The distribution and ecology of the liverwort *Lembidium longifolium* R.M.Schust. (Lepidoziaceae : Hepaticae)

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Abstract

Field observations and existing herbarium records demonstrate that *Lembidium longifolium* occurs over a wide geographical area, and can be locally abundant at some sites. The presence of this species at a site appears related to the occurrence of disturbance events that expose vertical soil substrates. This dependence upon disturbance is supported by the capacity for asexual reproduction possessed by this species, which is unusual within subfamily Lembidioideae. This life strategy and habitat preference suggest that the observed abundance on Hauturu (Little Barrier Island), where human impact is minimal, may be related to the burrowing activities of nesting seabirds.

Keywords

Lembidium longifolium; Lepidoziaceae; Lembidioideae; distribution; ecology; New Zealand; liverwort conservation.

Introduction

The Lembidioideae (Lepidoziaceae), like many "cool adapted" liverworts, has its centre of diversity and endemism in New Zealand (Schuster 1982). All four genera (*Lembidium, Hygrolembidium, Isolembidium*, *Chloranthelia*) recognised by Schuster and Engel (1987) occur within the New Zealand botanical district (as defined in Allan 1961). *Lembidium* is a regionally endemic genus, occurring only in New Zealand and its sub-Antarctic islands. *Lembidium nutans* is common throughout New Zealand, on damp soils, and is commonly observed growing alongside forest tracks in the northern half of the North Island.

In 1980, Schuster described a second species, *Lembidium longifolium* R.M.Schust., also endemic, based on material he collected on Little Barrier Island (Schuster 1980). *Lembidium longifolium* is distinct from *L. nutans* in its narrower, spreading leaves that are usually strongly notched at the apex, and bear several small irregular teeth on their margins (Schuster & Engel 1987). In the field one of the most distinctive features of *L. longifolium* is its colour, being a bright, glaucous lime-green, in contrast to the bright clear green of *L. nutans.* Schuster and Engel (1987) state that *L. longifolium* and *L. nutans* are ecologically differentiated in that *L. longifolium* occurs as a pioneer on rock faces, whereas *L. nutans* occurs on compact moist soils, and never on rock faces.

At the time of Schuster's and Engel's (1987) revision of subfamily Lembidioideae (Lepidoziaceae), *Lembidium longifolium* was known from only three localities, Little Barrier Island, and two locations in Westland; Camp Creek west of the Alexander Range, and the Rapahoe Range. The apparent rareness of this species was cause for its being regarded as rare, and perhaps deserving of inclusion in threatened plants listings. This short note reports several new localities that reduce disjunctions in the observed range of *Lembidium longifolium*, and add to knowledge of the range and ecology of this species.

Range extensions (Figure 1)

In the North Island, *Lembidium longifolium* was observed in Pirongia Forest Park immediately below Wharauroa, (800 m) (AK 257605), growing on a vertical rock face covered with a thin organic layer, and shaded by *Blechnum novae-zelandiae* on the trackside. This is the first record for the species for the North Island mainland (Figure 1). *Lembidium longifolium* was also observed on Hauturu (Little Barrier Island), the type locality, where it is common at high altitude. Sizeable colonies were noted, (though not substantiated by voucher specimens) at Herekohu (694 m) on wet vertical humus below tree roots; Hauturu summit track (710 m); Parkins knoll (600 m) growing on dripping humus banks; and at Orau (647 m), on a dripping vertical rock face covered by a thin organic layer.

Figure 1: Distribution of *Lembidium longifolium*, based on previous herbarium records and field observations by the authors.

In the South Island, *Lembidium longifolium* has been observed at a range of sites, particularly in northern Westland. At Coalbrookdale, near Denniston (570 m), *Lembidium longifolium* grows on soil just below the top of a man-made cutting in the shade of dense tall scrub (*JEB* 98500G). The species is present along the banks of Big Nugget Gully, Deadman's Creek, Greymouth (190 m) (CMSAZ 117T/1), and on humus at the back of soil scours in surrounding forest. *Lembidium longifolium* grows alongside the Croesus track, Paparoa Range in a similar habitat, on overhanging soil at the very back of scours eroded out of dripping wet track cuttings (250–750 m) (AK 257608). Due to the abundance of available habitat the *Lembidium* is common along the track from Blackball Road to the tree line below Ces Clark Hut. *Lembidium longifolium* was observed on Sewell Peak at the southern end of the Paparoa Range, at 625 m, growing on compacted humus at the top of a bank along the summit access road (AK 257607). At Arthur's Pass National Park, at an altitude of 810 m, one patch of *L. longifolium,* covering some 25 square centimetres, was found growing on alluvium at the back of a scour in the true left bank of McGrath Stream (AK 257606). *Lembidium longifolium* has also been observed growing on vertical dripping banks in heavy shade around the Cascade River, South Westland (J.E. Braggins *pers obs*).

