Jack—or is it Jacqueline?—in the Pulpit

The unique sex life of a common forest plant

By Edna Greig

When you're in the moister parts of the woods this spring, be on the lookout for Jack-in-the-pulpit (*Arisaema triphyllum*), a common and easily identified understory plant that's native to eastern North America. But this common plant has some not-so-common adaptations for reproduction.

This common spring flower has unusual adaptations.

Jack-in-the-pulpit flowers

Jack-in-the-pulpit blooms in late April or early May with an unusual flowering structure that gives it its name. It has a club-like spadix ("Jack") that rises within and above the opening of a leaf-like spathe ("the pulpit"). The upper part of the spathe curves forward and downward, acting as an umbrella to prevent water from flooding the 30 to 60 tiny flowers that are hidden at the base of the spadix. Individual plants have either male or female flowers—botanists call this *dioecy*.

Pollination and the fate of pollinators

Jack-in-the-pulpit needs pollinators to transfer pollen from male plants to female plants, but its tiny, hidden flowers can't attract bees or butterflies. Instead, the spadix emits a fungus-like odor which attracts the fungus gnats that are its primary pollinators. Fungus gnats that approach the spadix often tumble to the bottom of the spathe and cannot crawl upward because of its slippery sides. The gnats scurry about the tiny flowers seeking a way out of the spathe.

Gnats that have fallen into male Jack-in-the-pulpits may be lucky enough to squeeze through a small "escape hatch" at the base of the male spathe—by the time it escapes, the gnat is usually loaded with pollen. Gnats that have fallen into female Jack-in-the-pulpits aren't so lucky since the females don't have an escape hatch. Gnats usually remain trapped and die within females, often along with valuable pollen that they've picked up from an earlier visit to a male. If pollen was successfully transferred, the female will produce a cluster of berries that start out bright green and then mature to a bright red in late summer.

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A multiple sex-changer

Jack-in-the-pulpit is unique because an individual plant can change sex each year from male to female or vice versa throughout its 20-year lifespan. Only a few species of plants are known to change sex. Plants will be female when they have reached a sufficient size to provide stored resources to support flower and berry production, but will revert to being male or nonflowering if stored resources are depleted. Sex also may fluctuate with environmental resources like moisture and nutrients.

So how exactly does that Jack-in-the-pulpit in your local woodland decide if it should be male or female this year?

Jack-in-the-pulpit has been the most widely studied of the sex changing plants, and these studies have shown that, basically, size matters. The sex of the current year's plant is determined by the size of the previous year's root storage structure, called a corm. Larger corms yield larger female plants, while smaller corms yield males or nonflowering plants. Corm size will be reduced in females that produce a lot of berries, and those plants often will be male in the following year.

Corm size also can be reduced if the leaves are eaten or otherwise damaged, which reduces the leaves' ability to photosynthesize. Slugs and caterpillars feed on Jack-in-the-pulpit leaves and can cause enough damage to reduce corm size. Deer also will feed on Jack-in-the-pulpit, even though the plants contain acrid, distasteful substances called oxalate crystals. In areas of high deer density, there may be few female Jack-in-the-pulpit plants.

If you see some Jack-in-the-pulpits this spring, take a closer look at the odd flowering structures and try to tell the "Jacks" from the "Jacquelines."

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