

TAXONOMIC AND CONSERVATION STATUS OF *DOCKRILLIA STRIOLATA* (RCHB.F.) RAUSCHERT (ORCHIDACEAE) IN TASMANIA

by Mark Wapstra

(with five text-figures, three plates, two tables and one appendix)

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Dockrillia striolata (Rchb.f.) Rauschert, known as the yellow rock-orchid, occurs in New South Wales, Victoria and along the east coast of Tasmania. Within Tasmania, populations occur on the islands of the Furneaux Group and on mainland Tasmania (Kelvedon Hills south of Swansea through to Wukalina/Mount William in the northeast). The taxonomy of the species is revised, with subsp. *chrysantha* no longer recognised as distinct based on a morphological examination of flower size and other characters. The species is restricted to Devonian granite-type rocks and Jurassic dolerite, usually in near-coastal areas and in various vegetation types. A review of the conservation status indicates that the species does not qualify as threatened under the Tasmanian *Threatened Species Protection Act 1995*, with it being well-reserved throughout its range, an extent of occurrence of ca. 7500 km², represented by at least 30 well-defined subpopulations, no apparent historical or contemporary declines in any population parameters, nor any identifiable risks.

Key Words: *Dendrobium striolatum*, *Dockrillia striolata*, Orchidaceae, rock-orchid, taxonomy, distribution, habitat, conservation.

INTRODUCTION

Most of Tasmania's approximately 214 species of native orchid (de Salas & Baker 2019) are terrestrial. Unlike subtropical and tropical parts of the globe that support a high diversity of epiphytic species, southern Tasmania supports only one true epiphytic orchid species, *Sarcochilus australis* (Lind.) Rchb.f. Amongst the terrestrial species, there is also one species that is a true lithophyte, currently referred to as *Dockrillia striolata* (Rchb.f.) Rauschert (de Salas & Baker 2019).

Until the mid-1990s, Tasmania's "rock-orchid" was widely known as *Dendrobium striolatum* Rchb.f., with no infrataxa recognised. *Dockrillia* Brieger was described in 1981 (Brieger 1981) as a "natural group of orchids which have been segregated from the large genus *Dendrobium*" (Clements & Jones 1996, Jones 1998). The segregate genus was accepted in more recent taxonomic treatments (e.g., Jones 1998) and incorporated into most formal and informal floras (e.g., Jones *et al.* 1999, Jones 2006). However, some broader taxonomic treatments (e.g., WCSP 2019), accept *Dendrobium* Sw. and places *Dockrillia* Brieger into synonymy. The present paper accepts *Dockrillia* Brieger, pending a broader review of Australian orchid taxonomy.

As part of a taxonomic review of Tasmanian Orchidaceae, Jones (1998) described a new infrataxon of *Dockrillia striolata*, namely the new endemic subspecies *chrysantha* D.L.Jones, which resulted in the autonym subsp. *striolata*. The subspecies were separated on four morphological features viz. "ab subsp. *striolata* floribus parum majoribus, vivide flavis; tepalis vittis paucis vel nullis; et labello valdius crenulato, differt". That is, the new subspecies tends to have slightly larger flowers, brighter yellow tepals (petals and sepals) that lack stripes or are only faintly striped, and a labellum with more strongly crenulate margins. The two

subspecies were originally also separated geographically, with subsp. *chrysantha* endemic to mainland Tasmania, and subsp. *striolata* absent from mainland Tasmania but present on the eastern Bass Strait islands and extending to Victoria and New South Wales (Jones 1998, Jones *et al.* 1999). This geographic separation was always considered minor because the gap between the northeasternmost Tasmanian mainland sites (e.g., Mount William National Park area) and Cape Barren Island was effectively no greater than disjunctions on mainland Tasmania.

There have been no formal published accounts of *Dockrillia striolata* in Tasmania. The present paper aims to document the distribution and habitat of the species in Tasmania, clarify its taxonomic and nomenclatural status, and provide information on its reservation and conservation status.

METHODS

Database and collection review

Five sources of records of native plants were reviewed to produce a complete list of all known locations of *D. striolata* in Tasmania, as follows: (1) collections at the Tasmanian Herbarium, Tasmanian Museum & Art Gallery (HO); (2) collections at the Queen Victoria Museum (QVM); (3) Department of Primary Industries, Parks, Water & Environment's *Natural Values Atlas* database (NVA, DPIPW 2019); (4) *Atlas of Living Australia* (ALA 2019); and (5) the Australasian Virtual Herbarium (AVH 2019). The data were "cleaned" to produce a definitive worksheet of known locations of the species. "Cleaning" included removal of obvious database duplicates; removal of records lacking sufficient information to precisely place the site (e.g., records

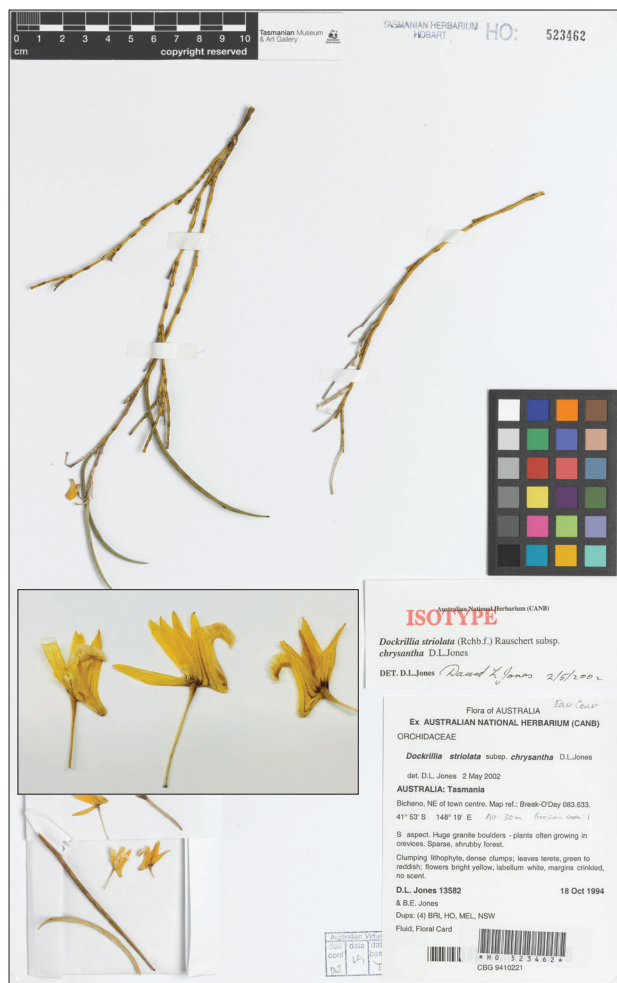


PLATE 1 — Isotype (HO523462) of *Dockrillia striolata* subsp. *chrysantha* from Bicheno, east coast of Tasmania, 18 Oct. 1994 (D.L. Jones & B.E. Jones), showing three separated flowers, all with a moderate degree of striping on the abaxial surface of the tepals [main image courtesy of the Tasmanian Herbarium; inset of three separated flowers by M. Wapstra (same flowers as in main image)].

labelled “Tasmania” or “East Coast”); and shifting of point locations to more precise sites where sufficient information was provided (e.g., records currently shown in the sea were shifted to a nearby terrestrial location if collection notes indicated an obvious location).

As it is virtually impossible to mis-identify *D. striolata* in Tasmania (it is a mono-specific genus in Tasmania), even when not in flower or fruit, because of its distinctive terete fleshy leaves and lithophytic habit, database records of the species in the NVA and ALA were taken as correct identifications to species level. Due to the taxonomic history of the species, however, collections and database records of the species had variable allocation of specimens/records to subspecific level, with many either missing this more detailed information or the subspecies clearly being allocated solely on a geographic basis (i.e. mainland Tasmanian records as subsp. *chrysantha* and Furneaux Group records as subsp. *striolata*). However, a reasonable number of specimens held at HO for mainland Tasmania had been allocated to subsp. *striolata*.

