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LIVING

Check out the bugs of winter

Look around and you'll find there's no such thing as a bug-less snow season

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 also allowed them to exploit a variety of different options for winter survival.



DREW MONKMAN

OUR CHANGING SEASONS

Depending on the species, insects can be found overwintering in every stage of their life cycle. The life cycle of most insects is called 'complete metamorphosis' and includes the stages of egg, larva, pupa, and adult. A smaller number of species goes through incomplete metamorphosis (egg, nymph, adult). Nymphs often look like small adults, but usually don't have wings. Larvae, on the other hand, do not look like adults and usually have a worm-like shape. Caterpillars are typical larvae. In the pupal (resting) stage, insects develop their adult characteristics such as wings but do not eat. Some species, like moths, weave a protective silk cocoon around themselves before entering the pupal stage. A butterfly pupa is called a chrysalis. There is no protective cocoon around a chrysalis.

DEEP FREEZE 'DIAPAUSE'

Most insects are inactive during the winter months and enter a dormant phase called "diapause." The insect's cells and tissues are protected by glycerol, a kind of natural, sweet-tasting antifreeze produced by the cells in the fall. In fact, Bernd Heinrich, in *A Year in the Maine Woods*, describes the taste of glycerol-rich, overwintering carpenter ants as "candy-sweet." Glycerol is similar to the ethylene glycol we put in our car radiators and allows an insect's body fluids to drop well below freezing without freezing solid. Not surprisingly, if you touch an insect larva at this temperature, it is still pliable. During diapause, there is no growth or development what so ever. In "hibernation," a term used for vertebrates, there is usually minor metabolic activity and new tissue is sometimes added to the animal's body.

One of the easiest insects to find and observe in its winter resting phase is the goldenrod gall fly. It overwinters in the ball-like swellings on the stems of goldenrod plants. These are actually caused by the female fly when she lays her eggs on the stems of developing goldenrod plants. The eggs hatch and the larvae burrow into the stem and create a chamber in which to feed. The plant responds to this intrusion by growing a spherical deformation around the insect chamber. If you open the gall with a knife, you will find a small white larva with a dark head. The larva spends the winter in this cozy enclosure.

In the spring, the larva becomes active again and chews out an escape route, almost to the outer surface of the gall. It then moves back toward the centre and pupates in a hard, cocoon-like puparium made from the larval



Wikimedia photos

You can find lady beetles (above, commonly called lady bugs) grouped together under leaf litter during the winter. Dragonflies (exoskeleton, top right) remain semi-active during the winter and the queen tri-coloured bumble bee, already pregnant, will overwinter in sheltered places.

skin. The adult escapes from the puparium and from the gall itself by inflating a spiny, balloon-like structure out through the front of its head. This structure presses a circular hole through both the puparium and the surface of the gall. It then retracts back into the head. If you open a gall in the spring, you should be able to see the exit tunnel created by the larva before it pupates. Old galls usually show a small hole on the outside through which the fly escaped. Adult goldenrod gall flies are about half a centimetre in length, have a light brown head and thorax and have attractive dark patterns on otherwise clear wings.

HOW THEY DO IT

The following are examples of how some other familiar insect species overwinter.

As an egg:

- Eastern tent caterpillar: The egg masses of the tent caterpillar form shiny brown rings that encircle the twigs of cherry trees. They have a varnished appearance and are only slightly larger in circumference than the twig itself.

- Field cricket: In the summer and fall, the female lays her eggs in damp soil through her ovipositor. The eggs usually hatch in May.

- Red-legged Grasshopper: In late summer, the female forces her abdomen deep into loose soil to deposit an egg pod that will hatch in the spring.

- European mantis (Praying mantis): In autumn, the female lays eggs in a frothy mass that hardens into a protective capsule, not unlike foam insulation.

- Mosquito (genus *Aedes*): The female lays eggs at the margins of ponds. They will hatch in the spring meltwater.

