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*Trichothelium assurgens* is small even for an epiphyllous foliicole. Its perithecia typically measure a mere 0.1–0.15 mm in diameter. They'd be all but invisible without their (2–)3–6(–8), long, whitish setae. The species colonizes the living leaves of ferns and sundry other understory forest plants. It's known from Queensland, New South Wales, Victoria, and Tasmania in Australia, plus the Cook Islands, New Zealand, the northern Mariana Islands, Solomon Islands, Hawai'i and Japan.

0.1 mm

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## Reinstatement of *Usnea capillacea* Motyka (lichenized Ascomycota, Parmeliaceae) to the New Zealand lichenized mycobiota

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### Abstract

The taxonomic histories of *Usnea capillacea* Motyka and *U. articulata* (L.) Hoffm. (Parmeliaceae) in New Zealand are discussed. Habitat preferences and molecular and morphological differences between the two species support reinstating *Usnea capillacea* to the New Zealand lichenized mycobiota for specimens currently referred to *U. articulata*.

### Introduction

*Usnea capillacea* Motyka, a characteristic mist forest lichen species of New Zealand (Galloway 1985), was synonymized with the widespread and cosmopolitan *U. articulata* (L.) Hoffm. by Stevens (1999). That decision was maintained by Stevens for Australia (Stevens 2004), and followed by Galloway (2007) for New Zealand.

The type material of *U. articulata* was collected in Burnley, England, 54°47'27"N, 02°14'25"W, (OXF-lectotype), and that of *U. capillacea* at Saddle Hill, Otago, New Zealand, 45°54'54"S, 170°21'00"E (Herbarium Motyka – holotype, CHR 343971! –lectotype). A comparison of DNA sequence data of specimens identified as *U. articulata* from the United Kingdom and New Zealand by Rafat (2014) and Rafat *et al.* (2015) did not find a close match. In addition, the descriptions of *U. articulata* from the United Kingdom (Smith *et al.* 2009) and that of *U. capillacea* from New Zealand (Galloway 1985) are significantly different, prompting us to reassess Stevens' 1999 synonymizing of *U. capillacea*. This paper presents a comparison of the morphology, ecology and available molecular data (ITS rDNA) of New Zealand material currently identified as *U. articulata* with information relevant to that species in the United Kingdom.

### Methods

A comparison of the two species is provided using *Flora of New Zealand Lichens* (Galloway 1985) and *The Lichens of Great Britain and Ireland* (James *et al.* 2009), as well as material from New Zealand. Thin-layer chromatography was carried out using the methods of Culbertson (1972) and White & James (1985), using Solvent C.

### Results

#### Morphology:

(1) *Usnea articulata* is pendent or scrambling over low vegetation, reaching over 1 metre in length, whereas *U. capillacea* is pendent but never scrambling, reaching up to only 40 cm in length. (2) The main branches of *U. articulata* can reach 3 mm in width, whereas *U. capillacea* (Fig. 1) has narrower branches up to only 0.7 mm in width (Fig. 2). (3) The older branches of *U. articulata* are strongly inflated with sausage-shaped segments (Figs 1, 3) *Usnea capillacea* can be jointed in part, but is never inflated to that extent (Fig. 2). (4) The cortex of

*U. articulata* can have white, comma-shaped pseudocyphellae (Figs 1, 3) which have never been seen in *U. capillacea*. (5) Apothecia are unknown in *U. articulata*, but they are not rare in *U. capillacea* (Fig. 4).

#### Chemistry:

The chemistry of *Usnea articulata* has been reported as having fumarprotocetraric acid in both British (James *et al.* 2009) and New Zealand (Galloway 1985) populations. The chemistry of *U. capillacea* (as *U. articulata*) also includes fumarprotocetraric acid. The isotype of *U. capillacea* contains fumarprotocetraric, succinoprotocetraric, protocetraric, confumarprotocetraric, conprotocetraric and usnic acids. Recent TLC results for New Zealand specimens usually show varying amounts of protocetraric acid.