Earlier collecting localities and inclusion of the taxon in earlier treatments in floras is examined.

Comparison of records to selected variables

The “cleaned” data files were manipulated in a GIS platform (ArcGIS v. 10.5.1) to compare the point locations with the following variables (all publicly available as GIS files and/or possible to interrogate directly on The LIST, www.thelist.tas.gov.au): land tenure, with particular reference to gazetted reserves under the Tasmanian *Nature Conservation Act 2002*; geology; and elevation (by reference to the 10 m a.s.l. contour interval).

Morphometrics

All collections held at HO were examined for specimens with well-pressed flowers. Any flowers showing the complete length of a tepal were measured from the visible base of the flower to the tip of the longest tepal using Vernier™ digital calipers (precise to 1/100th mm). Appendix 1 provides a complete listing of all specimens examined.

One-way analysis of variance (ANOVA) was used to compare the length of flowers for: (A) ISLAND groups (mainland Tasmania; Furneaux islands); (B) REGIONAL groups (mainland Tasmania – east coast; mainland Tasmania – northeast; Furneaux islands); and (C) SITE groups (from south to north – Freycinet area, Bicheno/Apsley River area, St Helens area, inland northeast (Lanka Road), Mt Cameron area (including Second Sugarloaf and Lanka Road); Mt William area (including Bayleys Hill); Furneaux islands – Mt Munro; Furneaux islands – Strzelecki; Furneaux islands – Patriarchs; Furneaux islands – Killiecrankie). Tukeys (HSD) test was used to denote means that were different at the 95% confidence interval. Some sites have low sample sizes, limiting the confidence of the ANOVA between sites.

A simple linear regression was calculated to predict flower size based on latitude (with latitude allocated in decimal degrees to samples from the following sites (south to north): Freycinet area (42.14737 S); Bicheno area (41.87471 S); St Helens area (41.18693 S); Mt Cameron area (40.93421 S); inland northeast – Lanka Road (41.03957 S); Second Sugarloaf (40.98063 S); Bayleys Hill (40.97866 S); Mt Cameron area (40.9342 S1); Mt William (40.90683 S); Furneaux – Mt Munro (40.37081 S); Furneaux – Strzelecki area (40.22103 S); Furneaux – Patriarchs (39.95719 S); Furneaux – Killiecrankie (39.80903 S).

RESULTS AND DISCUSSION

Early collection history in Tasmania

The first formal collection of *Dockrillia striolata* from Tasmania was by Joseph Milligan on 10 October 1845, shown on databases as without a specific location, but is in fact the type collection of *Dendrobium milliganii* F.Muell. (a synonym of *Dockrillia striolata*), labelled “Flinders Peaks,

granite rocks” (held at MEL & BM). Milligan was appointed as the superintendent and medical officer at Wybalenna, the Aboriginal community, on Flinders Island in late 1843, and he collected widely on both Flinders Island and the smaller Furneaux islands until April 1846 (Buchanan 1988). Milligan again collected the species on 4 October 1847 from “Mt Killiecrankie, nearly opposite Sisters Isles”, when he was stationed on Flinders Island for five months up to October 1847 (Buchanan 1988).

The first formal collection of the species from mainland Tasmania was in 1879 from “ridges near Ruby Plain, Georges Bay” by G.C. Smith (specimen AD 97708873). In 1880, there was a collection from the general St Helens (Georges Bay) area by an unknown collector (HO 4445), which was closely followed by collections from the same area by Leonard Rodway in 1890 and 1896. Oddly, there are no further collections or database records from the St Helens area. Later records are all from further afield such as the Mount Pearson area (and further north), but these were not until the early 1970s. It is likely that all early collections from “Georges Bay” refer to this much wider area, as evidenced by the Smith collection in 1879, which is from several kilometres west of St Helens.

Inclusions in earlier flora treatments

The species was not included in *Flora Tasmaniae* (Hooker 1858), essentially the first complete treatment of the flora of Tasmania. The omission is surprising given that the earlier collections of the species were by Milligan, one of the early colonial collectors mentioned specifically by Hooker, who cites numerous collections by him for other species, including many orchids. In *Fragmenta Phytographiae Australiae* (Mueller 1859), the species is treated as *Dendrobium milliganii*, with Mueller specifically recognising Milligan in his description of the species (“...legit amicus Dr. Josephus Milligan, florae Diemenicae indagator assiduus”. Mueller (1859) makes reference to specific locations and habitats in Tasmania (viz. “in fissuris rupium graniticarum montis Strzelecki’s Peak altitudine 3000’ et in montibus humilioribus orientalibus insulae Flinders’ Island freti Bassii; nec non in montibus graniticis circiter 1200’ altis pænisulae Freycenetii Tasmaniae”).

It was later included in *A Handbook of the Plants of Tasmania* (Spicer 1878), suggesting the species was well-known by then. In *The Tasmanian Flora* (Rodway 1903), the species is included with distribution notes indicating “East Coast, Bass Straits; also in New South Wales and Victoria”, again confirming the then-recognised distribution of the species, which remains accurate to this day. Firth (1965) in his *Native Orchids of Tasmania* included Cape Barren and Clarke islands as known locations outside mainland Tasmania. His observations are not supported by database records or collections, with only a single collection of the species from Cape Barren Island (from 1988) and none from Clarke Island. In *The Student’s Flora of Tasmania Part 4A* (Curtis 1979), the species’ distribution was described as “...local, especially on granite rocks at the east coast, also on Flinders Island and other islands of the Furneaux Group”, this latter observation again pre-dating



FIG. 1 — Distribution of *Dockrillia striolata* in Australia [source: ALA (2019)].

any formal recognition of the species from islands other than Flinders Island.

Contemporary distribution

Dockrillia striolata occurs along the Great Dividing Range from just west of Newcastle through to northeastern Victoria west of Mallacoota (fig. 1), and along the east coast of Tasmania (fig. 1).

Within Tasmania, the species is widespread in the eastern half of the State (fig. 2), occurring in the Flinders, Ben Lomond and South East bioregions. The southernmost confirmed site is in forested hills behind Kelvedon Beach, about 10 km south of Swansea. Heading northwards, the species has a somewhat disjunct distribution with clusters of records on the Freycinet Peninsula, Douglas–Apsley–Bicheno area, greater St Helens–Bay of Fires area, Mount Cameron, and Mount William areas. The northernmost record on mainland Tasmania is on Mount William itself. The species extends to Cape Barren Island and Flinders Island.

