

Pre-release impact assessment of the leaf-mining moth (*Digitivalva delaireae*), a potential biocontrol agent for Cape-ivy (*Delairea odorata*)



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INTRODUCTION

Pre-release efficacy assessments of potential agents are necessary to demonstrate that these agents will adversely affect key growth parameters of the target weed.

Digitivalva delaireae is a potential agent for *Delairea odorata* (Cape-ivy) in western North America, where two morphological varieties (stipulate and exstipulate) of Cape-ivy occur. The exstipulate variety is the most common in California, where it occurs more frequently at the northern and southern end of Cape-ivy's distribution range.

We conducted two experiments to assess (1) the oviposition preference of the moth for either of the two varieties and (2) its impact on plant performance using low and high densities of the moth on both varieties.

METHODS

1. Moth Oviposition Preference



- 2 plants per variety per cage
- 2 pairs of moths per cage
- n = 14 replicates
- Recorded proportion of damaged leaves per plant
- Used damage as a surrogate for oviposition preference
- Analysis: one-way ANOVA

2. Moth Impact



- 1st treatment: 3 moth densities (0, 2, or 4 pairs)
- 2nd treatment: 2 plant varieties
- n = 15 replicates
- Measured plant growth after 49 days
- Counted # of pupae & damaged leaves per plant
- Analysis: 2 factor ANOVA

