Copper butterflies and pōhuehue – *Muehlenbeckia*: brothers in arms

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Introduction

An informal roadside survey was undertaken to determine Copper Butterfly occurrence in North Canterbury. Adult Copper Butterflies remain relatively close to their host plants, our native pōhuehue (*Muehlenbeckia*), feeding on their flowers and a range of nearby native and exotic blooms. Their larvae, however, feed exclusively on the leaves of the four scrambling pōhuehue species, which are New Zealand's top Lepidoptera hosts (Patrick 2021, p. 4). A survey of pōhuehue sites yields information about the distribution of both host plants and the Lepidoptera that are dependent on them. In this article, we will describe the survey, give its initial results, and discuss some of the ecological issues that arise.

Factors and questions shaping the survey

1. Kaiapoi District is the Type Locality for the pōhuehue-dependent Rauparaha's Copper Butterfly (*Lycaena rauparaha*), but it has not been recorded there since soon after it was described in 1877.
2. The similarly pōhuehue-dependent Winter Copper butterfly (*Lycaena* complex) is unique in its genus in that adults emerge in Christchurch's Port Hills every month of the year. Does Winter Copper adult emergence occur in North Canterbury?
3. What is the extent and status of local pōhuehue populations?
4. The presence of pōhuehue specialist Lepidoptera, which have limited dispersal capability, may help to give an indication of age and ecology of remnant patches of vegetation in the landscape.

Methods

The geographical scope of the survey was an area bounded by the Waimakariri River in the south, by Oxford township and the foothills to the west, and by Amberley township to the north. *Muehlenbeckia astonii* is not found within the survey zone, but all the scrambling pōhuehue species are present.

Using a physical road map we drove the roads of the region identifying and recording any publicly accessible patches of pōhuehue and briefly investigating their nature first in winter from May 2020 and again the following summer to the end of March 2021. Suitable warm, sunny sites of braided rivers and streams were also visited but no attempt to survey private land was made.

Nationally, the feeding preference of the Common Copper butterfly complex, the Glade Copper, and Rauparaha's Copper (Figs. 1 & 2, p. 30) is for *Muehlenbeckia australis* and *M. complexa*, while the Boulder Copper butterfly complex feeds on *M. axillaris* and *M. ephedroides*. The local Winter Copper and Boulder Copper butterflies are undescribed members of the Common Copper Complex and the Boulder Copper Complex, respectively, which have representatives found nationwide. The undescribed Winter Copper is the only species of *Lycaena* worldwide to emerge over the winter months. Because of feeding preferences and the fact that *M. australis* and *M. complexa* at times grow together, the occurrence of these two plant species, whether growing singly or together, was considered as suitable habitat.

As much of this work was done in winter when many invertebrates are less observable, any patches of pōhuehue big enough to support a possible Copper Butterfly population were noted for revisiting in spring/summer when adults are visible. *Muehlenbeckia australis* and *M. complexa* recognition was made a little more difficult by annual hedge trimming removing obvious foliage, and the fact that much local pōhuehue is at least partially deciduous in winter, making it less obvious. On mown roadsides, *M. axillaris* makes a low mat that is easy to overlook.

Figure 1. Clockwise from top left: underside of Glade, Rauparaha's and Winter Copper butterflies. (Photos: Brian Patrick)

Figure 2. Upperside (left) and underside (right) of Rauparaha's Copper, showing the thin vein lines across its wings and the chocolate colouring of hindwing undersides that are characteristic and together distinguish it from related groups. (Photo: Brian Patrick)

Results

Occurrence of pōhuehue and Copper butterflies

Two hundred and sixteen sites with populations of one or more *Muehlenbeckia* species were located in the survey area. These were predominantly of *M. australis* and / or *M. complexa*, with an additional seven sites of *M. axillaris* and four of *M. ephedroides* (Table 1, p. 32).

Muehlenbeckia australis and *M. complexa*

Observations suggest remnants of large-leaved pōhuehue, *M. australis*, tend to be more common in areas previously covered with native bush as it is a conspicuous forest edge species. Its vigour means it is able to climb trees to several metres and its seed is actively dispersed by birds. Current populations tend to occur on land that is difficult for intensive human use, such as steeper terrace faces, undeveloped corners, old hedges, braided river edges and back dunes near the coast.

