

## ***Chaenothecopsis oregana* New to Canada**

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## *Chaenothecopsis oregana* new to Canada

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**Abstract.** During field surveys in the Lower Foothills region of Lesser Slave Lake, Alberta, we collected the first Canadian record of the resinicolous calicioid fungus *Chaenothecopsis oregana* Rikkinen. The specimen was collected from balsam fir (*Abies balsamifera*) resin and resin-impregnated wood in an old growth forest. We present the first scanning electron micrographs of this species. As currently documented, the species has a disjunct distribution (Europe and western North America), but it was hypothesized to be circumboreal, at least historically. As this was the sole resinicolous specimen found during 20 hours of searching by four lichenologists, it is clear more field surveys are required to document the range of calicioid species. Finally, based on public engagement through social media and a public lecture, with the purpose of arousing interest in these overlooked species, we propose the common name “Resin Whiskers” for this species.

**Keywords.** Alberta, calicioid fungi, *Chaenothecopsis*, old growth forest, range extension.

### INTRODUCTION

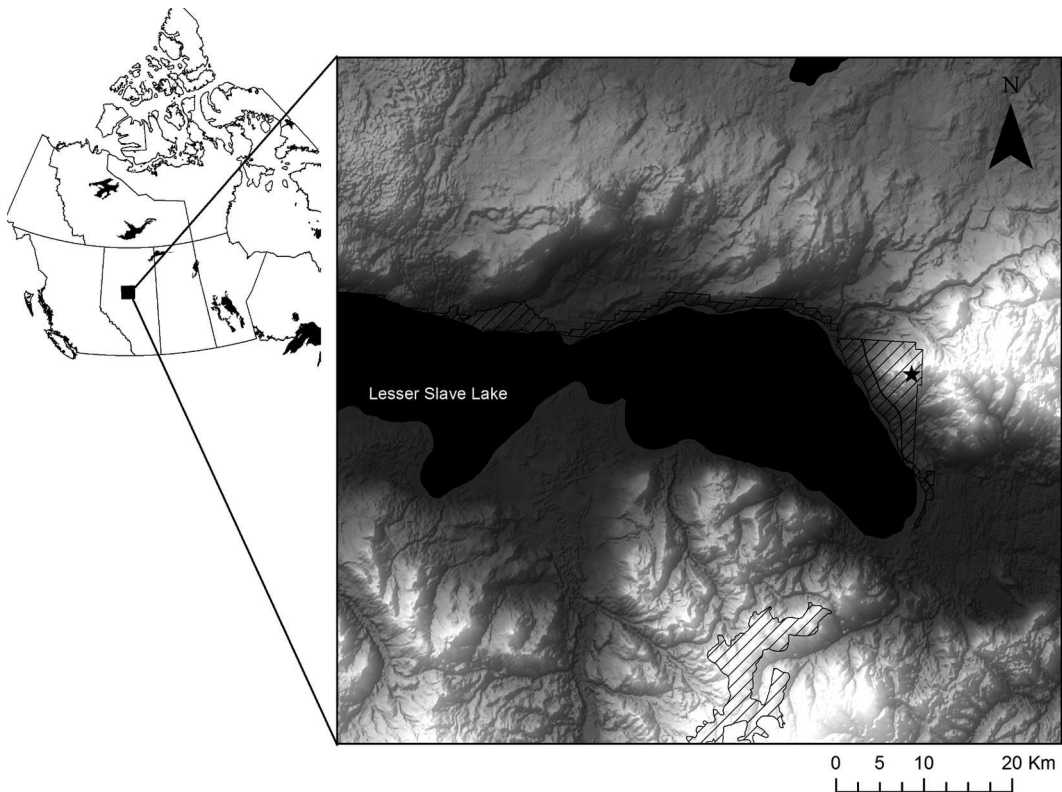
Calicioid lichens and fungi are under-detected in North American forests (Selva 2013). For example, recent collections by the Alberta Biodiversity Monitoring Institute, the authors and their colleagues, as well as collections by Patrick Williston, increased the known calicioid flora in Alberta from 23 species in 2012 (Government of Alberta 2012) to 44 species today (Haughland 2016, unpublished data). To further address this deficit regionally, calicioid expert Steve Selva was invited to Alberta, Canada to provide training on identification and field collection methods. Due in part to collections made by Patrick Williston, we focused our field work in central Alberta, where we hypothesized there was a high diversity of previously-undetected calicioid lichens and fungi. During this field trip the first Canadian record of the resinicolous *Chaenothecopsis oregana* Rikkinen was found in the Lower Foothills region of Slave Lake, near the Marten Mountain Viewpoint day use area, Alberta, Canada (Fig. 1). In this article we describe the geographic region in more detail, put this occurrence into context given the known species range as well as recent nomenclatural changes, and provide the first scanning electron micrographs for the species.

