



# Prospects for Biological Control of Cape-Ivy with the Cape-Ivy Fly and the Cape-Ivy Moth

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## Abstract

Cape-ivy (*Delairea odorata*, Asteraceae), native to coastal floodplains and mountain riparian zones in eastern South Africa, is an invasive vine in coastal riparian, woodland and scrub habitats in California and southern Oregon. Cape-ivy smothers native vegetation and may impair water flow in coastal riparian areas. The Cape-ivy moth, *Digitivalva delaireae* (Lepidoptera: Glyphipterigidae), and the Cape-ivy fly, *Parafreutreta regalis* (Diptera: Tephritidae) have been recommended for field release by the USDA-APHIS-Technical Advisory Group on Biological Control of Weeds (TAG), an international peer panel with members from the U.S., Canada, and Mexico. Applications to release both candidate agents in California and Oregon are currently being reviewed by regulatory agencies. The Cape-ivy fly and Cape-ivy moth were selected for biological control evaluation because they are widespread and damaging in the native South African range. In laboratory efficacy tests, the Cape-ivy fly galled shoot tips, reducing stem growth by 50%, and the Cape-ivy moth killed leaves and entire vining stems, reducing plant growth rate, stem length and shoot and root biomass by 20 to 40%. Among 100 other plant species evaluated in host range choice tests, including 27 native California members of the family Asteraceae that includes Cape-ivy, the Cape-ivy moth fed and reproduced only on Cape-ivy. Similar results were obtained for the Cape-ivy fly in tests of 100 plant species, including 28 CA native Asteraceae. Both insects complete their life cycle in two months. Once released, the Cape-ivy fly and moth will reduce the ability of Cape-ivy to spread vegetatively and smother other vegetation, and will reduce long-term survival of Cape-ivy.

## Cape-ivy (*Delairea odorata*, Asteraceae)

- From South Africa
- Introduced as ornamental
- Coastal invader in CA
- Invades stream banks
- Also forest and scrubland
- Coastal mountains
- Displaces native plants<sup>1</sup>
- Uses scarce water
- Chemical control: triclopyr, glyphosate<sup>2</sup>, repeat applications may be required

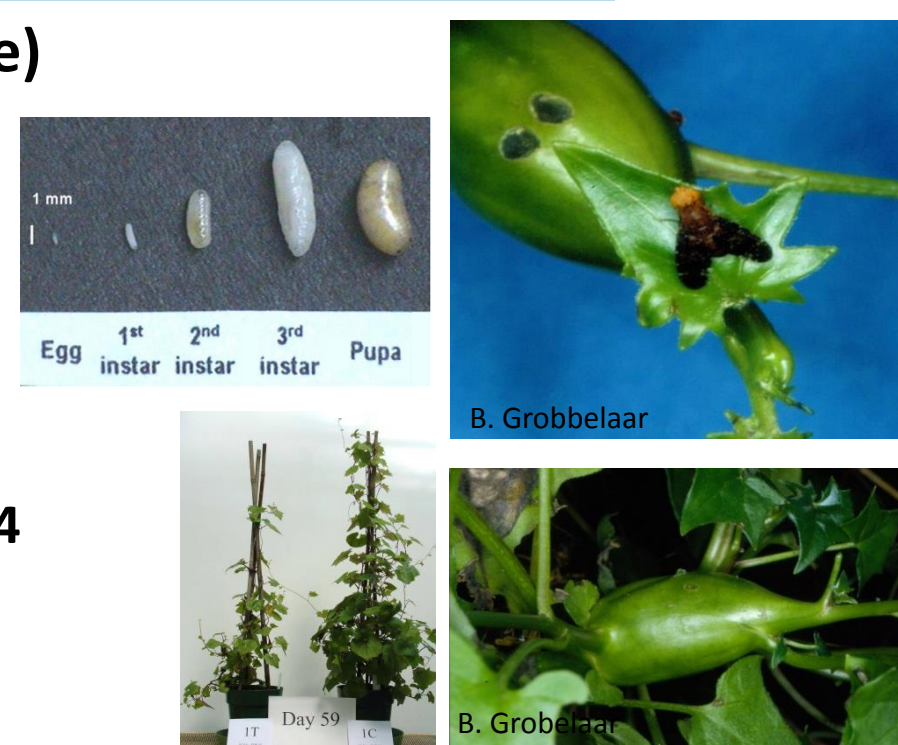


**Top left:** Distribution of Cape-ivy in California (from Robison and DiTomaso 2010). **Bottom left:** Exstipulate and stipulate forms of Cape-ivy found in California. **Right:** Infestations of Cape ivy near Little River State Park (Humboldt Co.) (top), Garrapata State Park (Monterey Co.) (middle), and Morro Bay State Park, San Luis Obispo Co. (bottom).

