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## RESEARCH ARTICLE

### Notes on *Caloplaca allanii* Zahlbr. (Teloschistaceae) a poorly known West Auckland, North Island, New Zealand endemic

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After a lapse of 81 years we report the rediscovery of *Caloplaca allanii* (Teloschistaceae), a lichen previously known only from the type collection. The species appears to be endemic to the Waitakere Ranges coastline west of Auckland, North Island, New Zealand. A revised description of the species based on fresh material is provided, and we expand the distribution of the species as well as describing its habitats and associated species. A table and key to the saxicolous, coastal *Caloplaca* of the Waitakere Ranges is also provided. As a narrow-range endemic, with apparently very specific habitat requirements, *C. allanii* is a naturally uncommon, biologically sparse species. Nevertheless because of the small total area of occupancy, we assess *C. allanii* as ‘Threatened’/‘Nationally Critical’ using the New Zealand Threat Classification System.

**Keywords:** *Caloplaca*; *Caloplaca allanii*; *Caloplaca acheila*; *Caloplaca cribosa*; *Caloplaca* cf. *litoralis*; Teloschistaceae; ecology; conservation status; New Zealand mycobiota

#### Introduction

The latest treatment of *Caloplaca* (Teloschistaceae) in New Zealand recognized 43 species (Galloway 2007). However, it was acknowledged that the treatment was ‘provisional’ and ‘not a thorough revision’ (Galloway 2007, p. 209). In particular the need for better ‘regional collecting [to be] undertaken, especially from coastal rocks, from calcareous substrata, from living bark and dead wood and from high alpine habitats’ was identified before a comprehensive treatment of the New Zealand members of the genus could be contemplated (Galloway 2007). At that time (Galloway 2007) noted that three species (*Caloplaca allanii* Zahlbr., *Caloplaca maculata* D.J.Galloway, *Caloplaca perileuca* Zahlbr.) were known only from the type material, and distributions for a further 15 were restricted to three or fewer locations. For many species of *Caloplaca* in

New Zealand the statement ‘still very poorly known here’ (Galloway 2007) still applies.

The first conservation assessment of the New Zealand lichenized fungi (de Lange et al. 2012) provided assessments for 46 *Caloplaca* taxa, of which five were assessed to be ‘Naturally Uncommon’, 17 were ‘Not Threatened’ and 24 were ‘Data Deficient’. One of the ‘Data Deficient’ *Caloplaca* was *C. allanii* Zahlbr.

*Caloplaca allanii* was discovered by Lucy Cranwell, who collected it in 1932 from Anawhata Beach, Waitakere Ranges, West Auckland. The species was described by the lichenologist Zahlbruckner (Zahlbruckner & Redinger 1934) from exsiccated material that Cranwell had sent and which was deposited in W, with isotypes in AK, ASU, CHR, G and MICH (herbarium acronyms follow Thiers [2014]). Following its description, between 1932

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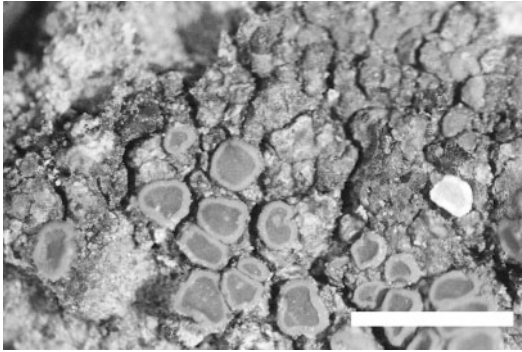
**Figure 1** Distribution of *Caloplaca allanii* (filled circles) on the Waitakere coastline, West Auckland, North Island, New Zealand. Inset showing location of the Waitakere Ranges in New Zealand.

and 2012 no further collections of it appear to have been made, which highlights the difficulty of providing accurate conservation assessments for New Zealand lichens, even for species that have been collected from extremely accessible locations such as Anawhata Beach. This beach is located some 28 km west of New Zealand's largest city, Auckland (Fig. 1). The problem here is that historically there have been, and currently are, simply too few resident and active lichenologists present to update our knowledge of what lichen species we

have. To that end, the New Zealand Department of Conservation through their Data Deficient Species fund provided a grant to enable a systematic survey of a selection of 'Data deficient' Auckland and Northland lichens. Here we report on our findings following a critical survey for *Caloplaca allanii*.