### METHODS

As part of a larger collecting trip focused on calicioid lichen and fungi, on May 31, 2013, four lichenologists spent five hours searching and probing resin on coniferous trees along approximately 1 km of trail. We collected sections of substrate supporting multiple apothecia for all calicioid lichenized and non-lichenized colonies found and stored them in temporary herbarium packets for identification in the laboratory. Once in the lab, both intact and longitudinally sectioned specimens were placed on an aluminum stub and sputter-coated with gold. Samples were imaged in the University of Alberta’s Earth and Atmospheric Sciences scanning electron microscope (SEM; Japan Electronics Optics Ltd., model 6301fXV). Light microphotographs were taken with a Leica DFC 500 camera through a Leica M165 dissecting scope or a Leica DM750 compound scope. Ascomata were squashed and mounted in water and examined before and after the addition of Lugol’s iodine (IKI) under oil immersion with a 100x objective. Microphotographs were taken at multiple depths and stacked in Photoshop.

## RESULTS

A single colony of *Chaenothecopsis oregana* was discovered approximately 1.5 m up the trunk of a mature balsam fir (*Abies balsamea*) in a closed-canopy old growth forest, at an elevation of 1,011 m (Fig. 1; specimen *Haughland 2013-10*). There were no co-occurring lichens or bryophytes. The forest consisted mostly of white spruce (*Picea glauca*), balsam fir and cottonwood (*Populus balsamifera*), and recently had sustained extensive wind damage. We made a single collection of *C. oregana*, including apothecia growing on resin and on resin-impregnated wood.



**Figure 1.** Locality of *Chaenothecopsis oregana* collection from Alberta, Canada. ★ marks the collection site. Provincial parks and protected areas are indicated with hatchmarks; water is coloured black.

Stalk height ( $0.7 \pm 0.14$  mm,  $n=16$ ), ascospore width ( $3.2 \pm 0.6$   $\mu\text{m}$ ,  $n=15$ ) and ascospore length ( $5.8 \pm 0.6$   $\mu\text{m}$ ,  $n=15$ ) corresponded to the dimensions provided by Tuovila et al. (2011). Stalks were typically shiny, and simple to less commonly multibranched (Fig. 2A, B, D). The capitula ranged from black to reddish-brown and were non-mazaediate and epruinose. Asci were simple with uniseriate spore arrangement, and were born on croziers. Narrow canals were observed penetrating the tips of some asci, and the paraphyses were septate. Spores were non-septate, and ellipsoid to oblong (Fig. 2C, F, G). The spore wall appeared smooth to minutely roughened under the light microscope (Fig. 2C) and minutely roughened in the SEMs (Fig. 2F). Minute hyphal projections were observed arising from the stalk just below the capitulum of one apothecium examined via SEM (Fig. 2E); the origin or possible function of these hyphae is unclear.

In squash mount the stalks and excipula exhibited the zebra-stripe pattern described by Tuovila et al. (2011, Fig. 2H, I) due to the thick, darkly pigmented cell walls, and the stalk and some portions of the hymenium reacted K+ reddish (Fig. 2H, I); portions of the hymenium remained yellow-brown. This intra-hymenial variation was observed across multiple apothecia. On a wet squash mount under a cover slip after pre-treatment with K the apothecia were IKI-. When IKI was flooded over the same apothecia after the cover slips were removed in order to partially dry the squashes, the stalks and excipula reacted IKI+ red, and the lower hymenium reacted IKI+ blue (Fig. 2J).

