POTENTIAL INDIGENOUS AND EXOTIC PREDATORS FOR THE BIOLOGICAL CONTROL OF THE NEWLY INTRODUCED PERSEA MITE, *Oligonychus perseae* IN AVOCADO ORCHARDS OF ISRAEL

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Oligonychus perseae

- *O. perseae* was first discovered in Israel in the fall of 2001 in several avocado orchards located in the Western and Upper Galilee.
- Since, it has spread to almost all the growing areas in the country, causing extensive foliar damage and leaf drop in most of these regions.

Extensive Leaf Drop

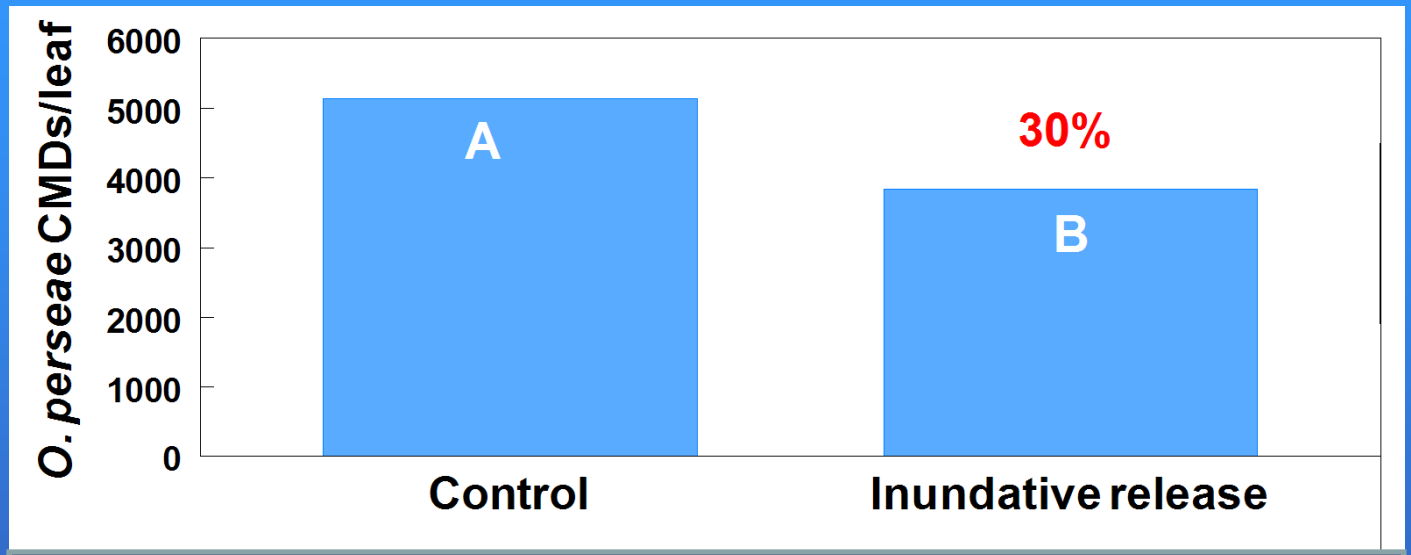
Research Objectives

1. Evaluate the efficacy of introduced phytoseiid predators.
2. Evaluate indigenous phytoseiid predators with and without pollen provision/application.
3. Identify insect predators for persea mite control.
4. Develop conservation techniques to enhance the level of control provided by indigenous natural enemies.

1. Evaluate the efficacy of introduced phytoseiid predators

- The exotic predatory mite *Neoseiulus californicus* was released in 2004 and 2005.
- The trials were conducted in plots in different geographic regions (5 plots in total).
- Two releases of 2000 mites/tree, with a fortnight interval between releases were performed.
- Pest and predator population levels were monitored fortnightly at each plot.
- Cumulative mite days (CMDs) of the pest were calculated.

Persea mite control and predator establishment



Evaluate the efficacy of introduced phytoseiid predators - Summary

- Despite a significant reduction of 30% in seasonal CMDs following *N. californicus* releases, leaf damage was still considerable and similar to control trees.
- Phytoseiid predators recovered from all release plots were mostly of the indigenous species *E. scutalis* ranging from 78-95%.

2. Evaluate indigenous phytoseiids with and without pollen provision/application

- A survey conducted in 2002 and 2003 in Upper and Western Galilee showed that *Euseius scutalis* was by far the most dominant species, accounting for more than 96% of the total predatory mite population (n=1586).
- Phytoseiid mites in the genus *Euseius* are known as pollen feeders that can utilize a wide variety of food including mites and insects (McMurtry and Croft, 1997).