Specimens examined

North Island: Tainui Ecological Region, Pirongia Forest Park, Wharauroa, (800 m), *M. Renner and M. Hede* 15.10.2001, AK 257605.

South Island: Nelson District, Denniston, Denniston incline track (200m), *A.J. Fife 11130*, 28 November 1997 CHR 515092; Coalbrookdale, near Denniston (570 m) *J.E. Braggins* December 1997 (JEB 98500G); Westland Ecological Region: Westport, Totara River, Lockington Pakihi road, (40 m), *D. Glenny 6995* 29 November 1997, CHR 530666; Deadman's Ecological Region: Big Nugget Gully, Deadman's Creek, Greymouth (190 m), *M. Renner* 5 May 2002 (CMSAZ117T/1); Paparoa Range, Croesus Track, Blackball side (290 m), *M. Renner* 28 March 2001, AK 257608; Sewell Peak, Road to summit (625 m), *M. Renner* 30 March 2001, AK 257607; Rapahoe Range (150 m), *J. Child H5404* 5 February 1984 CHR 385434; Hawdon Ecological Region: Arthur's Pass National Park, McGrath Creek (820 m), *M. Renner* 31 March 2001, AK 257606.

Ecology

Lembidium longifolium is capable of growing on soil, as well as rock, so is not as simply differentiated ecologically from *L. nutans* as portrayed in Schuster & Engel (1987). All plants observed, without exception, grew on near vertical to overhanging substrates that were often visibly damp and in fairly heavy shade, provided by either thick forest cover or dense overhanging vegetation, or by the depth of the scour. The plant's occurrence on soil appears to be associated with disturbance that exposes a bare vertical surface, such as periodic stream flooding, track construction activities, or as on Little Barrier, soil creep and turnover associated with steep terrain and the burrowing activities of nesting seabirds. *Lembidium longifolium* also grows on vertical rock faces that are covered by a thin organic scum. *Lembidium longifolium* occupies a wide altitudinal range, from close to sea level to over 800 m, though it appears to be restricted to higher elevations in the north of the North Island, so far being known only from cloud forests associated with steep terrain.

Identification (Figures 2 and 3)

While *Lembidium longifolium* (Figure 2) is highly distinctive in its colour and habitat, it is not the only plant of vertical shaded substrates with a glaucous aspect. At least three other species associated with this habitat, *Bazzania tayloriana* (Mitt.) Kuntze, *Lembidium nutans* (Figure 3) and *Telaranea elegans* (Colenso) J.J.Engel & G.L.S.Merrill, may cause confusion, but may be separated by the following key :

1. Leaves flat/planar, trifid, plants with incubous leaf insertion, shoots typically creeping, so as to lie parallel to level ground.....**2**
Leaves concave/boat-shaped, bifid, plants with transverse leaf insertion, shoots erect or pendulous, raised away from the substrate.....**3**

2. Leaf-lobes ending in uniseriate tip of 3–5 cells, appearing as a spine. Leaves with antical and postical margins straight and parallel. Vitta absent from leaves. Geotropic microphyllous axes absent. Underleaves bifid or trifid.----------***Telaranea elegans***
Leaf-lobes triangular, small, not spine-like. Leaves with antical margin at least somewhat convex. Vitta present in leaves. Geotropic microphyllous axes present. Underleaves quadrifid.---------***Bazzania tayloriana***

3. Plants glaucous, leaves imbricated to contiguous, transversely inserted, fragmenting, accessory teeth present on margins. ----------***Lembidium longifolium***
Plants not glaucous, leaves densely imbricated, slightly incubously inserted, very rarely (if ever) fragmenting, accessory teeth absent from margins.----------***Lembidium nutans***

Bazzania tayloriana and *Telaranea elegans* (as *Telaranea centipes* (Tayl.) R.M.Schust.) are illustrated in Allison & Child (1975). Schuster and Engel (1987) illustrate *Lembidium nutans* on pages 274 and 276, and *L. longifolium* on pages 278 and 279 and provide a key to species of *Lembidium*.