It is somewhat surprising that within the Furneaux Group of eastern Bass Strait islands the species is apparently restricted to Flinders Island and Cape Barren Island, with only one reported site on the latter (fig. 2). While many of the inner and outer Furneaux islands are low-lying and exposed to strong maritime influences, suitable substrates are available and many of the islands (such as Babel, Prime Seal, Big Dog, West Sister and Outer Sister islands; S. Harris pers. comm.) have locally suitable pockets of sheltered habitat. A comprehensive survey of the flora of the outer islands of the Furneaux Group (i.e. those excluding Flinders, Cape Barren and Clarke islands) is reported in Harris *et al.* (2001), where notably the species is not recorded. In particular, the absence of the species from the Kent Group (Deal,

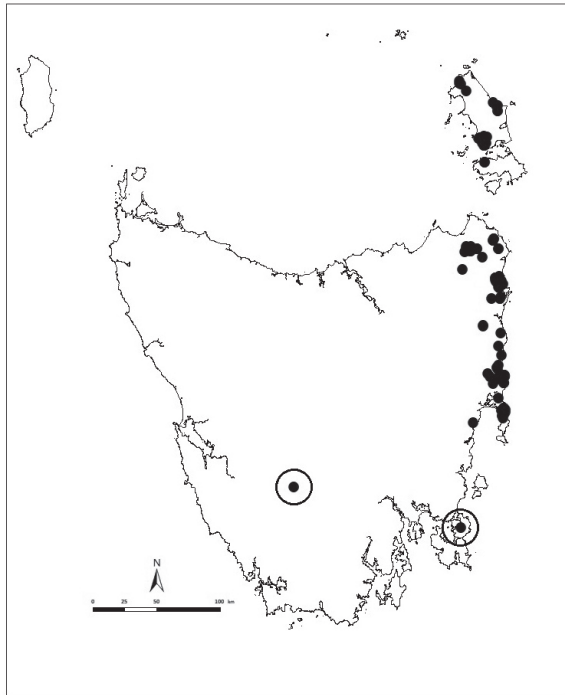


FIG. 2 — Distribution of *Dockrillia striolata* in Tasmania — records from all data sources combined. The dubious outliers on the Gordon River (western circle) and at Murdunna (eastern circle) are highlighted (refer to text).

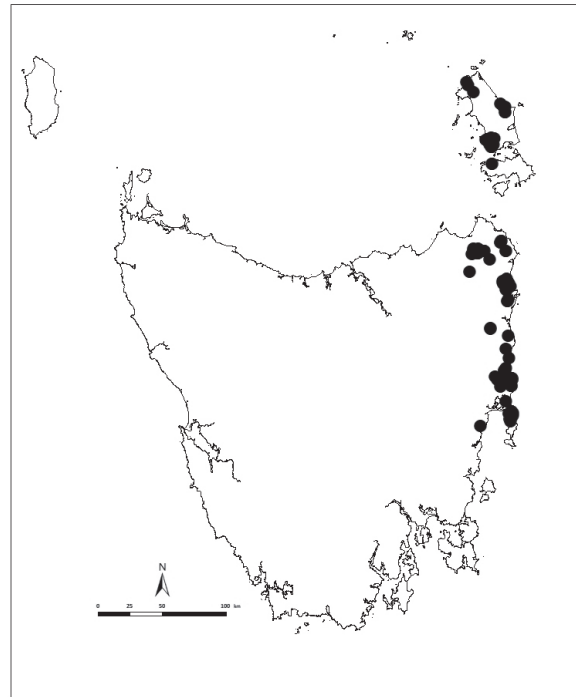


FIG. 3 — Distribution of *Dockrillia striolata* in Tasmania — records from *Natural Values Atlas* only.

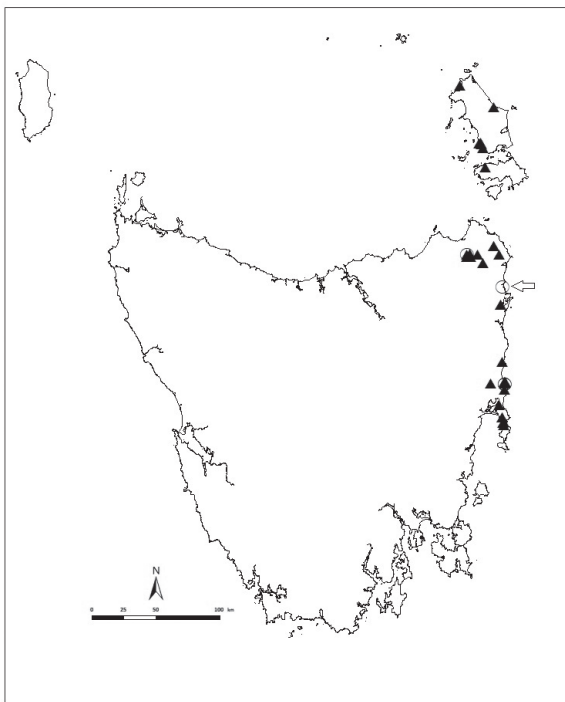


FIG. 4 — Distribution of *Dockrillia striolata* in Tasmania — records from collections at the Tasmanian Herbarium (filled triangles) and the Queen Victoria Museum (open circles) only — note that the QVM collections add an important range infill at Sloop Lagoon, north of St Helens (arrowed).

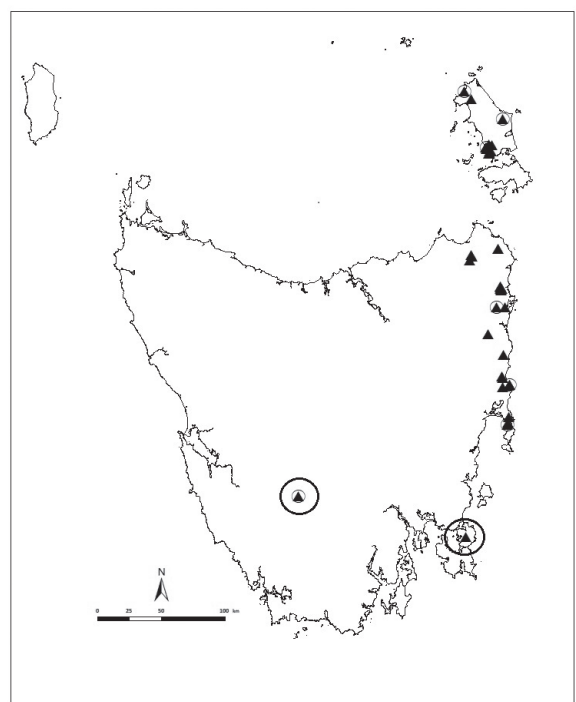


FIG. 5 — Distribution of *Dockrillia striolata* in Tasmania — records from the Atlas of Living Australia (filled triangles) and the Australasian Virtual Herbarium (open circles) only. The dubious outliers on the Gordon River (western circle) and at Murdunna (eastern circle) are highlighted (refer to text).

Dover and Erith islands) about halfway between Flinders Island and Wilsons Promontory (Harris & Davis 1995, Kirkpatrick 1995), Rodondo Island (just off the southern tip of Wilsons Promontory) and Wilsons Promontory itself, is a noticeable data gap between northeastern Tasmania (mainland Tasmania and Flinders Island) through to the northeastern part of Victoria (fig. 1). Interestingly, Mueller (1859, p. 88) referred to the absence of the species from the superficially ideal Wilsons Promontory, viz. “stirps forsitan in tractu altiore granitico promontorii Wilsonii haud frustra quærenda erit” (i.e. an in vain search of perhaps a quarter of the granitic Wilsons Promontory). Firth (1965) reported the species from Clarke Island, which is a relatively large granite-based island between mainland Tasmania and Cape Barren Island. Interestingly, recent biological surveys have not confirmed the species from the island (NCHD 2014).

Reconciliation of database sources

Interpretation of database/collection information has shown several inconsistencies between the available data sources used in this project. Reliable “clean” data is critical to any true understanding of the distribution, management requirements and conservation status of a species. Inconsistency between databases, often created by infrequent and/or partial one-directional exchanges, is a potential source of misunderstanding of the distribution of a species. It is useful to compare the four data sources used as part of the present project to highlight key differences.

In summary, the NVA holds 116 records of *D. striolata* (fig. 3), only 33 of which are cross-held in the ALA. Of the 116 NVA records, 32 represent collections held by the Tasmanian Herbarium (HO), four collections held by the Queen Victoria Museum & Art Gallery (QVM); refer to figure 4 for distribution of records from HO and QVM, and the balance from various data sources. The ALA (fig. 5) only holds 47 records (43 discrete collections) of *D. striolata* from Tasmania, 33 of which are cross-held in the NVA. However, 14 of the ALA records are not cross-held in the NVA, importantly including several earlier records (from 1911, 1914, 1931, and 1933). The AVH (fig. 5) only holds nine records (seven discrete collections) of *D. striolata* from Tasmania, only one of which is cross-held in the NVA (i.e. the AVH includes six “missing” sites). These discrepancies between data sources highlight the need for careful interpretation of records, and ideally, a centralised system of storing all records.