### Taxonomy

*Caloplaca allanii* Zahlbr. In A. Zahlbruckner & K. Redinger, *Lich. Rar. Exs.*: No. 336 (1934)



**Figure 2** *Caloplaca allanii* at type locality, Anawhata Beach, Waitakere Ranges, West Auckland, New Zealand. Scale bar = 2 mm.

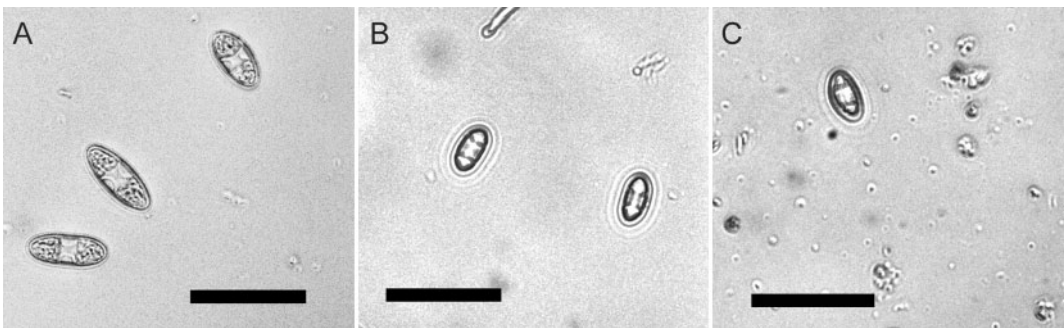
**Type.** New Zealand, North Island, Northland, Anawhata, on maritime rocks, c.10 m, 5 November 1932, L. M. Cranwell Lichen III (Holotype: W; isotypes: CHR 378731, AK18961!, G 290935, ASU 68154, MICH 62617, S-L2627).

**Description (Figs 2, 3).** *Thallus* granular; minutely subsquamulose or lacking, in irregular patches; granules 0.2–0.5 mm diameter; golden yellow to orange-white, K+ reddish purple, rounded to irregular, convex or plane, with apparent brown-black basal prothallus. *Apothecia* scattered and rounded to clustered and contorted through mutual pressure, 0.1–1.2 mm diameter; disc subconcave to plane; orange-brown–red-brown; thalline margin continuous or of scattered granules, thin or occasionally thick, same colour as thallus, proper margin thin or

thick, raised and orange, paler than disc. Epithecium yellow-orange, densely granular, 8–25 µm thick. Hymenium colourless, without oil droplets, 60–80 µm tall. Paraphyses slender, 1.5 µm wide, apices submoniliform, swollen, to 5 µm diameter. Asci clavate or cylindrical-clavate, 45–70 × 12–23 µm, eight-spored. Ascospores biseriata in ascus, ellipsoid, 12.00–26.25 × 5.0–10.0 µm wide; septum 3.0–7.5 µm, one-quarter to one-third the length of the spore.

**Chemistry.** Thallus K+ reddish purple; containing emodin, parietin, teloschistin, fallacinal, xanthorin and erythroglaucin (Santesson 1970).

**Representative specimens.** Auckland: Waitakere Ranges, Bethells Beach, south end, on sandy matrix in volcanic conglomerate, 36°54'01.78"S, 174°26'48.64"E, altitude 2 m, 9 May 2013, D. J. Blanchon & O. Er (UNITEC 5689); Waitakere Ranges, Anawhata Beach, on matrix of volcanic conglomerate, 36°55'15.38"S, 174°27'18.21"E, altitude 1 m, 26 October 2012, J. Sparkes & D. J. Blanchon (UNITEC 5419); Waitakere Ranges, Piha, Lion Rock, on granular matrix of volcanic conglomerate, 36°57'11.50"S, 174°28'00.80"E, altitude 2 m, 16 May 2013, O. Er & D. J. Blanchon (UNITEC 5694); Waitakere Ranges, Karekare Beach, on matrix of cobbly volcanic outcrop, 36°59'26.58"S, 174°28'29.47"E, altitude 3 m, 16 May 2013, D. J. Blanchon & O. Er (UNITEC 5691); Waitakere Ranges, Whatipu, Cutter Rock, on volcanic conglomerate, 37°02'



**Figure 3** A, *Caloplaca allanii* spores. B, *Caloplaca acheila* spores. C, *Caloplaca* cf. *litoralis* spores. All scale bars = 30 µm.