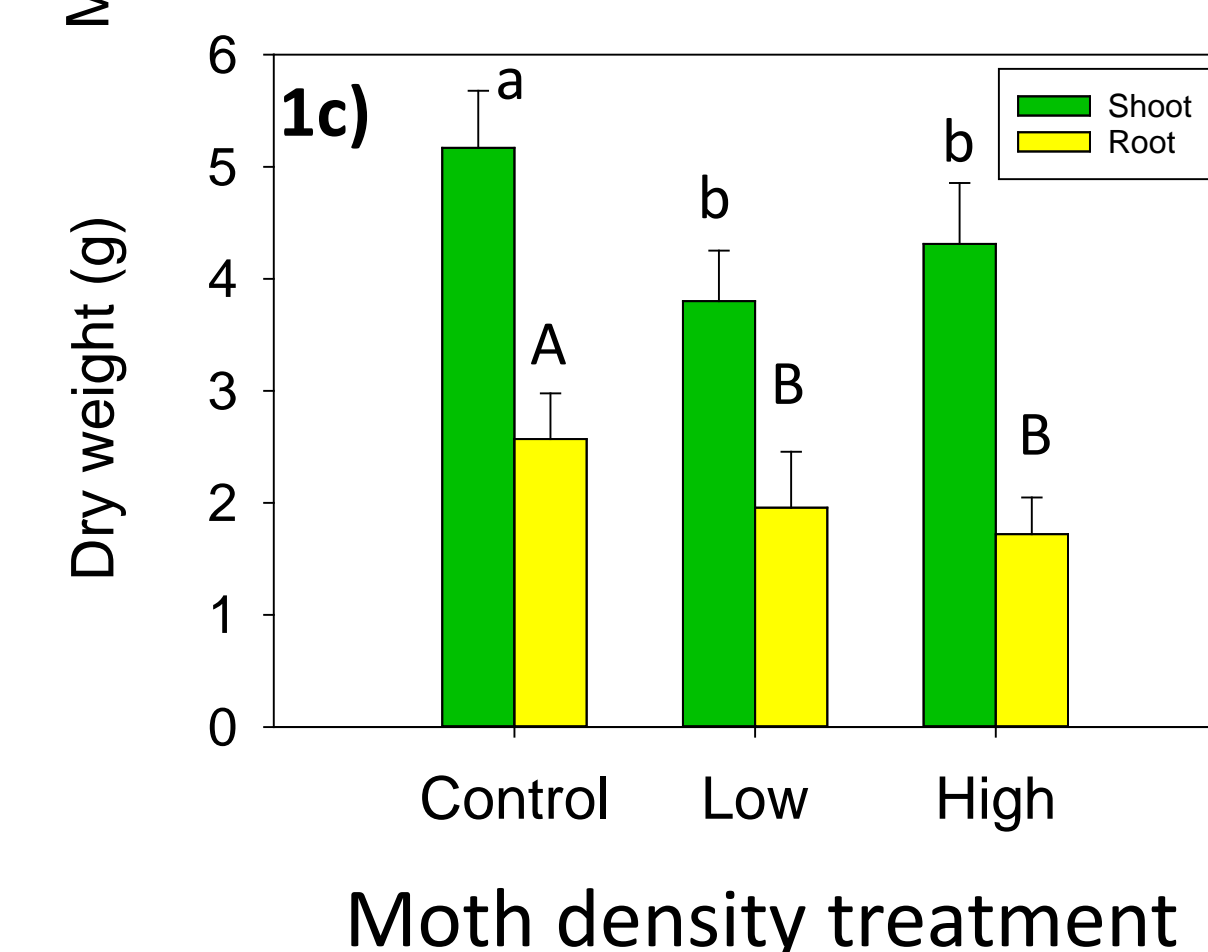
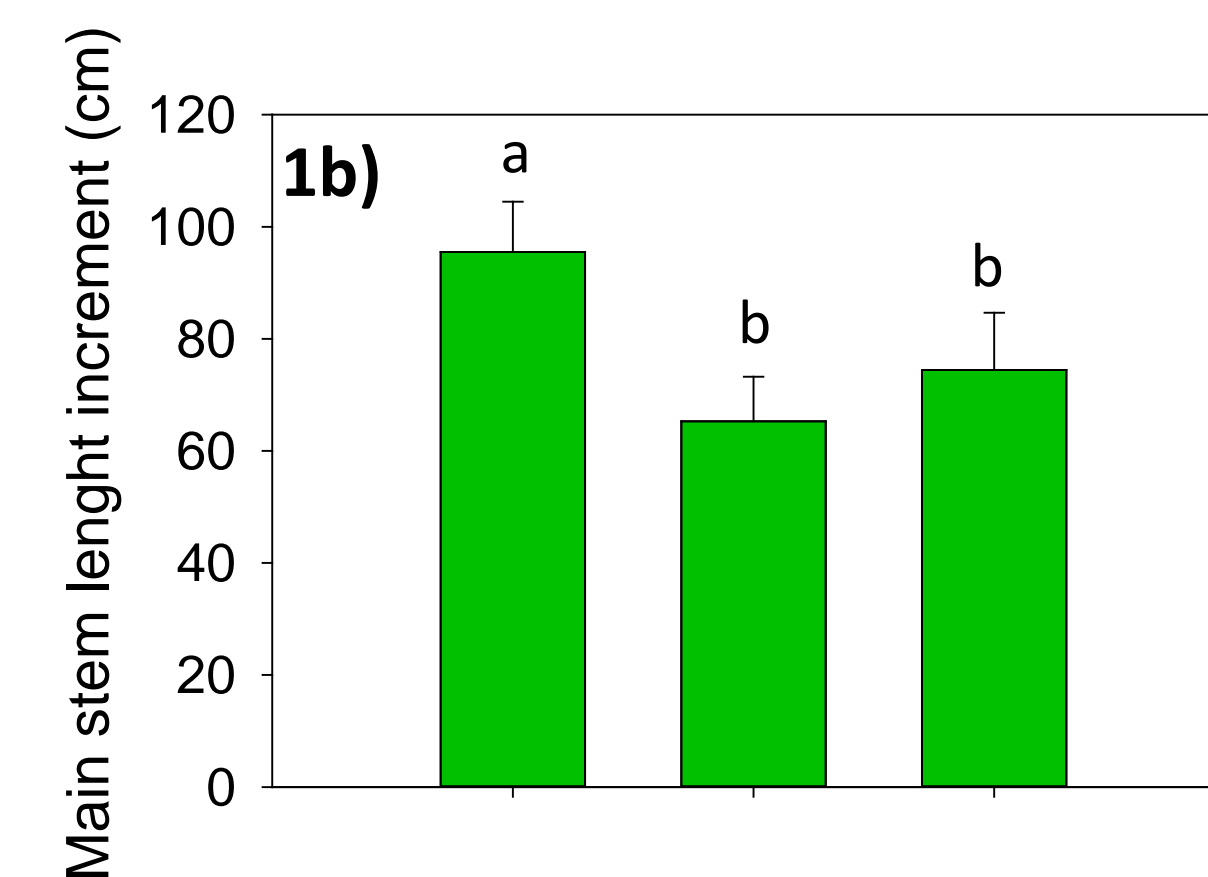
