



Fig. 4. *Hymenophyllum multifidum* at Windy Canyon, Great Barrier Island with upwards-bent sori. Photo: J. Warden, 15 September 2018.

After a lot of searching, the fern appeared to be isolated to a single old moss-covered kauri stump from a tree felled 100–150 years ago (Fig. 1). The general canopy consisted of kauri, tanekaha (*Phyllocladus trichomanoides*) and rewarewa (*Knightia excelsa*). Understory species of note included white maire (*Nestegis lanceolata*), mamangi (*Coprosma arborea*), *Coprosma spathulata* and lancewood (*Pseudopanax crassifolius*), and *Alseuosmia* spp. were common as small shrubs.

References

- Brownsey, P. J.; L. R. Perrie. 2016. nzflora. <http://www.nzflora.info/factsheet/taxon/Hymenophyllum-bivalve.html> Accessed 21/09/2018
- Goldwater, N.; Graham, P.; Holland, W.; Beadel S.; Martin, T.; Myers, S. 2012. Natural Areas of Rodney Ecological District (Northland Conservancy) Reconnaissance survey report for the Protected Natural Areas Programme). Survey Report, Wellington: Department of Conservation.

As indicated above, *H. bivalve* could be confused with *H. multifidum*. However, *H. bivalve* can be distinguished by its larger size, brighter green fronds (Fig. 2) and more shallowly toothed margins. The most distinguishing feature is when the sori are fertile. In *H. bivalve* the sori are smaller, protected by two separate indusial flaps (bivalved), and lie in the plane of the frond (Fig. 3). In *H. multifidum* the two indusia are fused into a tapered cylinder, and the sori are typically bent upwards at 90 degrees to the plane of the frond (Fig. 4) (Brownsey and Perrie 2016).

Acknowledgements

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Frugivory and seed dispersal in the Auckland region

Andrew P. McK. Pegman

Pigeons are essential worldwide for seed dispersal, especially for tree species that have large fruit and seeds. In New Zealand, the endemic pigeon (*Hemiphaga novaeseelandiae*, Columbidae) is almost the sole volant canopy-based disperser of fruits of some indigenous tree species.¹ This is because many canopy tree species in New Zealand produce large fruit with minimum dimension >15 mm and *H. novaeseelandiae* is the only widespread avian frugivore capable of swallowing and dispersing such fruits and seeds due to its distensible beak gape.

Two recent papers complement each other to show how factors on both local and landscape levels interact

to affect the outcomes of seed dispersal processes: In the first paper, Pegman et al. (2017) found that actively dispersed seeds were significantly longer than seeds from passively dispersed fruit, suggesting frugivore preference for larger fruit in two large-fruited canopy tree species (*Vitex lucens* and *Prumnopitys ferruginea*) located in the Waitakere and Hunua Ranges and Wenderholm Regional Park, as shown in Figure 1. This is important because the non-random selection of fruits by frugivores can affect plant demography by changing the probability of seedling recruitment. For example, larger fruits usually contain bigger seeds, which often have higher seedling survivorship during establishment than small seeds (Moles & Westoby 2004).

In the second paper, which explored the interaction of frugivory by *H. novaeseelandiae* and tree spatial heterogeneity and its effect on seed

¹ In contrast, weka (*Gallirallus australis*) conducts flightless ground-based dispersal of seeds from large-fruited tree species, such as *Elaeocarpus dentatus* (Carpenter et al. 2018).

