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Hunker Down and Hold On: Contractile Roots Give Skunk Cabbage Another Special Trait

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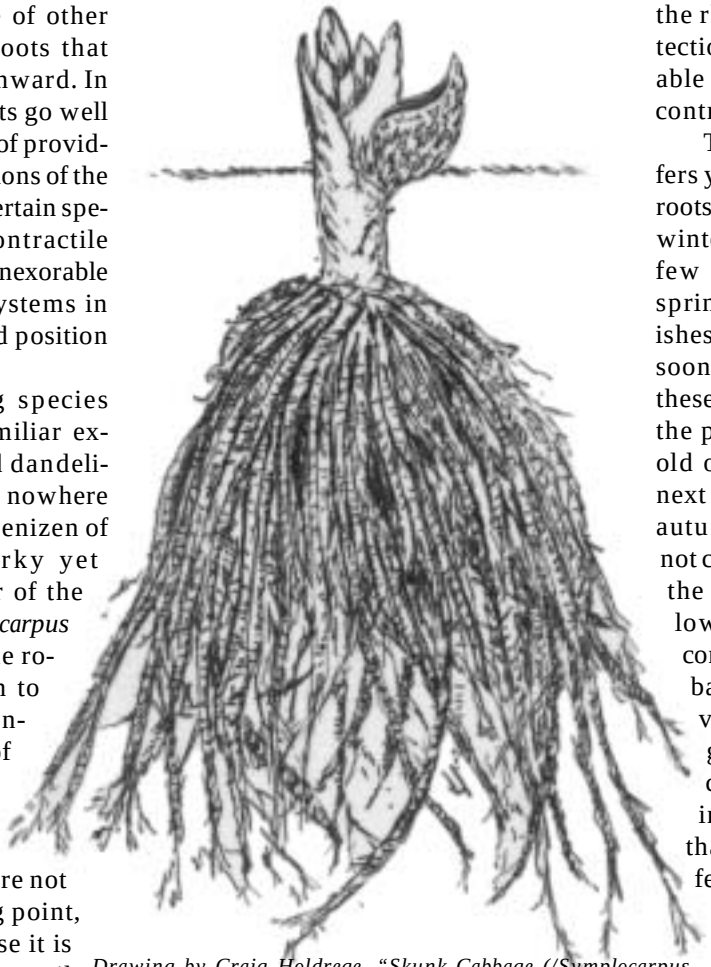
Contractile roots give skunk cabbage another special trait

I can remember the first time I ever heard of contractile roots. It was in graduate school at the University of Maryland and a friend of mine was busy preparing a lecture on roots. He said to me something like "Did you ever notice, while pulling up dandelions, that the darn weed seems to be pulling back? As it turns out, it is!" Strange but true, dandelions, along with a diverse assemblage of other species, have contractile roots that serve to pull the plant downward. In this capacity, contractile roots go well beyond the routine function of providing anchorage for aerial portions of the plant body. For plants with certain specialized growth habits, contractile roots serve to counteract the inexorable upward growth of shoot systems in order to maintain a preferred position relative to the soil surface.

Many rosette-bearing species have contractile roots. Familiar examples include the dreaded dandelions that seem to spring from nowhere in our lawns and also that denizen of swampy mires, our quirky yet loveable VNPS Wildflower of the Year, skunk cabbage (*Symplocarpus foetidus*). For dandelions, the rosette habit is an adaptation to survive grazing and, incidentally, the whirling blades of lawnmowers. Hungry herbivores, like cows or sheep, may easily consume some dandelion leaves, but they are not likely to nip off the growing point, the apical meristem, because it is located at or slightly below soil level. With its meristem intact, lost leaves can be quickly replaced and the hardy dandelion persists, as any lawn caregiver will attest. Shoot apical meristems inevitably grow upward, incrementally, perhaps, in rosette plants, but upward nevertheless. Without their large contractile tap roots, dandelion meristems would eventually project significantly above soil level and thus become vulnerable to hungry herbivores or lawn mower blades.

The situation with skunk cabbage is slightly different. Rosettes of skunk cabbage leaves arise from the tips of fairly massive vertically-oriented rhizomes from which contractile roots project laterally and downward. These roots are thick, cord-like, and unbranched for most of their length; the tips, however, bear clusters of fine roots that act like anchors while the unbranched segment contracts, pulling the rhizome inexorably downward. Thus, while an individual skunk cabbage plant may be decades old, the growing tip of its massive rhizome never grows above the mud or water surface. For skunk cabbage, in addition to the anchorage that contractile roots provide, there may be another advantage, thermal protection for the apical meristem—even when frozen solid, muddy soils and shallow water will often be warm relative to the air just inches above, especially during extremely cold winter nights. Note: skunk cabbage flowers are thermogenic, but the rhizomes are not, so thermal protection of meristems seems a reasonable explanation for the function of contractile roots in these plants.

