Towards biological control of a generalist insect herbivore: the activities of generalist parasitoids are segregated between crop and adjacent non-crop habitats

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Harpinder Sandhu , Stephen D. Wratten and
Michael A. Keller

Photo by Yi Feng


1034 m
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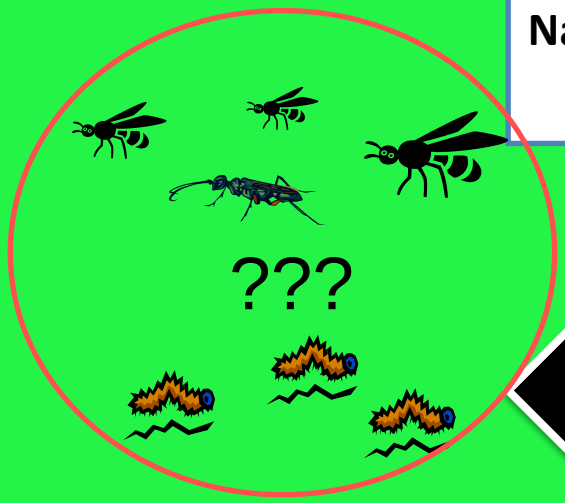
Google earth

Adjacent Vegetation

Crops



Natural enemies & insect pests

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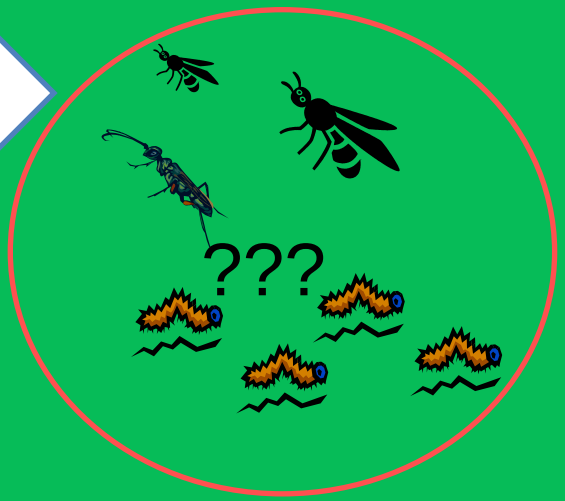
Natural enemies & insect pests



Questions

- Is adjacent vegetation the source of parasitoids in vineyards?

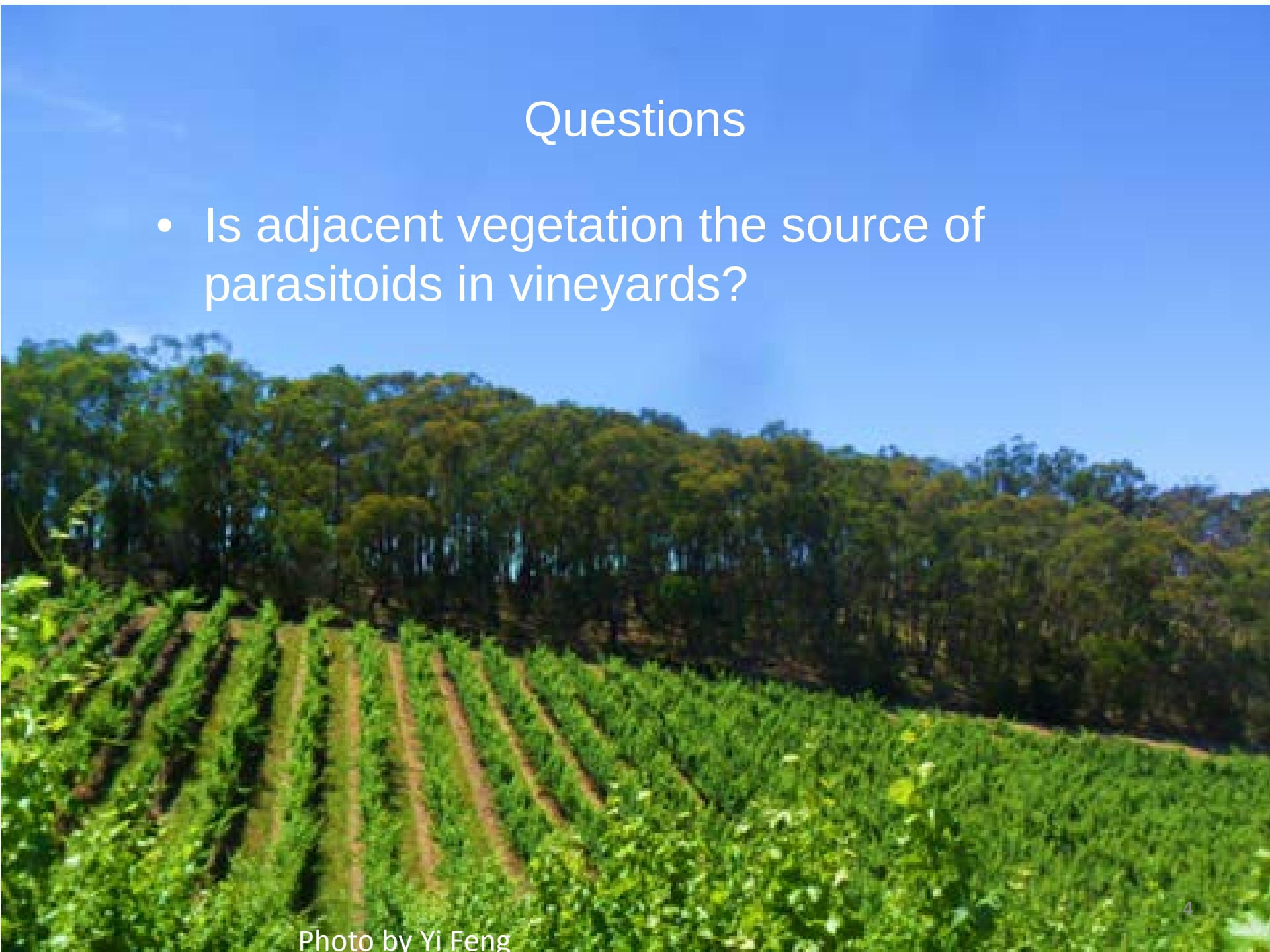
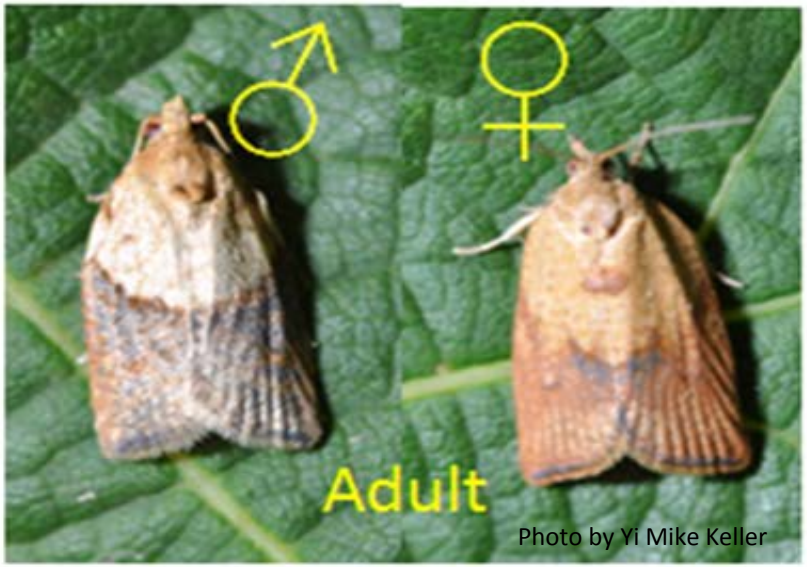