## Cape-ivy shoot tip-galling fly

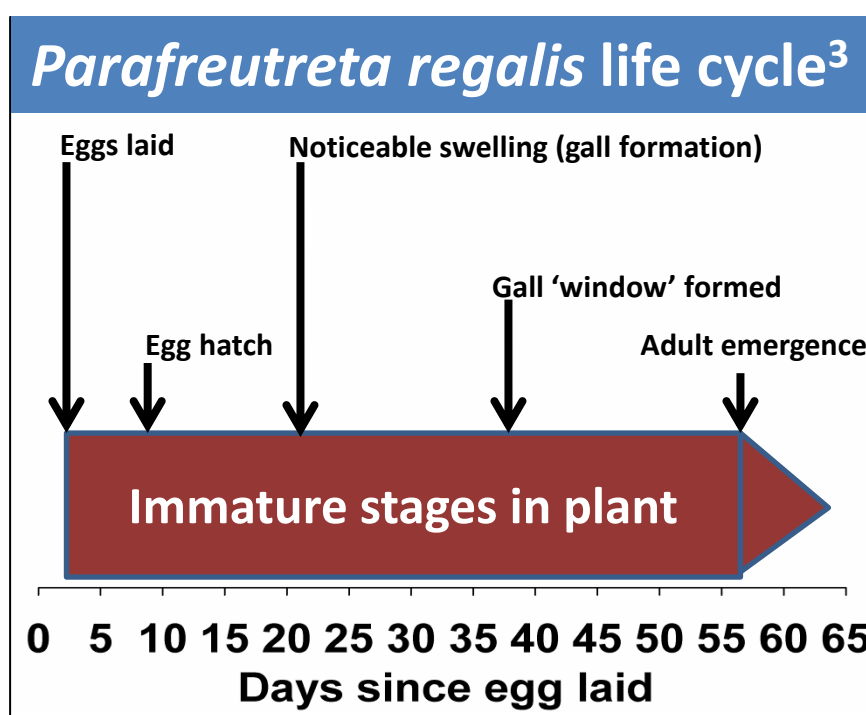
*Parafreutreta regalis* (Diptera: Tephritidae)

- From South Africa
- Makes galls (tumors) in shoot tips
- Completes life cycle in two months<sup>3</sup>
- Reduces plant size and growth<sup>5</sup>
- No galling or development on 100 other plants<sup>4</sup>
- Favorable recommendation for release-TAG
- Release permit application under review



### Laboratory evaluation of impact<sup>5</sup>

Treatment	Total stem length	Stem weight	Total nodes	Additional large leaves	Leaf weight
High density- 10 ♀	-56%	-36%	-52%	-69%	-48%
Low density - 2 ♀	-48%	-40%	-35%	-32%	-33%



## Host range testing

- Choice tests (4 non-target plants per test)
- Four female:male pairs per test
- Allow 4 days exposure to non-target plants only
- Then add one Cape-ivy plant to cage
- Use test results only if the Cape-ivy plant is damaged and produces pupae
- Non-target plant species were tested at least five times



