

The Lichens and Lichenicolous Fungi of Haida Gwaii, British Columbia, Canada. 6. A New Species of *Buellia* with Four-celled, *Callispora*-type Ascospores

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ABSTRACT. – A new species of crustose lichen belonging to the “*Hafellia*” group of the genus *Buellia*, i.e., having *Callispora*-type ascospores with uneven lateral wall thickening, was discovered growing on lignum on a beach on Haida Gwaii, British Columbia. It resembles and is related to *B. fosteri* but has longer, predominantly 4-celled ascospores and a hymenium that is not interspersed with oil. It is described and illustrated here as *B. gibstoneorum*. It is compared with *B. fosteri* and some other species with *Callispora*-type ascospores. The new combination *Buellia bispora* is made for *Hafellia bispora*.

KEYWORDS. – Coastal lichens, *Hafellia*, Pacific Northwest, *Buellia gibstoneorum*.

INTRODUCTION

The lichen biota of Haida Gwaii (Queen Charlotte Islands), British Columbia, is well known for its diversity and abundance (Brodo 1995). Since the first author took up a study of its lichens in 1967, 574 species of lichens and lichenicolous fungi have been documented on the archipelago (Brodo, unpublished data), including 24 new species described from Haida Gwaii material (e.g., Brodo 2004, 2010; Brodo & Hertel 1987; Brodo & Ahti 1996; Brodo & Santesson 1997). More than 30 additional taxa are known to be distinct, but are either undescribed or yet to be determined (Brodo, unpublished data).

Among the novelties discovered during the first year of field work was a puzzling crustose lichen growing on wood at the edge of a beach near the village of Tlell on the eastern shore of Graham Island. It resembles *Buellia fosteri* (Imshaug & Sheard) Perlmutter & Rivas Plata (\equiv *Hafellia fosteri* Imshaug & Sheard), which, in fact, was found growing in a similar habitat on the north shore of Graham Island at Tow Hill (Brodo 9896, CANL!), but differs in several significant characteristics. Related species classified in the genus have been revised (Sheard 1992), and it therefore seemed clear that our lichen was an undescribed species. In the 53 years since the specimen’s collection and 28 years since its reevaluation by both authors, no name has been found for it, even though some detailed and thorough floristic studies have appeared over that period covering the crustose lichens of the Pacific Northwest (e.g., Noble 1982; Spribille et al. 2010, 2020; McCune 2017a, b). We therefore describe it as new here, despite its being known from only a single specimen. Since *Hafellia* is a synonym of *Buellia* based on the latter’s typification (see discussion in Perlmutter and Rivas Plata 2018), the new species is placed in *Buellia*.

MATERIALS AND METHODS

This study is based on material collected by the first author on Haida Gwaii in 1967 and specimens deposited at the Canadian Museum of Nature (CANL) and Oregon State University (OSU). Specimens were examined with compound and stereo dissecting microscopes at the Canadian Museum of Nature and University of Saskatchewan using standard microscopic techniques (Brodo et al. 2001). Ascospores were examined at 1250X to reveal wall ornamentation and were measured in both water

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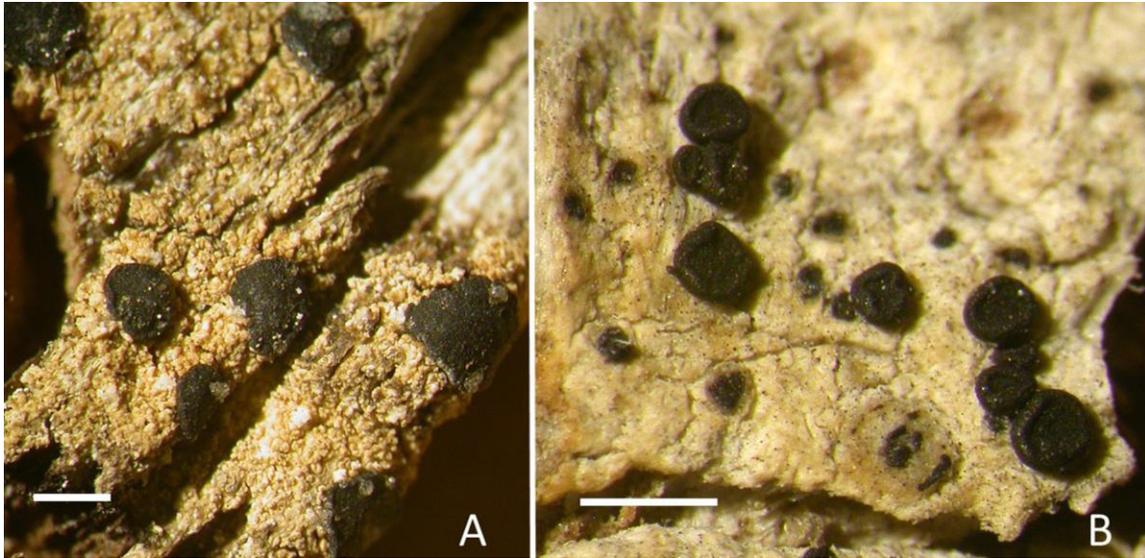


