



Lichens

More Than Meets the Eye

Often overlooked or ignored, symbiotic organisms known as lichens, such as the *Xanthoria parietina* dotting a Martha's Vineyard farmhouse, are attracting new attention for their medicinal, decorative, and pollution-detecting properties.

By **SYLVIA DURAN SHARNOFF**
Photographs by the author and
STEPHEN SHARNOFF

Not plants, but . . .

For almost 25 years now my husband, Steve, and I have been captivated by the strange beauty and amazing diversity of lichens. Seven years ago our fascination drove us to photograph as many as we could of the 3,600 species in the United States and Canada. In pursuit of lichens we traveled from Alaska to the Florida Keys. We climbed trees, scaled cliffs, waded through swamps, crawled over tundra hummocks and desert sands—always hoping to find a lichen we hadn't seen before.

In the windswept valleys of eastern Idaho we found several. Ignoring the dramatic sagebrush country around me, I focused my attention on the ground, where yellowish almond-size lichens nestled amid the gravel (right). These were "vagrant" lichens, unattached and free to be blown about like tiny tumbleweeds. Collecting on snow-free ridges, they provide food for pronghorn during long, harsh winters. In the Middle East similar drifting vagrants were gathered by villagers and made into bread:

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the biblical "manna from heaven," some scholars believe.

Despite plantlike forms, lichens are not plants. Often called tiny ecosystems, they are actually compound organisms made up of two, or even three, very different partners, none of which is a plant. Biologists no longer find the concept of two great kingdoms—plants and animals—adequate for the classification of all living things. Fungi, bacteria, and simple organisms like algae now occupy kingdoms of their own. The dominant partner in the lichen symbiosis is a fungus, with a colony of algae or cyanobacteria—sometimes both—supplying food by photosynthesis.



Separated from its partners, the fungus itself would be a shapeless glob. In his studies of symbiosis in the 1970s, Vernon Ahmadjian teased apart *Cladonia cristatella* (right) into its fungal and algal components, which he cultured and then induced to recombine. Ahmadjian, of Clark University in Worcester, Massachusetts, was one of the first scientists to recombine lichens. His resynthesized lichen even produced the early stages of the red spore-bearing structures that give this species its common name, British soldiers.

This is the first appearance in the GEOGRAPHIC of the work of nature photographers SYLVIA and STEVE SHARNOFF.





Lichens to dye for

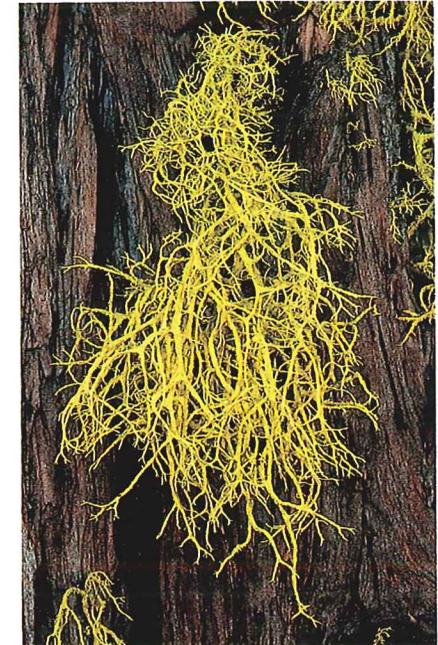
An arsenal of nearly 600 chemicals unique to lichens helps them survive in marginal environments and ward off attacks by bacteria, other fungi, and grazing herbivores. Called lichen substances, these pigments, toxins, and antibiotics have made lichens very useful to people in diverse cultures, especially as a source of dyes and medicines.