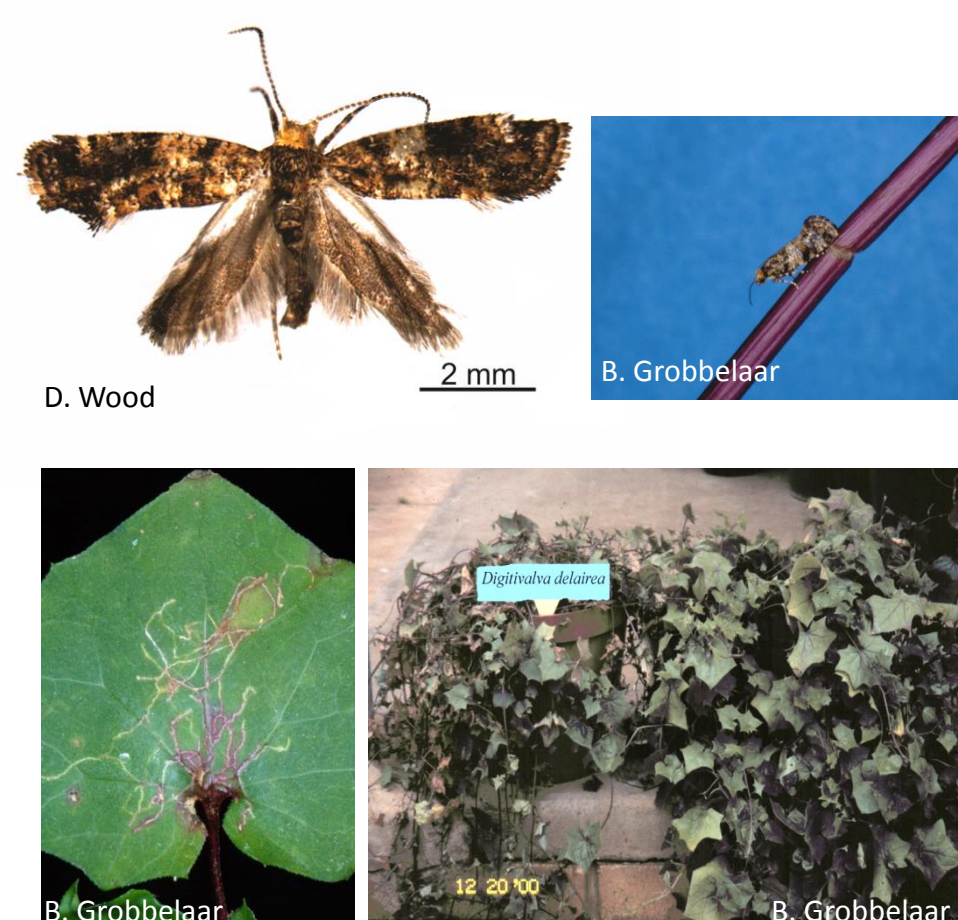
Laboratory host range testing results for 100 plant species examined for pupation of the Cape-ivy fly and Cape-ivy moth (numbers of species tested per category):  
**No pupal development on any species other than Cape-ivy.**

Test plant category	Tribe Senecioneae		Other tribes of Asteraceae		Other families- hosts of congeners of the insects		Other families- habitat associates of Cape-ivy		Percent of plants tested that occur in Cape-ivy habitats or nearby	
	Fly <sup>4</sup>	Moth <sup>6</sup>	Fly	Moth	Fly	Moth	Fly	Moth	Fly	Moth
Plants native to California and co-occurring with Cape-ivy	13	13	15	14	4	2	5	5	100%	100%
Other plants native to California or elsewhere in U.S.	3	2	3	3	1	0	0	0	0%	0%
Non-native crops and ornamental plants in U.S.	8	8	9	8	0	6	5	4	77%	77%
Non-native weeds in U.S.	4	4	8	7	0	1	2	3	79%	73%
South African plants that do not occur in U.S.	15	15	4	4	0	0	1	1	0%	0%
<b>TOTAL SPECIES</b>	<b>43</b>	<b>42</b>	<b>39</b>	<b>36</b>	<b>5</b>	<b>9</b>	<b>13</b>	<b>13</b>	<b>73%</b>	<b>70%</b>

