Skunk Cabbage

(Symplocarpus foetidus)

Craig Holdrege

Figure 1. Group of skunk cabbages in March.

People often find it strange that I've spent parts of six years studying skunk cabbage and that I'm an unabashed admirer of this plant. After all, skunk cabbage stinks and has no beautiful blossoms. But I'm not alone. A friend of mine was driving along the northern California coast and, being attuned to skunk cabbage through my influence, she noticed a well-fashioned wooden sign on the roadside she may have overlooked otherwise: "Skunk Cabbage Discovery Trail."

The unknown comrade who made that trail has probably shared my experience that there's much more to skunk cabbage than meets the casual eye. In this essay I can't take you on such a trail—you'd have to come to our wetland boardwalk for that—but I can share with you some of the discoveries I've made on my journeys to skunk cabbage over the past years.

The Flowering Bud

To find the first spring plant in flower in our region—the edge of the Taconic range an hour southeast of Albany, New York—you have to get out before it feels much like spring at all. It's March, the ground is still frozen, and frost comes nearly every night. The days are rapidly getting longer, but the spring equinox is still ahead. Walking through the woods, you see the grey and brown tree trunks, a coloring mirrored in the ground litter of leaves from the previous year.

There is no green. Not only the temperature but the whole mood of the woods is cool.

Then you walk down to the edge of a meandering stream or, in my case, to a wooded wetland. Here, too, the ground is frozen, and patches of ice spread between groups of bushes and small trees (mainly red maples and alders) that dominate the wetland. In this still, quiescent world, little centers of emerging life are visible, the first sign of early spring. What I see are the four-to-six-inch-high, hood-like leaves that enclose the flowers of skunk cabbage. (See Figures 1 and 2. All drawings are by the author.)

Figure 2. Skunk cabbage spathes.

Both color and shape are striking. Some leaves are completely deep wine-red or maroon, while in others this background coloring is mottled with patches or stripes of yellow or yellow green. The shape is hard to describe: it's like a spiral, sculpted hood drawn around itself, leaving only a narrow opening on one side. I've often thought that if an artist were searching for an appropriate image of a gnome or dwarf, she would find it in these little figures emerging from the ground when everything else is still in a wintry sleep. Not only the colors, but also the specific shapes are manifold; some are pointed and strongly twisted, others rounder and squat. As my eye sweeps over the twenty or thirty plants before me, my gaze is brought into a spiraling movement when it tries to rest upon any single specimen. The deep color is warm, the sculpted form alive.

Looking at skunk cabbage on one of the first warm, sunny March afternoons (it's maybe 50° F) with the light shining through the leafless trees and shrubs and illuminating the wetland floor, I often sense for the first time that spring is on its way. On such days I've even seen the first bees of the year flying in and out of the skunk cabbage hoods.

The hood is, in botanical terms, a highly modified leaf called a spathe. The spathe wraps around itself to form a space that encloses a spherical head of flowers, called a spadix (Figure 2). The spathe functions as a bud that holds and protects the flower when it emerges out of the ground. But it is a bud that never unfolds. When the flowers are full in bloom, they are still enwrapped by the spathe. You can see the flower head only by peeking inside the narrow opening in the spathe.

The roundish flower head (about 2 cm in diameter) has a spongy consistency like the spathe itself. It consists of numerous small, tightly packed individual flowers (Figure 3). They have no petals, which make up the showy part of the flower in most plants. Rather, they have four inconspicuous, fleshy, straw-colored sepals (which in many plants form the bud leaves enclosing the petals) that never really unfold.

Figure 3. Front part of spathe cut off to show flower head (spadix).

The flowers "bloom" when the stamens grow up between and above the sepals and release their pale yellow pollen. Following this the style grows out of the middle of each flower to be pollinated by insects carrying pollen from other flower heads. All of this happens *within* the enclosing spathe. These first flowers of spring never leave their protective enclosure.

