photos courtesy Wendy Applequist

MBG botanist Reza Ludovic presses plant specimens at Midongy du Sud National Park.

Why It Matters

Garden scientists in 36 nations around the globe discover over 200 new plants per year! Every single one—from the tiniest orchid to the largest tree—helps fill gaps in our knowledge about the history of the earth and the biology of its organisms. Once scientifically documented, plants can be analyzed for medicinal properties and included in conservation plans. Your Garden membership helps fund these worthwhile science and conservation programs around the world.

Chemical Companions

Why Plants Matter So Much to Humans

by Ashley Glenn, Research Specialist and Sacred Seeds Program Manager

All organisms evolve in a chaotic world, constantly thwarting threats to survival. How we survive is as varied as our biology. Humans use community and tools; giraffes use far-reaching necks and speed; and snakes use camouflage and venom. And plants? Well, plants use chemistry. Incredibly complex chemicals that we can only hope someday to fully understand. What we do know about plant chemistry shows that plants aren't passive nutrient factories, but rather organisms fully engaged in their environment.

Plants can't see, hear, talk, or touch, so chemicals become their senses. Stems and leaves can sense variations in light waves and grow toward the best light. Roots analyze soil nutrients and optimize intake by growing toward rich soil. Plants sense the changing of seasons to know the best time to flower and fruit. Most plants employ these strategies. Chemical compounds that serve these crucial functions, such as growth and photosynthesis, are primary compounds.

Where the story gets really interesting, however, is with the other chemicals, the secondary compounds. Plants produce a staggering array of chemicals that don't fit the primary compound role, and are involved in more specialized communication. In the past, these compounds were considered chemical "noise," leftovers from the more crucial biochemical pathways. However, in the past several decades, diligent botanists and chemists have unearthed an amazing tale of evolutionary adaptation from these secondary compounds. The scent of an orchid attracting its specific pollinator, the spicy cayenne pepper deterring hungry animals, the "poison" in poison ivy: all secondary metabolites, produced by the plant to help it thrive in its particular environment. Some serve to attract beneficial species that help the plant by pollination or protection, and others serve to deter pests, from microbes and insects, to animals and even humans. But we humans are evolving, too, and we innovate for our own survival. We have learned how to avoid or disarm many poisonous plants, and even how to make these chemicals work in our favor.

Take the *Salix*, or willow, for example. When a willow leaf is under microbial attack, the plant will produce salicin in response. This compound prompts the tree to start making heaps of pathogenic chemicals, thereby defending the plant from future attack. Some of this salicylic acid can become airborne and is sensed by nearby willow trees, telling them to defend themselves as well. Humans have taken advantage of this adaptation for millennia, and cultures as diverse as the Cherokee and ancient Greeks have used willow bark to lower fevers and alleviate pain. If you have ever taken an aspirin, you have benefited from all of this botanical and medicinal innovation, as salicin studies led to the development of aspirin, initially created from salicylic acid.

Another incredible success in the study of plant chemistry is the discovery of vincristine and vinblastine in *Catharanthus roseus*, the rosy periwinkle. This flower from Madagascar produces these compounds to act as powerful insecticides. The Malagasy use the plant to treat diabetes, which alerted scientists to its bioactivity. While testing for effectiveness against diabetes the scientists came up empty, but noticed strong "cytotoxic" activity—the compound was toxic to certain cells. The extracts made from this discovery have resulted in over 80 percent remission of Hodgkin's disease and acute childhood leukemia!

From these cases alone the value of plant chemistry is clear to see. The amazing evolutionary advances made by plants, coupled with mankind's amazing ability to innovate, can have profound effects on our well-being. To continue this story, we need dedicated botanists, chemists, and doctors exploring plant chemistry. And perhaps most importantly, we need the plants to survive long enough for us to discover their secrets. We can't predict what is hidden in our forest and jungles, but it's clear we have only begun to scratch the surface.

Rosy Periwinkle

Sacred Seeds: Conserving Medicinal Plants

Often when we talk about human plant use and conservation, these ideas appear in conflict. Humans are responsible for the overharvesting and deforestation that threaten so many species. And yet, there are numerous ways to encourage plant use while still conserving ecosystems.

Among the many conservation efforts of the Missouri Botanical Garden is the Sacred Seeds program. Sacred Seeds is a network of sanctuaries around the world conserving both biodiversity and traditional plant knowledge. Each sanctuary houses a botanical garden as a "living seed bank," comprised of plants used for medicine, ceremony, food, and crafts. This garden serves as a venue for exercising, sharing, and experimenting with plant traditions. Our work highlights the reliance people have on their local forests, and we work with communities to ensure that both people and plants benefit from our efforts. By ensuring that medicinal and other valuable plants are protected, we promote a future of health and vitality for the people that depend on these plants.

The Missouri Botanical Garden Sacred Seeds program is sponsored by New Chapter.