In the case of *D. striolata*, examination of only formal collections held at the Tasmanian Herbarium (32) provides a reasonable picture of the distribution of the species within Tasmania (fig. 4). However, the NVA provides a much more complete representation of the species’ distribution (fig. 3). Scrutiny of the ALA/AVH highlights the inconsistency between data sources (fig. 5), with those databases showing two obvious outliers (described below) not included in the NVA, and missing several records, a key one being the one from Cape Barren Island (also described below). In turn, the NVA is missing several important records held in the ALA, most notably the earliest record of the species from

mainland Tasmania (G.C. Smith, AD 97708873).

The ALA is missing the record of the species from Cape Barren Island, which was cited in Jones (1998), shown on the distribution map in Jones *et al.* (1999), and which is represented by a collection at the Tasmanian Herbarium (Collier 3574), and included in the NVA.

The ALA also suggests that the species occurs on the Forestier Peninsula, putatively near Murdunna Hill (fig. 5), based on an observation included in the NVA (F. Duncan, 5 or 6 June 1983, project code “FT:dry” referring to extensive State-wide dry forest vegetation surveys). The original observer confirmed no field activities on the Forestier Peninsula in that period and suggested that the record more likely referred to a site near Mount Cameron in the northeast, with the northing entered incorrectly into the database as the easting coincides with that part of the state, where extensive fieldwork was undertaken in dry vegetation types (F. Duncan pers. comm.). This record is now marked as “bad” in the NVA (W. Potts pers. comm.).

There is an ALA database record labelled “Gordon River” (fig. 5) from 15 October 1911 by A.L. Rogers. The record is supported by a specimen (AD 97708874) held at the State Herbarium of South Australia (pl. 2). This record represents a significant outlier (fig. 5) and may also be from atypical habitat, i.e. non-coastal riparian rainforest

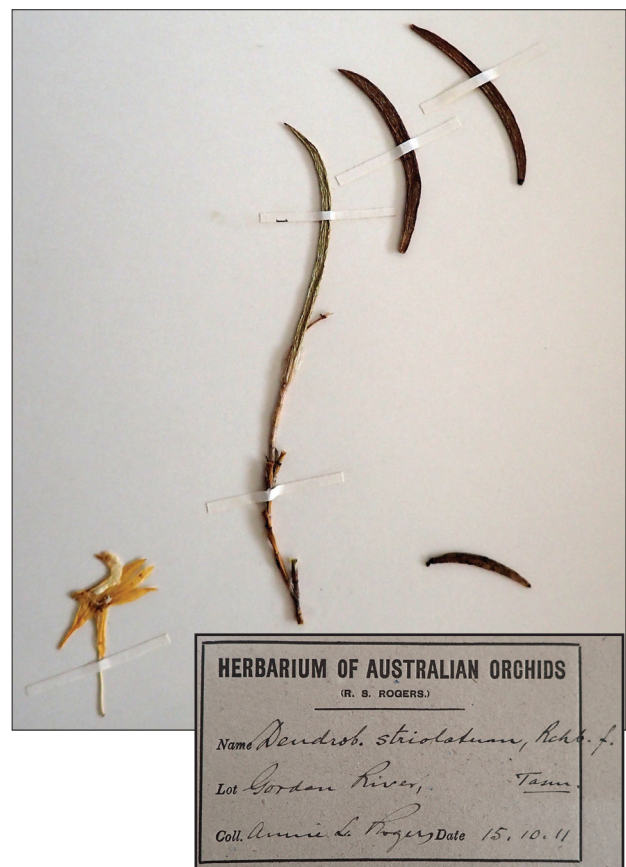


PLATE 2 — Specimen (AD97708874) of *Dockrillia striolata*, with inset showing clearly written label stating “Gordon River, Tasm.” [images courtesy of the Board of the Botanic Gardens and State Herbarium (Adelaide, South Australia)].

vegetation. However, there is only one Gordon River in Tasmania, which runs from the King William Range south and west to Macquarie Harbour on the state's west coast. While it is tempting to discount this record as erroneous (e.g., a mix-up of locations by the original collector or perhaps a reference to a different Gordon River such as the one in Queensland), the collection sheet (with very clearly written location label) and supporting card catalogue record are identical (J. Kellermann pers. comm.). In addition, the Australasian Virtual Herbarium (AVH 2019) indicates 15 collections by A.L. Rogers, all of which are orchids, nine from Tasmania on 25 September 1907, 1 October 1911, 15 October 1911, 10 November 1911 and 13 December 1911, providing strong evidence for the specimen of *D. striolata* having at least been collected from Tasmania. It is presumed that A.L. Rogers was related to R.S. Rogers (1861–1942), widely recognised as one of South Australia's (indeed Australia's) foremost orchidologists (Gibberd 1988), and who collected widely, including in Tasmania. The “problem” with the record is that most of the Gordon River is presently in remote wilderness, a context even stronger in 1911. However, at this juncture, it is impossible to more precisely place the collection.

Habitat

Dockrillia striolata is an obligate lithophyte. Its two primary substrates in Tasmania are Devonian granite-granodiorite (and related igneous rock types) and Jurassic dolerite. Jones *et al.* (1999) stated that the species occurs occasionally on sandstone, but this is not borne out by database/collection information. While several records are associated with substrates other than granite or dolerite, these invariably have low precision and more precise placement of the records associates them with granite or dolerite. Mainland Australian records (as per the ALA) indicate numerous records on sandstone and similar substrates, suggesting that substrate type *per se* is not a limiting factor in the distribution of the species.

In Tasmania, the species tends to grow on massive rock outcrops taking advantage of crevices and imperfections in the rock surface. Smaller boulders and outcrops, especially of granite in more open forests, can also be occupied. While Jones *et al.* (1999; p. 143) suggested that “most colonies are found on east-facing sites directly exposed to moisture-laden sea breezes”, this is not supported by field observations that indicate the species can occupy all parts of a rock outcrop, often including aspects sheltered from the effects of the sea. This is particularly the case for sites further inland, well away from any maritime influence.

Most Tasmanian sites of the species are within 2–10 km of the coast, the majority within the 2–6 km range. A cluster of sites in the Mount Cameron area is ca. 12–14 km from the nearest coast. The record from Mount Nicholas is also ca. 14 km from the coast. The most inland of Tasmanian sites is at Moorina Hill, ca. 27 km and 30 km from the north and east coast, respectively. Mainland Australian records (as per the ALA) indicate numerous records greater

than 50 km inland (with one at least 110 km inland), suggesting that a maritime influence *per se* is not a limiting factor in the distribution of the species.

The vegetation associated with *D. striolata* in Tasmania is highly variable ranging from dry sclerophyll forests and woodlands dominated by species such as *Eucalyptus amygdalina* Labill., *E. viminalis* Labill., *E. tenuiramis* Miq. and *E. sieberi* L.A.S. Johnson to wet sclerophyll forest dominated by *E. regnans* F. Muell. The species is most strongly connected to the drier end of the vegetation spectrum although it is often associated with sheltered and naturally fire-protected sites such as gullies.

D. striolata occurs over a wide range of elevations. On mainland Tasmania, most sites are below ca. 200 m a.s.l., although several sites are at higher elevations (e.g., Mount Cameron ca. 550 m a.s.l., Mount Nicholas ca. 800 m a.s.l., The Hazards to ca. 485 m a.s.l., Bedgood Hill ca. 380 m a.s.l.). Most of the sites on Flinders Island and Cape Barren Island are below 500 m a.s.l.

