LICHENOGRAPHIA THOMSONIANA: NORTH AMERICAN LICHENOLOGY
IN HONOR OF JOHN W. THOMSON.
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SEARCHING FOR CALICIALES IN THE ADIRONDACKS OF NEW YORK

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Abstract: Twenty-one Caliciales species in 9 genera are reported for three previously investigated northern hardwoods stands in the Adirondacks of New York. Given the fact that no Caliciales were listed among the 63 lichen taxa recorded in the original study, and that most of the species recorded in the reinvestigation were associated with microhabitats that were not included in the original sampling procedure, it is suggested that it is not so much the small size of these species that eludes detection as it is the fact that we are not looking for them in the right places.

INTRODUCTION

Since remarking in 1845 that "it is not every eye that can see a *Calicium*; nor are they easily to be found. . .", Edward Tuckerman's "most puzzling group of lichens", the Caliciales, are, today, as elusive as ever (Tuckerman 1845). How is it that these species--perhaps our most sensitive biomonitors, either escape detection completely, or are represented in our floras by only the commonest and most obvious forms? Are they really that small, or have we been looking for them in the wrong places? Twenty years' experience teaching a field course in lichenology and searching for Caliciales species in the Northeast suggest the latter and becomes the working hypothesis for the current investigation.

Since the summer of 1986, I have been engaged in a research project in which lichens are being used to assess the continuity of forest ecosystems in northern New England and Maritime Canada. Patterned after a study by Francis Rose (1974, 1976) in Britain, the continuity of 33 northern hardwood and spruce-fir stands in Maine, New Hampshire, Vermont, and New Brunswick have been assessed using indices of ecological continuity that are based upon the percentage occurrence of ancient forest indicator lichen species found at each site (Selva 1994, 1996). The data show that not only do epiphytic

lichen floras become richer over time--with older stands harboring more rare species, but that the total number and presence of particular Caliciales species collected at a site is, itself, an indicator of continuity.

According to Tibell (1980), the Caliciales are "very sensitive to changes in forest climate, and most species indeed seem to depend on the occurrence of mature forests containing trees of different ages and a varied light and humidity regime." Like Tibell, who noted that, because of clearcutting, the majority of Caliciales species "have already been exterminated over vast areas of Scandinavia and are now found only in forest reserves and national parks", I, too, have recorded similar declines in northern New England where many of the rarer Caliciales are restricted to old-growth and ancient forest sites (e.g., Selva 1988, 1994, 1996). Interestingly, of the 20 lichen index species selected by Tibell (1992) for an Indicator Species Index of Forest Continuity designed for the boreal forests from southern Sweden to Lapland, 10 belong to the Caliciales.

During the summer of 1994, I decided to expand my study area westward into the Adirondacks of northern New York. The lichens at Adirondack Mountain Reserve, Ampersand Mountain, and Forked Lake Forest Preserve, two old-forest and one young forest stand, respectively, had previously been studied by Schmitt and Slack (1990) as part of a comparison of epiphytic lichens and bryophytes between the Adirondack Mountains and the Southern Blue Ridge Mountains of North Carolina. They compared host specificity for *Acer saccharum*, *A. rubrum*, *Betula alleghaniensis*, *Fagus grandifolia*, and *Tsuga canadensis* both between the Adirondacks and Blue Ridge Mountains, as well as with other studies for which epiphyte data was available. On the basis of lichen species lists provided by me, for example, they determined that 61% of the species they recorded on *Acer saccharum*, 59% of the species they recorded on *Betula alleghaniensis*, and 57% of the species they recorded on *Fagus grandifolia* in the Adirondacks can also be found in northern Maine (Schmitt and Slack 1990).

When I began looking at the actual species represented in these percentages, I found it curious that there were no Caliciales species recorded among the 63 lichen taxa reported by them for the Adirondacks. I decided to conduct my own investigation of these sites and, in order to test my hypothesis, would concentrate my collecting effort on microhabitats not included in the original sampling procedure. Specifically, this meant that I would include "the full range of southern exposures", "the lower half meter of trunks", lignicolous substrates, and trees at various stages of decomposition (Schmitt and Slack 1990).

METHODS

The mixed northern hardwoods sites at Adirondack Mountain Reserve, Ampersand Mountain, and Forked Lake Forest Preserve in the Adirondack State Park in northern New York--previously investigated by Schmitt and Slack (1990) and described by them in detail--were visited over the course of three days by me and a field assistant.

Caliciales specimens were collected from all corticolous and lignicolous substrates, with no bias as to their condition, in a conscious effort to collect specimens from the diversity of substrate types present. Epiphytes from standing

as well as fallen trees, whether intact or at some stage of decompositon, were collected in systematic traverses of the terrain. Specimens on standing trees were collected from breast height downward to soil level, and from accessible branches. All surfaces and edges of substrate fragments were examined in the lab, where specimens were identified using standard techniques and following nomenclature according to Esslinger and Egan (1995). Specimens are currently housed in the herbarium at the University of Maine at Fort Kent.