Photo by Yi Feng

Epiphyas postvittana or **Light brown apple moth** (LBAM)



http://wanda.uef.fi/biologia/nyman/IOWleaftiers.htm

LBAM is the major insect pest on wine grapes in Australia

Feeding damage
($18M annual lose)

Botrytis bunch rot ($52M annual lose)

apple, grape, peach, apricot, pear, nectarine, citrus,

Persimmon, cherry, almond, walnut, poplar,

LBAM has been recorded to

redwood, cottonwood, pine, coast, eucalyptus,

attack at least 250 different

kiwifruit, Strawberry, blueberry, corn, pepper,

plants in Australia, and other

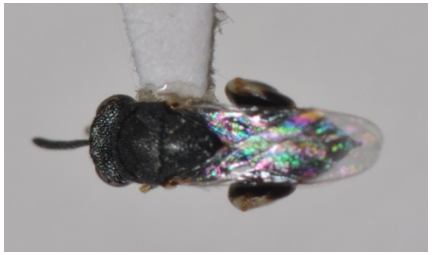
cabbage, carrot, rose, camellia, Boysenberry,

countries

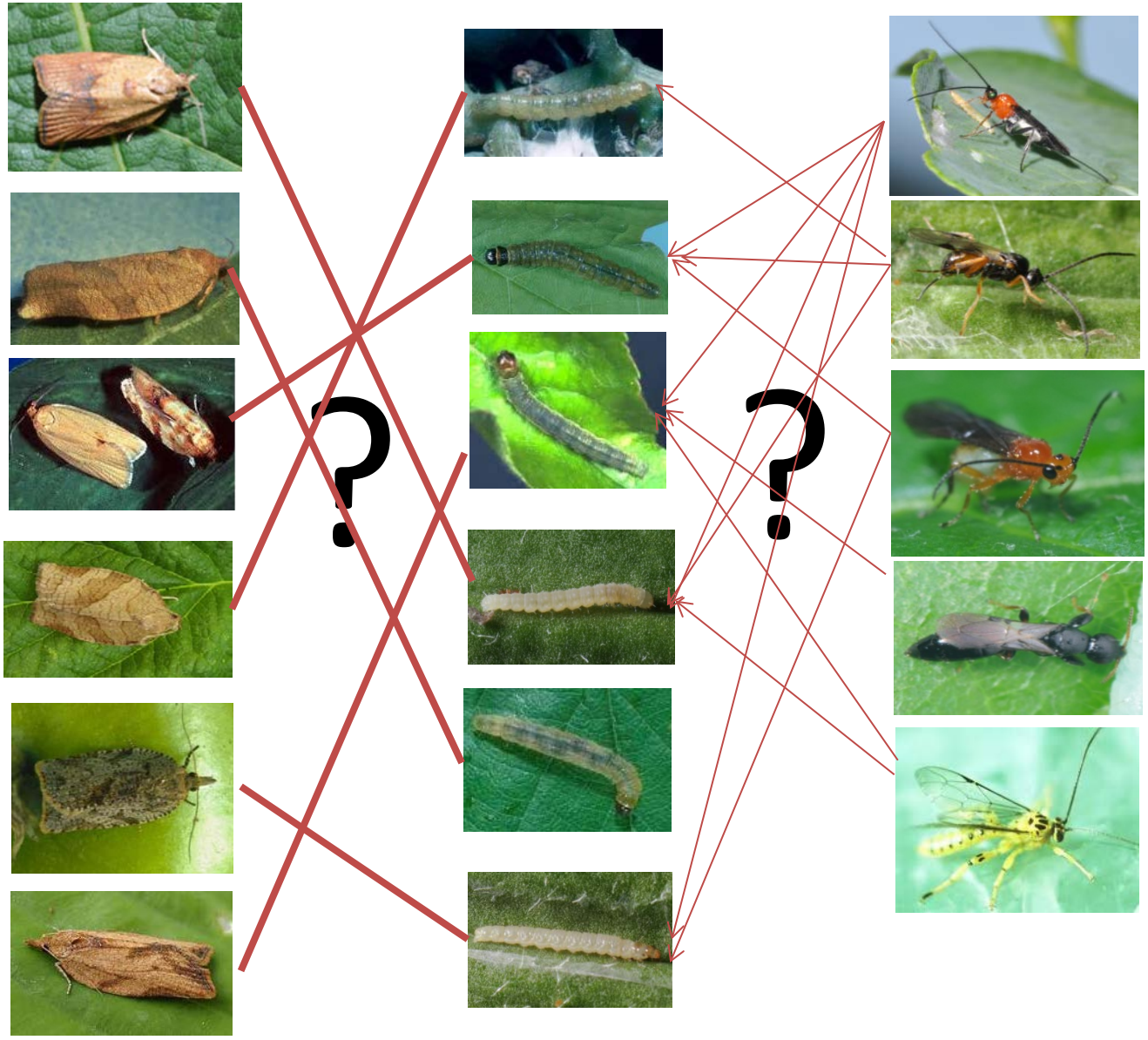
raspberry, alfalfa, tomato, pumpkin, jasmine,

chrysanthemum, clover, plantain apple, grape,

Conservation Biological control: enhance parasitic wasps activity benefit pest management



