

# North American Fungi



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## ***Calicium denigratum* (Vain.) Tibell, a new lichen record for North America**

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**Abstract:** *Calicium denigratum* was previously known from Europe and Siberia. It is reported here for the first time in North America from open canopy woodlands in northeastern Ontario and northeastern New Brunswick. Distinctions between the two species that are most similar, *C. abietinum* and *C. glaucellum*, are also presented.

**Key words:** *Calicium denigratum*, *Calicium abietinum*, *Calicium glaucellum*, North America.

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**Introduction and Methods:** *Calicium denigratum* (Vain.) Tibell (syn. *Calicium curtum* var. *denigratum* Vain.) was first moved to the species level by Tibell (1976). This uncommon lichen occurs in open canopy woodlands in Europe and Siberia (Tibell 1999). It is reported here for the first time in North America.

Images of the ascomata were captured using a Hirox KH 7700 digital microscope. Images of the spores were captured using a FEI Inspect S50 scanning electron microscopy equipped with a tungsten filament. Specimens were prepared for the scanning electron microscope using a stereomicroscope to remove ascomata and place them onto an aluminum stub using double sided carbon tape. The stubs were placed in a Cressington AutoSE sputter coater equipped with a gold target. A thin film of gold (~ 20 nm) was deposited onto each stub before imaging.

**Results and Discussion:** *Calicium denigratum* was discovered at three localities in the Cochrane District of northeastern Ontario where it was growing on lignum in open boreal woodlands. This district is within the Hudson Bay Lowlands and the northern clay belt. The region is characterised by clay soils, poor drainage, flat topography, and *Picea mariana* is the dominant tree type (Rowe 1972). In all three localities the tree cover was dominated by *Picea mariana* and *Pinus banksiana* and the ground cover was dominated by species of *Cladonia* subgenus *Cladina*. The soil at these sites is sandy to sandy-loam, which is uncommon in the region. Thirty-four ecologically similar localities (forest stands) were examined for *C. denigratum* in northeastern Ontario, but it was only located at three of the stands.

The three forest stands in Ontario in which *C. denigratum* was found were aged using forest resource inventory maps provided by the Ontario Ministry of Natural Resources and AbitibiBowater (now Resolute Forest Products), then ground truthed for accuracy. The first stand

was 101-140 yrs old, the canopy closure was 44%, the live tree stem density was 320 stems/ha, the snag stem density was 69 stems/hectare, and the tree composition was *Picea mariana* 68% and *Pinus banksiana* 32%. The second stand was 40-50 years old, the canopy closure was 60%, the live tree stem density was 913 stems/ha, the snag stem density was 31 stems/ha, and the tree composition was *Picea mariana* 72%, *Pinus banksiana* 27% and *Abies balsamea* 1%. The third stand was 51-60 years old, the canopy closure was 70%, the live tree stem density was 465 stems/ha, the snag stem density was 7 stems/ha, and the tree composition was *Picea mariana* 65% and *Pinus banksiana* 35%. All specimens were collected from the hard wood of standing conifer snags that had lost their bark. It is uncertain if these snags were *Picea mariana* or *Pinus banksiana*. Detailed descriptions of the stands and methodologies used to collect the structural data for each stand are presented by McMullin (2011).

In northeastern New Brunswick, *C. denigratum* was discovered at one locality in the Jacquet River Gorge Protected Natural Area. It was lignicolous on *Pinus strobus* in a mesic to wet forest dominated by *Picea mariana*, with scattered *Abies balsamea*, *Acer rubrum*, *Thuja occidentalis*, and large *Pinus strobus*. The ground cover was variably dominated by *Pleurozium* spp. and *Sphagnum* spp.

**SPECIMENS EXAMINED. CANADA.** ONTARIO: Raven Township, Iroquois Falls Forest, Cochrane District, 49° 12 N, 80°33 W, lignicolous in a mature open canopy boreal forest (*Picea mariana* 68%, *Pinus banksiana* 32%), 14 July 2008, McMullin 7555 (OAC); Stimson Township, Iroquois Falls Forest, Cochrane District, 49° 01 N, 80°24 W, lignicolous in a mature open canopy boreal forest (*Picea mariana* 65%, *Pinus banksiana* 35%), 10 August 2008, McMullin 7556 and 7559 (OAC); Freele Township, Iroquois Falls Forest, Cochrane District, 49° 08 N, 80°33 W, lignicolous in a

mature open canopy boreal forest (*Picea mariana* 72%, *Pinus banksiana* 27%, *Abies balsamea* 1%), 5 Aug 2008, McMullin 7557 and 7558 (OAC). NEW BRUNSWICK: Gloucester County, Jacquet River Gorge Protected Natural Area, near Big Meadow, 47° 46 N, 65° 54 W, lignicolous on *Pinus strobus*, August 15, 2010, Selva 10740B (UMFK). SWEDEN.