As a larva:

- Black fly: Many species of black fly have bowling pin-shaped larvae that hook themselves into a pad of silk, attached to wood or rocks in streams. However, those black fly species that bite us later in the summer overwinter as eggs on the river bottom.

- Isabella tiger moth: In its well-known "woolly bear" caterpillar stage, the future moth curls up under bark, a log or some similar debris for the winter. It pupates in the spring, emerging two weeks later as an adult moth.

As a nymph:

- Common whitetail dragonfly: Although there are some exceptions, most dragonflies and damselflies spend at least a year at the bottom of pond or river in the nymph stage before transforming into aerial adults. They remain



semi-active during the winter. Some nymphs can even live a short while encased in ice, thanks to protection from glycerol.

- Mayfly: Depending on the family, some mayfly nymphs flatten themselves against solid objects in running water. Others live in U-shaped burrows. They feed actively and grow all winter to emerge as adults in early spring.

As a pupa:

- Canadian tiger swallowtail: The grey pupa (chrysalis) is attached to a twig or bark by a silk button at the posterior end and a silken noose in the middle. The grey colouration provides a near-perfect camouflage effect.

As an adult:

- Mourning cloak butterfly: Mourning cloaks, like tortoiseshell and comma butterflies, take refuge for the winter in tight holes and crevices in trees, rocks and buildings. They may even emerge and fly about should the temperature climb above 10 C.

QUEEN OF COLD

- Tri-coloured bumblebee: Pregnant queen bees overwinter in sheltered places and emerge in spring to start a new colony. Males and workers die. Wasps overwinter in the same fashion.
- Honey bee: The entire bee colony

survives the winter in the adult stage. They are the only insects to maintain an elevated body temperature all winter. They do so by clustering together and vibrating their flight muscles. They feed on stored honey.

- Ladybird beetle (Ladybug): Ladybugs take refuge in the leaf litter under the snow and in crevices. They are frequently found in large groups.

- House mosquito (*Culex pipiens*): Mated females overwinter in sheltered locations such as animal burrows, basements and sewers. The males die before the winter.

- Monarch butterfly: The last monarch generation of the summer migrates to the mountains of Mexico to spend the winter. It is in these mountains that they find their favourite tree, the oyamel fir. Its needle-like leaves are the perfect match for the monarch's legs to cling to. Secondly, the temperature is cool but not freezing. The thermometer usually remains below 12 C which makes it too cold to fly. And, because the monarchs remain inactive most of the time, this allows them to save their precious fat reserves. They will need these reserves later in the winter when they mate and begin flying north. The forest trees serve as a buffer against snow, rain, cold and wind, all of which could be potentially fatal. They also help to maintain high moisture levels in the air, thereby preventing the butterflies from drying out as a result of moisture loss.

TAKE TO THE TREES

- Carpenter ants: Adult carpenter ants hibernate in clusters in the centre of both dead and living trees. They are often found in logs that have been split for firewood. Carpenter ants quickly become active when temperatures rise above freezing.

- Common green darner dragonfly: There appear to be two separate populations of this species in Ontario. One population matures quickly from egg to adult and migrates south in the fall, reproduces and its progeny return in the spring. So, like monarchs, the same individual does not make a round-trip. A second population green darner population, indistinguishable in appearance, matures more slowly and spends the winter in ponds and wetlands as a nymph, just like most other dragonflies do.

In conclusion, I'd like to add a word about spiders. Their situation is all over the map. Depending on the family, some spiders overwinter as eggs covered by thick, silken sacs and attached to plants or hidden under loose bark. Crab spiders overwinter as adults behind loose bark. Hunting spiders, too, spend the winter months in the adult stage and can sometimes be seen walking on the snow on mild days. Wolf spiders survive as sub-adults and actually remain active throughout much of the winter in the sub-nivean space under the snow.

Although you may think that one of winter's greatest appeals is its lack of "bugs," remember that this is not entirely true. They are actually all around us, just waiting to spring into action once again when warm spring weather returns.

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