A sticky solution to a tricky problem: restoration of *Ileostylus micranthus*

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In spite of its ability to parasitise a number of hosts, both native and exotic (de Lange *et al*. 1996), and a liking for sunny sites, both seemingly advantageous attributes in a lowland New Zealand cleared of most of its forest, the mistletoe *Ileostylus micranthus* has become an especially rare plant in the Wellington region. (Note: in this article the 'Wellington region' refers to the area south of the Waikanae River and Rimutaka Range crest and west of the Rimutaka and Orongorongo Ranges.)

On a national level, the species is ranked as 'declining' (de Lange *et al*. 1999), whereas for the Department of Conservation's Wellington Conservancy it attracts a ranking of 'endangered', reflecting its state within the Conservancy's geographical area (Empson & Sawyer 1996).

Tom Moss drew attention to the plight of the species in his notes for the Wellington Botanical Society's inventory of Wellington's threatened plants in the early to mid-1980s, noting that the principal threats were 'possums and people of similar I.Q.' (Moss T. C., unpublished notes). At that time one specimen was known from Heretaunga, near the golf course.

MISTLETOE AT BENGE PARK

In 1987 Syd Moore reported an excitingly large population of *Ileostylus* from Benge Park, Upper Hutt, noting that it grew on three host species (*Lophomyrtus obcordata*, *Melicope simplex* and *Podocarpus totara*) and that there were at least 22 individuals (Moore 1987) (Fig. 1).

By the time Peter de Lange and I visited Benge Park in December 1990, *Ileostylus* was no longer present on one host species (*P. totara*) and was present on fewer individuals of its major host, *M. simplex*. In 1987, plants were recorded growing on 11 of 15 *M. simplex* individuals, yet by spring 1995 the number of hosts of this species had declined to just two individuals. Only on *L. obcordata* had it apparently increased—from

Figure 1. *Ileostylus micranthus* at Benge Park.

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one host plant in 1987 to two in 1995, but one of these was not healthy.

Benge Park is, in essence, a mown paddock of some 0.98 ha, surrounded by houses and supporting over part of its area a remnant group of forest canopy trees and mature subcanopy shrubs. Similar trees are also present in a number of neighbouring properties, but these do not contain mistletoe. There is no understorey present and no regeneration of mistletoe host species. The park is a reserve controlled by the Upper Hutt City Council.

The precarious state of this population was further illustrated when we visited the site in January 1991 after a period of sustained north-westerly winds. While these winds were strong, they were not unusually severe, yet had blown over one of the major host trees, a specimen of *Melicope simplex*, weakened by vandalism yet supporting perhaps one-third of the total *Ileostylus* population at that time (Fig. 2). Further loss of plants as a result of these natural and foreseeable events and the eventual extinction of *Ileostylus* at this site appear inevitable.

Figure 2. Host and mistletoes lie together after high winds.

In such a situation it seems pointless to attempt to record the number of individual mistletoes as the small number of hosts and lack of regenerative possibilities has effectively reduced the population to that of the number of its hosts. Thus, the situation in 1997 was that there were effectively four mistletoes at Benge Park, no change from 1995.

MISTLETOE TRANSLOCATION

In 1993, I obtained seeds of *Ileostylus* from Rarangi, Marlborough and placed them on a number of trees at Percy Scenic Reserve, partly to see if the results of a successful attempt to grow this mistletoe reported by Colin Ogle (Ogle 1987) could be replicated and also to obtain information on the establishment and growth rates of the species on a wide range of hosts.

This experiment proved unsuccessful. Though a number of seeds did germinate, leading to a deal of initial optimism, none were able to form attachments to their hosts and all subsequently desiccated and died during the spring and early summer of 1993. This led me to look at the idea of mistletoe translocation from first principles and saved the experiment from total failure.

Discussions with Peter de Lange during the summer of 1993 led to the adoption of a strategy based on the following conservation principles:

1. try to move the parasite to a host of the same species as that used by the parent plant;
2. try to move the parasite as short a distance as possible from the original host;
3. if possible, combine the above.

Monitoring of the Benge Park population continued during the first half of 1994 with no further loss of hosts or mistletoe plants, and a search for potential transfer sites was started.

On 4 June 1994, the Wellington Botanical Society held a work bee at Te Marua Bush, a small remnant of lowland alluvial forest, administered by the Wellington Regional Council, and located a few kilometres north of Benge Park. The route to this forest passes close to Benge Park so a quick visit was possible and I found the mistletoes in fine health and heavily in fruit. Barely had I left the car to join the Botanical Society members at Te Marua bush than I spied a healthy shrub of *Melicope simplex* on the bush edge at the northwest corner of the Reserve (Fig. 3). A weed pulling day had also become a threatened species conservation exercise.

Figure 3. A new home for threatened plants.

A return to Benge Park easily yielded some 40 *Ileostylus* fruits which were promptly taken to Te Marua and transferred to this new *Melicope*. No especially fancy methods were used in the transfer, rather it was simply a case of squeezing one end of the ripe fruit and watching as the seed popped out and stuck to the chosen branch with its own mucilage.