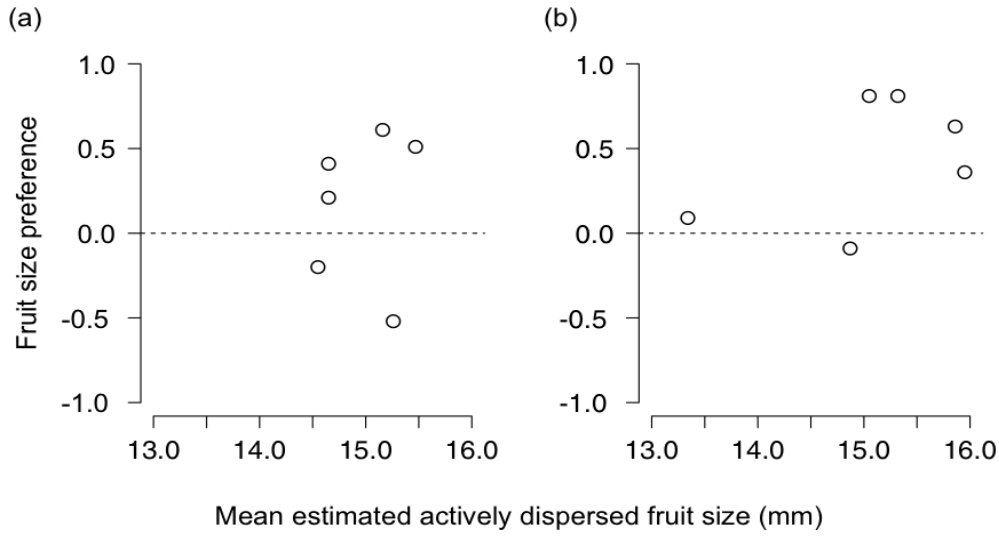


Fig. 1. The relationship between mean estimated actively dispersed fruit size (mm) and fruit size preference by *H. novaeseelandiae* across **a**, six *P. ferruginea* trees and **b**, six *V. lucens* trees, in one fruiting season, across Waitakere and Hunua Ranges and Wenderholm Regional Park. Fruit size preference was calculated by subtracting the mean passively dispersed fruit length from the mean estimated actively dispersed fruit length; values greater than zero indicate a preference for larger than average fruit and values less than zero represent a preference for smaller than average fruit.

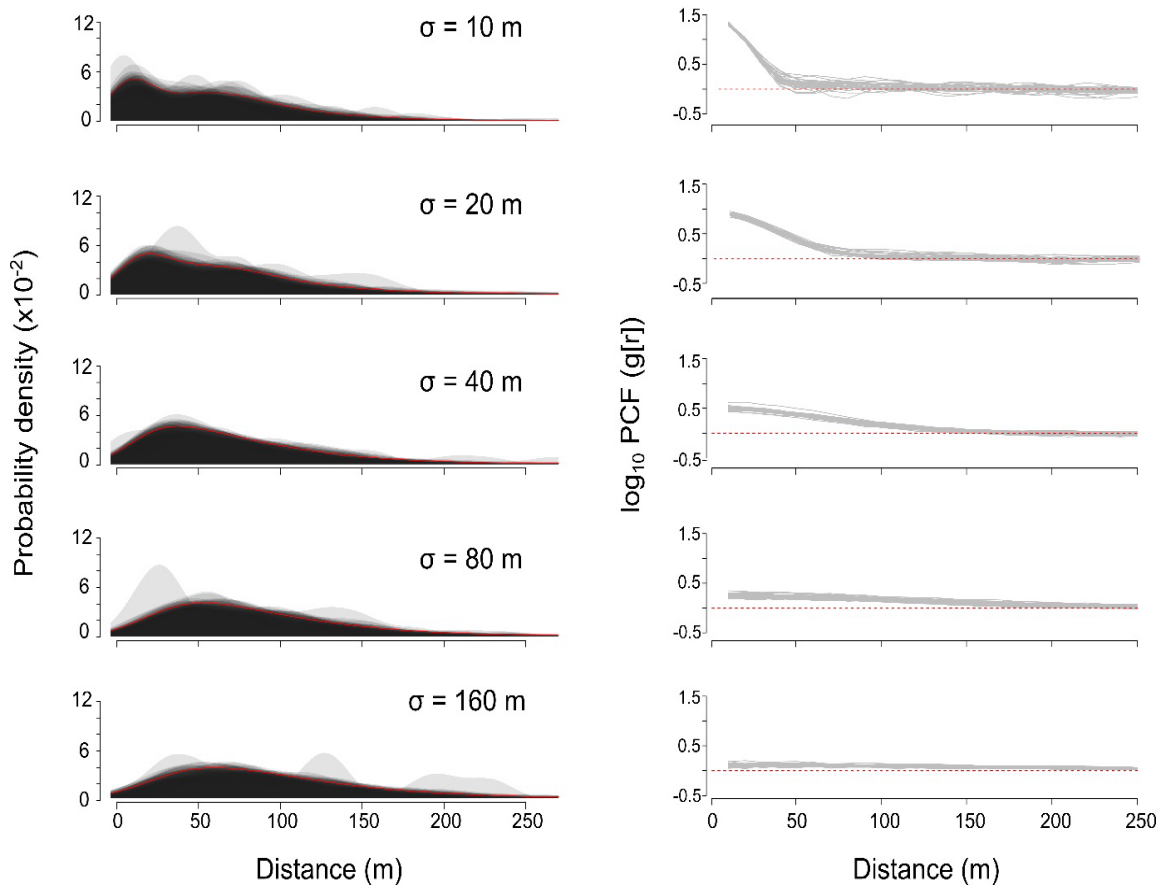


Fig. 2. The left hand column shows simulated seed dispersal kernels generated by 30 randomly selected *H. novaeseelandiae* from the total pool (light grey shaded areas), with the darkest curved area showing the kernel density estimated across all frugivores, with σ , the degree of tree aggregation, increasing from top to bottom (highly aggregated to diffuse trees). The right hand column shows the spatial association between trees and seed deposition events using the bivariate pair correlation function for each of 30 replicates (irregular lines) for each value of σ . The dotted horizontal line is the theoretical expectation ($g[r] \equiv 1$) under a null homogeneous Poisson model, and the distance (x- axis) at which the irregular lines approach this value gives an estimate of the distances over which seed deposition occurred with respect to fruiting trees. The simulation model that was developed to generate these data was parameterized, in part, with empirical data obtained at Waitakere and Hunua Ranges and Wenderholm Regional Park (Pegman 2016).