Morphometrics

Following the formal description of subsp. *chrysantha* by Jones (1998), with ongoing field observations and collections it became apparent that the described differences between subsp. *chrysantha* and subsp. *striolata* were difficult to distinguish in both fresh and curated material, with obvious continuities within some of the features. Examination of publicly available images of the species from across its natural range in Australia reveals a wide range in flower size, crenulation of the labellum margin and flower colour. Images of representative flowers from across the Tasmanian geographic range of the species are provided in plate 3. While variation in several features is present, these are considered to be well within the likely expression of minor genetic differences of disjunct populations.

One-way ANOVA indicated that flower size differed significantly between mainland Tasmanian populations and Furneaux Group population [ISLAND group: $R^2 = 0.3991$, Adjusted $R^2 = 0.3951$, $F(1,148) = 98.307$, $MSE = 356.53$, $p < 0.0001$], with flowers smaller on mainland Tasmania compared to the Furneaux islands (table 1). There was no significant difference between east coast and northeast coast populations on mainland Tasmania, but the Furneaux population was significantly different from both mainland Tasmanian populations [REGION group: $R^2 = 0.3991$, Adjusted $R^2 = 0.3961$, $F(2,147) = 49.87$, $MSE = 180.55$, $p < 0.0001$], again with flowers smaller on mainland Tasmania compared to the Furneaux islands (table 1).

One-way ANOVA indicated that flower size differed significantly between sites [SITE group: $R^2 = 0.5788$, Adjusted $R^2 = 0.5518$, $F(9,140) = 49.87$, $MSE = 57.451$, $p < 0.0001$], with populations from Freycinet, Bicheno, St Helens, inland northeast, Mt Cameron, Mt William and Killiecrankie not significantly different, all with smaller flowers (table 2). Mean flower size from the Mt Munro population is significantly smaller than that of the Strzelecki population but not to the preceding mainland Tasmanian

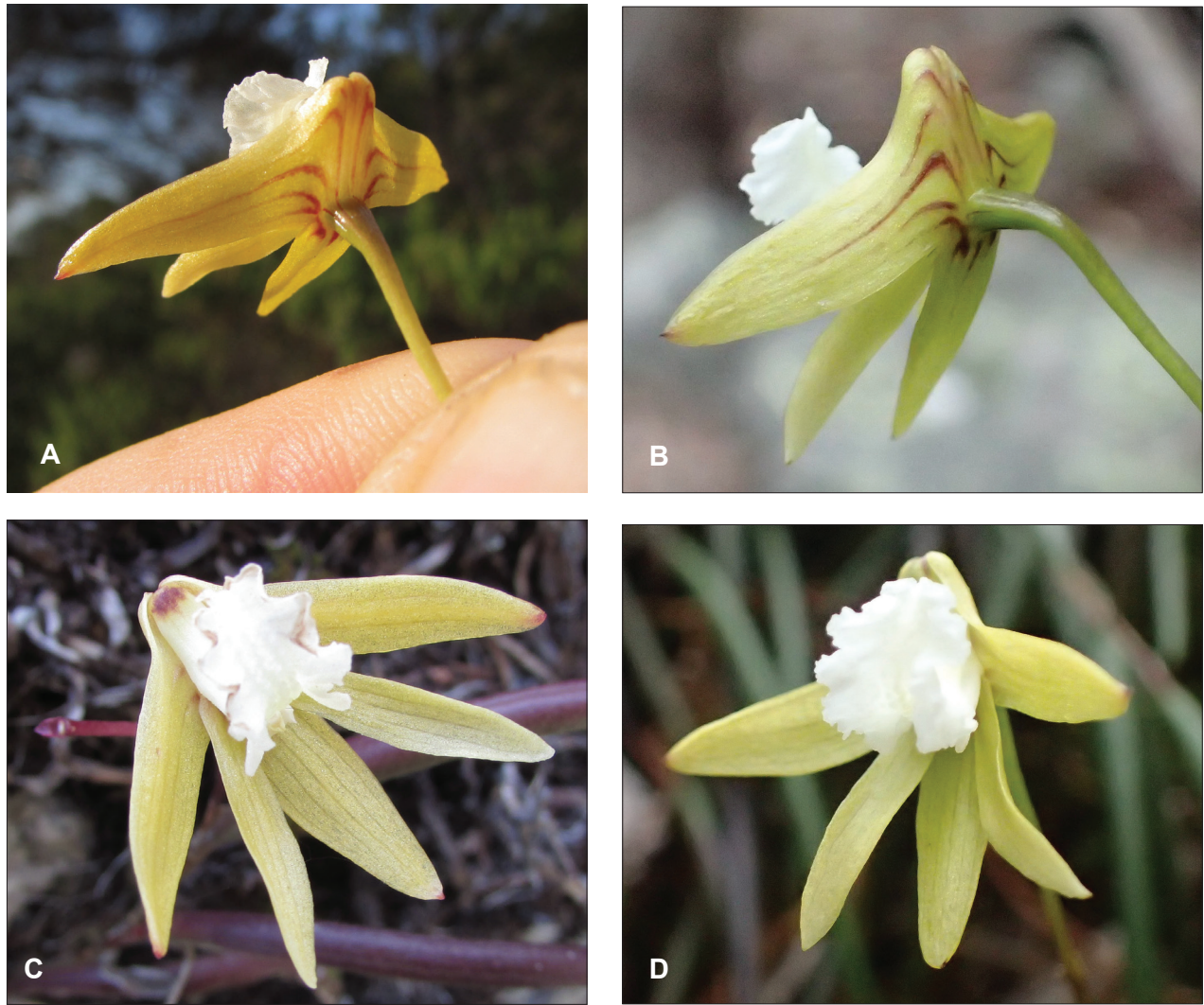


PLATE 3 — Examples of *Dockrillia striolata* from Tasmanian sites. (A & C) – Whalers Lookout, Bicheno, 14 Oct. 2015 (essentially the type location of subsp. *chrysantha*): note the moderate obvious striping on the abaxial surface of the tepals as well as faint striping on the adaxial surface of the tepals. (B & D) – Strzelecki walking track, Flinders Island, 3 Oct. 2017: note the similar degree of striping on the abaxial surface of the tepals and the very faint striping on the adaxial surface of the tepals.

TABLE 1 — Flower size differences between Furneaux islands and mainland Tasmanian populations

Region	Mean (mm)	SD	n	Minimum (mm)	Maximum (mm)
Furneaux	19.30	2.43	30	14.12	23.89
Mainland Tasmania (all)	15.44	1.75	120	11.24	19.42
East coast	15.20	1.93	48	11.24	19.11
Northeast	15.60	1.62	72	12.30	19.42

and Killiecrankie (northernmost Furneaux site) populations. The Strzelecki population has statistically the largest mean flower size (table 2) of all populations.

The results of the regression indicated latitude explained 27.4% of the variance ($R^2 = 0.2738$, $F(1, 148) = 55.8$, $p < 0.0001$), with flower size decreasing by 1.8474 mm for each degree of latitude. That is, the size of the flowers increases from south to north, although the Killiecrankie population (northernmost site) is highlighted as having a mean flower size which is the same as the Freycinet

population (southernmost site), but the sample size for the former population is very small (table 2).