A couple of times I've been lucky enough to see spathes growing up through a thin layer of ice, the ice melted around the spathe in a circular form. This is an indication of skunk cabbage's remarkable capacity to produce heat when flowering. If you catch the right time, you can put your finger into the cavity formed by the spathe and when you touch the flower head, your finger tip warms up noticeably. Biologist Roger Knutson found that skunk cabbage flowers produce warmth over a period of 12-14 days, remaining on average 20° C (36° F) *above* the outside air temperature, whether during the day or night. During this time they regulate their warmth, as a warm-blooded animal might!

Physiologically the warmth is created by the flower heads breaking down substances while using a good deal of oxygen. The rootstock and roots store large amounts of starch and are the likely source of nutrients for this break down. The more warmth produced, the more substances and oxygen consumed. Knutson found that the amount of oxygen consumed is similar to that of a small mammal of comparable size.

We must imagine that as the spathe grows out of the usually frozen ground, the flower head heats up and the warmth radiates outward. While in this heating phase, the flowers bloom, releasing pollen and being pollinated by insects. Not only can you see the first insects flying around between skunk cabbages, but you also find beetles and spiders crawling around within the warm enclosures of the spathes. You can even discover a spathe opening veiled with a spider net.

The flowers also release a noticeable odor at this time. On a calm day coming down to the wetland you can smell a lightly pungent, somewhat skunk-like odor. If you put your nose to the opening of a spathe, the scent is markedly stronger. Small flies and other insects are attracted to the flowers by the smell. These creatures are in part the same species that are attracted to carrion —decomposing flesh. Some of the typical volatile organic compounds released by a decomposing carcass—with graphic names like putrescine and cadavarine—are also formed by the flowers of some members of the Arum family (Araceae), to which skunk cabbage belongs. Whether skunk cabbages emit precisely these or other related compounds has not yet been investigated.

Due to the warmth production, a constant circulation of air in and out of the spathe occurs. From the flower head, warmth is generated and the air moves up and outward, while cooler air is drawn into the spathe. A vortex is formed with air streaming along the sculpted, curved surfaces of the spathe. In a habitat with numerous skunk cabbages, a microcosm of flowing warmth and odiferous air is created in which the first insects of spring fly.

This is the world of skunk cabbage over a number of weeks in March and sometimes into April: on the one hand, the enclosed, protected life just peering out of the still wintry earth, and a flower that remains in a bud; on the other hand, the active, warmth-, movement-, and scent-emanating organism that creates a unique environment for the first stirrings of insect life. Skunk cabbage mirrors the quality of early spring—flowering at ground level in a bud that doesn't open, while at the same time helping to create the environment for its own development.

Rapid Unfolding and Decay

When the spathe emerges out of the ground, there is often the tip of a large bud next to it, sticking an inch or two out of the ground (Figure 4). This bud contains all the leaves that will develop on the plant and is often already visible in the fall. Only when the spathe slowly begins to wilt does this tightly-packed bud of leaves begin to grow. It grows longer than the spathe and is shaped like the tip of a spear. Then, when the days begin to get noticeably warmer at the end of April and into May, the bud unfolds rapidly. It's clear that skunk cabbage now needs outer warmth to develop. The bright green leaves unfold in a beautiful spiraling pattern. Each leaf is rolled in upon itself and at the same time enwraps the next leaf. It's the closest thing to an archetypal process of unfolding you can imagine.