43.56°S, 174°30'05.80"E, altitude 1 m, 15 January 2013, P. J. de Lange & D. J. Blanchon (UNITEC 5502); Waitakere Ranges, Whatipu, Paratutai Island,<sup>1</sup> on matrix of volcanic conglomerate, 37° 02'44.14"S, 174°30'34.10"E, altitude 2 m, 15 January 2013, P. J. de Lange & D. J. Blanchon (UNITEC 5502).

**Distribution** (Fig. 1). Endemic. New Zealand, North Island, West Auckland, Waitakere Ranges. So far *C. allanii* is still only known from the Waitakere Ranges coastline, where it has been collected from Bethells Beach south to northern Manukau Heads (Paratutai Island). At present the species seems endemic to the Waitakere Ranges coastline. In this area it has a patchy distribution being apparently absent from much of that coastline. Further field surveys for it on rocks with similar geology elsewhere in Northland have failed to locate it.

**Recognition.** *Caloplaca allanii* can be distinguished from other species of *Caloplaca* found in the same habitats (Table 1) by its orange-brown to brown-yellow apothecial discs (Fig. 2) with thalline margin of the same colour as thallus, large

spores (12.00–26.25 µm long) (Fig. 3A–C), with short septae (one-quarter to one-third the length of the spore). Galloway (1985) reported that the spore length was 12–15 µm and the septum was one-quarter the length of the spore, based on the original description (Zahlbruckner & Redinger 1934). However, spore size in *Caloplaca* can be difficult to determine because spores can be over- or underdeveloped (U. Söchting, University of Copenhagen, pers. comm. 2012). So for the purposes of obtaining spore measurements for *C. allanii*, spores were only measured if they were fully formed. Abnormally shaped spores or those with aberrant septae were excluded. Further, spores were examined from multiple apothecia and collections, and compared with other *Caloplaca* species in the same localities. The description was subsequently revised to include a larger spore size (12–)15–17(–18.2) × 6.5–8.2 µm; and septum to spore length ratio (one-quarter to one-third the length of the spore) (Galloway 2007), based on the examination of the isotype in CHR (D. Galloway, pers. comm.). Based on an examination of fresh material and the isotype in AK, we have further extended the upper range of the spore size, and we found that the smaller spores were often undeveloped.

**Table 1** Comparison of *Caloplaca acheila*, *Caloplaca allanii* and *Caloplaca* cf. *litoralis* (modified from Zahlbruckner & Redinger 1934; Galloway 2007).

	<i>Caloplaca allanii</i> Zahlbr.	<i>Caloplaca acheila</i> Zahlbr.	<i>Caloplaca</i> cf. <i>litoralis</i> Zahlbr.
Thallus form	Granular; subsquamulose or lacking; 0.2–0.3 mm diameter	Granules 1.0 × 0.2 mm	Crustose and verrucose, or areolate to cracked
Thallus colour	Golden yellow to yellow-orange	White or orange	Grey/white to grey/yellow to yellowish
Apothecia colour	Orange to brown-yellow, thalline margin same colour as thallus, proper margin thin, raised and orange	Orange, thalline margin thin and same colour as thallus, proper margin swollen and orange-yellow	Orange/red brown, margins pale yellow
Apothecia size and shape	0.1–1.2 mm diameter; subconcave to plane	0.1–0.5 mm diameter, urceolate at first becoming plane	Entire to crenulate, 0.5–1.2 mm diameter, concave to plane
Spore dimensions	12.00–26.25 µm long 6.5–10.0 µm wide	10–13 µm long 5.0–8.5 µm wide	12–17 µm long 5–7 µm wide
Septum length	3–5 µm, one-quarter to one-third the length of the spore	5–7 µm, half the length of the spore	about one-third the length of the spore

Comparison of internal transcribed spacer DNA sequence data as part of an as yet unpublished molecular study of New Zealand *Caloplaca* by Ulrik Søchting confirms the distinctiveness of *C. allanii* (U. Søchting, University of Copenhagen, pers. comm. 2013).

