

Identifying pre-dispersal seed
predators and seed dispersers
of shrubby tororaro
(*Muehlenbeckia astonii* Petrie)

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Gavin Udy

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Gavin Udy

Motueka Area Office, Department of Conservation,
PO Box 97, Motueka, New Zealand

ABSTRACT

Seed predation is one factor believed to threaten the recovery of *Muehlenbeckia astonii* (shrubby tororaro) in the wild. Identifying pre-dispersal seed predators or seed dispersal agents is integral to the recovery of the species. Four southern Marlborough *M. astonii* female plants were video-monitored and trapped for rodents, possums, and lizards during April 2004. A total of 7 ship rats (*Rattus rattus*), 27 mice (*Mus musculus*), 2 hedgehogs (*Erinaceus europaeus*) and 1 common skink (*Oligosoma nigriplantare polychroma*) were caught. Video recording shows 39 silvereyes (*Zosterops lateralis*), 1 yellowhammer (*Emberiza citronella*), 1 chaffinch (*Fringilla coelebs*), and 10 unidentified passerines visiting plants. Stomachs of 6 ship rats and 1 mouse were found to contain fragmented seed which was unlikely to germinate. Silvereyes were observed feeding on fruit and are implicated as seed dispersers. Inferences about *M. astonii* seed predation may be obfuscated by the season's poor fruit set, rodent abundance, and/or the small sample size.

Keywords: *Muehlenbeckia astonii*, shrubby tororaro, grey scrub, seed, predation, dispersal, video monitoring, eastern dry-country, Marlborough, New Zealand

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1. Introduction

Shrubby tororaro (*Muehlenbeckia astonii*) is a partially or wholly deciduous divaricating shrub of the Polygonaceae family, endemic to the south-eastern North Island and north-eastern South Island. It is a shrub typical of a large group of eastern New Zealand native plants which have become extremely uncommon following human settlement. Surveys and research have demonstrated that most *M. astonii* populations are unlikely to recover in the wild without active management (de Lange & Jones 2000).

Several factors are believed to threaten the survival of *M. astonii* in the wild (de Lange & Jones 2000), in particular, seed predation. Flowers are insect-pollinated and the quick-maturing fruits (10–15 days) are produced over the summer and autumn. Seeds are probably animal-dispersed, but the fate of seed is largely unknown. Seeds have been found in the faeces of gecko (*Hoplodactylus maculatus* s.l), for example, and birds have been observed eating fruit (de Lange & Jones 2000). Mice have also been seen eating fruit, but examination of their stomach contents shows the seed to be very finely ground (Jan Clayton-Greene, pers. comm. 2004) and, therefore, unlikely to germinate. Identifying the pre-dispersal seed predators or seed dispersal agents is central to *M. astonii* species recovery.

2. Methods

2.1 STUDY PLANTS

Grid references given for the southern Marlborough plants studied are found on the NZMS 260 series 1 : 50 000 metric maps P29, Q29 (Grassmere).

Seddon Vineyard

The female *Muehlenbeckia astonii* plant is situated within Seddon Vineyard on the true right bank of the Awatere River at E2591123 N5946509 at an altitude of 113 m. This female had moderate fruit set overall, with a heavy set area on an outlying branch.

On 31 March 2004 three Victra leg-hold, two lizard pitfall, two mouse, and four rat traps, and a video unit were set up. The video camera was trained on the area of heavy fruit set.

Atkinson Road

The roadside *M. astonii* female plant is situated on the true left of Tetley Brook at E2599993 N5941062 at an altitude of 92 m. This plant had moderate fruiting compared to other females.

On 1 April 2004 three Timms, two lizard pitfall, two mouse, and six rat traps were set up. There was no video monitoring of this plant.

Cape Campbell covenant

The Cape Campbell *M. astonii* female plant No. 6681 (Clayton-Greene 2000) is situated on an east-facing slope at E2615916 N5940012 at an altitude of 13 m. This female had virtually no fruit, but was chosen after determining other females within the covenant had even less fruit. It was hoped that this female would develop fruit as monitoring progressed.

On 5 April 2004 3 Victa leg-hold, 2 lizard pitfall, 2 mouse, and 6 rat traps were set up around the plant. There was no video monitoring of this plant.

Te Hau

The female *M. astonii* is situated in a south-west facing gully on the Blind River Loop Road at E2605689 N5944789 at an altitude of 40 m. When compared with the other females being monitored, this female had the heaviest fruit set.

On 12 April 2004, 2 rat and 2 mouse traps were setup around the plant. Two lizard pitfall and a further 2 rat traps and were added on the 13 April 2004 and a video unit was installed with the camera focussed on the top one-third of the plant. On 15 April 2004 the camera was re-positioned to reduce picture contrast.

2.2 TRAPPING

Possum

At selected sites, either Timms or haze-fenced Victa leg-hold traps were used. No possum trapping was done at the Te Hau site. All traps were placed within 10–30 m of the plant and checked daily. Apple was used for bait and changed every 3 days.

Rodent

For rat trapping the Seddon Vineyard, Cape Campbell, and Atkinson Road sites used double-set Victa or Ezyset rat traps in metal tunnels. The Te Hau site used single-set Victa or Ezyset rat traps in corflute tunnels. For mouse trapping, all sites used single-set Victa mouse traps in corflute tunnels. Rat traps were placed within 10–30 m of the plant and mouse traps within 0–5 m. A pre-mixed peanut butter and rolled-oats bait was used and changed every 3 days.