Figure 1. Comparison of habit between *Buellia fosteri* and the new species. **A**, *B. fosteri* (Crane & Noble 5335a) with well-developed epixylic thallus with granules. **B**, *B. gibstoneorum* (holotype) with plane endoxylic thallus. Scales = 1 mm.

mounts and preserved in permanent preparations. Ascospore measurements are presented as percentiles, (5–)25–75(–95), with gross outliers thereby being excluded. Spot tests with K, C, KC and PD were performed as described in Brodo et al. (2001). Thin layer chromatography was used to check the chemical products in the thallus and apothecia using solvents A, B' and C, as described by Orange et al. (2010).

TAXONOMIC RESULTS

***Buellia gibstoneorum* Brodo and Sheard sp. nov.**

Mycobank #837451.

FIGURES 1B, 2 AND 3C-D.

A crustose lichen with brown, mostly four-celled ascospores of the *Callispora*-type, 8/ascus. Similar to *Buellia fosteri*, but with longer ascospores, (26–)29–34(–36) × (11–)12–14(–15) μm, median l/w ratio 2.4 (vs. 2.0 in *B. fosteri*), and with a largely non-inspersed hymenium (vs. heavily inspersed with oil in *B. fosteri*). Growing on exposed lignum near the sea along the Pacific Northwest coast.

TYPE. CANADA. BRITISH COLUMBIA: Queen Charlotte Islands [Haida Gwaii], Graham Island, Tlell, along W shore of Tlell River inlet, 53°36'N 131°56'W, behind fore-dune, 17.vi.1967, on fence post, *I.M. Brodo 10010* & *M.J. Shechpanek* (CANL!, holotype).

DESCRIPTION. – Thallus persistently endoxylic, containing some POL+ granules, light grey to cream colored. Apothecia sessile, frequent, contiguous or not, 0.4–0.7 mm in diam.; disc black, persistently plane; margin concolorous with disc, entire, prominent and persistent, ca. 0.10 mm wide (Fig. 1B). Proper exciple ca. 80 μm wide laterally, inner 20 μm, more lightly pigmented, not inspersed with granules (POL–), expanded to ca. 130 μm below, darkly pigmented throughout, continuous below hypothecium where it merges with a dark stipe, peripheral cells ca. 7.5 μm wide (Fig. 2A). Hypothecium light brown, ca. 80 μm deep. Hymenium 95–110 μm high, not inspersed to very lightly inspersed with oil drops; paraphyses ca. 2.0 μm wide, apices darkly pigmented, 6.5–7.5 μm wide, forming a very dark epihymenium (Fig. 2B). Asci ca. 90 × 27 μm, with a darkly stained lining of the axial body in K/I (*Bacidia*- or *Lecidella*-type); ascospores 8/ascus, 4-celled at maturity, *Callispora*-type, (25.9–)28.5–33.4(–36.1) × (10.7–)12.5–14.0(–15.5) μm, median 31.0 × 12.9 μm, l/w (2.0–)2.2–2.6(–2.9), median 2.4, n=37, callisporoid thickening below apices only evident in late 2-celled stage when the locules also possess a broad porus, rapidly becoming 4-celled, a