**Ecology.** *Caloplaca allanii* occupies a very specific habitat, with all collections made from the matrix of the Miocene-aged andesitic Piha conglomerate (Hayward 1979; Edbrooke 2000). Further, the species seems to be confined to the most exposed situations, often growing close to or at the spray zone. The species also eschews shaded sites. Similarly, at Cutter Rock *C. allanii* now grows some 200 m inland, though again in very exposed situations. Cutter Rock was within the tidal zone at the turn of the century, but following the northward movement of sand (Hayward 1979; Cameron et al. 2008), was isolated from the sea by 1954 (Pegman & Rapson 2005), and it now lies surrounded by a dune field.

Within its habitats *C. allanii* is often locally, though patchily, common. Its normal co-associates include *Buellia cranwelliae* Zahlbr., *Caloplaca acheila* Zahlbr., *Caloplaca* cf. *litoralis* Zahlbr., *Xanthoria ligulata* (Körb.) P.James and *Xanthoparmelia* spp. Of these species it most usually co-associates with *Caloplaca* cf. *litoralis*, the other taxa tending to grow on the associated conglomerate clasts rather than the matrix.

**Conservation status.** With the confirmation of *C. allanii* as extant in the wild, and an improved understanding of its distribution and ecology, a

revision of its current conservation listing of ‘Data Deficient’ (de Lange et al. 2012) is appropriate. *Caloplaca allanii* is now known from seven sites (six new) in scattered locations along the Waitakere Coastline from Bethells Beach south to the northern Manukau Heads (Paratutai Island). We have also surveyed for it, so far unsuccessfully, outside the Waitakere Ranges in a number of seemingly suitable habitats throughout coastal New Zealand. For many crustose lichen species the definition of a genetic ‘individual’ lichen thallus, especially in the field, can be difficult. Therefore we have followed the strictures adopted by the New Zealand Lichen Threat Assessment panel, that in situations of doubt we considered individuals to be represented by visually discrete ‘patches’. An estimate of individuals suggests that there are c.400 ‘patches’, which would suggest a conservation listing of ‘Nationally Endangered’ or ‘Naturally Uncommon’, assuming the population is stable. In combination with the number of populations (seven), it could be argued that the conservation listing should be ‘Nationally Vulnerable’ or ‘Naturally Uncommon’. Because we recognize that counting patches may or may not correlate well with a genetically distinct individual, we have also calculated the area of occupancy for each location supporting the species. In combination, the area of occupancy for this species would be less than 1 ha, indicating a conservation listing of ‘Nationally Critical’. Using the precautionary approach prescribed by Townsend et al. (2008) we have chosen this higher threat classification and designate this species as ‘Nationally Critical’ Data Poor (DP) and Range Restricted (RR).

**Key to species of *Caloplaca* found on volcanic rock outcrops of the coastal Waitakere Ranges, Auckland**

1. Thallus subfruticose, +/- rosette-forming, plicate-radiate with +/- terete chrome-yellow lobes ..... *Caloplaca cribrosa*  
Thallus crustose, subsquamulose, granular or lacking; yellow, yellow-orange, orange or white.....2
2. Thallus crustose, yellow to grey-yellow, continuous or areolate to cracked ..... *Caloplaca* cf. *litoralis*  
Thallus granular and dispersed, subsquamulose or lacking, yellow-white or orange.....3

3. Apothecial discs orange-brown, margins paler, spores large (12–26.25  $\mu\text{m}$ ), septum small (one-quarter to one-third spore length) ..... *Caloplaca allanii*  
 Apothecial disc and margins orange, spores smaller (10–13  $\mu\text{m}$ ), septum larger (one-half spore length) ..... *Caloplaca acheila*

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### Note

1. Although widely known as ‘Paratutae Island’ and recorded as such on most New Zealand maps, this name (meaning ‘loose bowels’) was apparently recorded in error for ‘Paratutai’ (meaning ‘high tide level changes’, which frequently occur around the island). As such, the local iwi, Te Kawarau   Maki, have requested that the correct spelling ‘Paratutai’ be used henceforth for this island (see Cameron 2013).

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