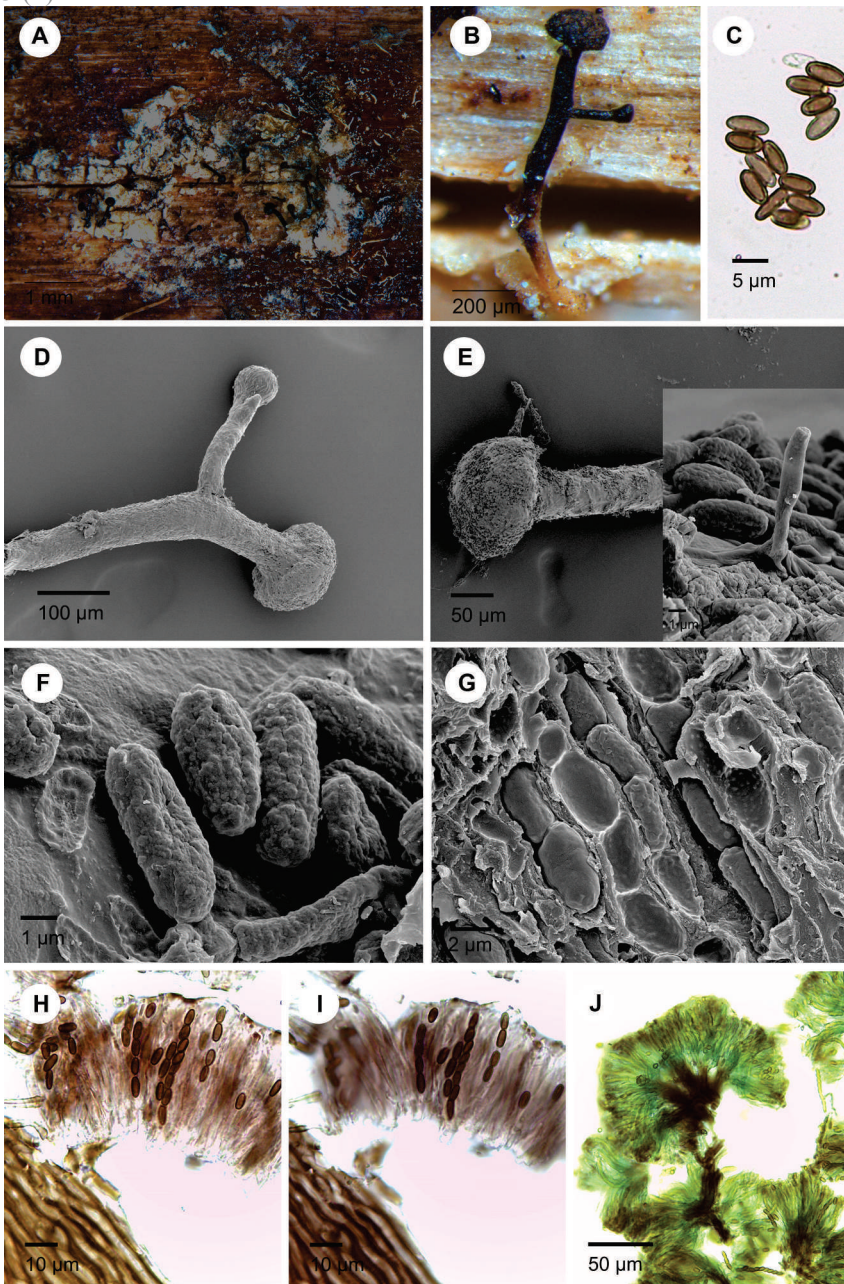
## DISCUSSION

*Chaenothecopsis oregana* was first described by Rikkinen (2003b) as a resinicolous species on *Abies* and *Tsuga* in the mature forests of Oregon (Rikkinen 2003a). After re-examination of the type material, Tuovila et al. (2011) determined that there were two distinct species present. As the holotype of *C. oregana* did not contain apothecia corresponding to its original description, Tuovila et al. (2011) discarded the epithet *oregana* and described two new species from the type material, *Chaenothecopsis zebrina* Rikkinen & Tuovila and *Chaenothecopsis diabolica* Rikkinen & Tuovila. Given the availability of paratypes, however, Tuovila et al. learned that the original epithet *oregana* should not have been discarded; a lectotype was designated, the original epithet reinstated and *C. zebrina* was reduced to a synonym of *C. oregana* (Tuovila et al. 2012). The second species in the original type material of *C. oregana*, *Chaenothecopsis diabolica* Rikkinen & Tuovila, has larger spores that often have a roughened coat, whereas our material corresponds with the description of *C. oregana* in Tuovila et al. (2011) as *C. zebrina* (nom. illeg.).

The known distribution of *C. oregana* until now encompassed Oregon, Spain, Sweden and Switzerland (Fig. 3). Previous authors have speculated that the species could be widely distributed in western North America (Rikkinen 2003b), and perhaps was even circumboreal historically (Tuovila et al. 2011). Our specimen brings us another data point closer to evaluating these hypotheses.