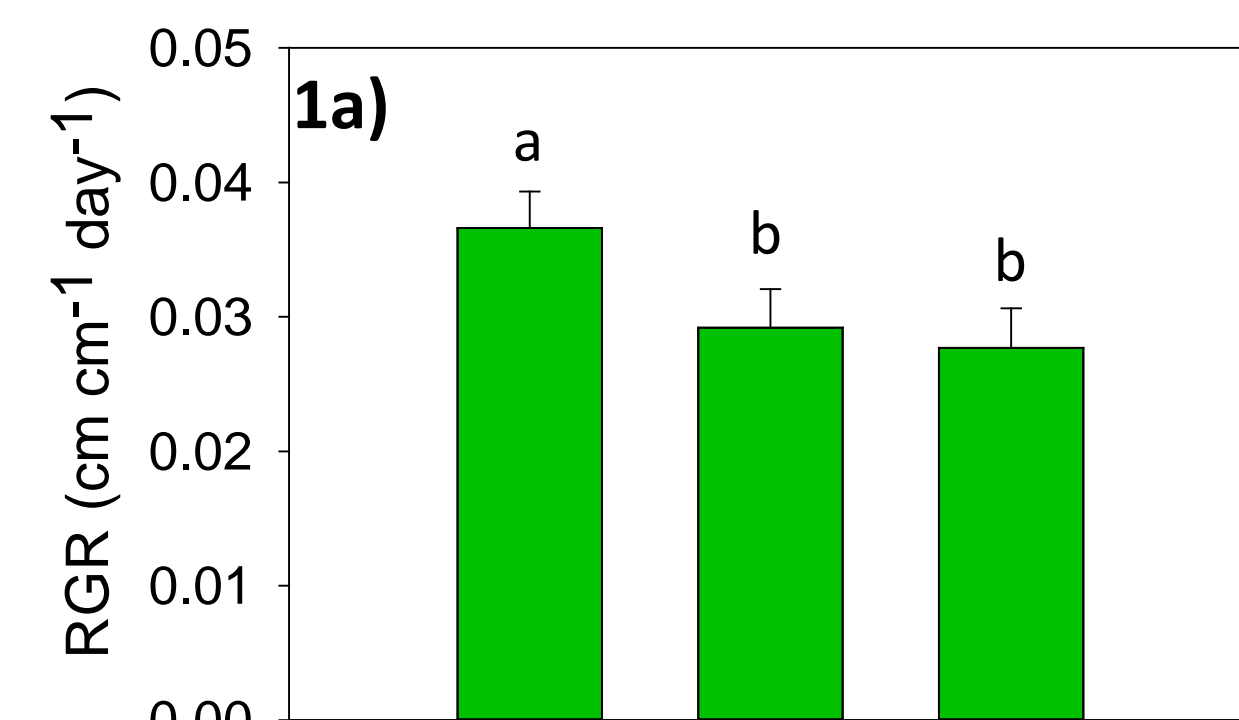
RESULTS