Investigate the links between leaf roller and the associated parasitoids



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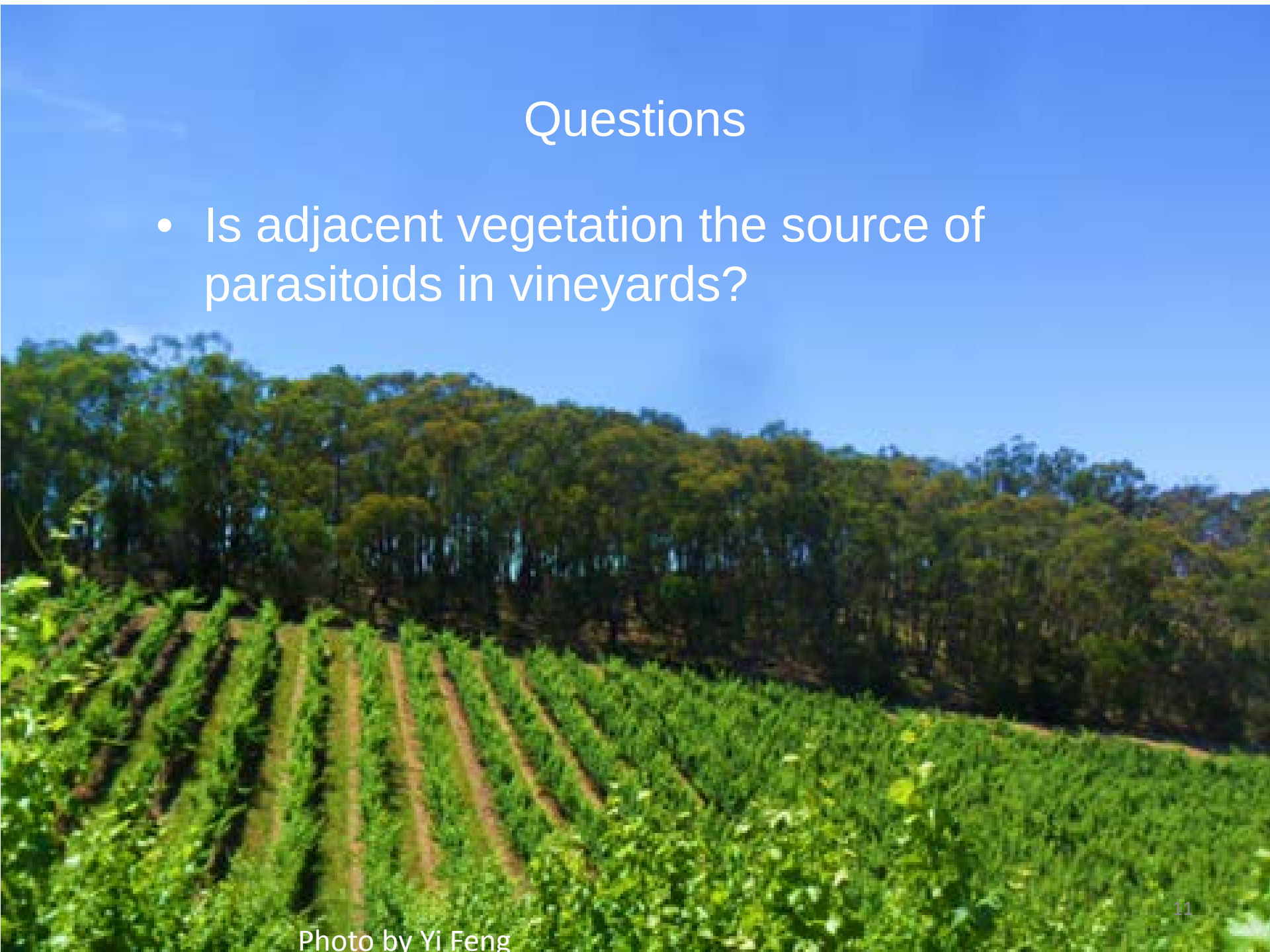
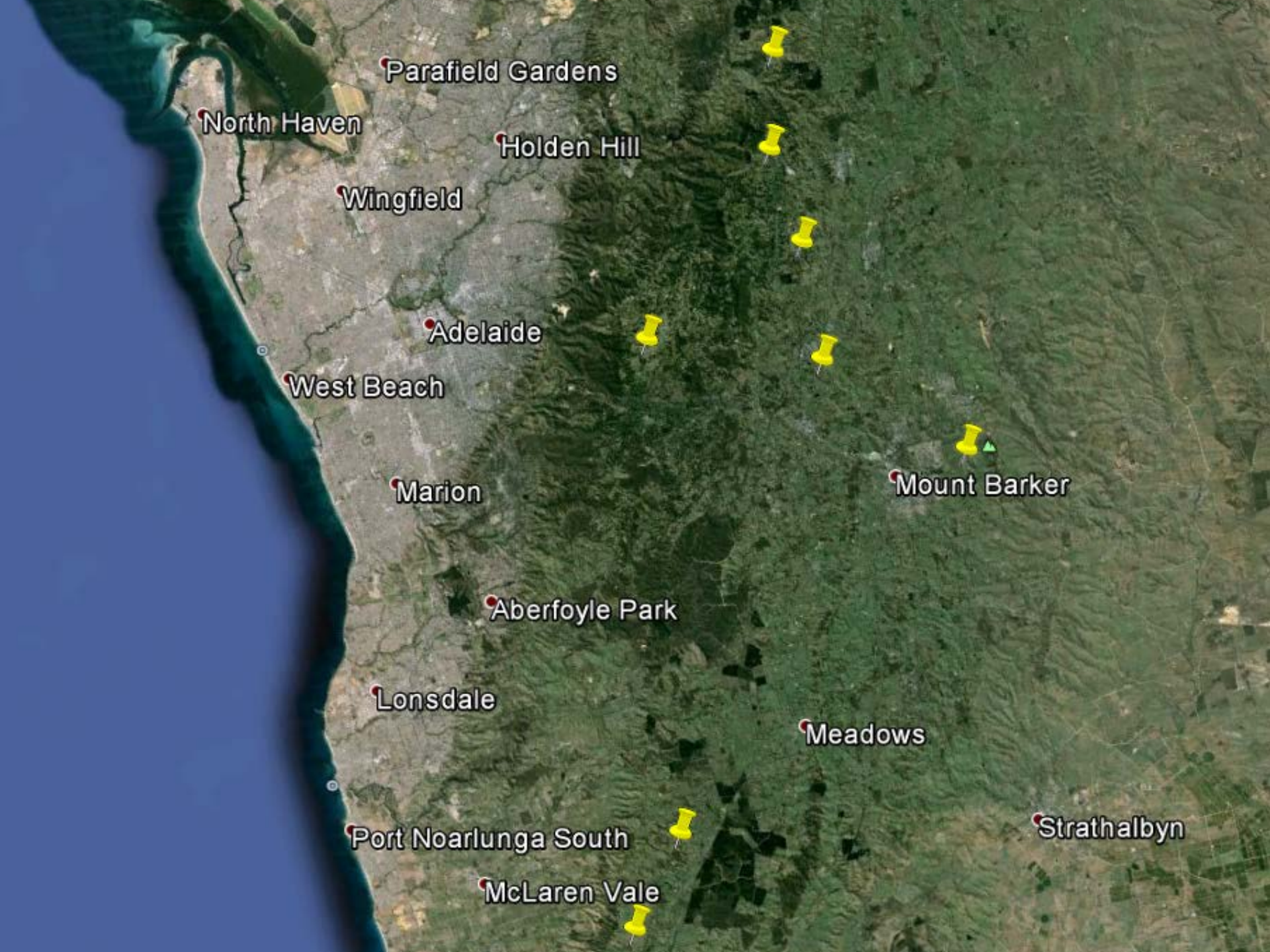