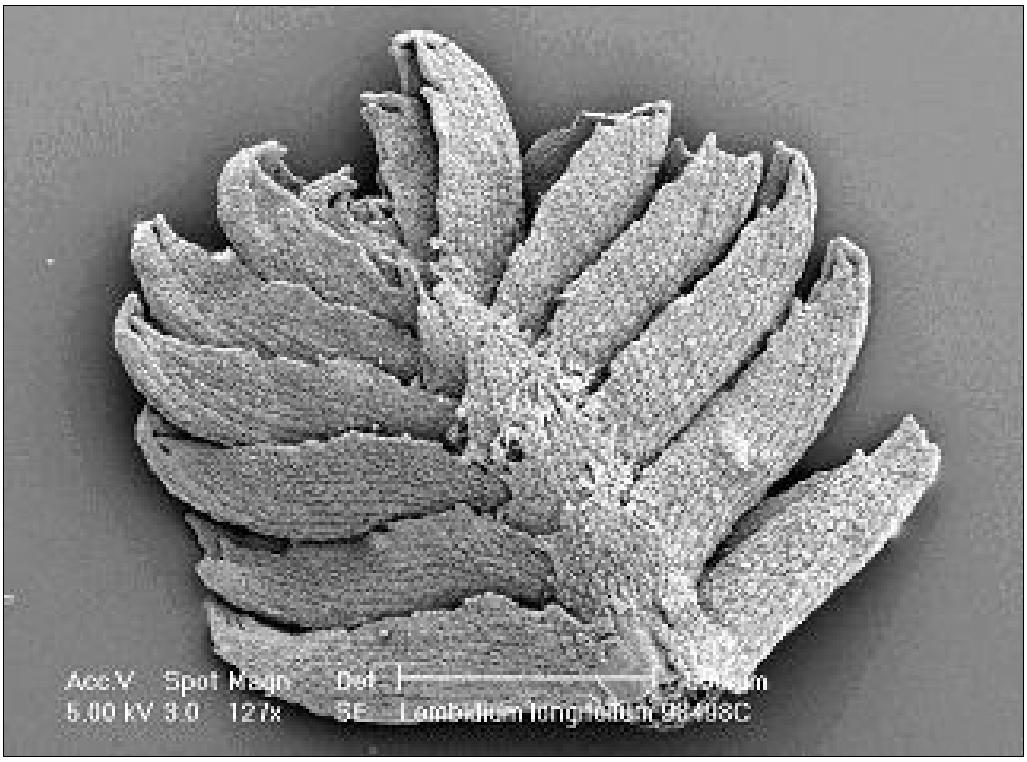

Figure 2. Ventral view of *L. longifolium* stem, showing narrow underleaves, and imbricated shallowly bifid leaves with irregular accessory teeth along lobe margin. Image : JEB.

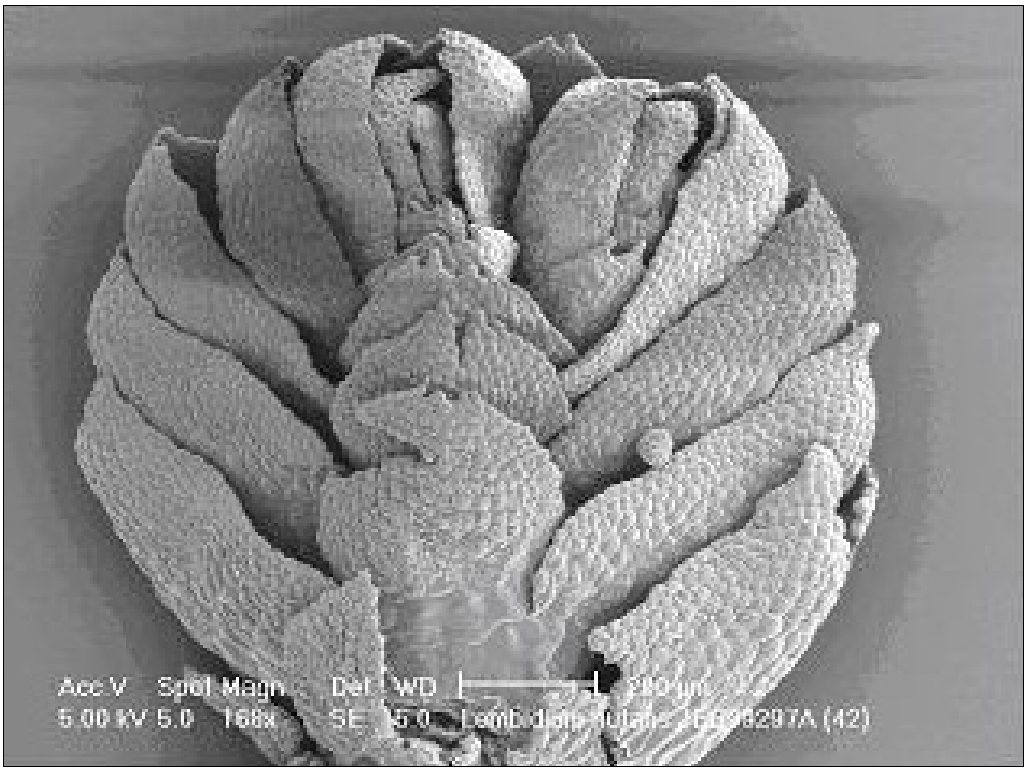

Figure 3. Ventral view of *L. nutans* stem showing broader underleaves and tightly imbricated, barely bifid leaves that lack accessory teeth. Image JEB.