The warm browns in rugs made by members of the Ramah Navajo Weavers Association come from

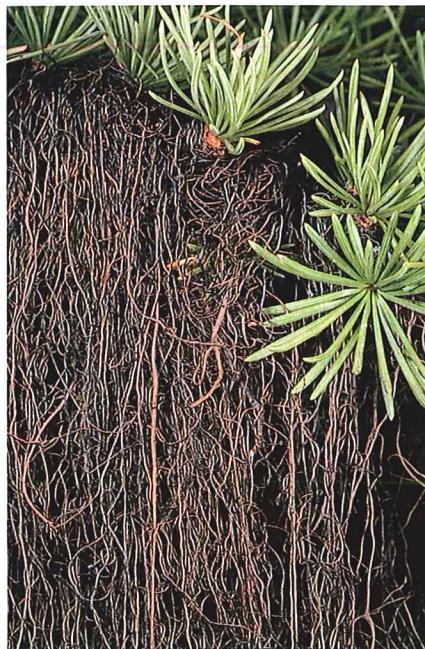
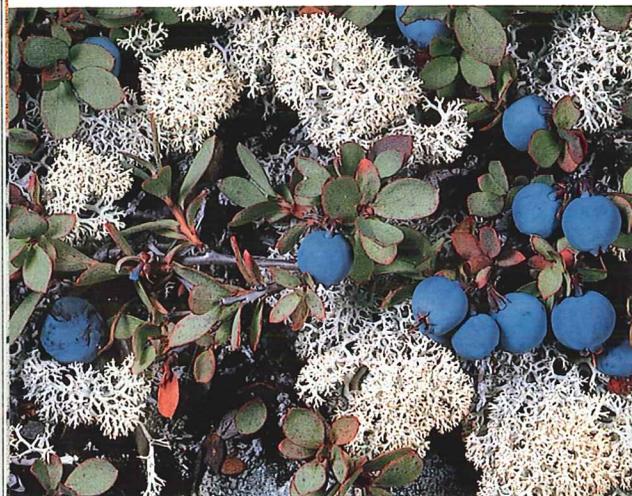
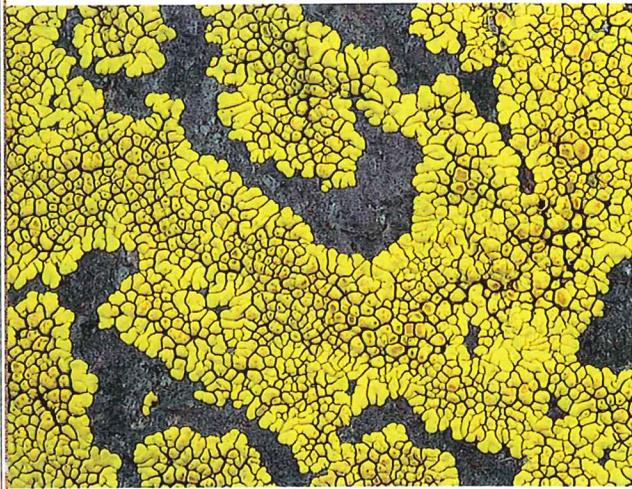


boiling the vagrant lichen *Xanthoparmelia chlorochroa*, seen in a basket with a skein of dyed wool (left). The lichens once used to dye Scottish Harris Tweed contain substances that gave the fabric an earthy aroma and reputedly made it moth repellent. Shrubby gray lichens, scraped off Mediterranean coastal rocks and soaked in ammonia-rich stale urine, yielded some of the famous royal purple dyes of antiquity.

The most widely used dye lichen among Native Americans was the eye-catching wolf lichen *Letharia vulpina* (above right). The Chilkat Tlingit in Alaska traded coastal commodities such as fish oil for wolf lichen from the interior to color their prized dancing blankets, still worn by the Chilkat Dancers of Haines, Alaska, in their performances (top).



Though famed as a wolf poison, the wolf lichen often found a place in the Native American pharmacopoeia. The Okanagan-Colville, Blackfoot, and others made a medicinal tea from it or used it externally to treat skin problems. While scores of lichens have served as traditional medicines, few can compete with members of the genus *Usnea* (above left) as effective healers, used in teas and salves in nearly every part of the world. The lichen substance usnic acid has been used in some European antibiotic creams.

