LICHENS OF AGES

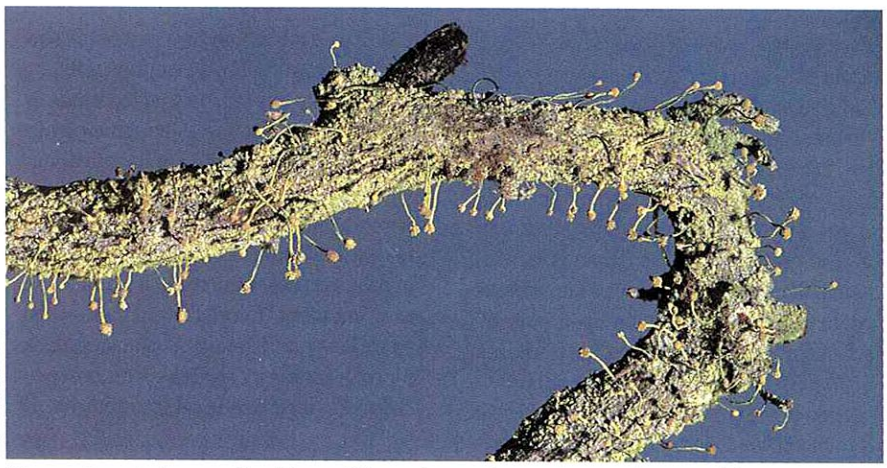
Members of the Caliciales family are particularly fond of oldgrowth forests

To an antique dealer, the word patina might bring to mind an old cabriolet chair darkened to a rich brown hue by the passage of time. To a geologist, it might evoke a wind-bronzed boulder standing alone in some desert waste. But to a well-seasoned naturalist with an eye to the living world, the word patina can reasonably mean only one thing: a veneer of crust lichens.

As a group, crust lichens are nothing if not biological patina. At Canadian latitudes, very few natural surfaces stand exposed to the elements very long without acquiring a colourful surfacing of them. So fine and true is this surfacing that it often gets mistaken for the underlying surface itself, whether tree, or log, or rock, or patch of ground.

A good place to confirm (or refute) this assertion is a tree trunk near you. Depending on where you live, and how close you look, you may be surprised to discover that what you had always assumed was "just bark" is actually a patchwork veneer of living, breathing lichens. And more: that what you had always assumed was a tree trunk is actually only circumstantial evidence that a tree trunk stands at this address. What you see are really only lichens; the tree trunk, if it exists at all, is hidden from view beneath its biological veneer.

If your putative tree trunk happens to be standing in an old woodland, look again. (A hand lens may help here.) Intermingled with the whitish lichen crusts, the greyish lichen crusts, the greenish lichen crusts, and so on, you may discern one or several assemblies of tiny, upright, stubbly stalks that collectively lend the bark a certain "five-o'-clock-shadow" look. These are crustose members of the Caliciales: the *ultra qua non* of lichenological patina.



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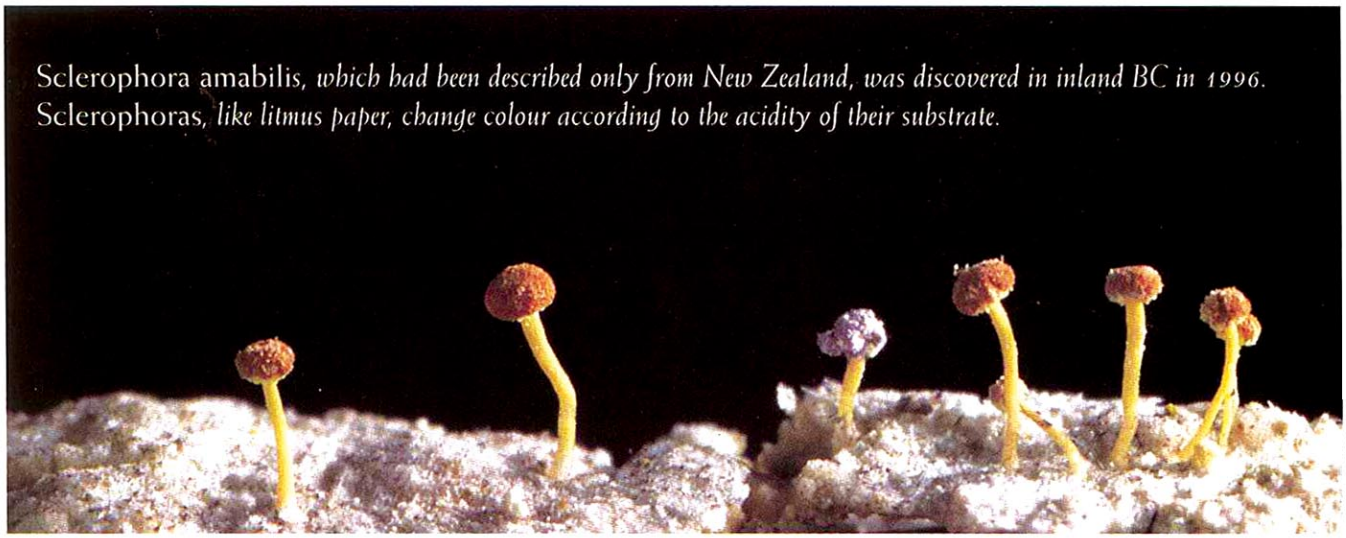
Chaenotheca furfuracea, *the sulphur stubble, is a denizen of upturned roots and ranges widely across Canada.*

Lilliputian in size, most Caliciales routinely go unnoticed—except of course by hand lens-toting lichenologists. A majority of the 190 species so far known may be described as thin, pale crusts out of which grow scattered "stands" of thin, stubbly stalks to about 0.5-2.0 mm long. Each of the stalks terminates in a minute cuplike process that overbrims, in the case of the "stubble lichens", with a spherical mass of powdery spores. In some species, the spores are black, while in others they are, or at least appear, brown or yellowish. Because they alone among lichens possess powdery spores, stubble lichens are easily recognized at the flick of a finger: if the spores rub off as a black or brownish smudge, then it's a stubble lichen alright. In other Caliciales, including the "pin lichens", the spore mass is compact, and the spores do not rub off; but the tiny pin-like fruiting structures are unmistakable.