dispersal kernels using a simulation model, Pegman et al. (2016) demonstrated that the spatial arrangement of the above two canopy tree species plays an important role in dispersal processes. Tree aggregation was correlated with a lower mean seed dispersal distance, as shown in Figure 2, although it was accompanied by occasional long-distance dispersal events. Conversely, tree dispersion was correlated with an increase in mean dispersal distance, potentially increasing the probability of seeds finding suitable habitats for germination and growth.

References

- Carpenter, J.K.; Kelly, D.; Moltchanova, E.; O'Donnell, C.F.J. 2018: Introduction of mammalian seed predators and the loss of an endemic flightless bird impair seed dispersal of the New Zealand tree *Elaeocarpus dentatus*. *Ecology and Evolution* 8 (12): 5992–6004.
- Moles, A.T.; Westoby, M. 2004: Seedling survival and seed size: a synthesis of the literature. *Journal of Ecology* 92: 372–383.
- Pegman, A.P.McK.; Perry, G.L.W.; Clout, M.N. 2016: Exploring the interaction of avian frugivory and plant spatial heterogeneity and its effect on seed dispersal kernels using a simulation model. *Ecography* 40 (9): 1098–1109.
- Pegman, A.P.McK.; Perry, G.L.W.; Clout, M.N. 2017: Size-based fruit selection by a keystone avian frugivore and effects on seed viability. *New Zealand Journal of Botany* 55 (2): 118–133.

The good news is that *H. novaeseelandiae* has been doing an excellent job in dispersing seeds from other large-fruited canopy trees too. For example, Pegman (in prep.) has shown that seeds of *Corynocarpus laevigatus* and *Beilschmiedia tarairi* (two other large-fruited indigenous tree species) were found under canopies of *V. lucens* and *P. ferruginea* in the Waitakere and Hunua Ranges, where almost no *C. laevigatus* and *B. tarairi* trees were observed.

***Corybas rotundifolius* (Hook.f.) Rchb.f. in Woodcocks Kawaka Reserve, near Warkworth**

Maureen E. Young

During the time that I have been aware of the tiny helmet orchid, *Corybas rotundifolius* (Fig. 1), it has been known by three different names. When *Flora of New Zealand Volume II* was published (Moore & Edgar 1970) this orchid was confused with an Australian species, *C. unguiculatus*, and Lucy Moore, author of the orchid chapter in that publication, used that name. Later, when the *Corybas* genus was split up by two Australian botanists (Jones et al. 2002), the name *Anzybas rotundifolius* was used.¹ Much to the frustration of us ordinary mortals it has been changed yet again, and has now settled for the time being, as *Corybas rotundifolius*. In Moore and Edgar (1970: p.116) the distribution was given as:- "Known only from a few localities, all north of lat. 38°; near Kaitaia; north of Whangarei; Glen Eden slopes of Waitakere Range; Tauhei near Morrinsville; Moanatuatua near Cambridge rare and easily overlooked".

In 1981, David Given, then New Zealand's leading authority on rare and endangered native plant

species, published *Rare and Endangered Plants of New Zealand* (Given 1981), and compiled, together with Gordon Williams, the *Red Data Book on Threatened Species in New Zealand* (Williams & Given 1981). These two volumes brought to the attention of the botanical world the presence of many species that were poorly known, and with many more informed searchers out in the field a truer picture was gained of the numbers of these various plant species. *Corybas rotundifolius* was one of those species.

Although rather spasmodic in occurrence, *C. rotundifolius* is no longer considered to be a threatened plant, being found from Spirits Bay to Warkworth, with one outlier at Opuatia, near Rangiriri, and also on the Chatham Islands and Great Barrier Island. It is usually found in regenerating forest or gumland scrub amongst dense litter. A single ovate leaf up to 2.5 cm long, occasionally notched on each side, subtends a solitary maroon and white flower that stands directly over the leaf. It does not have the long, filiform lateral sepals and petals that are seen in many of the other *Corybas* species and give them the common name of "spider orchids".

And so the scene is set for the exciting discovery, in 1985, of *C. rotundifolius* in Woodcocks Kawaka

¹ **Footnote from Editors** : Confusingly, in Flora Vol II the name *N. rotundifolia* is mentioned only in notes appended to the entry for *Corybas oblongus* (Moore & Edgar 1970, p.117), but Jones et al. (2002) clarified matters: *Anzybas rotundifolius* was based on the basionym *Nematoceros rotundifolia* J.D.Hook. in Hooker's *Flora Novae-zelandiae* 1: 251 (1853).