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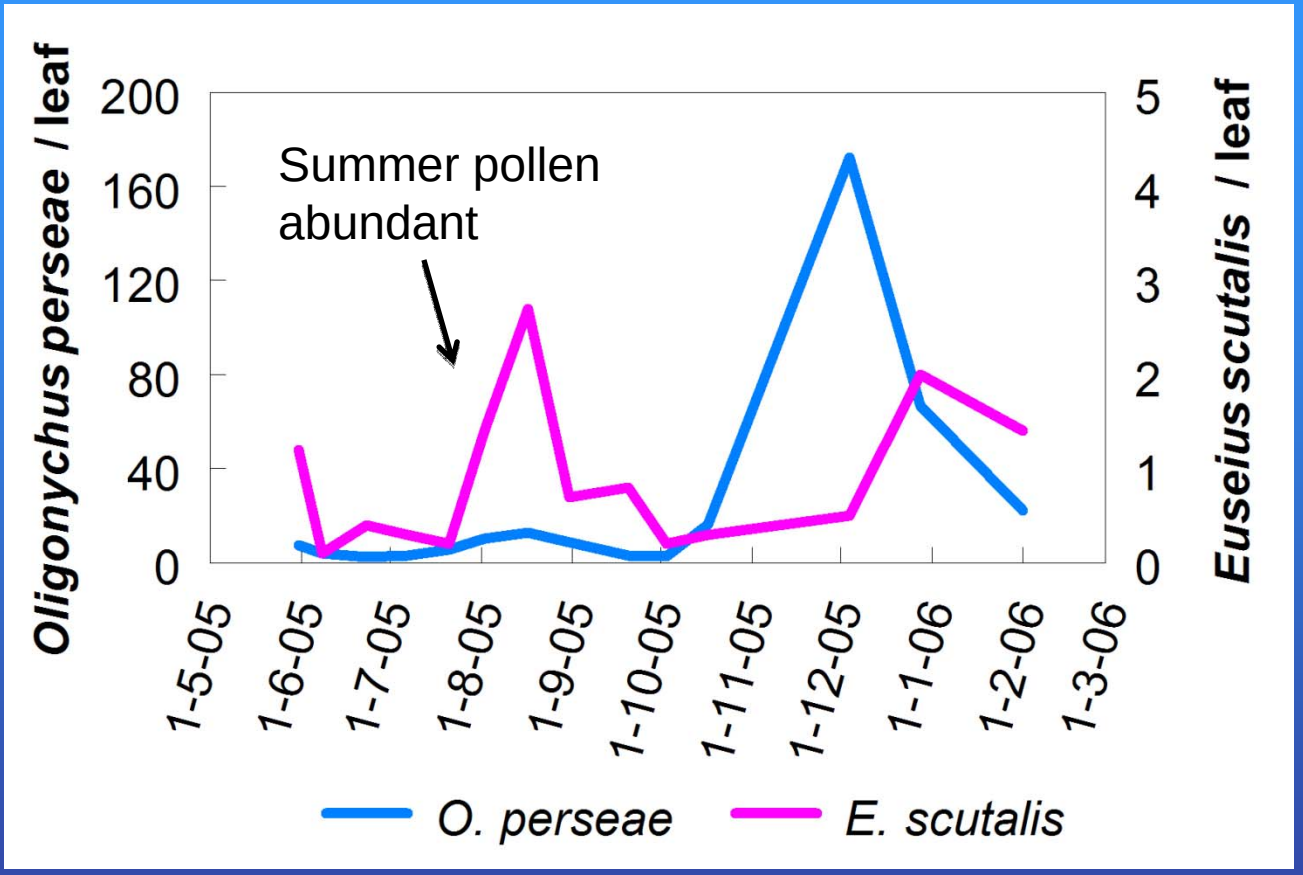
Oligonychus perseae & *Euseius scutalis* predator prey dynamics



Population of the *O. perseae* and the *E. scutalis* during 2005-2006 in a pesticide-free avocado plot. Negative correlation between pest and predator?

Euseius scutalis – predation potential

- In preliminary laboratory leaf disc trials we observed that *E. scutalis* cannot enter the persea mite nests.
- However, while monitoring persea mite in the field on avocado trees, within torn nests and outside of the nests we observed *E. scutalis* feeding on persea mites.
- Working hypothesis – *Euseius scutalis* does not control persea mite when this is the only food available but when pollen is present it can have a substantial effect on persea mite control.

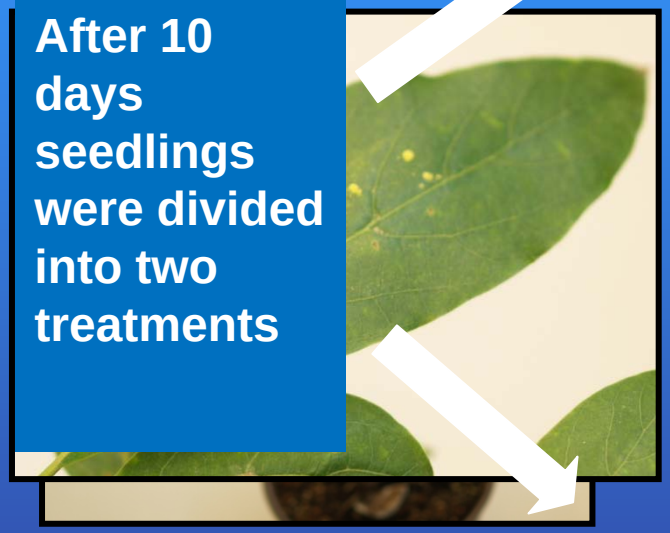
Seedling Experiment - Methods

Experiment was initiated by sprinkling pollen on one leaf and placing 10 females of *E. scutalis* per plant. Fresh pollen was added every three days