It is noted that the gradation in flower size from south to north (smaller to larger) is opposite to the description of subsp. *chrysantha*, which described mainland Tasmanian flowers as larger than those from the eastern Bass Strait islands and mainland Australia (Jones 1998). Flower size alone is too variable to be useful for separating mainland Tasmanian populations from those from mainland Australia and the Furneaux islands, with differences most likely to

TABLE 2 — Flower size between all sites (ordered north to south)

Region	Mean (mm)	SD	n	Minimum (mm)	Maximum (mm)
Furneaux (Killiecrankie)	14.33	0.29	2	14.12	14.53
Furneaux (Patriarch)	18.50	0.69	5	17.75	19.46
Furneaux (Strzelecki)	20.72	1.67	18	17.56	23.89
Furneaux (Munro)	16.96	1.16	5	16.09	18.38
Mt Cameron area	15.95	1.59	45	12.30	19.42
Mt William area	15.01	1.62	15	12.40	18.19
Inland northeast	14.20	0.21	2	14.05	14.35
St Helens area	15.21	1.54	10	12.91	17.71
Bicheno area	15.78	2.04	28	11.24	19.11
Freycinet area	14.33	1.44	20	11.85	13.51

be caused by minor genetic or phenotypic variation at the sub-population level.

The original description by Jones (1998) states that flower colour is taxonomically important for separating *D. striolata* subsp. *striolata* from subsp. *chrysantha*. If apparent minor variations in flower colour and size are accepted as unreliable characters on which to separate infrataxa (or indeed higher level taxa), and the degree of crenulation in the margin of the labellum is accepted as a subjective feature only (possibly only related to flower size), this leaves only the degree of striping on the tepals that can be reliably used to separate subsp. *chrysantha* from subsp. *striolata*. The often-cited (e.g., Jones *et al.* 1999) feature of subsp. *striolata* as having tepals with “dark stripes, particularly prominent on the outside of the perianth segments” and of subsp. *chrysantha* as having tepals that “lack stripes or are only faintly striped” fails to hold true. The images of the two subspecies provided with the type description (Jones 1998; p. 215) shows the prominently striped outside of the tepals of subsp. *striolata* from Genoa Peak in Victoria but does not show the inside of the tepals, and only properly shows the inside of the tepals of subsp. *chrysantha* from Bicheno in Tasmania (type location; pl. 1). The outside of the flowers from the latter site is mainly obscured but partial dark red stripes and reddish apices of the tepals are visible in some flowers. My own examination of fresh flowers from the type location of subsp. *chrysantha* at Bicheno (both Whalers Lookout and Lookout Rock) indicate that while the inside of the tepals may only be faintly striped, the outside of the flowers is moderately striped with dark red bands (pl. 3). Examination of online images of mainland Australian *striolata* clearly shows a wide range of striping on the inside (and outside) of the tepals, indicating a continuum in this character, insufficient to warrant subspecific (or even varietal) rank. It is considered that differences in flower colour and degree of adaxial/abaxial striping on perianth segments (pl. 3) most likely reflect minor genetic variation at the sub-population level, the differences presumably persistent because of periods of genetic isolation.

Taxonomy

The revised taxonomy is as follows:

Dockrillia striolata (Rchb.f.) Rauschert, *Feddes Repert.* 94(7-8): 447 (1983)

Dendrobium striolatum Rchb.f., *Hamburger Garten-Blumenzeitung* 13: 313 (1857); *Callista striolata* (Rchb.f.) Kuntze, *Revis. Gen. Pl.* 2: 655 (1891); *Dockrillia striolata* (Rchb.f.) Rauschert subsp. *striolata*.

TYPE: “Im Garten des Herrn Consul Schiller Von Herrn Stange cultivirt.” cult., *Schiller* (holo W, *vide* Clements 1989).

Dendrobium milliganii E.Muell. *Fragm. (Mueller)* 1(4): 88, t. VI (1859).

TYPE: Flinders Peaks, granite rocks, 10 Oct. 1845, *J. Milligan* 923 (lecto MEL, *vide* Clements 1989).

Dockrillia striolata (Rchb.f.) Rauschert subsp. *chrysantha* D.L.Jones, *Austral. Orchid Res.* 3: 9 (1998).

TYPE: Tasmania, Bicheno, 18 Oct. 1994, *D.L.Jones* 13582 & *B.E.Jones* (holo CANB).

The vernacular “yellow rock-orchid” is suggested to reflect the flower colour and lithophytic habit, in line with Jones *et al.* (1999), Jones (2006) and Wapstra *et al.* (2005).

As part of the present project, all specimens held at HO have been re-determined by the author to *Dockrillia striolata* (Rchb.f.) Rauschert, with no subspecies recognised.

Conservation status: population parameters

The Scientific Advisory Committee, established under the provisions of the TSPA, produced a set of “*Guidelines for Eligibility for Listing under the Threatened Species Protection Act 1995*” (DPIW 2008). These *Guidelines* include definitions of some key population variables that are used in most measures of conservation status, and these are explored below for *D. striolata*. These are further explored in the section on the conservation status of the species.

D. striolata is likely to be an under-collected species because of its fleshy leaves making curation difficult (the leaves and flowers also readily disarticulate, resulting in poorly presented specimens). In addition, non-threatened

species tend to be under-represented in databases. While it is recognised that there are numerous additional sites of *D. striolata* in Tasmania not represented by formal herbarium collections and/or database records, sufficient information is available to estimate several population parameters.

Extent of occurrence

A minimum convex polygon created around the known records/collections (excluding the dubious records from Murdunna and the Gordon River) equates to an extent of occurrence of ca. 7500 km², which is ca. 270 km and 50 km in a north–south and an east–west direction, respectively. It is highly unlikely that there have been any material changes to the extent of occurrence historically (e.g., from habitat loss). It is reasonable to assume that there will be future minor range infills and possibly limited range extensions.

Number of subpopulations or locations

Defining the number of subpopulations or locations of *D. striolata* in the traditional sense of the terms is problematic. For example, while it is simple enough to define a subpopulation of the species that occurs on Thirty Acre Creek south of Swansea because it is represented by a single database record, defining the number of subpopulations that are present on Freycinet Peninsula is impractical. There are only sixteen database records for the entire Freycinet Peninsula, two of which are obvious duplicates. Only seven of the remaining fourteen records have any location information, none better than “Coles Bay”, “Freycinet Peninsula” or “Wineglass Bay Track”. However, to field botanists, it is well-known that the species occurs on perhaps hundreds of rock outcrops across The Hazards and in surrounding lower-lying terrain. That said, it is interesting to note the lack of any records south of The Hazards – that is, the species is apparently absent from the southern part of the peninsula, including Schouten Island, despite superficially identical habitat to the northern part of the peninsula.

As such, using available information to estimate the number of subpopulations (or locations) is impractical, beyond defining some of the broader locations (table 1), and noting that several database records have not been considered due to lack of any supporting notes as to location.

The species is represented at six locations on the Furneaux islands: five on Flinders Island (Mount Killiecrankie, possibly the Wingaroo area (most likely Mount Blyth or Mount Boyes, both low-lying granite rises), North Patriarch, South Patriarch, and several sites in the Strzelecki range), and one on Cape Barren Island (Mount Munro). This is likely to represent a significant under-estimate of the number of locations supporting the species across the greater Furneaux region, with several sites being prospective such as Mount Kerford on Cape Barren Island (S. Harris pers. comm.). On mainland Tasmania, the species is represented at ca. 27 locations (excluding the dubious records from Murdunna and the Gordon River), the precise number is very much dependent on how a location is defined (i.e. the distance between locations, especially taking into account imprecision in database/collection information). The total

number of locations is ca. 33, although there are several caveats to this (previously discussed) that indicate the number of locations is likely to be much greater.

There is no evidence of an historical decrease in the number of locations supporting the species. Given the reasonable likelihood of range infillings, there is likely to be a minor increase in the number of locations supporting the species.