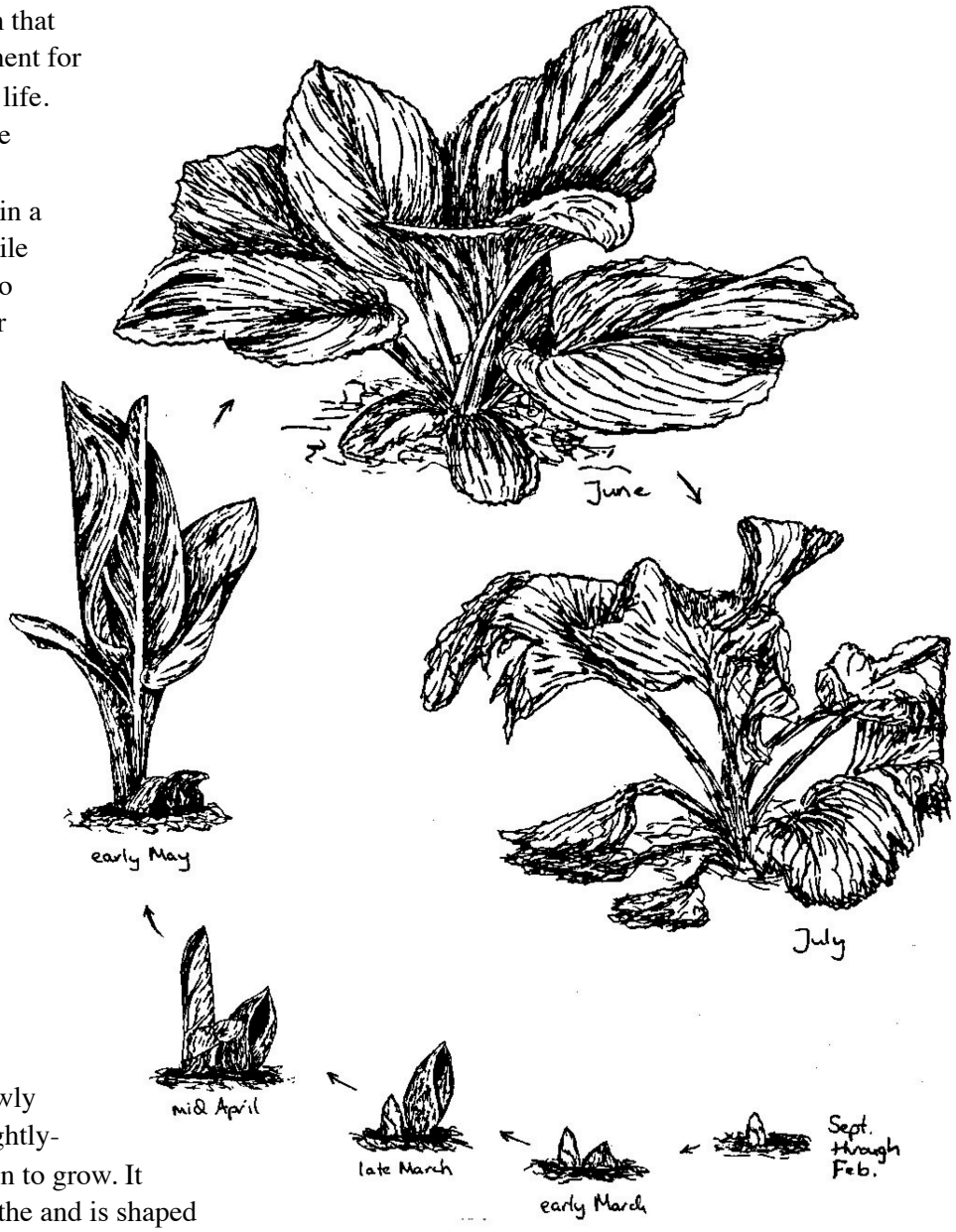

Figure 4. Skunk cabbage development.

Gradually a large, funnel-shaped rosette forms. The largest leaves reach three, occasionally four feet in length. By mid-May this surge of growth

peaks and the wetland is flooded with green patches of skunk cabbage. The leaves are oblong in shape and have a long leaf stalk. The leaf stalks are thick, but also easy to crush. They have no woody fibers and consist primarily of air and water inlaid with soft plant matter. This consistency extends, untypically, into the flowering part of the plant: both spathe and flower are watery and spongy. By contrast, think of the distinct difference you find in a wild rose between the hard, prickly, wooded stems carrying divided, fibrous leaves on the one hand and the refined, almost rarified petals on the other.

