Book Reviews

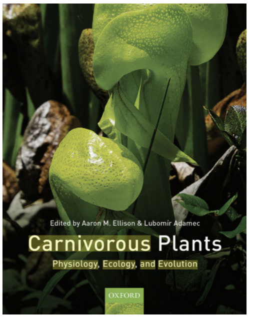
Book Review Editor's Note: *The Canadian Field-Naturalist* is a peer-reviewed scientific journal publishing papers on ecology, behaviour, taxonomy, conservation, and other topics relevant to Canadian natural history. In line with this mandate, we review books with a Canadian connection, including those on any species (native or non-native) that inhabits Canada, as well as books covering topics of global relevance, including climate change, biodiversity, species extinction, habitat loss, evolution, and field research experiences.

Currency Codes: CAD Canadian Dollars, USD US Dollars, EUR Euros, AUD Australian Dollars, GBP British Pound.

Botany

Carnivorous Plants: Physiology, Ecology, and Evolution

Edited by Aaron M. Elison and Lubomír Adamec. 2018. Oxford University Press. 510 pages, 125.00 CAD, Cloth. Also available as an E-book.



When *Carnivorous Plants: Physiology, Ecology, and Evolution* arrived on my doorstep, I knew by its heft that this would not be a light read. As a review of the most up to date research on carnivorous plants, this is ideal for senior undergraduate or graduate students, academics, and those with a keen interest in carnivorous plants, but it would be a difficult read if you had no background knowledge in evolutionary biology, botany, or biochemistry. There is a baseline of assumed vocabulary, so if you've never heard the words Diptera, saprophagous, or entomophily, grab a dictionary. In other words: this is a textbook, so plan accordingly.

Editors Aaron Ellison and Lubomír Adamec have done an excellent job of compiling a collection of chapters that represent a range of knowledge in the field, including an overview of the carnivorous syndrome, the evolution of each major genus of carnivorous plant, symbiotic insect and microbial communities, biotechnology and pharmaceuticals, and the mechanisms of prey attraction, retention, and digestion.

Approximately 800 known species of carnivorous plants are found around the world, with hotspots in southeast Asia, Australia, South Africa, and the southeast United States. They grow in a variety of habitats, but thrive in nutrient-poor, warm, and wet conditions. To be truly carnivorous, a plant must display all five of the following traits: capture prey in specialized traps; kill the captured prey; digest the prey; absorb nutrients from the killed prey; and use the nutrients for plant growth and development.

The mechanics of prey attraction, capture, and retention are remarkable. Robert Naczi covers the systematics and evolution of my favourite carnivorous plant—*Sarracenia purpurea* (commonly known as the Northern Pitcher Plant or Purple Pitcher Plant, and native to peatlands in eastern North America)—in Chapter 9. As discussed in Chapter 12, contrasting red and green stripes called "nectar guides" attract prey to the lip of the pitcher, along with olfactory cues. Downward facing hairs on the interior guide the prey to the water-filled bottom, where most insects die by drowning. Although the liquid is mostly collected precipitation, death comes faster in a pitcher plant than in pure water—possibly because of the addition of digestive enzymes, and other animals that live in the pitcher plant that help to breakdown prey (more on that later).

One of the interesting contradictions of carnivorous plants is that they are almost all entomophilic (pollinated by insects). These are plants that have evolved to attract and trap insects for prey, and yet they rely on insects for survival of the species. Cross *et al.* (Chapter 22) explain that pollinator-prey conflict is rare, owing perhaps to several adaptations, including physical space between the flower and the trap, temporal space between the time of pollination and the time of trap maturation, and different scents emitted by different parts of the plant, designed to attract different insects.

I am fascinated by carnivorous plants and their mutualistic relationship with certain arthropods. I first learned about the Pitcher Plant Mosquito, *Wyeomyia smithii,* while reviewing *The Secret Life of Flies* (Bocking 2017). The female lays eggs in the water of the pitcher, where the mosquitoes hatch and live their entire larval lifecycle, living off the decomposing prey and resident bacterivores and microbes. The trap of a pitcher plant is home to an entire food web that helps the plant break down prey so the plant can more easily absorb its nutrients. The life of *W. smithii* in *S. purpurea* is the most studied relationship of a carnivorous plant and its inquiline (an animal that lives in the living space of another) but, as is discussed in detail in Chapter 24, most carnivorous plants are host to several species of invertebrates, microbes, and bacteria. We may think about the complexity of the hairs on a sundew, but this is just the surface: there are entire communities of organisms living on, within, and amongst these astonishing plants.

Until recently, the conservation status of only 10% of carnivorous plants was understood. Now we have a basic understanding of about 70%, but there is still work to do. In particular, it's difficult to model how these plants will adapt to a changing climate. Their habitats are diverse and widespread, but it is likely that the availability of suitable habitat will decrease faster than new habitat will become available. Fitzpatrick and Ellison conclude in Chapter 28 that one of our best assurances against species loss is habitat protection. In Canada, we must protect our wetlands, where most carnivorous plants are found.

This is not a book of fast, easy facts, but it does reward the careful and thorough reader who is passionate about botany. The next time you walk by a sundew, bladderwort, or pitcher plant in your local wetland, you might find yourself with some questions about how these crazy organisms even exist. If you're curious, spend some time with those plants, and with this book.

Literature Cited

Emma Bocking. 2017. [Book review] The Secret Life of Flies. Canadian Field-Naturalist 131: 287–288. https://doi.org/10.22621/cfn.v131i3.2059

EMMA BOCKING
Halifax, NS, Canada