Area of occupancy

It is difficult to estimate the area of occupancy because most records are not accompanied by detailed collection notes. Most sites are represented by locally dense “colonies” that in themselves occupy a few square metres. Even with hundreds, perhaps low to mid thousands of “colonies”, within the species’ distribution, the total area of occupancy is unlikely to exceed a few hectares at most. As with the extent of occurrence, there is no evidence that there has been an historical decrease, or that there is a reasonable anticipation of a future decrease, in the area of occupancy of the species. The concept of area of occupancy has limited applicability to this type of colony-forming species, with localised clumps scattered over severally closely positioned rock outcrops, themselves scattered widely across a whole mountain range.

Number of mature individuals

Estimating the total State-wide abundance of mature individuals for *D. striolata* is difficult due to the lack of information associated with most records and the growth habitat of the species. Some authors (e.g., Jones *et al.* 1999) refer to “colonies” of the species, referring to locally dense clumps of the species on rock outcrops, which may represent one or many individuals. However, at any particular site (e.g., Wineglass Bay lookout on Freycinet Peninsula or Whalers Lookout at Bicheno), the location supporting the species may only be represented by a small number of formal records but it is locally common, occurring at numerous sites, each of these represented by one to many “colonies”. On this basis, it is only possible to make vague estimates of population abundance, herein suggested to be in the order of low to high thousands of “colonies”.

Severely fragmented

The *Guidelines* describe “severely fragmented” as the situation in which increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations, which may go extinct with a low probability of recolonisation. The *Guidelines* consider fragmentation relevant in relation to flora if it increases the risk of disease or weed invasion by increasing edge effects, increases inbreeding effects, or decreases reproductive output. The distribution of *D. striolata* is somewhat disjunct but hardly properly fragmented. In fact, it is more likely that some of the apparent gaps in the distribution (e.g., in the Douglas–Apsley area and the St Helens area) will be filled with more comprehensive reporting of the species.

Conservation status: reservation status

Dockrillia striolata is a well-reserved species with populations reported from the following gazetted formal reserves: Freycinet National Park, Coles Bay Conservation Area, Lookout Rock State Reserve, Whalers Lookout Conservation Area, Douglas-Apsley National Park, Lower Marsh Creek Regional Reserve, St Patricks Head State Reserve, Huntsmans Cap Regional Reserve, Mount Pearson State Reserve, Doctors Peak Regional Reserve, Cameron Regional Reserve, Mount William National Park, Strzelecki National Park, Patriarchs Conservation Area, Foochow Conservation Area, Wingaroo Nature Reserve, and Killiecrankie Nature Recreation Area. These reserves span the effective geographic range of the species. Jones *et al.* (1999, p. 143) stated that “subsp. *chrysantha* is well represented in reserves, but subsp. *striolata* is represented only in the Strzelecki National Park”. This statement is now no longer correct, with the species represented in at least three formal reserves on Flinders Island. Due to imprecise database information, it is likely that the record (labelled “North Patriarch”) from the Foochow Conservation Area is actually from the Patriarchs Conservation Area. The record from the Wingaroo Nature Reserve is difficult to place because it is associated with numerous other plant records from the same collector on the same date that extend beyond the boundaries of the reserve, but is most likely from Mount Blyth or Mount Boyes, both low-lying granite rises.

Four records fall within former commercial wood production forests, currently referred to as Future Potential Production Forest (Crown), and only two within areas designated as Permanent Timber Production Zone Land. One of the latter is of very low precision and is more likely from some form of reserved land. The other is from Moorina Hill, first reported in 1970, and confirmed by the author in 1995–2000 as part of a pre-harvest forestry coupe survey.

The species also occurs in one site on private land subject to a conservation covenant under the Tasmanian *Nature Conservation Act 2002*.

There are relatively few records (19 of 109 records in the NVA) on unreserved private freehold, most of which are imprecise and likely refer to nearby reserved land such as the Douglas-Apsley National Park, Strzelecki National Park or reserves in the Bicheno area. One site is on Mount Munro on Cape Barren Island, currently without any formal reservation status. Firth (1965) reported the species from Clarke Island (although no information exists to support this), which is classified as the lungtalanana Indigenous Protected Area.

While reservation *per se* does not impose necessarily ideal management regimes nor preclude potentially deleterious management regimes to a species, in the case of *D. striolata*, the high level of reservation across its range, combined with several separated sites within particular reserves (most notable in reserves such as Freycinet National Park, Douglas-Apsley National Park and Cameron Regional Reserve), appears to offer a reasonably high level of persistence

potential and long-term security to the species across its range and sub-regionally.

Conservation status: conservation management

Dockrillia striolata appears to be a generally robust and resilient species, with many “colonies” that are very long-lived. For example, the well-known sites at Bicheno, Freycinet Peninsula and on Flinders Island have been present for over a century. Jones *et al.* (1999, p. 143) suggested that because the “roots spread widely over the rock surfaces and in crevices [they are] not insulated by soil [and] the plants are very vulnerable to all but low-intensity ground fires”. However, there is little evidence that the species is deleteriously affected by wildfire or prescribed (fuel reduction) burns. For example, The Hazards on Freycinet Peninsula were subject to an intensive wildfire in February 1980 that left the slopes denuded for many years, exposing many of the massive granite boulders supporting *D. striolata*, but the species remains abundant and healthy across this mountain range.

At a highly localised level, specific “colonies” may be affected by minor land use activities such as the construction and use of walking and mountain bike trails. Again, however, it appears that despite very high visitation that includes visitors scrambling over rocks to gain the best views, “colonies” remain healthy and long-persistent, flowering and fruiting each year, at sites such as Whalers Lookout/Lookout Rock at Bicheno and the lookout on the Wineglass Bay Track on Freycinet Peninsula.

Wood production activities have the potential to include localised sites supporting the species. At a broader level, within the wood production landscape, many sites supporting *D. striolata* would be excluded informally through management of streamside reserves as required by the *Forest Practices Code* (FPA 2015), or through informal reservation through the Management Decision Classification system developed by Forestry Tasmania for publicly managed forests (Orr & Gerrard 1998). At a finer scale of forest management, microhabitats such as rock outcrops are recognised as a site of potential significance for flora in the *Forest Botany Manual* (FPA 2005), the primary planning tool used by forest planners to take account of conservation values in commercial wood production activities. The usual practice is for such habitat features to be excluded from intensive forestry activities. For example, a site on a massive granite outcrop in *Eucalyptus regnans* wet sclerophyll forest at Moorina Hill was detected during a pre-harvest forestry coupe survey (M. Wapstra pers. obs.) and subsequently protected, with a substantial buffer, from surrounding hardwood plantation development.

Conservation status: a review of the formal conservation status of *Dockrillia striolata*

Dockrillia striolata is not presently listed as threatened on either the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBCA) or the

Tasmanian *Threatened Species Protection Act 1995* (TSPA). With such a widespread distribution (eastern Tasmania through to northern New South Wales), the species would not qualify for listing under the EPBCA.

However, a review of its potential status on the TSPA is considered warranted because there has been informal concern that former subsp. *chrysantha* may be “possibly threatened” (listing under the NVA), presumably because of its endemic status. Even with the revised taxonomy that no longer recognises the subspecies, the opportunity is taken to assess the taxon against the “*Guidelines for Eligibility for Listing under the Threatened Species Protection Act 1995*” produced by the Scientific Advisory Committee, established under the provisions of the TSPA (DPIW 2008).

Due to its widespread distribution and number of locally abundant subpopulations, there is no notion that the species would qualify as either endangered (Schedule 3) or vulnerable (Schedule 4) under the Act. Following are the criteria for Schedule 5 (rare), copied verbatim from the *Guidelines*, with my comments on their specific application to *D. striolata* in square brackets below each.