Hunker down & Hold on



Drawing by Craig Holdrege, "Skunk Cabbage (/Symplocarpus foetidus/)" /In Context /#4, 2000 (online: http://www.natureinstitute.org/pub/ic/ic4/skunkcabbage.htm)

The common garden gladiolus offers yet another example of contractile roots. In warm climates, glads can overwinter as dormant corms positioned a few inches deep in the soil. In the spring, stored food in the corm nourishes rapid growth of leaves, followed soon by a flower stalk. Depleted by these efforts, the old corm shrivels and the plant builds a new corm atop the old one, storing masses of starch for next year's growth. By the following autumn, the old corm is shriveled, but not completely gone, so the position of the new corm is incrementally shallower than its predecessor. Without contractile roots that diverge from the base of new corms, and pull the developing corm slightly downward, gladiolus corms would eventually come to lie on the soil surface, losing the protection and anchorage that would have been provided by a few inches of soil.

Not all roots capable of contraction do so by the same mechanism. They all seem to grow normally at first, elongating, and achieving typical-looking mature tissues well before contraction begins. Most commonly, downward forces are generated by parenchyma cells in the cortex region of the root. Deposition of additional layers of cell wall material in special patterns results in the radial expansion of these cortex cells. Overall, the root gets thicker and, simultaneously, shorter. In extreme cases, contracting roots can lose as much as two-thirds of their length. In some desert plants the mechanism can be a little different: fleshy living roots formed during

(See Root system, page 8)

Native grass growers sought for project

Jake Hughes, a representative of the Shenandoah National Park, is looking for some volunteers for a park seed propagation project. The targets of the project are native grasses: little bluestem, Indian grass, purpletop, poverty oatgrass, and hairgrass. The plants will be introduced into several sites in the Shenandoah National Park. Jake will provide supplies including seeds collected from sources within the park; all you need is your green thumb and the ability to accommodate an 8 inch by 8 inch container(s) on your window sill or growing area. Contact Jake at 540-999-3500, ex. 3492 or jake_hughes@nps.gov for more information.

• *Treasures*

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biological treasure that takes any visitor on a trip back in time. The site has the largest Carolina ash in the nation, the largest swamp cottonwood in the state, and a state-rare plant called the shade mudflower."

No public access facilities are planned for the property. Access to the site may be arranged through Darren Loomis, southeast region natural areas steward, at 757-925-2318 or darren.loomis@dcr.virginia.gov.

• Annual Meeting

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Western Community College Arboretum, and the Blue Ridge Parkway will host a trip. One trip will take a look at roadside ditches and a newly designated natural area in the Jefferson National Forest.

On the evening of September 26 we plan to have a silent auction to raise money for the Flora of Virginia Project. Bring extra cash. This will be followed by a banquet and the annual meeting. The evening will culminate with our featured speaker, Professor Doug Tallamy from the University of Delaware. Doug is the author of the book *Bringing Nature Home.*

There is a block of 40 rooms with queen beds or 2 double beds reserved at the LaQuinta Inn in Salem. We look forward to seeing many familiar and new faces at this year's annual meeting.

Butch Kelly, Blue Ridge Wildflower Society

• *Root system*

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the wet season push soil aside, when these same roots die in the dry season, their desiccation results in contraction, pulling the plant crown downward.

Roots, being out of sight, are too often out of mind. Who would have guessed that such disparate plants as garden gladiolus, dandelion, and skunk cabbage share much of anything in common? Each, however, has its own version of contractile roots by which they can hunker down and survive to flower another day.

W. John Hayden, VNPS Botany Chair

• Flora Project

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learn of corrections and of developments in taxonomy. Teachers, likewise, will be able to communicate with one another, students, and Flora Project staff.

It's disheartening to feel the economic crunch just as we're hitting our stride. Cuts in state funding and heightened competition for grants have placed a greater financial burden on the Flora Project. We appreciate the support we receive from you, and in this season of renewal, we hope you'll renew your support of the Flora Project. More information about giving may be found on the website. Or call me, Bland Crowder, at 804-371-5561.

Bland Crowder, Flora of Virginia editor