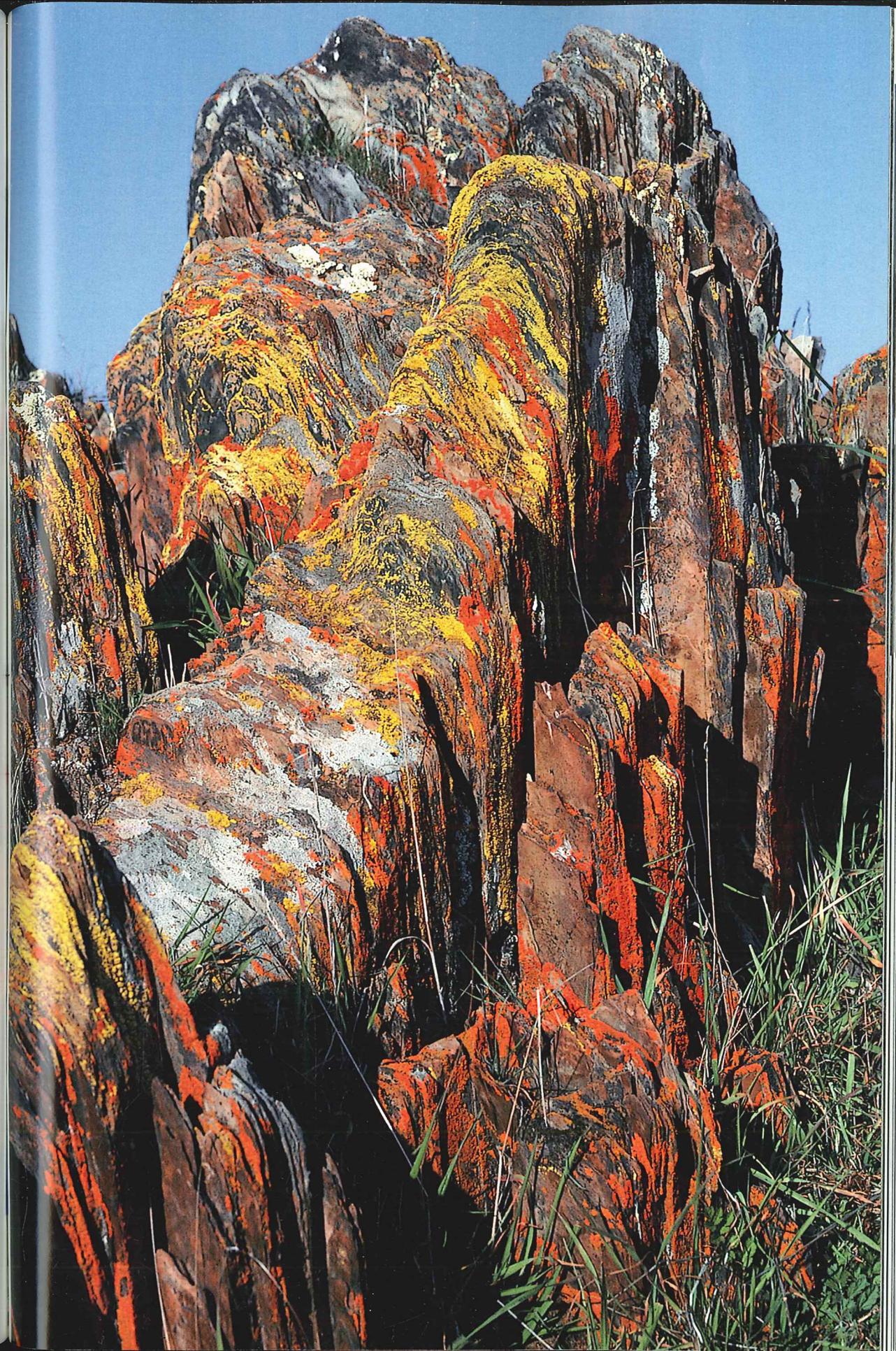


Designer rocks

As if painted by a mad hand, a slate outcrop is encrusted with lichens in the Sierra Nevada foothills of California (right). In western Nevada the Northern Paiute name for brightly colored crustose lichens used as medicines, such as *Pleopsidium oxytonum* (left), translates literally as "lizard semen," alluding to the push-ups that lizards do during courtship displays.

