

intricate work bears comparison with its photographic counterpart here under review.

Some of the reasons for studying seeds are due to their resistance to weathering, or digestion, so providing information about the diet of animals and about past soils. They are relatively conservative in evolutionary diversification and so are useful in plant classification. This is exemplified in this volume in that following each group which is today the subject of keen investigation, as in the Orchid family, we can expect an expert contribution, and rigorous taxonomic application of names.

## References

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## *Leptinella nana* in Christchurch Botanic Gardens

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*Leptinella nana* (pygmy button daisy) is a very small, perennial herb that forms very low open mats. It is one of New Zealand's most threatened species (Fig. 1, p. 93). It has a disjunct distribution and is known from only three sites: Mount Pleasant, Port Hills (Canterbury) discovered by A. Wall in February 1918, Titahi Bay coast (Wellington), and Rai Valley (Marlborough). Populations at the Port Hills and Titahi Bay comprise only a few plants and extend over extremely small areas, whereas at the Rai Valley site the species is scattered along 15 km of river margin.

Being that *Leptinella nana* is so rare and inconspicuous, it is difficult to follow changes in population size. Even detecting change in the number of plants in a population has proven hard because it is a challenge to determine what constitutes an individual plant. Mount Pleasant *L. nana* is found in two locations, both along a walkway. The first location is c. 20 m x 4 m, the 4 m being the track width, where *L. nana* is confined to a very narrow strip on the track edges. The second location is also of similar dimensions and is found c.

200 m from the first site (N. Head, pers. comm. 2001). The species undergoes frequent seasonal fluctuations in abundance and that makes long-term estimation of population changes difficult. The regular fluctuation in population size also makes it difficult to interpret the significance of those changes. Six years of study at the Mount Pleasant site indicated no significant change in overall abundance, although the precise distribution of patches of the species can change markedly (Given, Baird and Head, unpublished data).



**Figure 1.** A close-up of the pinnatifid leaves of *Leptinella nana*.

The habitat of the three population sites varies from forest to cliff-top grassland, but common features are the need for disturbance patches, shelter, and supply of moisture. The species appears to have adopted a strategy of constant colonisation of small patches of bare ground and so occupies a highly dynamic and changing micro-habitat (DOC 2001). In cultivation *L. nana*, like *L. filiformis*, is reported to have a preference for semi-shaded environments (Head et al. 2004).

The three most vulnerable points in the biology and ecological requirements of *Leptinella nana* are:

- (1) The requirement of bare sites for colonisation: sites that are dynamic and require constant disturbance to create these habitat openings. A management challenge at Mount Pleasant exists in that a small to moderate amount of disturbance by the passage of people is beneficial in maintaining and creating bare sites, but that too much foot traffic will also destroy plants by compaction, crushing and smothering;
- (2) The species seems to have a narrow range of soil moisture tolerance. It does not tolerate drying out for long periods in summer, but with too much moisture, sites are pre-empted by other small herbs, grasses and bryophytes;
- (3) *L. nana* is small and cannot compete with other taller colonising plants such as grasses.

The peculiar distribution pattern, with three widely separated sites, suggests that formerly it may have been more widespread but overlooked. Likely reasons of local extinctions of *L. nana* include loss of open sites for colonisation, increased competition from other plants, opening up of protective vegetation allowing sites to dry out or become weedy, increased erosion or deposition of debris, excessive trampling by people and animals, loss of seed dispersal vectors, like terrestrial birds and other animals, and indiscriminate herbicide use.

### **In the Christchurch Botanic Gardens**

An ex situ colony of *Leptinella nana* exists along the edges of the pathway around the Leonard Cockayne Memorial Garden in the Christchurch Botanic Gardens. It has existed there since around 2001 after plants acquired by David Given seeded/spread from the garden bed and found their preferred habitat in the gravels of the path. Pathways of the New Zealand plant collection have been kept weed free through decades of hand cultivating with a push hoe. This allowed for the selective removal of competing weeds and the encouragement of *L. nana* as a ground cover. In 2017 the *L. nana* colony occupied 40 m of path edge where it was associated with mosses, *Sagina procumbens*, *Cotula australis*, *Poa annua*, *Arthropodium candidum* and *Bellis perennis*. This is equivalent to the size of the wild population found on the Port hills. Plant vigour, size and flower size appear to be reduced where gravels have stabilised with established mosses and bryophytes (Fig. 2, p. 95). During flowering an opportunistic observation was made of a small species of hoverfly visiting flowers over a period of two days.