Photo by Yi Feng


Parafield Gardens
North Haven
Holden Hill
Wingfield
Adelaide
West Beach
Marion
Mount Barker
Aberfoyle Park
Lonsdale
Meadows
Strathalbyn
Port Noarlunga South
McLaren Vale

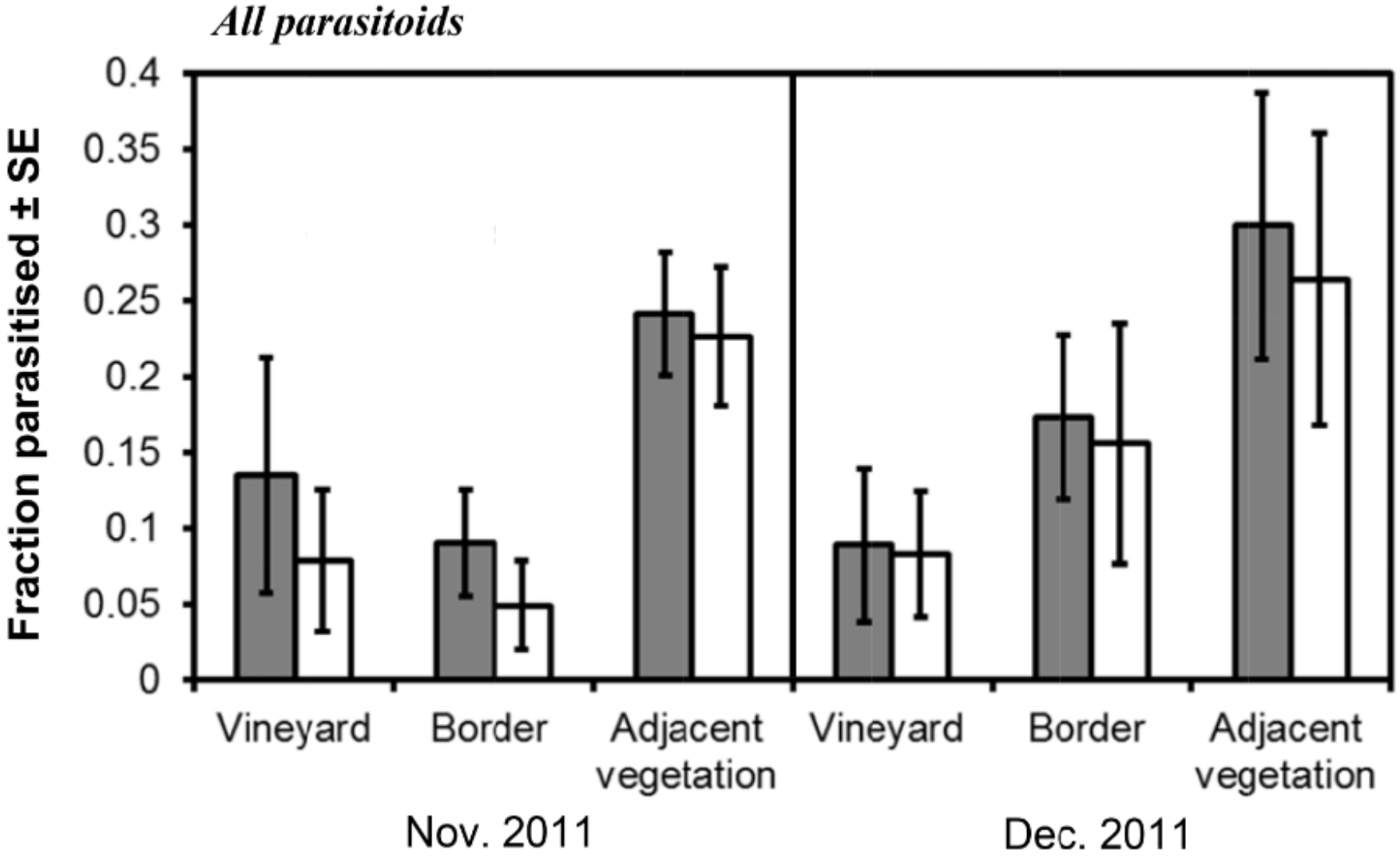
2011 vineyard Experiment

Adjacent Vegetation

Vineyard

Potted Grape

Potted plantain



Adjacent vegetation > Vineyard; Adjacent vegetation > Border (ANOVA, followed by multiple comparisons with a Bonferroni test, $F_{2, 10} = 4.33$; $P < 0.05$)

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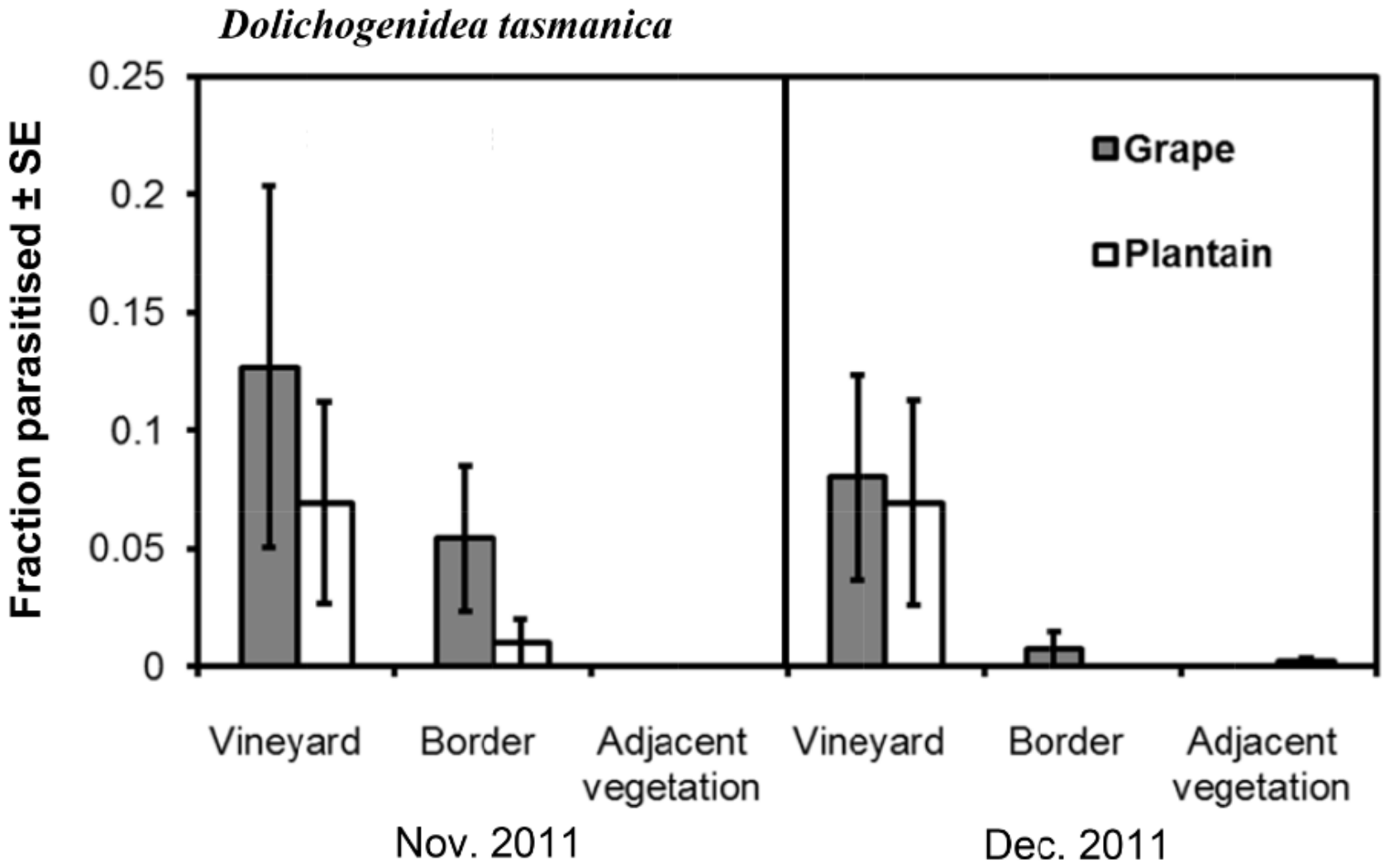

