the better known members of this group, we find queen bumble bees and wasps, ladybird beetles, mourning cloak butterflies, ants and some mosquitoes. Once again, most species call upon sugar-based compounds such as glycerol to prevent damage to their cells. In fact, overwintering ants are reputed as tasting "candy-sweet". Other species, such as mated female *Culex* mosquitoes, avoid freezing altogether by finding shelter in locations where the temperature remains above 0 C. These include cellars, sewers, well pits and even animal burrows. It is not uncommon to find an active mosquito in the house, even in the middle of winter.

Honey bees have evolved a totally different approach to surviving winter in the adult stage. They are the only insects that can be exposed to freezing conditions and still maintain an elevated body temperature all winter long. They do so by clustering together in a large ball within the hive and vibrating their flight muscles to generate heat. The energy required to fuel this amazing feat comes from stored honey. This explains why you sometimes see bees flying around a hive on mild winter days.

Finally, a handful of insects simply choose the snowbird option when it comes to winter and head south. The monarch butterfly is the poster boy for this group. Monarchs from the Kawarthas are arriving right now on their wintering grounds in the Sierra Madre mountains north of Mexico City. We'll see their grandchildren back here next June.

Surprisingly enough, one species of dragonfly also migrates. Within the common green darner population, some individuals mature quickly over the summer from egg, to nymph, to adult. When fall arrives, they migrate to the southern United States. The same individuals actually return to Canada in the spring. A second population of green darners, indistinguishable in appearance, matures more slowly and spends the winter in ponds and wetlands under the ice as semi-active nymphs. They emerge as adults in the spring but, unlike their migratory cousins, only live for a few short months.

What to watch for this week

By 9:00 p.m. you can easily see the Orion constellation in the southeast with its famous stars Betelgeuse and Rigel. High to Orion's right, you will find the beautiful Pleiades star cluster, while low to Orion's left is Sirius, the brightest of all our stars.

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