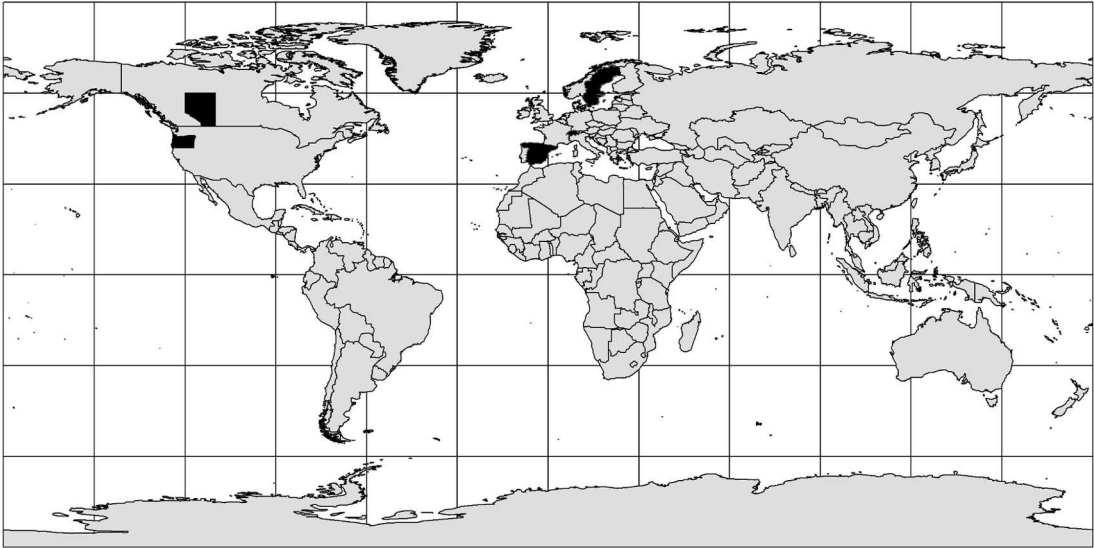
In addition to its importance in housing this population, the Lesser Slave Lake region is lichen-rich and deserving of further exploration. The region is a juxtaposition of multiple natural subregions, and includes provincially-protected areas of old-growth forest such as Lesser Slave Lake Provincial Park, Lesser Slave Lake Wildland and Grizzly Ridge Wildland. The disjunct eastern limit of the Lower Foothills natural subregion is found east of the lake, where elevation ranges from 578 m at the town site and lake shore to over 1,000 m at the Marten Mountain Viewpoint and trailhead. Temperatures are intermediate between those found in the mountain natural regions and the boreal (Natural Regions Committee 2006), and it's likely the frequent lake effect fog positively influences the lichen diversity of the area. There is a diversity of forest types, ranging from *Picea mariana*/*Larix laricina*-dominated bogs, to *Pinus banksiana* lichen woodlands to mixedwood forests such as those where we collected this species.

This area also is undergoing a large amount of anthropogenic development from diverse industries such as forestry and oil and gas extraction (Alberta Biodiversity Monitoring Institute 2015), as well as experiencing large-scale natural disturbances such as the high-intensity wild fires of 2011 (Municipal District of Lesser Slave River 2015). Loss of old-growth and microhabitat-rich forest is detrimental to many calicioid lichens and fungi (e.g., Holien 1996), but the general public largely is unaware of the existence of these species, much less their depletion. As part of a larger effort to arouse public interest in the lichen flora of Alberta, we used social media in conjunction with a public lecture to ask attendees and Facebook® followers of the Royal Alberta Museum to vote for a common name for *C. oregana*. Common names can incite the



**Figure 2.** *Chaenothecopsis oregana* Rikinnen specimen Haughland 2013-10. **A.** On *Abies balsamea* wood and resin. **B.** Branched stalk. **C.** Spores in water. **D.** SEM of branched stalk. **E.** SEM of simple apothecium with minute hyphal projections arising below the capitulum, and inset illustrating origin of hyphae is likely the stalk. **F.** SEM of spores with textured walls. **G.** Cross-section of apothecium showing impressions of spores in asci as well as ascospores with minutely textured spore walls. **H.** Mid-section of stalk and part of hymenium in water. **I.** Same section as illustrated in H after treatment with K. **J.** Hymenium and base of exciple after treatment with K then IKI. During image processing, image colour was not altered, but images A, B are photostacked composite images, and all images were sharpened.

imagination and typically are more memorable to the general public than scientific nomenclature. Of the three options we presented (Resin Whiskers, Sticky Stubble, and Oregon Five O'Clock Shadow), Resin Whiskers was the most popular, winning 40% of the 68 votes cast. While fungi do not currently have a formal method of proposing common names, here we propose the use of Resin Whiskers as a common name for *C. oregana*.



**Figure 3.** Known global distribution of *Chaenothecopsis oregana*. Places where populations have been recorded are coloured black. Collections from outside of North America are from *C. zebrina* specimens (nom. illeg.) cited in Tuovila et al. 2011.

### ACKNOWLEDGEMENTS

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