Braided river-edge populations are often mixed with exotic weeds such as old man's beard (*Clematis vitalba*) and periwinkle (*Vinca major*). This happens in each of the Ashley/Rakahuri, the Makerikeri, and the Kowai River edges. Although *M. australis* maintains considerable biodiversity when growing with exotic lianes, these areas are sometimes considered "wasteland zones" in need of control, and pose management issues. Sometimes *M. australis* and *M. complexa* grow side by side in hedgerows.

Remnants of *M. complexa* are most common on fence lines, hedges or undeveloped areas in variably sized patches. The nature of these sites is that *M. complexa* often forms in linear shapes following fences, hedges or roads (Fig. 3). Outliers often develop under bird perches such as fence posts, though recruitment into thick exotic swards seems difficult. It grows from coastal areas to dry inland plains, sometimes alongside *M. australis*, especially in gorse hedges.

Figure 3. Typical roadside patch of *Muehlenbeckia complexa*. (Photo: Geoff Henderson)

Both *M. complexa* and *M. australis* are known to be host plants to Winter Copper, Glade Copper and Rauparaha's Copper butterflies and a range of other Lepidoptera. In this survey, Winter Copper butterflies were found at 10 of the 205 *M. australis* and/or *M. complexa* sites. No Glade or Rauparaha's Copper butterflies were found at these sites (Table 1).

Muehlenbeckia axillaris

Mat pōhuehue survives best on stable braided river terraces where taller exotic weeds such as tree lupin (*Lupinus arboreus*), broom (*Cytisus scoparius*) and gorse (*Ulex europaeus*) do not dominate. It also survives as a mat on mown road verges and against fence lines where the exotic sward is sparse, such as in dry gravelly areas. There are few of these in the survey area compared to south of the Waimakariri River, where soils are more often dry and gravelly. *Muehlenbeckia axillaris* sometimes occurs with a variable number of dryland associates such as *Leucopogon fraseri*, *Microtis unifolia* and a range of mosses and lichens. As remnants, these prevail where lush exotic growth is limited by factors such as aridity or low fertility.

Muehlenbeckia axillaris is the host plant for the Boulder Copper butterfly, which flies low to the ground and does not venture far from host plants, often alighting on stones to sunbathe. Of the seven sites carrying populations of *M. axillaris* in the survey area, two were on braided river terraces on the Ashley/Rakahuri and Kowai Rivers, and these were associated with populations of Boulder Copper butterflies. Two small remnant populations of *M. axillaris* well away from braided river edge terraces on dry gravelly sites at Silverstream Reserve, which are actively managed by Waimakariri District Council, also had populations of Boulder Copper butterflies. All four of these *M. axillaris* sites where Boulder Copper butterflies were found also had populations of Winter Copper butterflies. No recordings of the Boulder Copper butterfly were made at three other *M. axillaris* sites on roadsides (Table 1).

Muehlenbeckia ephedroides

This creeping plant has a status of "Threatened, Nationally Vulnerable" and is rare in the local landscape. We found only four roadside populations, all affected by weed growth, shading, short verge cutting or herbicide. *Muehlenbeckia ephedroides*, being taller than *M. axillaris,* is less well adapted to coping with mowing on roadsides. Although nationally, *M. ephedroides* hosts the Boulder Copper butterfly, no recordings of the Canterbury Boulder Copper were made on *M. ephedroides* in our survey (Table 1).

Table 1. Numbers of sites where different pōhuehue (*Muehlenbeckia*) species were identified in the survey, and the numbers of these sites where different Copper butterfly species were found.

***Muehlenbeckia* species**		**No. of sites**	**Sites with Glade Copper**	**Sites with Rauparaha's Copper**	**Sites with Boulder Copper**	**Sites with Winter Copper**
M. australis and / or *M. complexa*		205	0	0	0	10
M. axillaris	dry gravels / river terraces	4	0	0	4	4
	roadsides	3	0	0	0	0
M. ephedroides		4	0	0	0	0
Totals		**216**	**0**	**0**	**4**	**14**

Ecological considerations

All pōhuehue species occurrences in North Canterbury are the remnants of pre-human patterns combined with changes since human habitation. All species' seeds are distributed by birds and lizards, which worked well for dispersal of this colonising genus across the post-glacial dynamic mosaic landscape where continual disturbance provided ample niches for all species. As human activity landscape modifications reduced available habitat, today's patterns of distribution reflect relatively limited opportunity for pōhuehue recruitment in the modified landscape. Consequently, this limits biodiversity dependent on pōhuehue.

