

# The Outside Story



## Goldenrod Golf Balls

By: Declan McCabe

A few Thanksgivings ago, my then-ten-year-old daughter and I went for an afternoon stroll. Unseasonably warm weather made for a longer than planned walk through a power line right-of-way and on down through steeply sloping woods to the Winooski River. As we moved through the tall scrub, Lauren's interest was drawn to the golf ball-sized swellings on desiccated goldenrod stalks.

As usual, she had many really good questions: what were these woody spheres on dead plants; why did some have holes; what did they look like inside? We pocketed a few and continued our walk. The soft silty river bank was peppered with footprints left by raccoons, herons, skunks, and deer that prompted more questions. By sunset we had made it through the Muddy Brook Natural Area and back out onto the gravel road. Our catch of the day remained in our pockets until after dinner.

The spheres we collected were goldenrod ball galls. A gall forms when, in spring, a fly species (*Eurosta solidaginis*) lays a single egg into the growing goldenrod tip. These flies are picky. They lay their eggs only on three of the many goldenrod species growing in our region. Once a larva emerges, it burrows to the center of the still growing stalk. The plant responds by thickening its stem to grotesque proportions, often ten times the original diameter (for a human scale comparison, imagine growing a basketball around your wrist).

The hungry larva fattens up on plant material inside its spherical castle and excavates a small chamber in the center. It also digs a tunnel towards the surface of the gall, stopping just shy of the outside world. Once that work is complete, and the time is right, the larva transforms radically to form a pupa. Months later, assuming the larva did its tunneling job well, the adult fly will break through to emerge and complete its cycle by laying eggs in new goldenrod plants.

A careful snip with pruning shears provides a window into the strange world of goldenrod galls. My Saint Michael's College students and

I trek out to gather hundreds of them each spring. We learn that galls, quite frequently are invaded by other species. Parasitic wasps (*Eurytoma gigantean* and *E. obtusiventris*) insert their eggs through the thick protective wall. The hatchling wasp larva consumes the fly and makes use of its former home until its own spring emergence. The predatory beetle *Mordellistena convicta* follows a similar pattern. Wasps and beetles tend to favor smaller galls they can penetrate more easily.

Birds also get into the act by consuming both the goldenrod gall fly larvae, and the larvae of their wasp and beetle usurpers. You can tell the crisp chiseled hole in the gall left by a woodpecker from the untidy mess left by a chickadee. My students and I find what biologists have found before: birds more often attack larger galls. Perhaps they are easier to find, or to perch on, or perhaps it's the promise of a meatier morsel in a season of slim pickings.

Despite the waves of attackers, more than enough flies survive to found the next generation. They hatch in the spring from their galls on dead goldenrod stalks as the next year's plants sprout below. In the laboratory, we experiment by warming galls, and by playing tricks with day length to simulate an early spring. While most of our hatchlings are flies, we also hatch some beetles and wasps. Fewer galls kept in the dark hatch and those kept in the freezer never hatch.

While it might seem that the thick gall would insulate the flies from winter extremes, their true survival mechanism is far more

interesting. Insulation works when there is heat to conserve, but tiny larvae and pupae with slow metabolisms don't generate very much warmth. Instead, goldenrod gall flies rely on antifreeze properties of their tissues to prevent ice crystals from rupturing their cells. Whether their galls are exposed to the air or insulated in snow, they can survive the coldest New England weather.

When my daughter and I opened our pocketed galls, we found fly larvae in more than half of them. It made for some interesting observations of mobile, spherical, legless larvae after apple cider and pie. Whether for a classroom, an educational stroll, or as winter foodstuff for hungry birds, goldenrod galls have a fascinating story to tell.

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