RESULTS AND DISCUSSION

Because the aging old-growth forest is a dynamic place offering a wide variety of ever-changing microhabitats, a reliable typological concept of Caliciales communities is not easily developed. It includes, in large part, the so-called Calicion alliance discussed by Barkman (1958), James, Hawksworth and Rose (1977), and Rose and Wolseley (1984) and described by them as a species diverse association, rich in the Caliciaceae, found on dry sides of ancient trees and on decorticated wood in humid situations with plenty of diffuse light but without direct sunlight.

In my investigations of the alliance, to date, in Maine, New Brunswick, New Hampshire and Vermont, recognizable patterns of distribution have become apparent. Because of the even supply of wood in various stages of decay that characterize natural forests in late successional stages, the species diversity of Caliciales on decorticated surfaces increases with stand age and decomposition of the substrate. A 60 year old hardwood stand, for example, may have only 2-3 species–represented almost invariably by *Mycocalicium subtile* and other "weedy" Mycocaliciaceae, while an old-growth stand may have 5-10 lignicolous Caliciales. Specific microhabitats include standing, decorticated hulks, stumps, and fallen logs and branches and exposed heartwood of living trees. Substrates are typically dry, the surface intact and smooth vs powdery or crumbly.

Certain species typically found on lignum (e.g., *Calicium salicinum, Mycocalicium subtile,* and *Chaenotheca trichialis*) are more frequently also found on bark in aging forests. This may be due in large part to the acidification of bark that occurs during stand succession (Barkman 1958). Also borne out in my earlier investigations is the contention by Hyvarinen et al. (1992) that the tolerance of many of the Caliciaceae to acidity "may be a decisive factor in competition with macrolichens for space". This would help explain the near exclusion of all but the Caliciales on the trunks of many of the oldest trees at many of these old-growth sites. I have found up to four or five Caliciales species on the bark of trees passed over by others for lack of a macrolichen flora.

While preliminary results show that the Calicion may be found on all sides of older trees–from near the base to approximately 2 meters high, you will not find many species growing among the rest of the lichen epiphytes on the trunk. You will find them instead on the side of the tree where they are not competing with the other lichens and bryophytes for space and where they are out of direct sunlight. Some of the exceptions are *Sphinctrina*, which typically grows parasymbiotically with *Pertusaria* or *Lecanora* species and *Phaeocalicium polyporaeum*, which grows associated with polypores. Also, except for *Sphinctrina*, neither the upper trunk nor the canopy branches of hardwoods or

conifers support much of a Caliciales flora.

Some of the least investigated of the Caliciales microhabitats include that of smooth bark--specifically that of saplings and seedlings, but sometimes also including the branches of older trees. Several *Stenocybe* and *Phaeocalicium* species are restricted to the smooth bark of *Alnus, Betula, Quercus*, or *Rhus,* for example. Other microhabitats are the roots of upturned trees, cave-like "grottos" formed at the base of trees, the surface of polypores, and resin--including that formed around broken branch collars. Species may also be restricted to the more porous inner bark of certain species, found down in the cracks of deeply fissured bark, and on the lower surface of bark chips and flakes.

Twenty-one Caliciales species in 9 genera (Table 1) were collected on eleven different tree species at the three Adirondack State Park sites under investigation (Table 2). Eighteen of these species were collected on *Acer saccharum, Acer rubrum, Betula alleghaniensis, Fagus grandifolia*, and *Tsuga canadensis*, the host trees studied by Schmitt and Slack (1990), while 3 species *Calicium trabinellum, Sphinctrina anglica,* and *Stenocybe major* were collected exclusively on other tree species.

Table 1. The following Caliciales species were recorded at the three Adirondack sites under investigation.

1. Calicium parvum
2. Calicium salicinum
3. Calicium trabinellum
4. Chaenotheca chrysocephala
5. Chaenotheca ferruginea
6. Chaenotheca furfuracea
7. Chaenotheca stemonea
8. Chaenotheca trichialis
9. Chaenothecopsis brevipes
10. Chaenothecopsis debilis
11. Chaenothecopsis pusilla
12. Chaenothecopsis pusiola
13. Chaenothecopsis rubescens
14. Chaenothecopsis savonica
15. Cyphelium lucidum
16. Microcalicium disseminatum
17. Mycocalicium subtile
18. Phaeocalicium polyporaeum
19. Sphinctrina anglica
20. Sphinctrina turbinata
21. Stenocybe major

All species were found associated with one or more of the microhabitats discussed in the introduction to this section, which would seem to confirm the hypothesis that we have heretofore been looking for Caliciales species in the wrong places.