The Winter Copper, Glade Copper, and Rauparaha's Copper butterflies are known to prefer both *M. australis* and *M. complexa* for larval feeding. However, no Rauparaha's Copper or Glade Copper observations have been made to date and no winter emerging Winter Copper were recorded. Winter Copper butterflies were also found on four of the *M. axillaris* sites.

Of the 205 patches of *M. australis* and/or *M. complexa* recorded in our study, summer monitoring revealed only 10 sites to date where Winter Coppers were observed. This might have been because isolated pōhuehue patches are not large enough to support a viable population of butterflies. However, many sites with no Copper butterflies present exceeded the size of the smallest patch that did support a Winter Copper population. In one site the Winter Copper was abundant in summer on roadside *M. complexa*, yet on a sizable *M. complexa* patch only 300 metres away, only one adult was seen flying during the summer. This suggests that Winter Copper butterfly vagility (the ability to move about freely) is low, with limited dispersal within the wider landscape, even over a number of seasons.

Scrambling pōhuehue species are active colonisers after disturbance. In the dynamic flood-plain post glacial landscape, availability of host plants seems unlikely to have been limiting for Lepidoptera as disturbance and re-colonisation from existing populations would have been an on-going process. In addition to this, braided rivers would have remained as corridors for successional terrace ecology. It appears that pōhuehue are able to disperse more quickly through the landscape than Copper butterflies, which fly only short distances from host plants.

In sites where pōhuehue hosts a variety of New Zealand native moths and butterflies, the low vagility of many of the associated Lepidoptera could perhaps give a clue to how long patches of those plants had been in the landscape and be an indicator of ecological complexity. The longer the plants have been there, the more likely they are to support a greater number of associated biota.

Given that all roadside patches of pōhuehue rely more or less on chance for their survival, there is a serious risk that any of these 10 butterfly populations could be lost by "tidy up' activity removing pōhuehue. This process is common to both agricultural and lifestyle land uses. Braided rivers remain useful corridors for pōhuehue and its associated fauna and they are the stronghold of the Canterbury Boulder Copper butterfly populations. Road and railway reserves also support important sites where there is little development, though herbicide use on both road and rail verges can limit this opportunity.

Both Burnside Primary School and Orana Wildlife Park have taken an active interest in setting up a colony of Canterbury Boulder Coppers. Already a garden has been established at Burnside Primary and butterflies translocated there in February 2021. Monitoring in spring 2021 will determine if this translocation has been successful or not. Such programmes raise awareness of local native ecology, keeping people in touch with our native fauna and flora.

Conclusions

Around 7% of pōhuehue patches surveyed showed Winter Coppers present in summer, with no adult emergence observed in winter. No Rauparaha's Copper or Glade Copper butterflies were recorded. The Boulder Copper occurred on braided river edge terraces and on dry gravelly sites.

Muehlenbeckia ephedroides remains rare in the survey zone with only four patches observed, all of which have local issues impacting their continued viability. No species of Copper butterfly was seen on this plant species.

Muehlenbeckia axillaris mainly occurs on maturing weed-sparse braided river terraces. Some roadside populations take advantage of road verges where mowing suppresses competition from tall exotic vegetation. The best populations of the Boulder Copper butterfly are all in the braided river/stream sites or at Silverstream Reserve. Virtually all roadside populations of mat pōhuehue are unnoticed and unprotected.

In the Canterbury region, *M. australis* and *M. complexa* support a wide range of Lepidoptera, including Winter Copper, Glade Copper and Rauparaha's Copper. Some idea of the age of local patches can be gauged from the number of species of Lepidoptera present, those with greater diversity likely being older.

Recent public exposure through work with schools, Orana Wildlife Park and Waimakariri District Council and some local nurseries is helping public awareness of the unique remnant ecology of pōhuehue in Canterbury and across the country.

Reference

Patrick BH. 2021. Indigenous hostplants of New Zealand's endemic Lepidoptera. *Canterbury Botanical Society Journal 52:* 4–35.