The Caliciales are a diverse lot, both in ancestry and in lifestyle. Most species exhibit a lichen lifestyle, though some are unlichenized. The distinction turns on whether a given species has learned the art of subsistence farming or not. To put the matter succinctly: lichenized fungi cultivate (and feed on) algae among the threads of which they are composed, whereas non-lichenized fungi do not.

In the beginning, probably all Caliciales made a living feeding directly and exclusively on bark and wood. But over evolutionary time, appetites diverged. Some species, for example, took to living off the resin exuded by living trees, while others developed a taste for tree-hungry fungi. Some species acquired the lichen's knack of



Sclerophora amabilis, *which had been described only from New Zealand, was discovered in inland BC in 1996. Sclerophoras, like litmus paper, change colour according to the acidity of their substrate.*

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cultivating algae, while others took up the even neater knack of parasitizing their lichenized relatives. Still others, in an intriguing evolutionary flipflop, evolved first in the direction of the lichen lifestyle, and then back again to their old wood-eating ways. Even to this day, a few species appear to remain undecided on this matter: at times they cultivate algae, but at other times they get by on a diet of bark or wood. Strictly speaking, such species are not true lichens; but as they routinely get studied by lichenologists, perhaps they can be thought of as "honorary lichens".

Not much is known about the reproductive biology of the Caliciales, though one thing does seem clear: most species depend for dispersal on their spores. But how do their spores actually disperse in the rather windless forests in which most Caliciales are most at home? In the case of the compact pin lichens, the answer is straightforward enough: at maturity the spores are forcibly ejected into the air via a popgun mechanism common to nearly all lichens. Not so, however, the stubble lichens, whose powdery spores would seemingly sit in place forever, were it not, apparently, for the agitated comings and goings of trunk-loving birds (creepers, nuthatches, woodpeckers) and tree-living mammals (chipmunks, marten, squirrels). Though the role of these creatures in stubble dispersal has yet to be studied in detail, there can be little doubt their movements contribute much to the local distribution and frequency of these lichens.

Swedish lichenologist Leif Tibell has recently postulated a second mechanism of dispersal for the stubble lichens: violent windstorms. While wind by itself is probably not enough to coax stubble spores into the air, the impact of wind-thrown trees appears to be another matter. According to Tibell, vibrations transferred to these lichens each time a falling tree hits the ground may be sufficient to shake loose stubble spores in the hundreds of millions. Once thus launched into the wind, the spores likely get carried great distances, and may perhaps journey in this way from continent to continent. This, at any rate, is one plausible explanation for the impressive global distributions seen in some species.

Most ecological studies performed to date on these lichens have been done in Europe, but during the past decade Steve Selva, of the University of Maine, has been studying their ecological behaviour on this side of the Atlantic, in the forests of New England and adjacent Canada. Over the years, Selva has passed countless hours documenting stubble lichen diversity in forests of different ages. Time and again, his findings have led him to a single overwhelming conclusion: the greater the diversity of Caliciales, the older the forest. Nowadays Selva has put this insight to good use, distinguishing truly old forests from forests that may appear old, but are not. At first he included other indicator lichens in his assessments, but soon he found that relative forest age could be adequately determined using the Caliciales alone.

Wherever they have been studied in detail, the Caliciales have been shown to occur in much greater variety in older forests than in younger forests. Indeed, old forests appear to provide exclusive lodgings for at least half of the 60-odd species known to occur in Canada. There can be few groups of organisms—not amphibians, not birds, not mammals—that include such a high proportion of oldgrowth-dependent species. It is in this sense especially that the Caliciales may be described as biological patina.

What is it about old forests that so favours these lichens? Three things, apparently: high humidity, rain-sheltered substrates, and bark and wood in all stages of decay. By the size of their trees and the depth of their shade, old forests provide a degree of continuous high air humidity exceeded only by the spray zones of waterfalls. By their copious constituency of leaning trees and tip-up mounds, they also afford rain-free nooks and crannies unheard of in younger forest types. And by their ongoing production of trees and snags in all phases of life and death, old forests provide an unrivalled supply of bark and wood in every stage of soundness and of decay. Taken together, these attributes are the breath of life for stubble lichens and their kin.

As a group, then, the Caliciales tend to occupy habitats that become available only long after a forest comes of cutting age. Indeed, even after a forest has acquired all the usual attributes of oldgrowth (snags, large woody debris, structural heterogeneity, etc.), it has yet to acquire its full complement of pins and stubbles. To put this observation another way, oldgrowth forests are not mere endpoints in forest succession, rather they are themselves part of the successional continuum; in common with younger forest types, they too continue to change and evolve throughout their tenure.

If the patina of oldgrowth has anything to teach us, surely it is this: even in the oldest of our oldgrowth forests, new life is forever finding new purchase. From the perspective of the Caliciales, there really is no such thing as a "decadent" forest. Instead there is only an endless proliferating of habitats suitable for colonization by species ever more specialized in their ecological requirements.

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