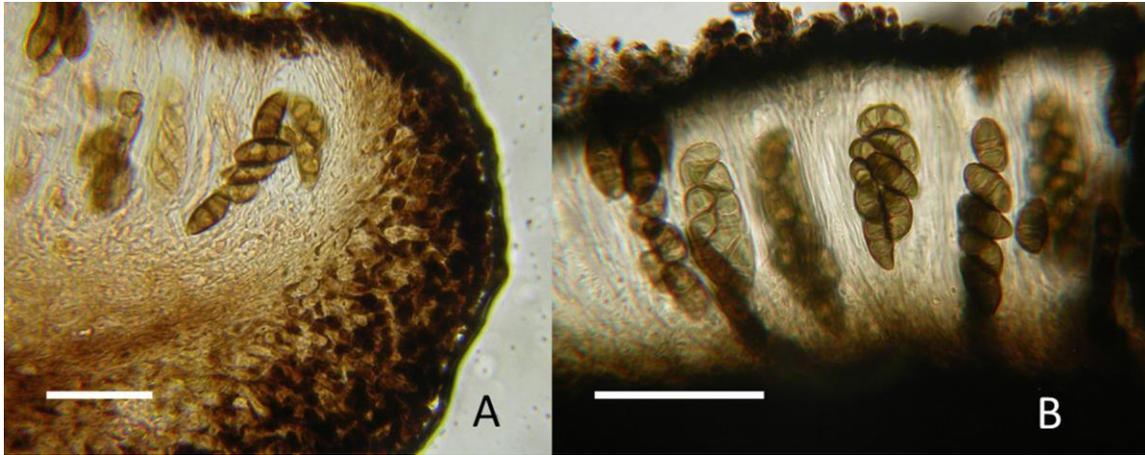


Figure 2. Apothecial anatomy of *Buellia gibstoneorum* (both from the holotype). **A**, microtome section of apothecium showing proper exciple. **B**, Free-hand section of a portion of the hymenium illustrating the absence of inspersed oil drops. Scales = 50 μm .

central septum sometimes visible, becoming obscured by heavy wall pigmentation, walls pitted ($\times 1250$) (Figs. 3C, 3D). Pycnidia black, immersed in substrate, ca. 0.10 mm diam.; conidia bacilliform, 5.5–6.5 \times 1.0–1.5 μm .

CHEMISTRY. – Spot tests all negative. Thallus lacking chemical substances in thin layer chromatography. TLC was not repeated because of the small amount of material in the holotype. However, sections of the thallus lying within the wood tissue revealed some granules (POL+, KOH soluble) that suggest the presence of atranorin (or some other lichen substance). The absence of atranorin based on TLC should be considered as questionable pending confirmation with additional collections.

ETYMOLOGY. – The epithet “*gibstoneorum*” combines the names Gibson and Stone to honor both Susan Gibson and the late Allan D. Stone, whose generosity through their Lichen Foundation provided 40% of the funding needed to publish *Lichens of North America* (Brodo et al. 2001). We are profoundly grateful for their vision and support, without which the publication of that book may never have occurred.

HABITAT. – On bare lignum of a fence post close to the sea, fully exposed, potentially in the company of other members of that community such as *Lecanora xylophila* Hue, *L. orae-frigidae* R. Sant. and *Xylographa opegraphella* Nyl.

DISTRIBUTION. – *Buellia gibstoneorum* is known only from the holotype but has probably been overlooked. It likely grows on lignum substrates such as logs and fence rails elsewhere along the coast of the Pacific Northwest from Oregon to southeastern Alaska.

DISCUSSION. – The 4-celled ascospores and their pitted walls suggest that *Buellia gibstoneorum* is most closely related to the Mexican species *B. bispora* (Sheard) Brodo & Sheard (\equiv *Hafellia bispora* Sheard; see Appendix I) from which it is, nevertheless, well separated by the smaller ascospores in *B. gibstoneorum* that occur 8/ascus (vs. 2/ascus in *B. bispora*), the less well developed thallus, persistently plane apothecial disc (vs. quickly becoming convex), lightly inspersed hymenium (vs. heavily oil inspersed), the broad apices of the paraphyses (vs. tips up to 3.0 μm in diameter), and the possible lack of chemical substances (vs. containing atranorin and diploicin) (see Sheard 1992).

The new species is most likely to be mistaken for *Buellia fosteri* (Fig. 1A; see Appendix II for comparative specimens examined), which has virtually identical apothecia, a similar yellowish white, continuous thallus (although somewhat thicker and epixylic) and occurs in a similar habitat (on hard, exposed lignum near the seashore along the Pacific coast). Both lichens have *Callispora*-type ascospores (Fig. 3) with irregularly thickened lateral cell walls (Sheard 1992), but the ascospores of *B. gibstoneorum* are predominantly 4-celled (vs. predominantly 2-celled in *B. fosteri*) and are significantly longer: (26–)29–34(–36) \times 11–15 μm in *B. gibstoneorum* vs. (19.8–)21.9–25.7(–27.8) \times (10.2–)10.8–12.6(–13.9) μm , median 23.6 \times 12.0 μm , l/w (1.7–)1.8–2.1(–2.4), median 2.0 μm , n=33 in *B. fosteri*). This additional length



Figure 3. Comparison of ascospores between *Buellia fosteri* and the new species. **A and B**, ascospores of *B. fosteri* (Crane & Noble 5335a). **C and D**, ascospores of *B. gibstoneorum* (from the holotype). Scales = 10 μ m.

