

INFLUENCE OF LICHEN SPECIES ON COLONIZATION OF

FAGUS GRANDIFOLIA BY CRYPTOCOCCUS FAGISUGA:

PRELIMINARY OBSERVATIONS FROM CERTAIN NOVA SCOTIAN FORESTS¹

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Abstract.--Some crustose lichens that colonize the stems of beech trees favor infestation by C. fagisuga, while others do not favor infestation. A predominance of species unsuited for infestation appears to be a reason why trees growing on some sites in Nova Scotia are remarkably free of beech bark disease.

INTRODUCTION

Bark epiphytes, especially mosses and foliose lichens, are known to provide habitats that favor the establishment of Cryptococcus fagisuga in North America (Ehrlich 1934). Houston et al. (1979) suggested that young European beech trees in southern England may be rendered prematurely susceptible by dense coatings of the common crustose lichen, Lecanora conizoides. In 1981, we observed that beech trees growing on several steep south-facing slopes in Nova Scotia were nearly free of both C. fagisuga and the severe stem defects associated with beech bark disease usually abundant in that region. Bark surfaces of these trees were heavily colonized by a number of light-colored, densely compacted crustose lichens. In 1982, a study was conducted to determine if the absence or presence of C. fagisuga was influenced by specific lichens.

METHODS AND MATERIALS

Bolts cut from lichen-colonized trees, growing on steep slopes near Marble Mountain, Cape Breton Island, and on North Mountain near Bridgetown, Nova Scotia,³ were used for lichen identification. A field key was developed for the species present.⁴

In August 1982, 49 scale-infested trees growing on a steep, south-facing slope near Bridgetown, N.S., were sampled. The bark of each tree was examined from ground line to a height of 1.8 m. Whenever C. fagisuga was detected, the following information was recorded: associated lichen species, thallus size (LxW), height aboveground, aspect of the lichen thallus, and the number of C. fagisuga colonies present in the lichen thallus.

RESULTS

Trees growing on the study site were very heavily colonized by lichens. Often, no uncolonized bark could be found on the stem sections surveyed (Figs. 1 and 2). The lichens formed intricate mosaics of individual colonies separated by dark lines. Of the nine species most often encountered on these trees, only two were never infested by C. fagisuga (Table 1). But great differences existed in the degree to which the other species were infested.

Trypethelium virens infested by C. fagisuga occurred on 80% of the trees, yet this dominant lichen was only lightly

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³Samples were obtained by personnel of the Canadian Forestry Service, Truro, N.S.

⁴Lichens were identified and a key was developed by Dr. Mason Hale, Smithsonian Institute, Washington, D.C.

infested (5.2 insects/thallus, and .05 insects/cm² of lichen area). T. virens seemed to be infested only when the centers of old colonies fractured and provided refuges for the insect. By contrast, infested colonies of Buellia stillingiana occurred on about half as many trees (43%) but were much more heavily colonized (2.9 insects/thallus and 0.9 insects/cm² of lichen surface). Bacidia spp. were next in dominance, and differences occurred between the two Bacidia species. The granular-surface species of small size was much more favorable for infestation than the smooth-surface species both in numbers of trees with infested colonies and in numbers of insects/cm². An as yet unidentified foliose species rarely encountered in this survey also harbored C. fagisuga.

One colony each of Pyrenula laevigata and Graphis scripta was found with C. fagisuga. P. laevigata was encountered rarely, but G. scripta was present on every tree and was especially dominant near the base of the tree. The one infested thallus of G. scripta was on a roughened area of a buttress root.

Table 1.--Association of Cryptinecoccus fagisuga and lichen species, on the lower 1.8 m of 45 beech trees, Bridgetown, N.S. 1961.

Species	Trees with scale-infested lichen colonies	Lichen colonies	Average lichen colony size	Av. scales per lichen colony	Av. scales per cm ² lichen colony
	Percent	No.	cm ²	No.	No.
<u>Trypethelium virens</u>	80	161	110.4	5.2	0.05
<u>Buellia stillingiana</u>	43	39	3.1	2.9	.93
<u>Bacidia</u> spp. (granular surface)	31	40	5.5	4.2	.76
<u>Bacidia</u> spp. (smooth surface)	14	8	852.6	10.6	.01
<u>Foliose</u> sp. A/	8	11	10.3	3.5	.34
<u>Pyrenula laevigata</u>	2	1	825.0	5.0	.01
<u>Graphis scripta</u>	2	1	24.0	5.0	.21
<u>Ochrolechia pallescens</u>	0	0	0	0	0
<u>Lecanora subfusa</u>	0	0	0	0	0

A/ Unidentified.