The sites for the transfer of the seeds were weighted toward the north and west facing branches, as *Ileostylus* is noted as a plant that likes the feel of the sun on its leaves (Duguid 1967), though a few unlucky seeds were placed on shadier parts of the plant to test of this theory. The seeds were placed on locations of various sizes from thin branch tips to the main trunk. The seeds soon began to germinate but, as this mistletoe has been reported as germinating on fenceposts, this was hardly surprising. The real test was not germination but attachment so it was a pleasure to note that by spring 1995 the mucilage on most of the seeds had set to become a hard shell through which the first leaves had appeared.

The next visit to this site was in late summer, a quick look that simply verified that indeed some of the seeds and resulting plants had managed to survive the

hot and dry season. At that time the plants could only be described as 'tiny' and no measurements were made.

In September 1995 I decided that the plants deserved another visit to see how they were doing, and to make a more complete record of their survival and growth.

RESULTS OF THE TRANSLOCATION

Some 20 live plants were relocated, of various sizes and mostly in good health, though I noted that basal leaves on some plants were freshly withered and wondered if this was due to low winter sap flows. At the time, though, the more important task was to see how well these new plants were growing.

With one exception the plants located were in high light sites on the western side of the host. The exception was a plant which was growing in a sheltered spot on the south-western side of the host, but in a 'light well'. The thickness of the branch appeared to have no effect on the ability of the mistletoes to attach, as they survived on branches of all sizes up to, and including, the main trunk.

On the 'best' plant the largest leaves were 40 mm long by 10 mm wide and the stem was 25 mm long from the point of attachment to the newest leaf. On ten plants the largest leaves were more than 10 mm in length, even though most had not yet formed stems (Fig. 4). The others were progressively smaller down to three that had not noticeably grown since germination. On two plants the creeping haustoria common in *Ileostylus micranthus* had started to form, being 10 mm long on one and visible on the other. Of the ten biggest plants, one was on the main trunk of the host, eight were on more or less exposed branches and one was in a sheltered, yet well lit, site near the main trunk.

Figure 4. Spot the difference! Mistletoe leaves peek out from their host.

Monitoring of the plants continued on an informal basis through the summer of 1995/96, just to ensure that the host was in good health and that there were some mistletoes growing on it. The next full inspection and measurements of individual plants were made at the end of October 1996.

Once again 20 live plants were relocated, and three had still not grown since germination. The others, however, had all made quite noticeable growth since the previous measurement.

The two largest plants had largest leaves of 45 × 15 mm with a stem length of 50 mm, and 50 × 29 mm with a stem length of 80 mm, respectively, though the latter plant was growing in a more sheltered spot. The average dimensions were leaves of 30 × 15 mm and a stem length of 30 mm, whereas leaves of 13 × 5 mm and no visible stem were the lower limit of those plants that had actually grown since the previous measurement.

At this measurement the haustoria on four plants had started to move away from the point of attachment, one by 5 mm, two by 10 mm and the fourth had moved 10 mm then turned back on itself and moved a further 20 mm.

A third set of measurements was taken in April 1997. This time 17 live plants were found, one still at the 'first leaf' stage. The largest two plants now had leaves up to 70 × 40 mm with a stem 200 mm in length and 70 × 30 mm with a stem length of 100 mm, respectively. The creeping haustoria so typical of *Ileostylus* were now present on 13 of the 17 plants located and two were branching from the base.

Detailed measurement finished with this visit. After some 36 months it was safe to say that the transfer was a success and that a population of mistletoe had established. The final piece of the story came in the spring and summer of 1999 and 2000 when the first of the Te Marua plants flowered, was pollinated and set seed.

CONCLUSIONS

It is now over six years since the seeds of this mistletoe were taken from Benge Park to Te Marua. The host is in good health, the plants themselves have signalled their approval by continuing to grow and, most importantly, have flowered and set seed.

There is still much to be discovered in the world of *Ileostylus micranthus*. For example, is it possible to infect plants growing in a nursery and then transplant the resulting host/mistletoe combination without the death of the parasite as a result of planting stress? Can the mistletoe seeds be encouraged to grow on a host different to that occupied by their parent plant? How far can the seeds be moved before they lose the ability to grow, even on the same host species as their parent?

This transfer was not designed to answer these or any other questions; rather its purpose was to rescue a threatened plant from an environment that was not

compatible with the plant's continued existence and move it to a more secure location.

Though this has not been an especially difficult project, it does point out graphically that threatened or even extinct species are themselves only symptoms of an ecosystem in decline. It would have been infinitely preferable to restore Benge Park in a way that was compatible with the continued existence of the mistletoe and other forest species, but that could not be guaranteed. In this case it was fortunate that another location was available and that the mistletoe was a willing participant.

ACKNOWLEDGEMENTS

Barbara and Kris for patience in a series of 'short stops' to look at tiny leaves; John Sawyer and Peter de Lange for reading an early draft and for encouragement during the writing process; and the Wellington Botanical Society members whose enthusiasm for Te Marua Bush led to a new home for the mistletoe.

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