- Vineyard > Adjacent vegetation ($F_{1, 10} = 6.67$, $P = 0.027$).
- Border Vs Vineyard & Border Vs adjacent vegetation (post-hoc Fisher test with the Bonferroni adjustment, $P > 0.05$)
- Grape > Plantain ($F_{1, 15} = 6.38$; $P = 0.023$)

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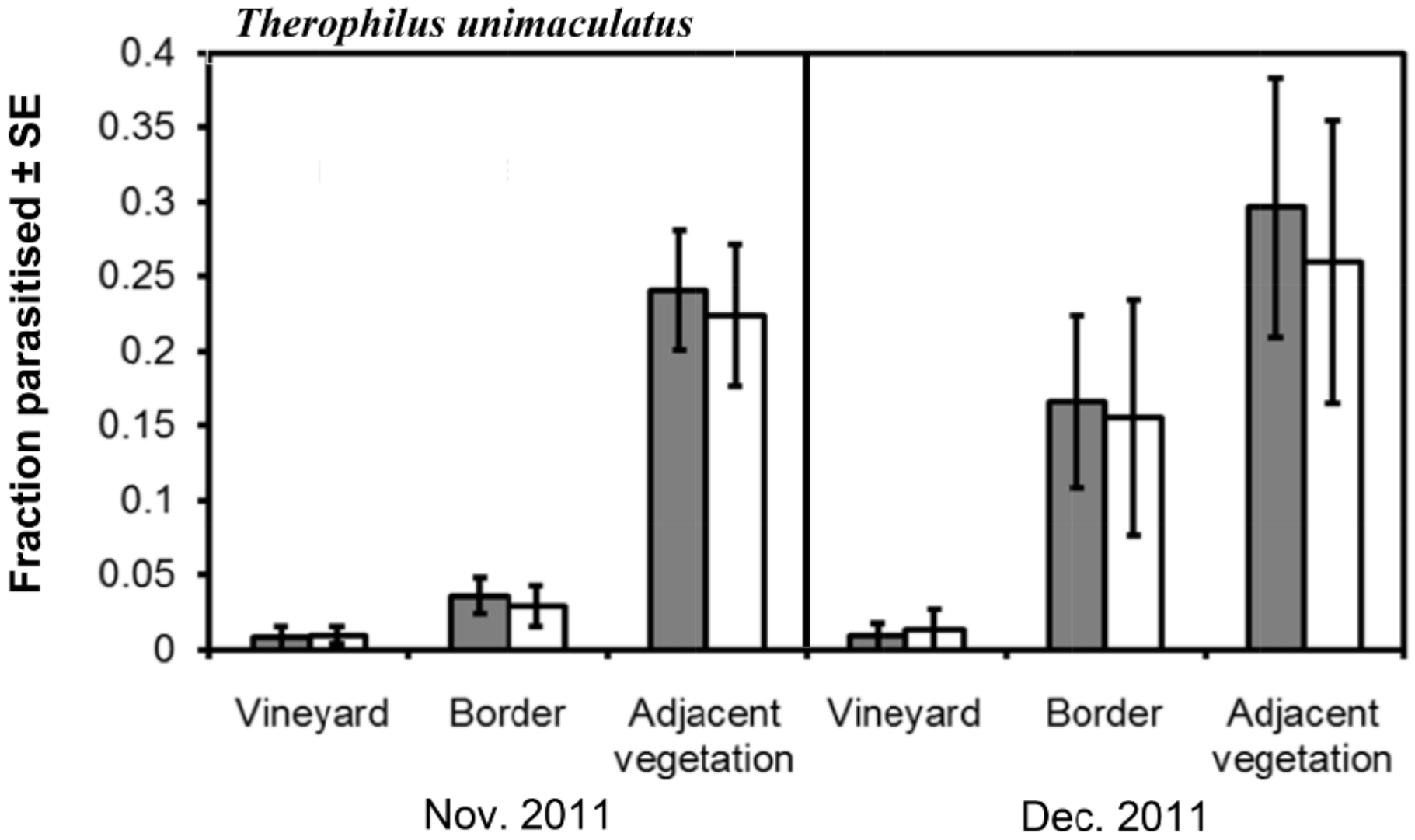

- Adjacent vegetation > Vineyard ($F_{1, 10} = 17.2$, $P = 0.002$).
- Border < Adjacent vegetation; Border not different from vineyard (post-hoc directional Fisher test with the Bonferroni adjustment)
- Dec.2011 > Nov. 2011 ($F_{1, 15} = 5.26$; $P < 0.05$)