Most of the species reported here and much of the information on substrate ecology corresponds with data reported by me for northern Maine (Selva 1988). Among the more interesting species recorded here is *Chaenothecopsis brevipes*, which was found growing on *Betula alleghaniensis* at Forked Lake Forest Preserve. This is only the second published report of this species in North America, although the species reported by Harris (1977) as *Chaenothecopsis* sp. #2 was later annotated by Leif Tibell as *C. brevipes* (Harris, personal communication). As in Maine, where it was first reported (Selva 1988), it was

found growing with *Chaenothecopsis rubescens* over *Arthonia byssacea*. The only Adirondack species that I have yet to find in Maine is *Sphinctrina anglica*. According to Lofgren and Tibell (1979) this species has, for reasons that are not yet understood, been experiencing a pronounced decline in Europe and is considered by them to be extremely rare. Unlike *Sphinctrina turbinata*, which, like other northeastern *Sphinctrina* species, is found growing on *Pertusaria*, *Sphinctrina anglica* is associated with an otherwise sterile crust identified by some as a *Lecanora*.

Finally, inasmuch as Schmitt and Slack (1990) do not list their species by site, but for the Adirondacks as a whole, it is impossible to assess the continuity of these stands using the index of ecological continuity developed by Selva (1994, 1996) for northern hardwoods. The Caliciales data alone, however, confirms the old-growth status of the stands at Adirondack Mountain Reserve and Ampersand Mountain and suggest that the stand at Forked Lake is as well. In fact, with 16 Caliciales species, including *Chaenothecopsis brevipes* and *Sphinctrina anglica*, the Forked Lake stand may well be an ancient one.

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As one of the reviewers of my first lichenological manuscript, "The Caliciales of Northern Maine", John Thomson's flattering comments not only made my day, but actually helped convince me that this was the field of research I belonged in. His continued support over the years has encouraged me to pursue the high standards that he set during his career as a researcher and teacher.

John Thomson is a great natural teacher. I first met him on the 1971 ABLS foray in Alberta and British Columbia. He had guided the bus driver to the nearest tree and was instructing him in the identification of corticolous lichens!

Later I visited my son, a graduate student at the University of Wisconsin, and stopped in to see Dr. Thomson. As a shy beginner in lichenology I did not risk bringing any of my many problems with me. What a mistake! He greeted me, "What, you didn't bring anything for me to look at?" Needless to say, on future visits I brought my puzzles along. And I became bold enough to mail even more specimens. He was always gracious and helpful.

Thanks, Dr. Thomson.

--- Claire Schmitt

Table 2. Caliciales found as corticolous (C) or lignicolous (L) epiphytes at Adirondack Mountain Reserve, Ampersand Mountain, and Forked Lake Forest Preserve. Host trees studied are *Acer saccharum* (As), *Acer rubrum* (Ar), *Betula alleghaniensis* (Ba), *Fagus grandifolia* (Fg), *Fraxinus americana* (Fa), *Prunus serotina* (Pse), *Tsuga canadensis* (Tc), *Thuja occidentalis* (To), *Picea rubens* (Pr), *Pinus strobus* (Pst), *Abies balsamea* (Ab), and unidentifiable lignicolous substrates (US). The lichen species are indicated by the numbers from Table 1.

	Adirondack Mountain Reserve							Ampersand Mountain					Forked Lake Forest Preserve								
	As	Ba	Fa	To	Fg	Tc	Pr	As	Tc	Ba	Fg	US	As	Ar	Ba	US	Ab	To	Pse	Pst	Tc	Pr
1						C																
2														L		L						
3																L		L				
4		C				C			C						C				C			
5									C	C		L			C			L	C		C	
6	C				C			C							C							
7	C																					
8	CL	C			L				L						CL	L	L		C			
9															C[1]							

	As	Ba	Fa	To	Fg	Tc	Pr	As	Tc	Ba	Fg	US	As	Ar	Ba	US	Ab	To	Pse	Pst	Tc	Pr
10					CL								L	L	L	L						
11		L				C	C		C												C	C
12	L				L										L	L	L					
13	C[1]	C[1]	C[1]	C[1]				C[1]							C[1]							
14		C						C														
15															C							
16		C																				
17					L	L	CL	C	L					L	C	L	L		L		C	
18		C[2]									C[2]											
19																		C[4]		C[4]		
20		C[3]												C[3]								
21																	C					

[1] Growing over *Arthonia byssacea*
[2] Growing on polypore *Hirschioporus pergamenus*
[3] Growing over *Pertusaria macounii*
[4] Growing over *Lecanora* sp.

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