NORRBOTTEN: Korpilombolo, 15 km SSE of Kainulasjärvi, Vinsanlehti, along Kurkijoki, in a mixed *Pinus sylvestris*-*Picea abies*-*Betula* forest, 66° 52 N, 22° 34 E, lignicolous on *Pinus* sp. snag, 15 Jul 1977, Tibell 6813 (ASU).

*Calicium denigratum* and *C. glaucellum* are similar in appearance to *C. denigratum*. *Calicium denigratum* is characterised by taller and thinner ascomata (0.7-1.3 mm tall) that are shiny black, lack pruina, and have a bell shaped capitulum (Tibell 1999)(Figure 1). The most reliable feature to distinguish these species, however, is the coarsely cracked surface of the spores of *C. denigratum* (Figure 2). *Calicium abietinum* is the most similar in appearance, but it is typically shorter (0.6-0.9 mm tall), lacks a bell shaped capitulum, and the surface of its spores are minutely warted instead of coarsely cracked (Figures 1 & 2). *Calicium glaucellum* usually has white pruina on the capitulum, it is typically shorter (0.5-0.9 mm tall), lacks a bell shaped capitulum, and its spores, though also coarsely cracked, have ridges (Figure 1). Spore surfaces can be seen with a compound microscope with a 1000x lens, but often with difficulty. A scanning electron microscope, however, produces clear images of spore surfaces.

Stands that are ecologically similar to those where *C. denigratum* was located occur throughout the boreal forest in North America. It is, therefore, likely that this species inhabits other boreal regions on the continent. However, its low frequency of occurrence in the 34 ecologically similar stands investigated in northeastern

Ontario within a relatively small region suggests that *C. denigratum* is an uncommon species even in the areas that it occurs. Similarly, many localities in northern NB were investigated and *C. denigratum* was only found in one. Our findings suggest *C. denigratum* is a rare species in North America, which perhaps explains why it was not discovered before now.

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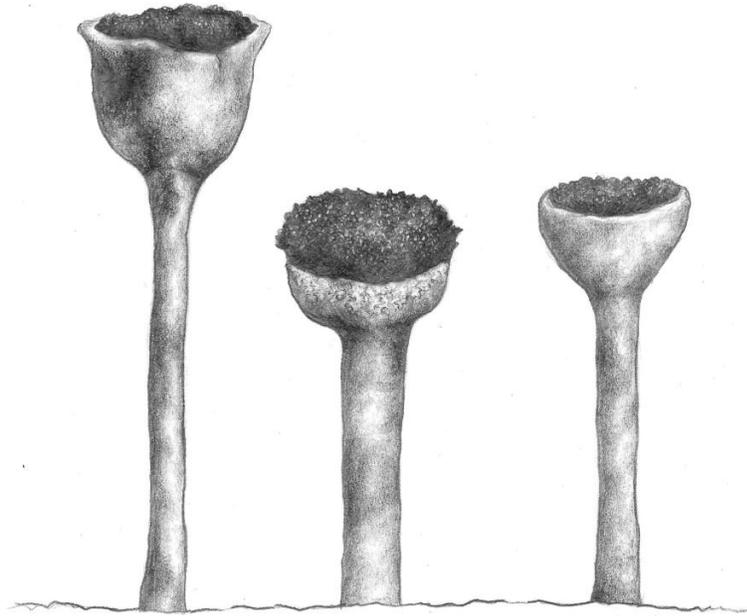


Figure 1. A comparison of mean ascomata size and shape. Left - *Calicium denigratum* (ascomata black, 0.7-1.3 mm tall, 0.06-0.09 mm wide at the center of the stalk, lacking pruina, and with a distinct bell shaped capitulum), middle - *C. glaucellum* (ascomata black, 0.5-0.9 mm tall, 0.1-0.2 mm wide at the center of the stalk, with white pruina on the capitulum, and the capitulum is obovoid to lenticular), right - *C. abietinum* (ascomata black to dark brown, 0.6-0.9 mm tall, 0.08-0.13 mm wide at the center of the stalk, without pruina, and the capitulum is lenticular - occasionally slightly bell shaped).