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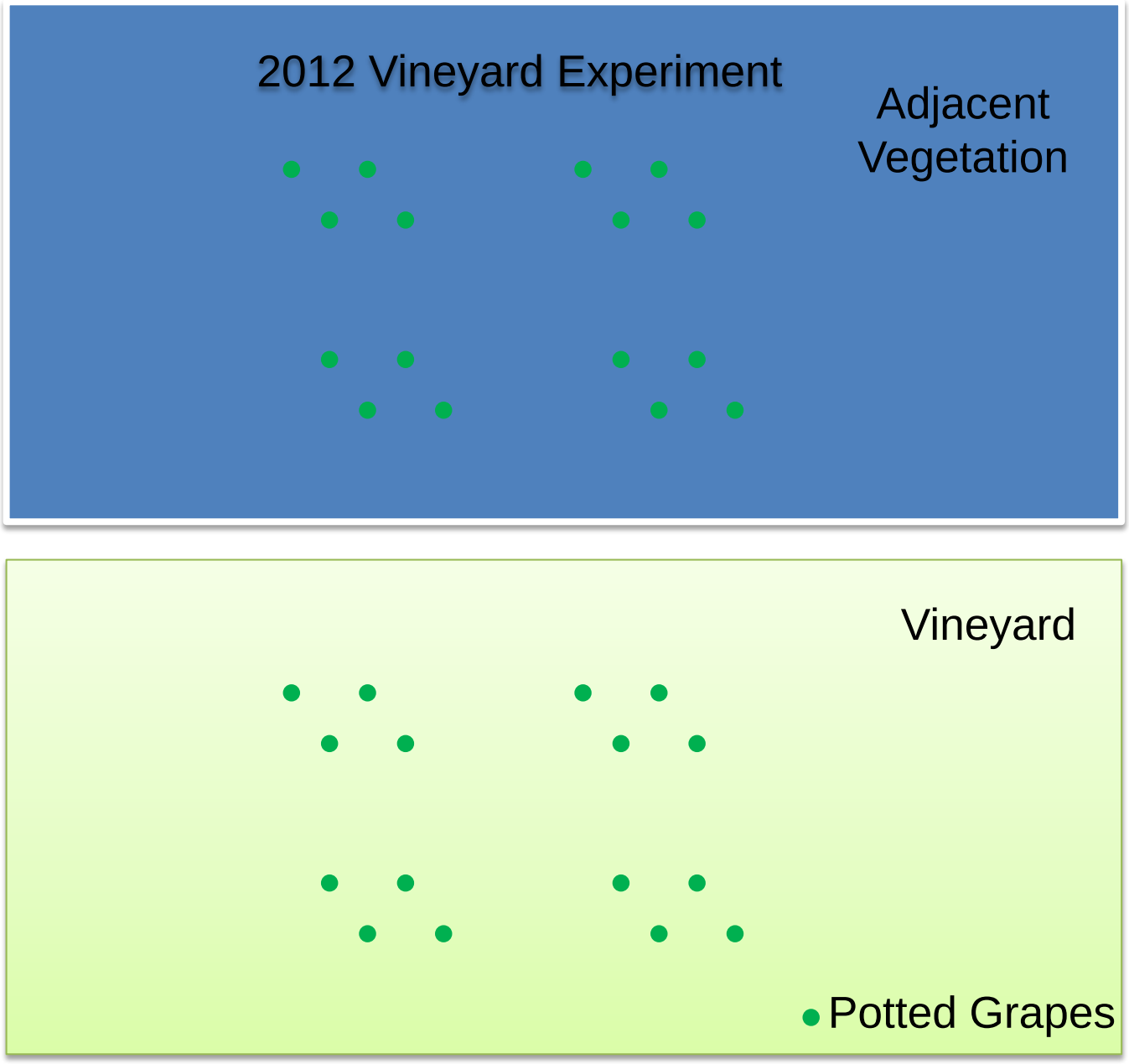
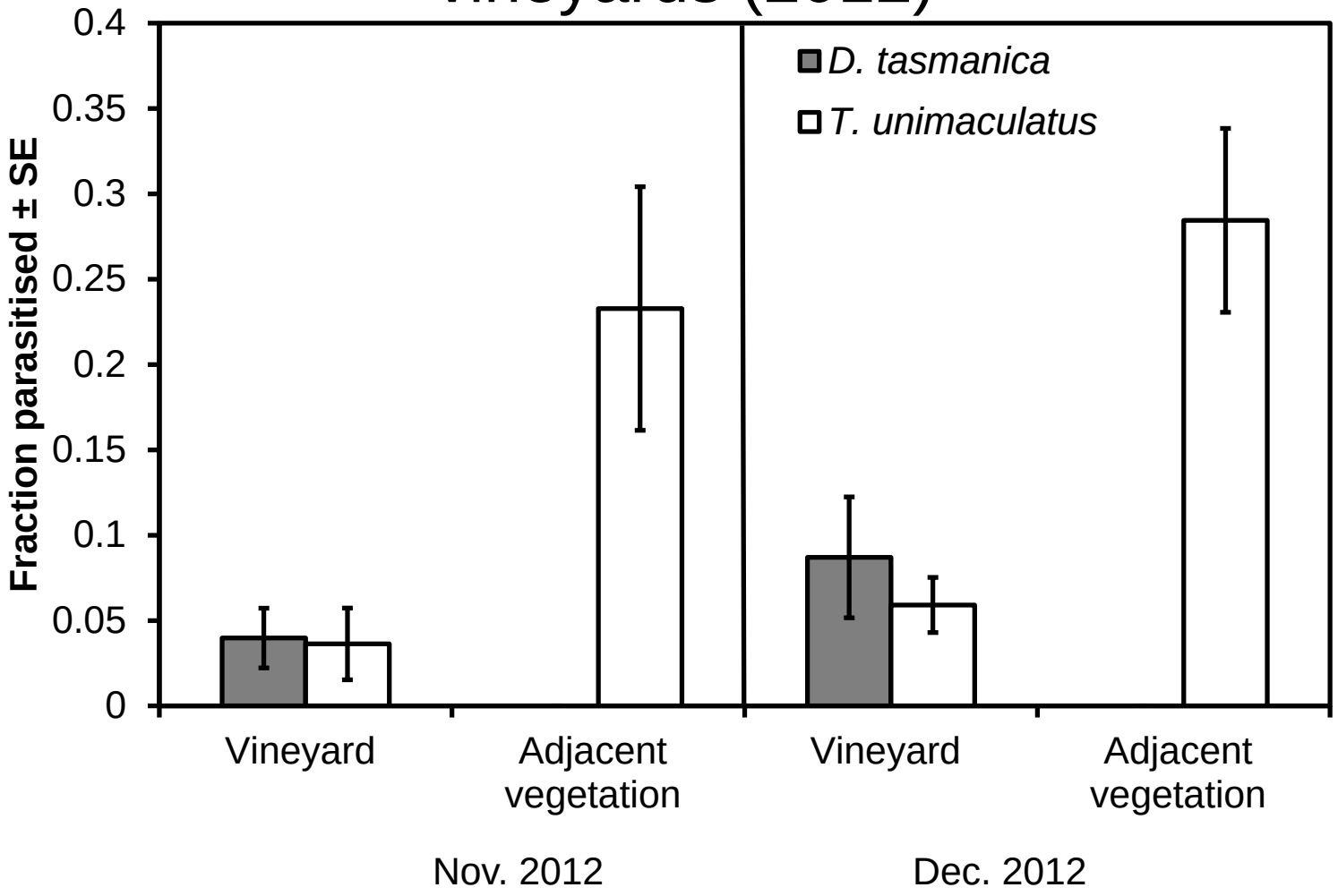
Conclusions 2011

- Location of LBAM significantly influenced the level of parasitism. Parasitism in vineyards was not closely linked to nearby native vegetation. ***T. unimaculatus*** was dominant in the native vegetation while ***D tasmanica*** was mainly active in vineyards.