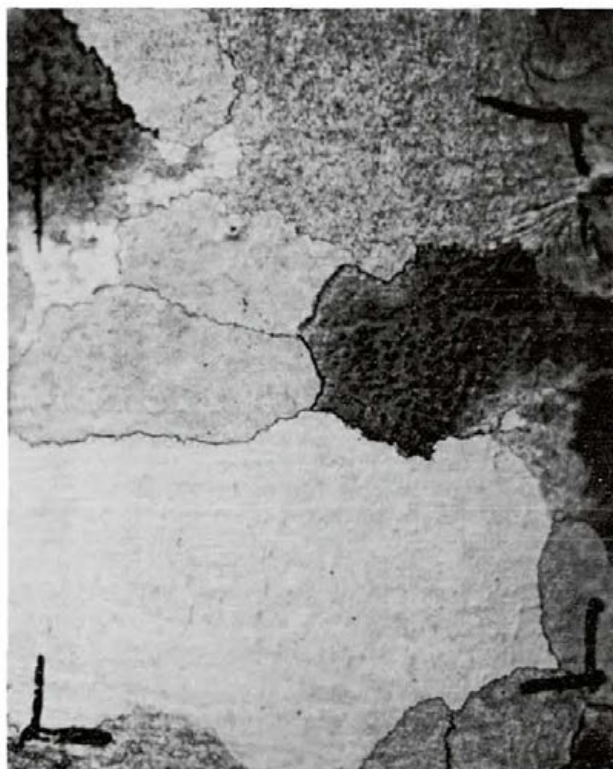


Figure 1.--Photo of a 10 cm x 10 cm area of beech bark colonized by lichens.

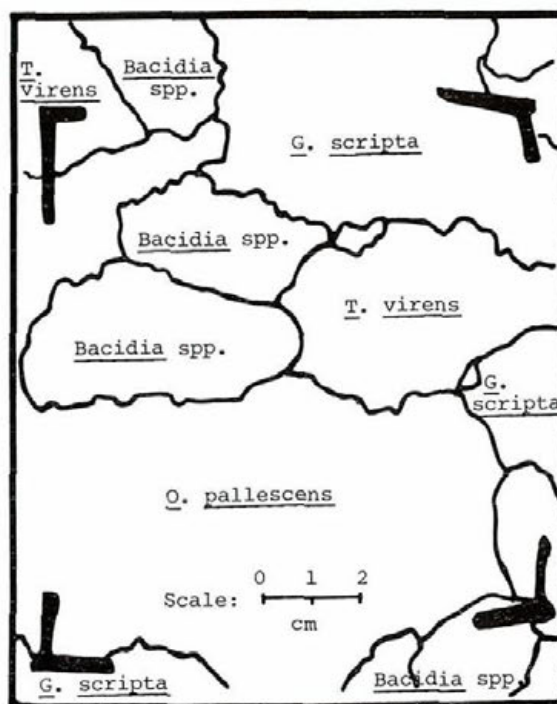


Figure 2.--Diagram of the area photographed in Figure 1 with lichen species identified.

Ochrolechia pallescens and Lecanora subfusca were never infested even though they were very common on these trees.

The 261 infested lichen colonies on the lower 1.8 m of 49 trees from Bridgetown, N.S., were distributed nearly equally from 20 cm to 140 cm aboveground:

Height aboveground (cm)									
1-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	
-----Percent-----									
0.4	12.9	16.0	14.9	14.5	14.5	14.9	6.5	5.3	

Above and below these heights, however, populations were lower. The virtual absence of insects from ground line to 20 cm (one infested colony) can be explained by the nearly total colonization of this region by lichens that are unfavorable for infestation, especially G. scripta.

Aspect also influenced the distribution of lichen species, and therefore of scale infestation (Fig. 3). Infested colonies of both B. stillingiana and Bacidia spp. occurred more frequently on the north sides of the trees, while slightly fewer infested colonies of T. virens occurred there.

DISCUSSION

Beech trees growing on certain sites in the aftermath forests of Nova Scotia differ markedly from those in nearby stands in that they support low populations of C. fagisuga and are nearly free of defect attributable to beech bark disease.

The nearly scale-free trees on these sites are remarkably well colonized by crustose lichen species, most of which are not readily infested by C. fagisuga. Conversely, lichen species that are readily infested by the insect occur in low numbers on trees on these sites. It may be that environmental conditions peculiar to these steep, south-facing slopes preferentially favor the early establishment and continued development of the less-hospitable lichens. The nearly complete colonization of lower stem and buttress root bark by less-hospitable lichens, especially G. scripta, may reflect the early establishment of these species on young trees. Future studies may reveal the site/environmental factors that enhance the spread and development of less-hospitable lichens. Such information would enable forest managers to predict where and under what conditions beech could be grown protected from beech bark disease by coatings of lichens.