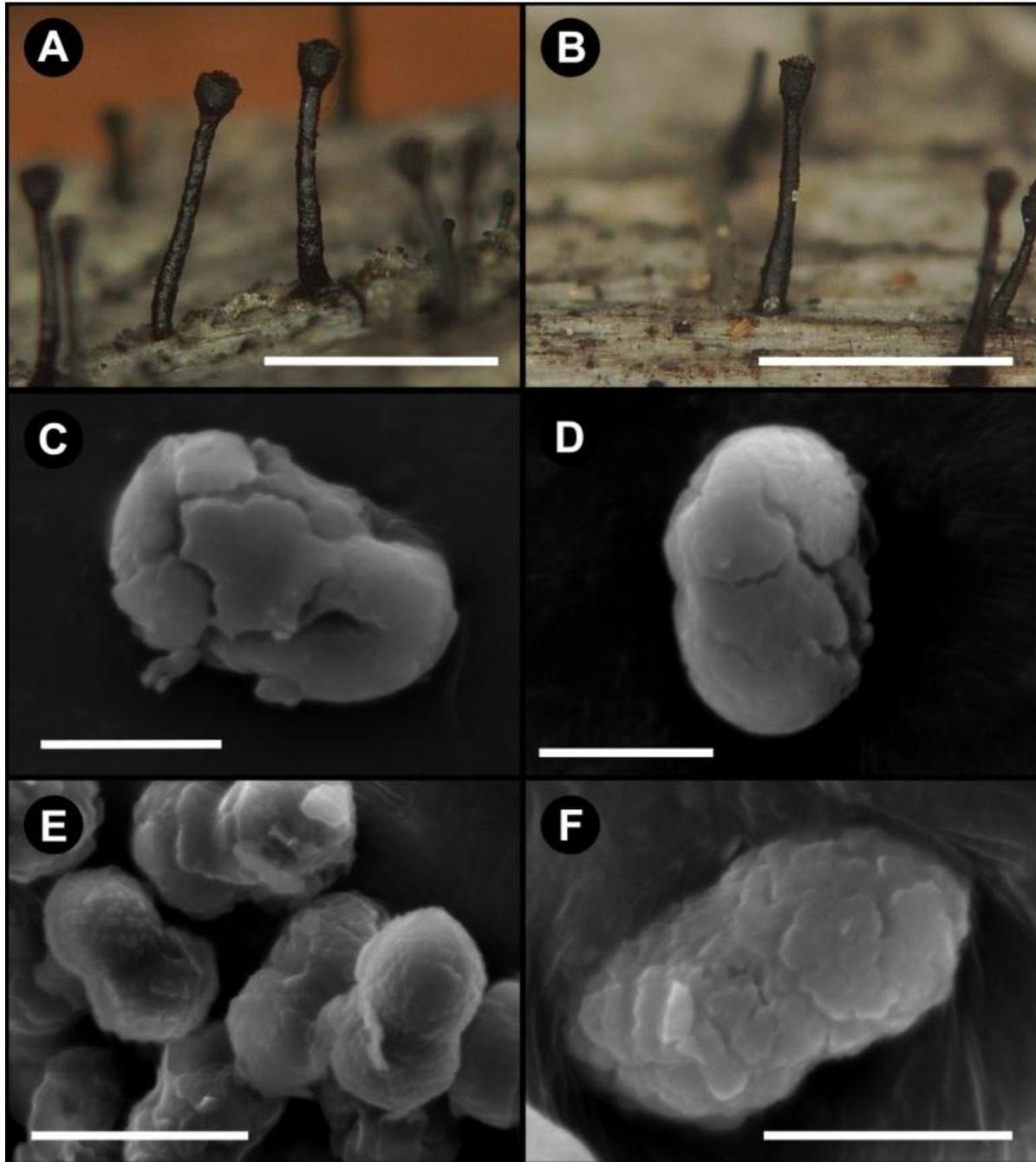


Figure 2. A-D: *Calicium denigratum*. A-B: Ascomata with a bell shaped capitulum, scale = 1 mm, McMullin 7558 (OAC). C-D: Spores with coarsely cracked surfaces, scale = 5  $\mu$ m. C: Selva 10740B (UMFK). D: McMullin 7558 (OAC). E-F *Calicium abietinum*, spores with a minutely warted surface, McMullin 7538 (OAC). E: scale = 10  $\mu$ m. F: scale = 5  $\mu$ m.