- Host plants had a significant effect on parasitism by *D. tasmanica*.


2012 Vineyard Experiment
Adjacent Vegetation
Vineyard
Potted Grapes

Per cent Parasitism of LBAM in 2 locations in 8 vineyards (2012)



- *D. tasmanica*: Adjacent vegetation > Vineyard ($F_{1, 7} = 7.30$; $P < 0.05$).
- *T. unimaculatus*: Vineyard > adjacent vegetation ($F_{1, 7} = 13.70$; $P < 0.05$).

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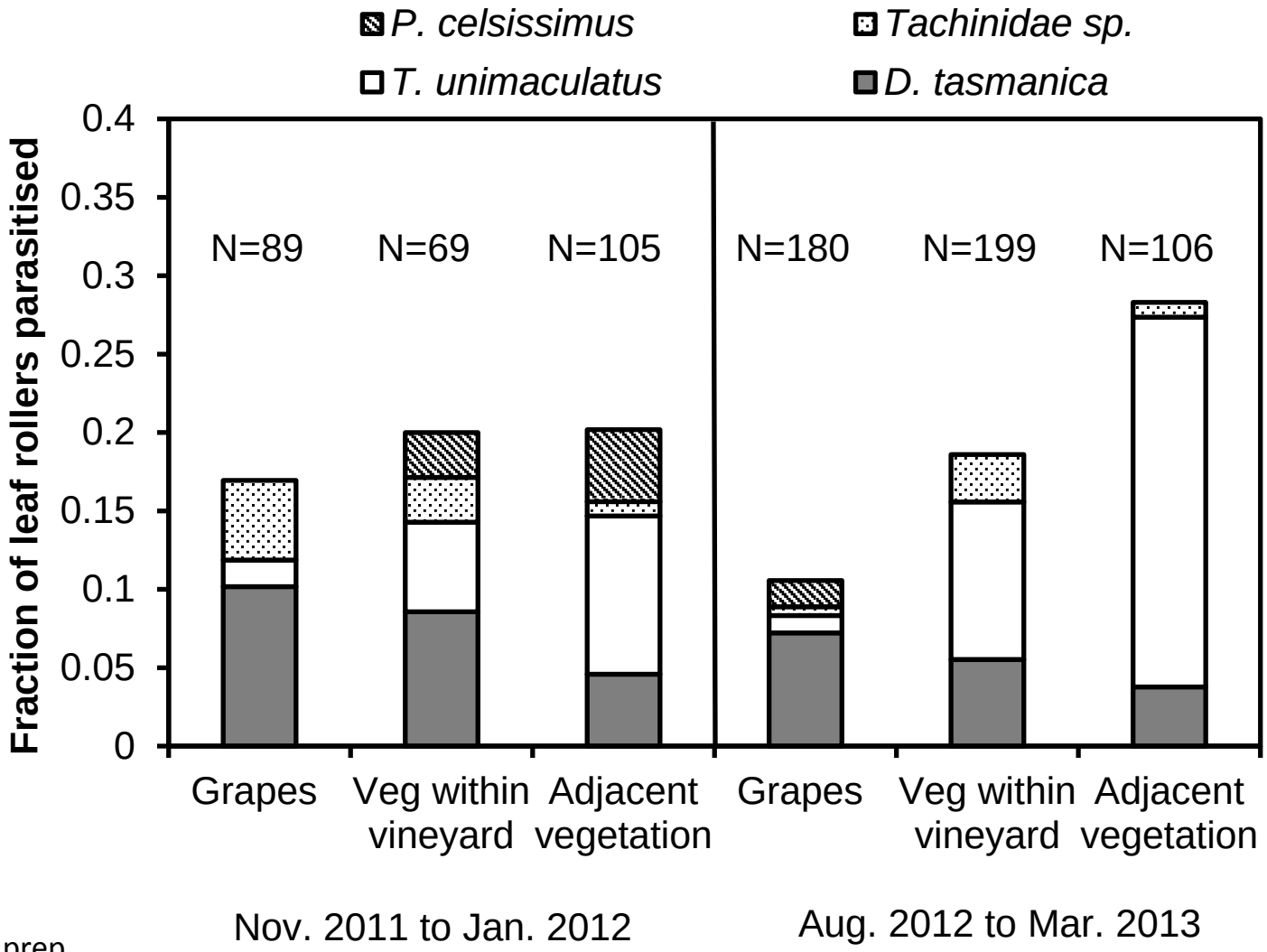
Conclusions (2012)

- Location of *LBAM* significantly affected the parasitism by both wasp species. Parasitism in vineyards was not closely linked to nearby native vegetation

  T. unimaculatus was dominant in the native vegetation while ***D. tasmanica*** mainly active in vineyards.

Fraction of leaf rollers parasitised by larval parasitoids of naturally occurring leaf rollers (November to December 2011 and August to March 2013)



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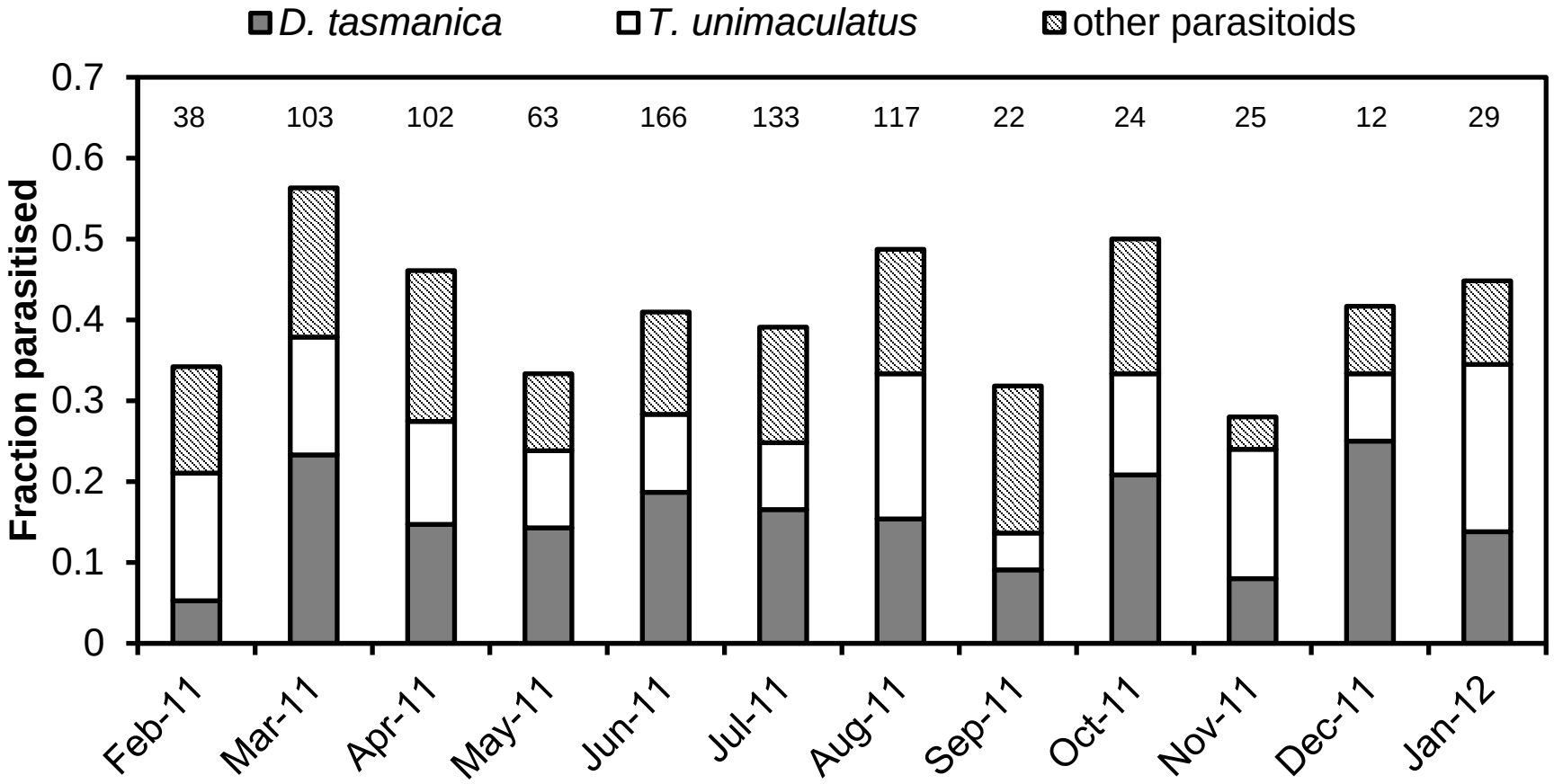
Fraction of leaf rollers parasitized by *D. tasmanica*, *T. unimaculatus* and other parasitoids collected monthly from February 2011 to January 2012 at the Waite Conservation Reserve