Discussion

Until recently, *Lembidium longifolium* was considered to be an uncommon species by New Zealand bryologists, however, the spate of recent collections of this species has changed this view. Based on these recent observations, it is anticipated that *Lembidium longifolium* will prove more widespread in both North and South Islands. In the upper North Island it is expected that the plant will be present on all undisturbed major high points and axial ranges, wherever steep terrain supports cloud forest. *Lembidium longifolium* has to date, been found growing on vertical surfaces, and its occurrence appears tied to disturbance events that create vertical mineral substrates. Given its abundance on soil in forest on Hauturu, where burrowing seabirds are still common, along cuttings associated with the Croesus Track, and along the banks of Deadmans Creek, suitable habitat can be created by a range of disturbance events, though all occur over a small spatial scale. The fact that *Lembidium longifolium* reproduces asexually via caducous leaves, suggests a life strategy tied to short lived habitat that is periodically available for colonisation on a small spatial scale, the perennial shuttle life strategy of During (1979). *Lembidium longifolium* was searched for without success around Hauturu Trig in the Waima Forest, Northland, despite the similarity of the vegetation and terrain to that found at altitude on Little Barrier Island. The plant's absence there may be attributed to recent disturbance by stock and fire, or to the absence of soil disturbance by hole-nesting sea-birds. Should the plant prove to be less widespread than anticipated, the link between habitat creation associated with the burrowing of hole nesting seabirds on steep terrain, may be a worthy first avenue of investigation regarding any decline in the range of this species. In contrast, a deliberate search for *L. longifolium* on Mt. Pirongia, Waikato, was successful, despite the search covering only the track to Wharauroa, though here the plant was found growing on a vertical rock face. Due to the wide geographical range occupied by this species, and its abundance at some localities we recommend that this taxon not be listed as threatened. However, we recognise a need for more comprehensive and systematic approaches to liverwort conservation, coupled with greater ecological knowledge of the plants themselves.

Acknowledgements

We would like to thank David Glenny for bringing to our attention the Croesus Track population of *Lembidium longifolium*. We would like to thank the Auckland Botanical Society (in the form of a grant from the Lucy Cranwell Research fund) and the Auckland University Research Fund for providing financial assistance, and Ewen Cameron and Mei Nee Lee of the Auckland Museum Herbarium (AK) for their generous assistance. Thanks also to Peter de Lange, Josh Salter, and Matt von Konrat for reviewing drafts of this communication, and Steve Ferriss for assembling the map. One of the collections by M.Renner from Deadmans Creek forms part of a national Carbon/Biodiverstiy monitoring programme being established by the New Zealand Ministry for the Environment. Finally we would like to thank Matt von Konrat for stimulating discussions regarding liverwort conservation.

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Note added in proof: *L. longifolium* has recently also been collected on the Herangi Range, west of Te Kuiti. J.E. Braggins.

Identifying the pampas grasses, *Cortaderia jubata* and *C. selloana*

Rhys Gardner

So well established in our landscape are these invasive South American megatussocks that a visitor could well see them as the vibrant flagships of some nationwide ecorestoration initiative, our motorways, pine forests and urban wastes all covered with two distinctive and ornamental Gondwanan species.

To head off this error I mention here first some features by which the much less weedy native cortaderias, that is, the various kinds of toetoe, can be told from the pampas grasses. Then the latter pair are distinguished from one another. This is not exactly new ground: in New Zealand there are the monographs by Zotov (1963) and Knowles & Ecroyd (1985), both of which are well-illustrated, and then the Flora of New Zealand V treatment (Edgar and Connor 2000). In Australia there are several Flora accounts, in which some characters not stressed in the NZ literature are mentioned (Jacobs & Hastings 1993; Morris 1994; Walsh 1994).

The two pampas grasses contrasted with the native NZ species:

Leaf sheath not waxy, with age recurving or spiralling and breaking up transversely into chaffy pieces, the blade being shed by the uppermost break which is always a short way below the ligule.

Leaf blade uniformly harsh in texture, i.e. nerves not differentiated, midrib not continued down into the top few centimeters of sheath.