1. Moth Oviposition Preference

- There was no difference in the proportion of leaves damaged by the moth between plant varieties ($F_{1,13} = 1.37$, $P = 0.26$).
means (\pm SE): stipulate: 0.21 ± 0.03 and exstipulate: 0.27 ± 0.05

2. Moth Impact

- Moth herbivory, but not plant variety, affected Relative Growth Rate (RGR) ($P = 0.005$), main stem length ($P = 0.005$), shoot biomass ($P < 0.001$), and root biomass ($P = 0.003$) of Cape-ivy.



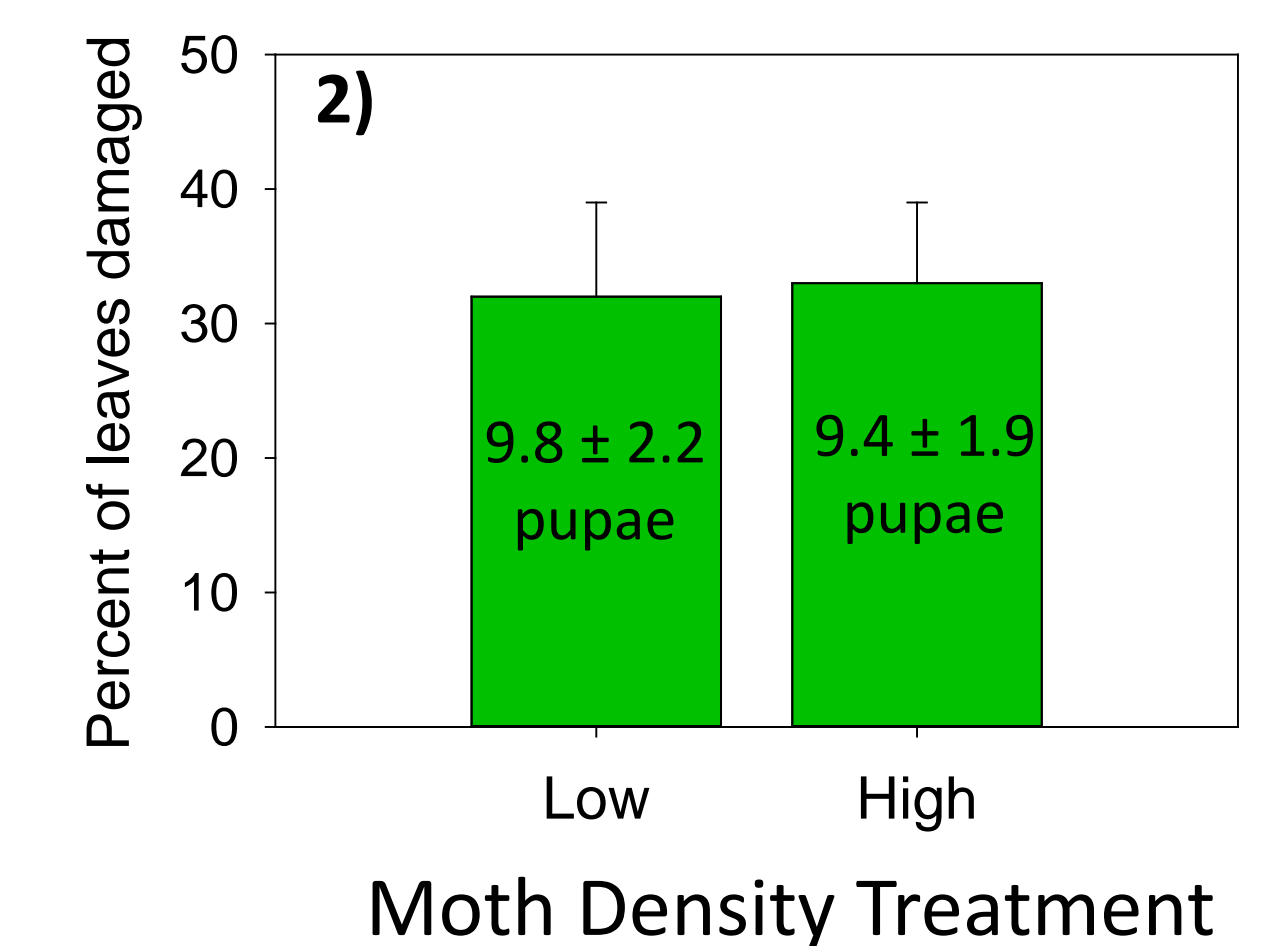
- Regardless of moth density, plant growth was reduced when exposed to moth herbivory (Fig. 1a-c).

- However, plant growth did not differ between the low and high moth density treatments (Fig. 1a-c)

- Moth herbivory reduced
 - RGR by 22%
 - Stem length increment by 27%
 - Shoot biomass by 22%
 - Root biomass by 28%

RESULTS

- There was no difference in percent leaves damaged ($P = 0.01$) and number of pupae per plant ($P < 0.001$) between low and high moth density treatments (Fig. 2).



CONCLUSIONS

- The moth does not show a preference for either of the two Cape-ivy varieties.
- The impact of moth herbivory on Cape-ivy growth was not dependent on plant variety.
- These results suggest that the segregated distribution in California will not negatively influence the effectiveness of the moth as a biological control agent.
- Cape-ivy was not able to compensate for moth herbivory under either moth density treatment.
- Once released, moth herbivory has the potential to reduced rapid growth of Cape-ivy (RGR and stem length), which is a key adaptation of vines.

Reference: Reddy, A.M., Mehelis, C.N., 2015. Pre-release efficacy assessment of the leaf-mining moth, potential biological control agent for Cape-ivy in western North America. *Biological Control* 90, 67-74.