A crushed leaf exudes a skunk-like odor, and ingested leaf juice calls forth a strong inflammatory reaction in the mouth and esophagus of human beings. Skunk cabbage not only produces its own warmth, it also stimulates warmth processes. Few creatures eat the leaves. I've seen leaf buds and also spathes that have been nibbled upon. In one instance the wetland was covered with a late March snow and tracks of wild turkeys led up to the buds, which apparently they had eaten from. Early Swedish settlers in Pennsylvania gave skunk cabbage the name "bear-weed," since bears were known to feast on the buds and leaves.

In our area the leaves of the trees and bushes unfold in May and a homogenous dark green canopy has formed by mid-June. At this time the leaves of skunk cabbage begin to decay. They don't dry up and fall onto the ground to become part of the leaf litter that is slowly decomposed by fungi over the next year. Skunk cabbage has its own characteristic way of decaying. The leaves get small holes in them, begin to hang down, and parts turn black and somewhat slimy. Essentially the leaves dissolve. This dissolution occurs rapidly, so that already by the end of July or early August the leaves are gone. You only find a few remnants of the bases of the leaf stalks. What dominated the appearance of the wetland in May has disappeared in August.

As strange as this way of decomposing at first seems, after studying the plant more intensively you begin to see how it fits with other characteristics. While growing, a plant is in its most fluid state. It then forms hard fibers, which, in biochemical terms, is a process of condensation and drying out. When the plant dies even more water is lost, and decay of the woody fibers sets in. Skunk cabbage stays in the watery phase; its substances don't condense and dry out. Therefore the dying leaves appear to evaporate, since they are mostly water, and almost no dry matter is left on the ground to decay. Skunk cabbage unfolds rapidly and disappears rapidly.

Deeply Rooted

Skunk cabbage has now receded into the earth. A fully-grown skunk cabbage has a massive root system (Figure 5). It's virtually impossible to dig a plant out of the ground. (I've tried.) A few inches into the ground the leaves grow out of the top of a thick roundish stem, called a rootstock or rhizome. Out of the rest of the rootstock the roots grow. Many roots, up to the thickness of a pencil, grow out of the rootstock in all directions. There is no taproot. The roots have virtually no branches until near their tips, where they ramify into many small, fibrous rootlets.

Figure 5.

The roots are wrinkled in a regular, ring-like pattern. This shows that they are so-called contractile roots. The roots grow and then contract, actually pulling the plant deeper into the mucky, dense soil. Skunk cabbage is a perennial. The seeds germinate on the surface, so that at the outset the rootstock, which gives rise to the roots, is also above ground. As the roots grow and contract, they pull the plant downward. Year by year skunk cabbage becomes more deeply anchored in the ground. Large, older plants lie correspondingly deeper than younger ones. No one knows how old an individual plant may become. In any one population you will find small plants with only one or two leaves—perhaps a few years old—next to plants four feet high with numerous leaves and perhaps decades old.

In the same wetland where I observe skunk cabbage, its close botanical relative, the wild calla (*Calla palustris*), grows. It always grows where water stands most of the year, while skunk cabbages grow where it's a bit drier, often emerging from small hillocks created by tree roots, old stumps or trunks of fallen-over trees. Before the wild calla plant flowers from mid-May on, its leaves resemble somewhat in size and shape those of a young skunk cabbage. But in contrast to skunk cabbage, you can easily pull a wild calla out of the soil. Its horizontally growing stem puts forth small roots that barely penetrate the surface of the mucky soil. The plants are essentially suspended in water, hardly rooted in the soil.