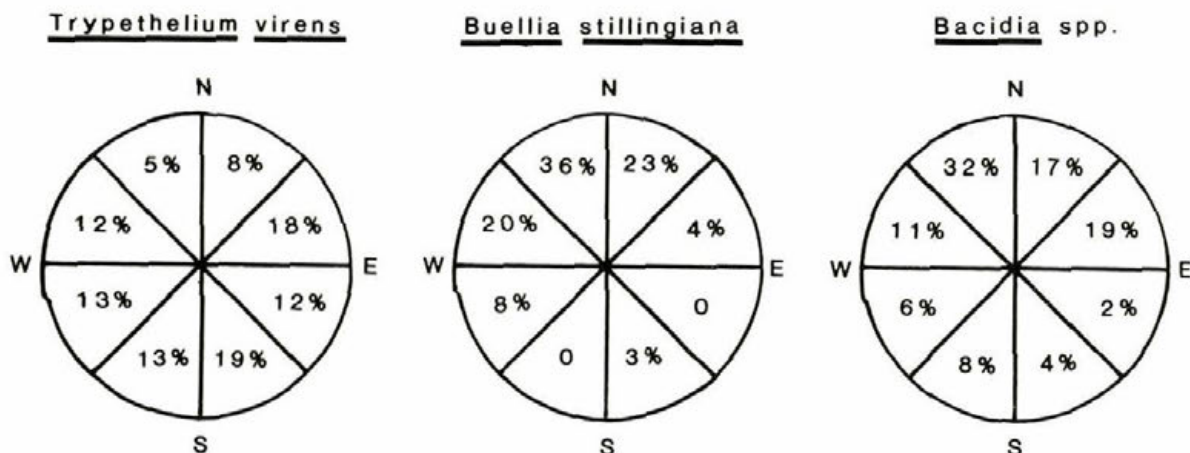


Figure 3.--Aspect distribution of the major lichens associated positively with beech scale (248 colonies) on the lower 1.8 m of 49 beech trees, Bridgetown, N.S., 1982.

Although it is not yet clear why some lichens are favorable and others unfavorable for infestation by C. fagisuga, it is probable that colony surface topography, thallus thickness, the relationship of the thallus to the bark substrate, and lichen chemistry, singly or in combination, are involved. Thalli of species that are unfavorable for infestation are thick, smooth surfaced and densely compacted and are epigenous (elevated above the bark surface). By contrast, thalli of species that are favorable for infestation tend to be thin, loosely compacted and rough or granular surfaced and are usually hypogynous--growing partly beneath the outer bark layers. Such surfaces would provide insects more protection from wash-off by stem flow, and would permit insects to settle nearer to the bark tissues they must probe.

SUMMARY

In the aftermath forests of Nova Scotia, certain mixed hardwood stands include beech trees remarkably free of C. fagisuga and defect. These trees are heavily colonized with crustose lichens, most of which are not infested by C. fagisuga. Uninfested species included O. pallescens, L. subfusca, P. laevigata, and G. scripta. Trypethelium virens, uninfested when young, became infested as it roughened and fractured with age. Bacidia spp. were infested often, and Buellia stillingiana, although occurring only as small colonies, was most frequently and heavily infested. A predominance of lichens unsuited for infestation by C. fagisuga may explain why trees on these sites are disease free.

RÉSUMÉ

Dans les forêts ravagées de la Nouvelle-Ecosse, certains peuplements feuillus mélangés incluent des hêtres complètement exempts de C. fagisuga et de défauts. Ces arbres sont abondamment colonisés par des lichens crustacés, dont la plupart ne sont pas infestés par le C. fagisuga. Les espèces non infestées incluent O. pallescens, L. subfusca, P. laevigata, et G. scripta. Le Trypethelium virens, non infesté lorsque jeune, devient infesté lorsque devenant rugueux et fissuré en vieillissant. Les Bacidia spp. étaient souvent infestés et le Buellia stillingiana, bien que rencontré en petites colonies seulement, était le plus fréquemment et le plus sévèrement infesté. Une prédominance de lichens inappropriés aux infestations du C. fagisuga peut expliquer pourquoi les arbres sur ces sites sont exempts de la maladie.

ZUSAMMENFASSUNG

In den Wäldern Neuschottlands, in denen die Buchen-Rindennekrose aufgetreten war ("aftermath forests") fallen in manchen Laubholz-Mischbeständen Buchen auf, die bemerkenswerterweise keinen Lausbefall aufweisen und frei von Schäden sind. Diese Bäume sind stark von Krustenflechten besiedelt, von denen die meisten keinen Besatz mit C. fagisuga aufweisen. Zu diesen gehören O. pallescens, L. subfusca, P. laevigata und G. scripta. Trypethelium virens war in der Jugend frei von Läusen, wurde aber im Alter, wenn sie rauher und rissiger wird, besiedelt. Bacidia spp. war oft mit Läusen besetzt und Buellia stillingiana war, obwohl sie nur in kleinen Kolonien vorkommt, am häufigsten und am stärksten besiedelt. Das Vorherrschen von Flechten, die für die Besiedlung durch C. fagisuga nicht geeignet sind, könnte erklären, daß diese Bäume von der Krankheit verschont blieben.

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