From January to September 2018, 86 m of pathway edges were cleared of vegetation, weeded and cultivated. In spring and early summer of 2018/2019 the Botanic Gardens experienced regular and heavy rainfall events and lacked the typical, extended hot and dry periods of northwest wind until February. In

addition, the autumn and winter of 2018 had been favourably wet and warm, with few frosts. The opening up of disturbed habitat and the favourable weather conditions allowed *L. nana* to rapidly colonise areas of pathway throughout the New Zealand plant collection (Fig. 3).



**Figure 2.** Bryophytes colonising *Leptinella nana* patches in stable gravels, reducing plant vigour.



**Figure 3.** A new colony of *Leptinella nana* in the Botanic Gardens one year after disturbance. The bare patch in the centre is where water pools on the pathway.

*Leptinella nana* seedlings sprang up in patches mostly along pathways leading from the original site. Seedlings seemed to show little preference for a particular microhabitat, germinating evenly along all disturbed sites. Some seedlings were also found in isolated garden beds across lawn areas from the original *L. nana* colony. Many of the new plants appeared within 25 m of existing patches of *L. nana*, showing limited dispersal ability by wind/surface water movement. Some seed had crossed up to 100 m of lawn to reach new garden sites suggesting some airborne dispersal as a possible factor. The wider dispersal patterns along pathways further from the original colony suggest that seed of *L. nana* may be able to be dispersed distances of up to 100 m on footwear.

Mats of *L. nana* quickly reached 50 mm in diameter throughout the autumn and winter and started to flower in the spring/summer of 2018, 6 months after germination. The length of path occupied by *L. nana* increased by 76 m. Plants continued to flower and grow through the favourable spring and early summer until February of 2019 when a typical Canterbury hot and dry month set in.

During the hot month of February plants growing in the open burnt off and died. But plants growing in semi- to full shade continued to grow. However, the extent of *L. nana* coverage was reduced by only around 6 m with plants in the open areas of the paths desiccating but plants growing along the edge of the path remaining.

The spring and summer of late 2019 provided less favourable growth conditions and *L. nana* experienced reduced vigour across the garden pathways. Some small patches established in newly formed garden beds that were covered in stone chip while some other patches did grow larger and became considerably denser. However, during the start of 2020 considerable patches of *L. nana* started to die back, which appeared to be both from drying out in open situations and also from “dampening off” in shady situations. This highlights the extremely fluctuating nature of *L. nana* populations.

In March of 2020 a “Threatened Plant Intern” was appointed at the Botanic Gardens through the Christchurch City Council’s Internship Programme. This allowed time to be dedicated to threatened plants, and allowed closer *L. nana* monitoring and more accurate measurements to be made. *Leptinella nana* patches were mapped linearly again and found to now occupy a path distance of 140.5 m. Patches were also measured in area when it was found that *L. nana* covered 67.2 m<sup>2</sup> in the botanic gardens. This makes the Botanic Gardens *L. nana* population over eight times larger than the wild population found on the Port Hills and an important refuge for this species.

Christchurch Botanic Gardens will continue to monitor its *ex situ* *L. nana* population in the coming years. Ongoing study involving Threatened Plant Interns shall allow more accurate recording of the *L. nana* coverage in the botanic gardens. It is hoped the data can help inform a better understanding into

the lifecycle and dispersal of this species, and provide further insights into its habitat requirements for further conservation.

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## **A rare natural hybrid between two common species: *Plagianthus divaricatus* x *P. regius***

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I first noticed this *Plagianthus* hybrid many years ago when working at the Christchurch City Council nursery. The nursery grows native revegetation plants including considerable numbers of both *Plagianthus* species from wild-sourced seed, *P. regius* from the Port Hills, and *P. divaricatus* from the Avon/Heathcote estuary. We noticed the occasional “off type” individual among the *P. divaricatus* seedlings. One of these was grown on for a few years and it soon became obvious that it was a hybrid.

These hybrid plants were a rare occurrence, only a very few among thousands of *P. divaricatus* seedlings. The *P. divaricatus* seed source growing around the estuary has *P. regius* nearby in reserve plantings and private gardens, close enough for pollinators and with potentially more hybrids in the longer term as these *P. regius* mature.

When walking on the Little River Rail Trail recently alongside Lake Forsyth I found a large hybrid plant. Though the nursery plants were all grown from seed collected from wild plants, this was the first *Plagianthus* hybrid I had seen in the