This contrast highlights skunk cabbage's pronounced feature of being so deeply and firmly rooted in the soil. The vibrant and lush growth of the leaves has its complement in the strong subterranean anchoring. The roots and rootstock store large amounts of nutrients that make rapid and exuberant growth of the leaves in spring possible, while the photosynthetic activity of the large leaves allows the storage of nutrients for the coming years. Bound to a very moist environment, skunk cabbage is deeply and intensely rooted in the soil, making the lush growth of this largest woodland wildflower possible. In contrast, the semi-aquatic wild calla barely reaches into the soil and remains a much smaller plant.

Rounding the Circle

When skunk cabbage's flowers have been pollinated, the fruits begin to grow. The flower head swells and develops into a fruit head (Figure 6). The spathe withers and dies, and the stalk that carries the fruit head elongates, growing along the surface of the ground. By mid-June the fruit heads are roundish balls, about two inches (5 cm) in diameter. They usually have the deep, wine-red color of the spathe. The fruit heads house numerous round, berry-like fruits, each containing one seed. In August the fruit head falls apart. The fruits lie on the ground—to be eaten, to decompose, or to germinate (either in the fall or next spring).

Figure 6. Fruit heads surrounded by decaying leaf stalks.

One often sees little skunk cabbages in the immediate vicinity of a large plant, which suggests that they are the offspring of the larger plants. Biologist Cris Winters found that skunk cabbage does not propagate vegetatively through branching of the rootstock, as so many woodland wildflowers do. It appears that the only way for a population to spread is through the seeds.

Most plants in any given population are well-established, with numerous years of development

behind them. But they also prepare for the future. In the summer I dissected a skunk cabbage, peeling away leaf after leaf from the base of the stalk. What I found astounded me, even though, having done some reading before, I was somewhat prepared for it. At the base of one of the middle leaves there was the bud of a spathe that will grow out in the following spring. It was about 2 cm long and already deep wine-red in color. A few leaves further inward another spathe bud was visible—smaller and still white. This spathe would emerge in the spring after next. Another, even smaller spathe follows after a few more leaves; it would emerge two and a half years later! When I cut the rootstock lengthwise, I could see several more tiny spathe buds (the size of the tip of a ball-point pen) at the base of the shoot. Spathes are being prepared years ahead.

In this way skunk cabbage lays down its future course of development. What we normally perceive encompasses the development of the spathe and the rapid outer growth and decay of the leaves each year. At the other pole of the plant, the roots grow ever further and draw the plant downward. In these two poles the plant unfolds activity into and with its environment. But hidden in the inner core of the plant, protected from all direct contact with the elements, a sketch of things to come is continually developing.

Bud-like, Watery Quality

In the years I've been studying skunk cabbage, I've gained a fairly detailed knowledge of its morphology and how it develops in relation to its habitat. As a part of this study I try to gain a saturated picture of the plant by connecting all the details in my imagination, so that I begin to overcome the separateness of the parts and begin to see the plant as a living process. It's impossible to understand the plant without such imagination. (If the term "imagination" sounds too airy, then substitute "precise pictorial thinking.") In this endeavor I've come to see how the various aspects of a plant's development, also in relation to its habitat, express certain unified tendencies.

When I see such relations, I sense that I'm finally beginning to cognize the plant, seeing through all the details to its unity and coherence. But at the same time, it's a new kind of territory. The terrain is difficult. Where before I had the solid objects—the different parts of the plant in their shape, size, consistency, etc.—now I'm dealing with the qualities that are expressed *through* these parts. And qualities aren't things. It's a real struggle to express these qualities so that someone else can see what you're talking about.

(In view of this difficulty I sympathize with scientific tradition, which banishes qualities from the discipline of science. Trying to encompass the qualitative means the scientist gives up the firm ground of quantifiable data to enter a realm that is much more fleeting and ephemeral, and therefore more difficult to formulate and express. But the easier way out is not necessarily more revelatory.)