In legends of the Northwest's Interior Salish peoples, Coyote's long hair became entangled in a tree and was magically transformed into food, hanging from branches in thick clumps. Seen here interspersed with larch needles (bottom), *Bryoria fremontii* was a delicacy for some tribes and distasteful famine food for others. Some Interior Salish mixed the lichen with mud and used it for chinking log cabins. Others used it as fiber to make clothing. Northern flying squirrels build nests of it, which serve as cozy live-in larders, providing winter food. Anthropologist Craig Kirkpatrick of the University of California at Davis recently discovered that two other *Bryoria* species are the primary food of the endangered Yunnan snub-nosed monkey in China.

One of the most important of the so-called reindeer lichens, *Cladina stellaris* (center, among ground-hugging blueberries) is a favorite food of North American caribou and their Eurasian counterpart, reindeer. When the lichens are covered by snow, the animals dig craters as deep as three feet to reach them, fighting off competitors horning in for a free meal. Arctic peoples once ate reindeer lichens when times were rough, boiling them in water. They were considered a treat, however, when consumed, fermented, from caribou stomachs.





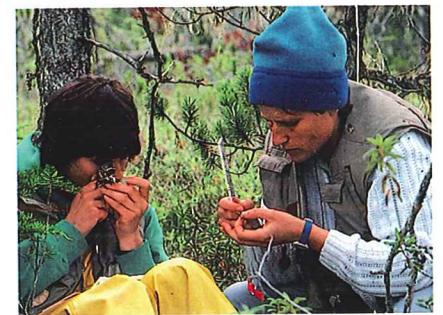
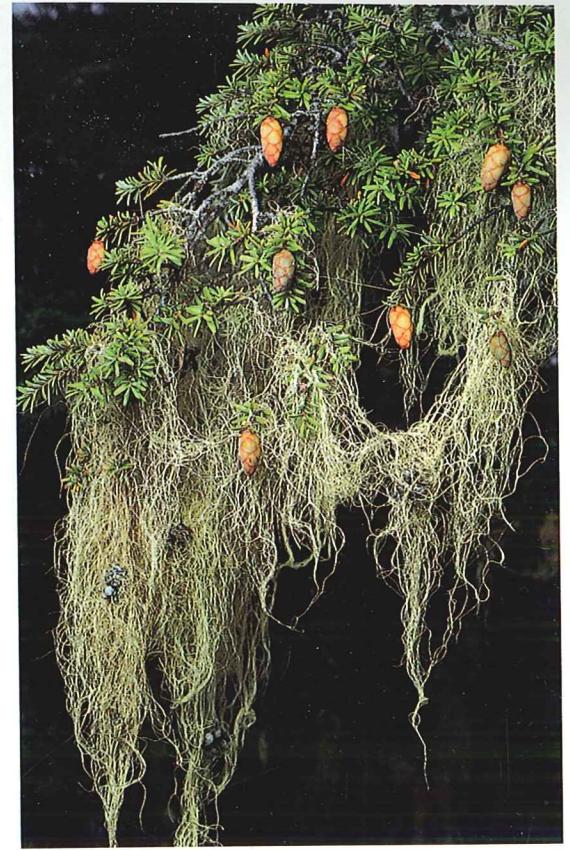
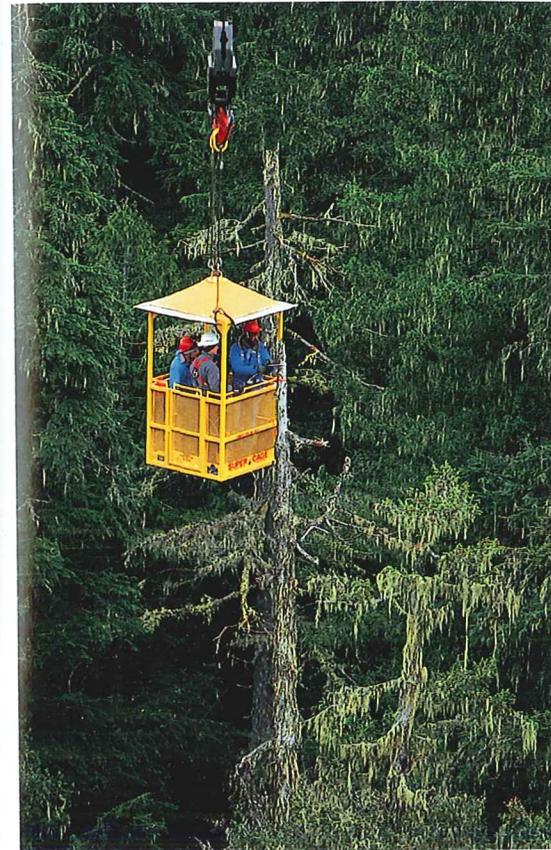
Colonizers