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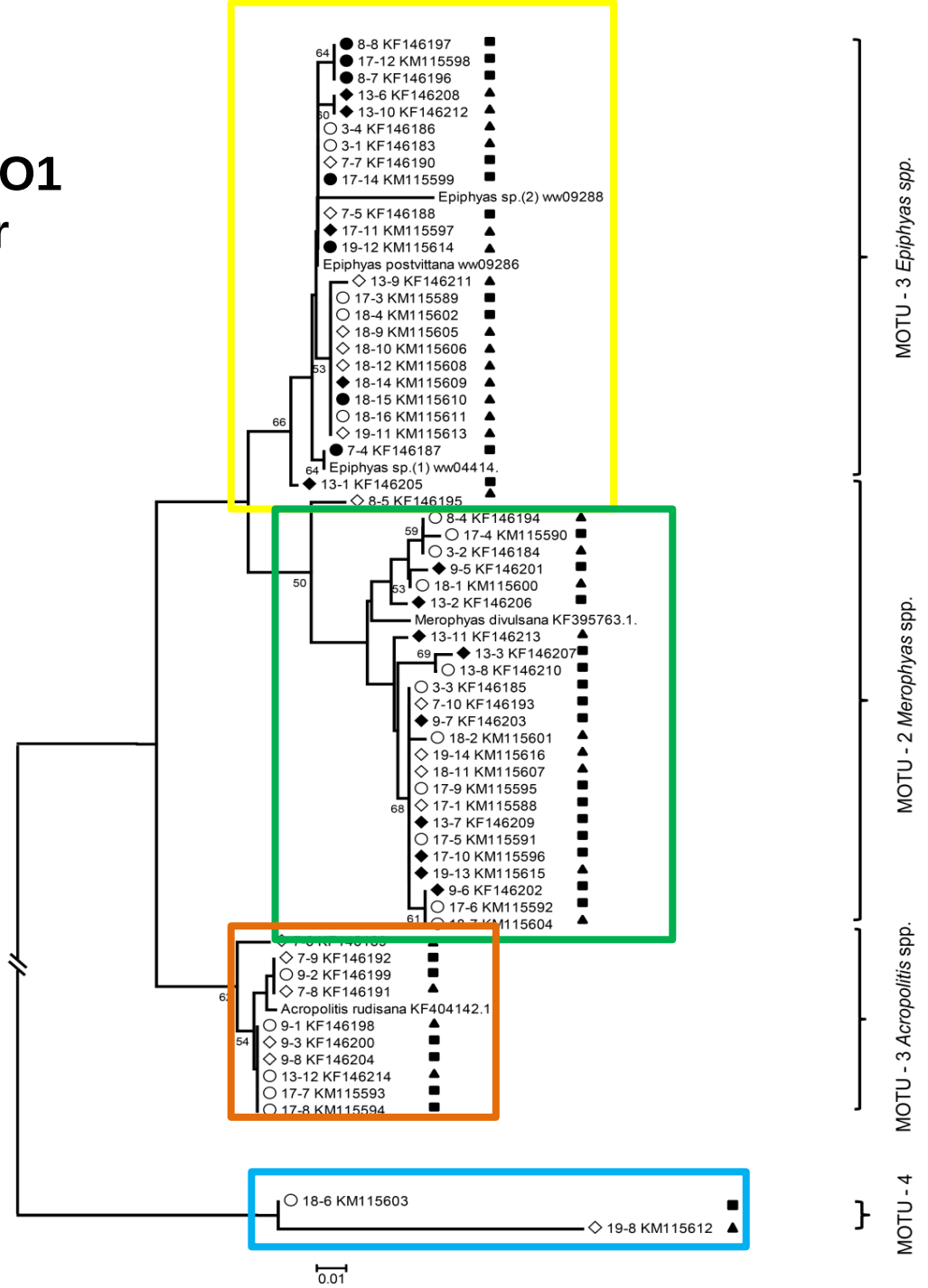
Neighbour-joining tree constructed with partial MT-CO1 sequences from the leaf roller remains left by parasitoids

Symbols on the right side of the sequence name indicate the reared parasitoids (▲:*T. unimaculatus*, ■:*D. tasmanica*). Symbols on the left side of the sequence correspond to the habitats from which the leaf rollers were collected (●: wine grapes in the vineyard; ○ : natural habitats not adjacent to vineyard; ◆ : cover plants in the vineyard; ◇ :adjacent vegetation).



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Why *T. unimaculatus* and *D. tasmanica* differ in their use of habitats?

Vineyards are typical spatially heterogeneous agro ecosystem

Hypotheses:

Plant, cyclical seasonal changes, landscape characteristics, alternative hosts, host density fluctuations and abiotic factors could generate spatial niche differences between vineyard and adjacent vegetation.

Conclusion

- Non-crop adjacent vegetation are not the likely source of parasitoids that attack *E. postvittana* in vineyards.

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James Thorpe,
Murray Leake,
Mike Harms,
Peter McIntyre.
Geoff Hardy

Photo by Mike Keller