Skunk cabbage expresses in many of its features, as we have seen, a bud-like quality. Its flowers are housed in the large bud-like spathe, never extending out of this mantle. Skunk cabbage blooms in a bud at the time of year in which most flowers, later to unfold, are still tightly encased in their buds. The flowers never reach the full light of day and the parts of a flower that normally unfold are highly reduced. While the petals are missing altogether, the small, fleshy sepals, all tightly packed into a sphere, open only enough to let the stamens and style slightly protrude. The flower head remains a big, fleshy bud within the bud-like spathe.

When the plant grows, leaf upon leaf unwraps out of the large bud. Since the stem never elongates but remains in the ground, the leaves never grow apart. Instead, they form a funnel-shaped rosette. The rosette is only fully open, that is, the leaves spread out in horizontal fashion, when the leaves are dying. Their life is in the unfolding bud; being unfolded signals decay. And

skunk cabbage never stops laying down new buds, so that an established plant contains within it the spathe and leaf buds, not just for the next season, which is typical for perennials, but for a number of years to come.

Skunk cabbage leaves all have about the same shape: a long leaf stalk and the large, fairly simple, oblong blade. Interestingly, this form corresponds to the first leaves on plants that go through a transformation of the leaves along the plant stem. In this sense skunk cabbage has "young" leaves.

We can go further and view these bud-like qualities in connection with skunk cabbage's dependency upon a wet environment. When I ask my eleventh grade students in an ecology field course how they determine where the wetland begins, they answer, "skunk cabbage shows you." Its roots need to be bathed in muddy soil throughout the year.

Skunk cabbage is not only dependent upon water, but also brings qualities of water—such as fluidity, movement, continuity, and the tendency to form surfaces—full to expression. Early in spring, when stasis reigns in the wetland, skunk cabbage brings movement and life. The spathe grows out of the frozen ground and expresses in its form the congealed movement of spiraling surfaces. With the help of water, solid starch transforms into fluid sugar sap. Rising from the roots and rootstock, the fluid sugar is utilized in all growth processes. Moreover, large amounts of sugar are broken down to produce the warmth in the flower head. This transformation from solid starch to flowing sugar sap to radiating warmth is mediated by water and brings movement into the dormant landscape of early spring.

The radiating warmth in turn brings the air and insects into motion. When the leaves grow, you can almost see the water moving out of wet soil through the roots into the leaves, swelling and unfolding them. The leaves have a large, undulating surface that is like a conduit for water. They don't have a thick, waxy cuticle that prevents transpiration. As a result water is continually flowing out of the soil, into and through the plant, and into the air, increasing the humidity of the lower layer of air in the wetland.

When skunk cabbage leaves decompose, they don't dry up and crumble; they dissolve. With few fibers, they consist mainly of water and air, as do the spathe and flowers, and disintegrate into these elements. Harder fibers are only found beneath the ground in the roots.

Conclusion

In getting to know skunk cabbage we enter into a unique and rich world. We've had to return to the plant again and again, questioning and searching for understanding. If we are to see the plant's life, it has to become alive in us. We must, as Goethe puts it, become "as flexible and mobile as nature herself" to penetrate beyond the surface of facts to what gives life and coherence to her creations.

As this process of knowing unfolds—the conversation with the plant—we begin to see the plant's unity. We have "aha" experiences in which we recognize connections between what previously appeared to us as separate facts. We see a common watery, bud-like quality in the form and consistency of spathe, flower head and leaves. Skunk cabbage reveals to us the fluid quality of water in the way it unfolds and decays, as well as in its undulating, flowing forms. And in all of these characteristics we see a vivid picture of early spring—a plant that is bud-like in so many ways and yet unfolds to bring the first life and movement to a still slumbering habitat.

Once you've come to understand a plant in this way, you never encounter it with the remark, "oh, that's just a skunk cabbage." Rather, you meet it with expectation and interest, wondering what else it has to show you. And the wonderful thing is that this attitude begins to inform your overall orientation toward nature. Any other plant, bug, or bird you see appears immediately as a riddle and not a thing. You know it carries within itself—as

you've experienced in skunk cabbage—a whole, unique world that's just waiting to be disclosed.

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