makes the ascospores of *B. gibstoneorum* appear to be narrower, although they are actually the same width, and this is reflected in the significantly different length to width ratio of the ascospores (usually > 2.2 in *B. gibstoneorum* and usually < 2.1 in *B. fosteri*). In addition, the hymenium is almost entirely free of oil droplets in *B. gibstoneorum* whereas it is strongly inspersed with oil in *B. fosteri* (but see note below). The ascospores of *B. fosteri* sometimes become 4-celled with age although they remain broad and lack pitted walls. The thallus of this species may also be endoxylic in part (especially in Oregon specimens) but it is mostly epixylic, smooth to rimose or even granulose in places, and it has much larger and sometimes lobed apothecia (0.5–1.1(–1.5) mm diam. vs. 0.4–0.7 mm in *B. gibstoneorum*).

There is some variation in the quantity of oil droplets in the hymenium of *B. fosteri* that led McCune (2017b: 108) to describe the hymenium as “not inspersed”. We therefore borrowed McCune’s material of *B. fosteri* (McCune 22296, OSC!) and can confirm that, although one apothecial section had a reduced amount of oil, it was still abundant enough to be called “inspersed.”

If the negative chemistry of *B. gibstoneorum* is confirmed, *B. gibstoneorum* would be among the few (if any) species in the *Hafellia*-group (with *Callispora*-type ascospores) to lack lichen substances. The others, including *B. fosteri*, typically contain at least atranorin and diploicin (thallus K⁺ yellow) or rarely norstictic acid (Sheard 1992). As noted above, however, some POL⁺ granules are present in the thallus, and so atranorin may be present in small quantities that were not detected during our investigations of the limited material.

CONCLUSIONS

Buellia fosteri and *B. gibstoneorum* are relatively rare crustose lichens living on exposed lignum such as logs and fence posts along the Pacific Northwest coast. Although their small black apothecia and thin pale thalli make them inconspicuous, once their ascospores are seen, identification should be straightforward. We hope that additional specimens of both species are found so that their chemistry can be confirmed and their phylogenetic affinities can be established.

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We are most grateful to Bruce McCune for navigating the hurdles of pandemic closures and managing to send us his Oregon specimens of *Buellia fosteri*. Similarly, Jennifer Doubt of the Canadian Museum of Nature, assisted by Laura Smyk, was able to retrieve the holotype and other relevant material from a locked-down CANL and deliver it to the home of the first author for study. We are deeply grateful for all their efforts and assistance. John McCarthy and his colleagues at Jesuits of Canada helped with Latin questions. We thank Fenja Brodo and Troy McMullin for reading the manuscript and providing helpful suggestions for improvements. We also thank Bruce McCune, James Lendemer and an anonymous reviewer for their comments and corrections.

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APPENDIX I – A NEW COMBINATION FOR *HAFELLIA BISPORA*

Buellia bispora (Sheard) Brodo & Sheard, *comb. nov.*
MycoBank #837452.

≡ *Hafellia bispora* Sheard, *The Bryologist* 92: 83. 1992. **TYPE: MEXICO. TAMAULIPAS:** Sierra Madre Oriental, just N of summit on Hwy. 101, 23°15'N, 99°37'W, 2,000 m., low forest of *Quercus*, *Pinus cembroides* and *Juniperus*, 21.iii.1976, on *Pinus cembroides*, B.F. Hansen *et al.* 3791 (NY, holotype).

Since the genus *Hafellia* is a synonym of *Buellia*, based on the typification of the latter genus with *B. disciformis* (Fr.) Mudd, as explained by Perlmutter and Rivas Plata (2018), it is necessary to provide the new combination for *H. bispora* here.

APPENDIX II – COMPARATIVE MATERIAL OF *BUELLIA FOSTERI*

Specimens of Buellia fosteri examined. – **CANADA. BRITISH COLUMBIA:** Discovery Island, 3 km E of Oak Bay, Victoria, 3.viii.1975, on driftwood with *Lecanora grantii* [= *L. xylophila*], A. Crane & W.J. Noble 5335a (CANL, SASK); Haida Gwaii, Graham Island, 2 mi W of Tow Hill (Yakan Point) on N shore, crest of foredune, 15.vi.1967, on protected area of an exposed log, I.M. Brodo 9896 & M.J. Shechpanek (CANL). **U.S.A. OREGON. LINCOLN CO.:** near mouth of Gwynn Creek on Pacific Ocean, 44°17'N, 124°06'W, 26.xii.1992 on driftwood, B. McCune 20197 (OSC). **COOS CO.:** ocean beach just S of Coquille Point just W of Bandon, 43°06.5'N, 124°25.9'W, iii.1995 on huge stump imbedded in beach, B. McCune 22296 (OSC).