A taxon of native flora or fauna may be listed as rare if it has a small population in Tasmania that is not endangered or vulnerable but is at risk (Section 15(4) of the Act).

The following criteria may provide evidence of the level of threat. In order to be considered as rare at least ONE of the criteria A-B should apply.

(A) A taxon of limited distribution or numbers, threatened by existing ongoing processes occurring over sufficient of their range to suggest that they would satisfy the indicative criteria for vulnerable unless the threatening process was abated based on (and specifying) any one of the following:

1. the extent of occurrence is less than 80×80 km or 2000 km²,

[The extent of occurrence is estimated at 7500 km² – SUB-CRITERION NOT MET].

2. the area of occupancy is not more than 0.5 km² (50 hectares);

[The area of occupancy is tentatively estimated at no more than a few hectares but the concept of area of occupancy has limited application to this species – SUB-CRITERION REASONABLY NOT MET].

3. taxa that are not A1 or A2 above, but that have very small and localised subpopulations wherever they occur (generally no subpopulation with an area of occupancy greater than 0.01 km² (1 hectare) and no more than 1,000 mature individuals).

[While difficult to estimate the abundance of any particular subpopulation, there is no direct evidence of any subpopulation occupying greater than 1 ha and/or more than 1000 mature individuals – SUB-CRITERION MET].

(B) Total population small or restricted and at risk in the form of EITHER of the following:

1. the total population consists of fewer than 10,000 mature individuals, and no more than 2500 mature individuals occur on land that is in an area free from sudden processes capable of causing largely irreversible loss of individuals or habitat; OR

[The total population is estimated in the order of low to high thousands of “colonies”, which may technically meet the “fewer than 10,000 mature individuals”. However, virtually all subpopulations are considered secure – SUB-CRITERION NOT MET].

2. 90% of mature individuals occur in 15 or fewer subpopulations or locations and no more than 5 of these occur in an area that is free from sudden processes capable of causing largely irreversible loss of individuals or habitat.

[The species is represented by more than 30 subpopulations (or locations), virtually all of which are considered secure – SUB-CRITERION NOT MET].

Evidence points to a species that is widespread, represented by many subpopulations that are well-reserved, resilient to various forms of natural disturbance, and not subject to specific identifiable anthropogenic threats. This statement is applicable to both the Tasmanian mainland part of the population and the Furneaux islands part of the population. However, the species technically meets Criterion A of the *Guidelines* because of the restricted area of occupancy. On this criterion, many Tasmanian vascular and non-vascular plants would qualify for listing. In the author’s opinion, a key phrase in the TSPA is “... but is at risk”. In terms of predictable threats such as fire, *D. striolata* appears to be a resilient and robust species. It is noted that reservation status *per se* does not form part of these criteria. However, for some species such as *D. striolata*, which occurs in vegetation not requiring specific management intervention to ensure persistence, occurrence in reserves contributes significantly to the concept of “security from risk”. This leaves stochastic events as the main threatening process, which by definition are unpredictable. For some species that occur as a single population, stochasticity can come into play. An example is *Azorella macquariensis* (Macquarie Cushion), which occurs on subantarctic Macquarie Island, where it was assumed to be quite secure, before being devastated by a disease, an event that caught everyone by surprise (i.e. genuinely stochastic). In the case of *D. striolata*, the potential impact of a stochastic event is unlikely to manifest as a State-wide whole-of-population crash because of the widespread and geographically separated subpopulations. In the author’s opinion, there is insufficient evidence to nominate *D. striolata* as a threatened species under the Tasmanian *Threatened Species Protection Act 1995*.

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(accepted 30 October 2019)

APPENDIX 1 — Specimens examined¹

AUSTRALIA: Tasmania: Mt William, W face, Mt William National Park, 27 Oct 1981, *M.J. Brown* 6 (HO55660), [7]; near Georges Bay, Jan 1896, *L. Rodways* s.n. (HO500736), [4]; Bicheno, Sep 1927, *F. Perrins* s.n. (HO503341), [5]; Bicheno, Lookout Rock, Jan 1984, *P.A. Collier* 22 (HO115674), [3]; Mt Strzelecki, lower quarter of track, Flinders Island, 12 Jan 2007, *M. Visoiu* 265, *L. Perrins* & *A.M. Buchanan* (HO543662) [0, no flowers present on collection]; North Patriarch, 30 km N of Lady Barron, Flinders Island, 26 Oct 1990, *P.A. Collier* 4872 (HO127074), [5], Mt Peter, summit, 29 Dec 1985, *A.M. Buchanan* 7686 (HO406932), [0, no flowers present on collection]; Cube Rock, SE slopes of Mt Cameron, *A. Moscal* 4088 (HO101481), [10]; Mt Strzelecki track, Flinders Island, *P.A. Collier* 780 (HO95849), [6]; Mt Killiecrankie, nearly opposite Sisters Isles, 4 Oct 1847, *J. Milligan* 923 (HO500737), [2]; Mt Munro, Cape Barren Island, 7 Oct 1988, *P.A. Collier* 3574 (HO118398), [5]; Apsley River, 2 Nov 1985, *P.A. Collier* 948 (HO116804), [7]; Mt Cameron, 18 Nov 1983, *A. Moscal* 4180 (HO94553), [17]; Mt Cameron, 21 Oct 1983, *A. Moscal* 3693 (HO82040), [9]; Mt William, summit, 8 Sep 1983, *A. Moscal* 2563 (HO70862), [3]; Bayleys Hill, summit ridge, 16 Sep 1983, *A. Moscal* 2758 (HO71758), [5]; Georges Bay, Nov 1890, *L. Rodway* 750 (HO500769), [6]; Second Sugarloaf, 2.5 km south east of

Gladstone, 29 Sep 1988, *F. Coates* s.n. (HO112450), [4]; Bicheno, Harveys Farm Road, 23 Oct 1992, *H. Wapstra* & *A. Wapstra* s.n. (HO329686), [2]; Bedggood Hill, near Bicheno, 20 Mar 1980, *A. Moscal* 234 (HO34275), [0, no flowers present on collection]; Wineglass Bay, Oct 1940, *W.M. Curtis* s.n. (HO500767), [1]; Strzelecki Track, Flinders Island, *H. Wapstra* & *A. Wapstra* s.n. (HO518504), [8]; Bicheno, NE of town centre, *D.L. Jones* 13582 & *B.E. Jones* (HO523462, TYPE of subsp. *chrysantha*), [3]; Bicheno, 5 Nov 1962, *no collector indicated* (HO537072), [4]; Wineglass Bay Track, Freycinet National Park, 25 Oct 2008, *J.K. Janes* 405 (HO549725), [2]; Coles Bay, Sep 1948, *W.M. Curtis* s.n. (HO536589), [6]; Coles Bay, Oct 1951, *G. Sharman* s.n. (HO536590), [5]; Lanka Road area, near the Great Musselroe River, 5 Oct 2005, *M. Douglas* s.n. (HO533819), [2]; NE end of Mt Cameron Range, 27 Nov 2005, *M. Douglas* s.n. (HO535874), [3]; Bicheno, 23 Oct 1969, *C. Shea* s.n. (HO563452), [7]; Flinders Island, Mt Strzelecki, 19 Oct 1976, *M. Allan* s.n. (HO569976), [4]; Freycinet National Park, Wineglass Bay Track, 25 Oct 1980, *M. Allan* s.n. (HO589553), [6]; Mt Cameron East, 22 Oct 1973, *C. Taylor* s.n. (HO589554), [2]; Coles Bay, Oct 1957, *H. Gulline* s.n. (HO500768), [1]; East Coast, Oct 1931, *J. Overall* 7 (HO105721), [1].

¹ Location (as per HO collection label), collector, date of collection, HO accession no., [number of flowers measured from collection sheet]