Almost any stable surface — like this gravestone on Cape Cod — makes suitable turf for lichens. Under favorable conditions, lichens will homestead on the stained-glass windows of cathedrals, on abandoned cars, highway signs, and roof shingles; even on the backs of Galápagos tortoises and beetles in New Guinea.

Growing imperceptibly for centuries — even millennia — some lichens are among the world's oldest living things. This makes them useful to scientists for dating archaeological artifacts and tracking geological events such as the retreat of glaciers.

Lichens help transform the landscape by slowly chipping away and dissolving rock into soil, adding organic matter when they die. In Israel's Negev desert, snails accelerate the process. Heavy dew-fall there sustains lichens that grow under the surface of limestone rock, showing only their fruiting bodies. Snails grazing on the lichens scrape apart and ingest the rock, then excrete impressive amounts of soil.

Lichens in the U.S. Southwest form stable crusts that protect desert soils from erosion. Unfortunately, these crusts are very fragile, taking decades or longer to recover after being crushed by livestock or off-road vehicles.



Underfoot and overhead

Forest-floor carpet in British Columbia (left) includes a soil-enriching lichen, *Peltigera aphthosa*, and star-shaped mosses. The lichen contains bright green algae and is peppered with dark warts holding nitrogen-fixing cyanobacteria. The pale underside shows at the edges. Thriving in pristine environments, this species, like many other lichens, is fast disappearing in regions of air pollution and habitat disturbance.

Because of their extreme sensitivity, lichens are useful indicators of air quality. In Alaska, Forest Service scientists Chiska Derr and Linda Geiser (lower right, from left) compile data on lichen species in Tongass National Forest, which will be compared with future inventories to see how the lichens have fared. Lichens act like

sponges, taking up pollutants that come their way. By analyzing lichens chemically, scientists can tell what's in the air.

Blown off trees in the Pacific Northwest during winter storms, witch's hair, *Alectoria sarmentosa* (top right), provides survival food for black-tailed deer. From the gondola of the Wind River Canopy Crane in Washington State, researchers study lichen growth patterns in treetops. Witch's hair becomes abundant only after trees are about a hundred years old.



Air monitors

After a winter rain, leafless trees in an Oregon farming valley come alive with lichens, including the oakmoss lichen, an important ingredient in many fine perfumes. Virtually dormant when dry, lichens become bright, plump, and metabolically active when damp.

Growing only where the air is very clean, *Usnea longissima* (right and with others at far right) was called pine gauze in a sixth-century Chinese herbal and is still used in traditional Chinese medicine. Locally abundant in the Pacific Northwest, it has all but disappeared in Europe.

Pollution is a serious threat to lichens even in the remote Arctic, and reindeer that rely on them for food are under increasing stress. In addition, fallout from the nuclear accident at Chernobyl contaminated lichens and thus reindeer in Scandinavia, where many herds had to be destroyed.

As early as 1859 European



scientists recorded that air pollution was killing lichens in urban and industrial areas. Today Steve and I note with growing concern that lichens are nearly absent from large areas, because the environment can no longer support this hardy yet vulnerable monitor of the very air we breathe. □