#### Habitat:

*Usnea articulata* lives in well-lit, xeric conditions, often on lowland deciduous trees (Fig. 5), whereas *U. capillacea* is a mist forest species growing on trees and shrubs from low altitude up to 1200 m (Fig. 6).

#### Distribution:

*Usnea articulata* is a cosmopolitan, mainly Northern Hemisphere species (Stevens 1999), whereas *U. capillacea* is a common and distinctive New Zealand lichen, mainly in the South Island but extending further south to Auckland Island.

#### Molecular data:

Rafat (2014) found that three specimens from New Zealand morphologically identified as *U. articulata* did not form a clade in a rDNA phylogenetic tree with a sequence from a specimen of *U. articulata* from Britain (where the lectotype of the species was collected) (Genbank ID FR799033). Rafat *et al.* (2015) found that the ITS rDNA sequence of a New Zealand specimen of *U. articulata* was not a close match for any sequences of *Usnea* species in Genbank (the closest matches were *U. sphacelata* R.Br. and *U. trachycarpa* (Stirt.) Müll.Arg. at 95%). A BLAST search of their sequence (Genbank ID JX144646), does not show a close similarity to European sequences of *U. articulata*.

### Conclusion

Based on the considerable differences in habit, morphology and DNA sequence data outlined above, as well as in distribution and habitat preference, the name *Usnea capillacea* is reinstated in the New Zealand mycobiota for specimens currently referred to *U. articulata*.

### SELECTED SPECIMENS EXAMINED

*North Island:* Wanganui-Manawatu: ● Ohakune, 39°24'24"S, 175°25'01"E, 600 m alt., *L. Ludwig*, 23.xi.2013 (OTA 72035). *South Island:* Tasman: ● Red Hills, 41°43'03"S, 172°00'25"E, 1129 m alt., on *Dracophyllum*, *T. Aldridge*, 22.x.2020 (OTA 73054); ● Moa Park, 40°56'06"S, 172°56'29"E, 1008 m alt., on *Leptospermum*, *A. Knight*, 23.x.2019, (OTA 72045); ● Mt Owen, 41°31'24"S, 172°33'40"E, 1209 m alt., on *Dracophyllum*, *T. Aldridge*, 3.xii.2020, (OTA 73126); Canterbury: ● Nina Valley, 42°25'32"S, 172°19'23"E, 758 m alt., on *Nothofagus*, *T. Aldridge*, 23.ix.2020 (OTA 73067); Southland: ● Borland Saddle Road, 45°26'42"S, 167°17'34"E, 392 m alt., on *Nothofagus*, *A. Knight*, 8.i.2020 (OTA 72405); Southland: ● Lake Te Anau, south-west arm, 45°08'24"S, 167°30'18", 158 m alt., on *Nothofagus*, *P. Gillette*, 17.x.2018 (OTA 71236); Otago: ● Rangelburn Forest, Blue Mountains, 45°57'31"S, 169°20'44"E, 550 m alt., on *Nothofagus*, *P. Gillette*, 23.viii.2018 (OTA 71181). *Auckland Island:* ● Ranui Cove, 50°32'25"S, 166°16'35"E, 5 m alt., *A. Knight*, 1.viii.2018 (OTA 71437).

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Fig. 1. Detail of Northern Hemisphere *Usnea articulata*, showing inflated, sausage-shaped branches with pseudocyphellae. On hawthorn, Grey Park Wood, Devon, UK.



Fig. 2. Detail of *Usnea capillacea* showing fine, capillary-like branches.



Fig. 3. Habit of *Usnea articulata*. On oak, Wistmans Wood, Devon, UK.



Fig. 4. Fertile *Usnea capillacea* with multiple apothecia, Lake Monowai.



Fig. 5. Lowland deciduous habitat of *Usnea articulata*. On oak, Wistmans Wood, Devon, UK.



Fig. 6. Subalpine evergreen mist forest habitat of *Usnea capillacea* Hump Ridge, Southland.