## Cape-ivy leaf-mining moth

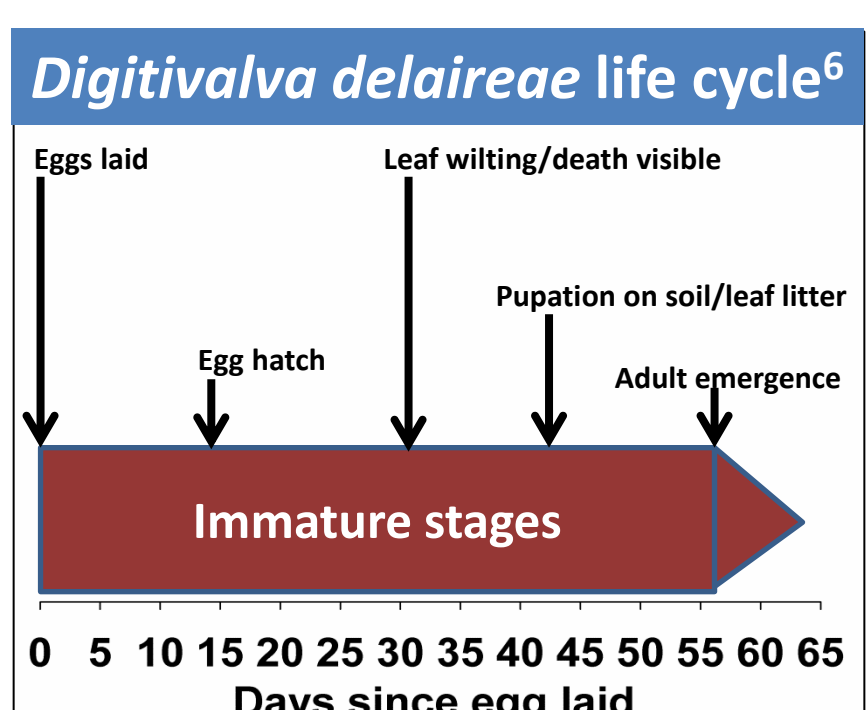
*Digitivalva delaireae* (Lepidoptera: Glyphipterigidae)

- From South Africa
- Mine leaves as young larvae
- Bore into stems as late-stage larvae
- Completes life cycle in two months<sup>6</sup>
- Reduces plant size and growth; kills stems<sup>7</sup>
- No pupal development on 100 other plants<sup>6</sup>
- Favorable recommendation for release-TAG
- Release permit application under review



### Laboratory evaluation of impact<sup>7</sup>

Treatment	Stem length gain	Stem weight	Node gain	Leaf gain	Leaf weight
High density- 4 ♀	-22%	-17%	-11%	+10%	-9%
Low density - 2 ♀	-31%	-26%	-24%	-11%	-14%



## References

- <sup>1</sup>Robison, R., and J. M. DiTomaso. 2010. Distribution and community associations of Cape-ivy (*Delairea odorata*) in California. *Madroño* 57: 85-94.
- <sup>2</sup>DiTomaso, J. M., G. B. Kyser, S. R. Oneto, R. G. Wilson, S. B. Orloff, L. W. Anderson, S. D. Wright, J. A. Roncoroni, T. L. Miller, T. S. Prather, C. R. Ransom, K. G. Beck, C. Duncan, K. A. Wilson, and J. J. Mann. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA.
- <sup>3</sup>Balciunas, J., and C. Mehelis. 2010. Life history of *Parafreutreta regalis* (Diptera: Tephritidae): a candidate agent for biological control of *Delairea odorata*. *Environ. Entomol.* 39: 114-120.
- <sup>4</sup>Balciunas, J., C. Mehelis, L. van der Westhuizen, and S. Nesar. 2010. Laboratory host range of *Parafreutreta regalis* (Diptera: Tephritidae), a candidate agent for biological control of Cape-ivy. *Environ. Entomol.* 39: 841-848.
- <sup>5</sup>Balciunas, J., and L. Smith. 2006. Prerelease efficacy assessment, in quarantine, of a tephritid gall fly being considered as a biological control agent for Cape-ivy (*Delairea odorata*). *Biol. Cont.* 39: 526-524.
- <sup>6</sup>Mehelis, C. N., Balciunas, J., Reddy, A. M., van der Westhuizen, V. D., Nesar, S., and Moran, P. J.. Biology and host range of *Digitivalva delaireae* (Lepidoptera: Glyphipterigidae), a candidate agent for biological control of Cape-ivy (*Delairea odorata*). Submitted.
- <sup>7</sup>Reddy, A. M., and C. N. Mehelis. Prerelease efficacy assessment of the leaf-mining moth *Digitivalva delaireae* – a potential biological control agent for Cape-ivy (*Delairea odorata*). Submitted.