Lizard

Pitfall traps were used to sample lizards at all sites. Pear was used for bait and changed every 3 days. Any lizards caught were identified and released upon discovery.

2.3 STOMACH CONTENTS

Rodent stomach contents were removed and stored in formaldehyde immediately. Analyses of contents for *M. astonii* seed was performed once field work was completed.

2.4 VIDEO SURVEILLANCE

At selected sites, a 24-hour time-lapse video unit and infra-red camera were used to monitor fruit fate. The camera was focussed on the heaviest fruiting area and was positioned 0.5–0.8 m from the plant. Video tapes and batteries were changed daily.

3. Results

3.1 TRAP CATCH

Twentyseven mice were caught, some at each of the four sites, but very high numbers at Cape Campbell. Seven rats were trapped, all at the Atkinson Road site. One lizard was caught at Te Hau. No possums were caught. Hedgehogs were also an unintentional bycatch at two sites. The results are summarized in Table 1.

TABLE 1. TRAP CATCH RESULTS.

SITE	POSSUM	HEDGEHOG	MOUSE	SHIP RAT	LIZARD
Atkinson Road	0	1	3	7	0
Cape Campbell	0	-	20	0	0
Seddon Vineyard	0	1	3	0	0
Te Hau	-	-	1	0	1
Total	0	2	27	7	1

- Indicates that no trap was set.

0 Indicates that a trap was set, but nothing caught.

3.2 STOMACH ANALYSES

Although no whole *M. astonii* seed was found, seed fragments were found in one Seddon Vineyard mouse and six of the ship rats (Table 1). One rat and four mice from Cape Campbell and one from Atkinson Road were partially eaten and missing their stomachs when found. The remaining Seddon Vineyard, Cape Campbell, Te Hau, and Atkinson Road mice stomachs contained a creamy coloured, finely ground paste, with no evidence of seed.

The hedgehog stomach contents were not analysed.

3.3 LIZARD IDENTIFICATION

The Te Hau lizard was identified as the common skink (*Oligosoma nigriplantare polychroma*) and released.

3.4 VIDEO MONITORING

Thirteen days of video footage from Seddon Vineyard was accrued between 31 March 2003 and 12 April 2004. Footage revealed that 39 waxeyes, 1 yellowhammer, and 3 unidentified passerines visited the plant within camera view. From Te Hau, 8 days of video footage was accrued between 30 April 2004 and 20 April 2004. Footage revealed 1 chaffinch and 7 unidentified passerines visited the plant in camera view. No rodents or lizards were seen.

Except for the yellowhammer, all passerines exhibited feeding behaviour. In most cases however, it was not possible to identify what the birds were feeding on. At Seddon Vineyard on 8 April 2004 and 9 April 2004 individual silvereyes were seen to take several fruit. On 11 April 2004 5 silvereyes removed the remaining fruit (c. 50) in less than 2 minutes.

All Seddon Vineyard passerine activity occurred between 0653 hours and 0830 hours and at Te Hau between 1046 hours and 1110 hours. Video footage showed a great deal of diurnal fly activity and nocturnal moth activity at both sites.

3.5 OTHER

Although fruit set was not quantified, the number of fruit on the Atkinson Road female declined significantly between mid day on the 10 April 2004 and midday on the 11 April 2004.

On 13 April 2004 a bird coprolite, from an unidentified source and containing 6 intact *M. astonii* seeds, was found underneath the Seddon Vineyard female plant.

4. Discussion

The discovery of *M. astonii* seed fragments within 24% of the analysed rodent stomachs confirms ship rats and mice as pre-dispersal seed predators. The seed found in the rodent stomachs was highly masticated and would not have germinated once it passed through the gut canal. Of these two rodent species the entire sample of ship rats had seed in their guts compared to only 4% of mice, suggesting rats may be the greater threat.

The significance of rodent predation is influenced by rodent abundance and the quantity of fruit set. Rodent abundance for this study, as compared with other years, is unknown. Because the four study sites are in quite different habitats and property management regimes, it is likely that rodent densities were not comparable between sites. The placing of traps around fruiting plants further clouds the picture. The ring of traps used in this study in effect protected the plants by removing the rodents, and to some degree would have reduced predation.

Fruit set was highly variable, and generally poor compared to other years (Jan Clayton-Greene, pers. comm. 2004). At Cape Campbell virtually no fruit was

set, and no seed fragments were found in any rodents caught at this site. Seddon Vineyard and Te Hau had moderate to heavy fruit set, but the lowest proportion of seed predation and the lowest trap catch rates around the fruiting plants. Atkinson Road had moderate fruiting, the highest proportion of seed predation, and the highest trap catch rate for a fruiting plant.

The often windy conditions and the fleeting visits of birds, meant video footage was not always useful in identifying visiting species or their behavior. However, some clear footage showed passerines consuming fruit, and visits corresponded with a steady decline in the number of fruit seen. The discovery of intact seed in a bird coprolite suggests strongly that silvereyes and other unidentified passerines are dispersers of *M. astonii* seed.

5. Conclusions

Whilst it is possible to say from this work that rodents do eat (and in so doing, kill) *M. astonii* seed, it is not possible to determine the significance of this predation. At best it can be said that observed predation, particularly at Atkinson Road, suggests that rodents (especially rats) could be a significant threat to *M. astonii* seed in areas or years of high rodent numbers.

- Ship rats and house mice are pre-dispersal predators of *M. astonii* seed
- Silvereyes and other passerines probably disperse *M. astonii* seed
- Inferences about *M. astonii* seed predation may be obfuscated by the season's poor fruit set, rodent abundance, and/or small sample size

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