Treatment 1

We continued to apply pollen every 3 days

After 10 days seedlings were divided into two treatments

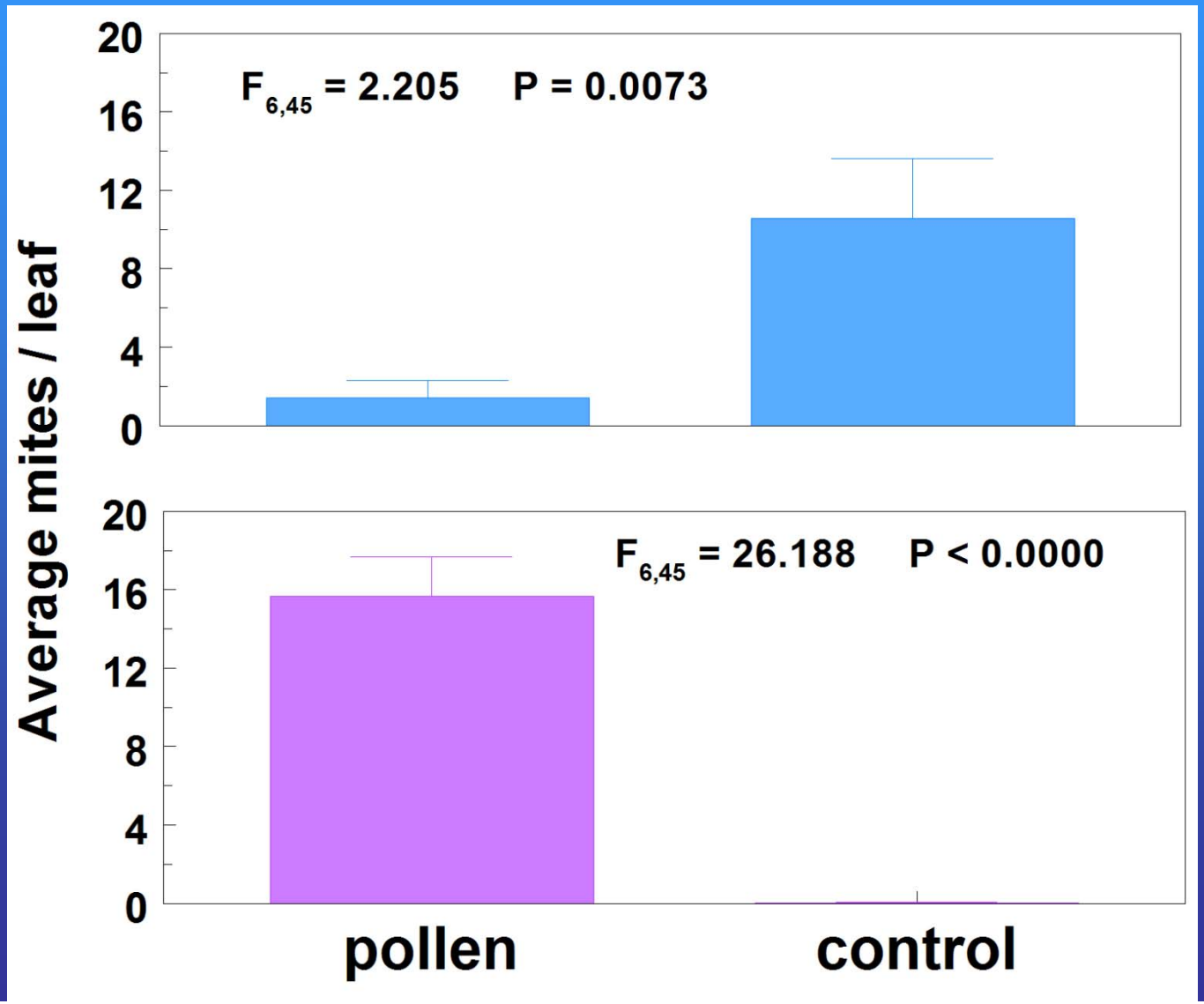


Then 30 persea mite motiles were added to each seedling and the experiment continued to run its course for six weeks

Treatment 2

Pollen was removed from the single leaf, care was taken not to remove predators and no pollen was provided for the remainder of the experiment

Seedling exp. - Pest and predatory mites six weeks post infestation of *O. perseae*

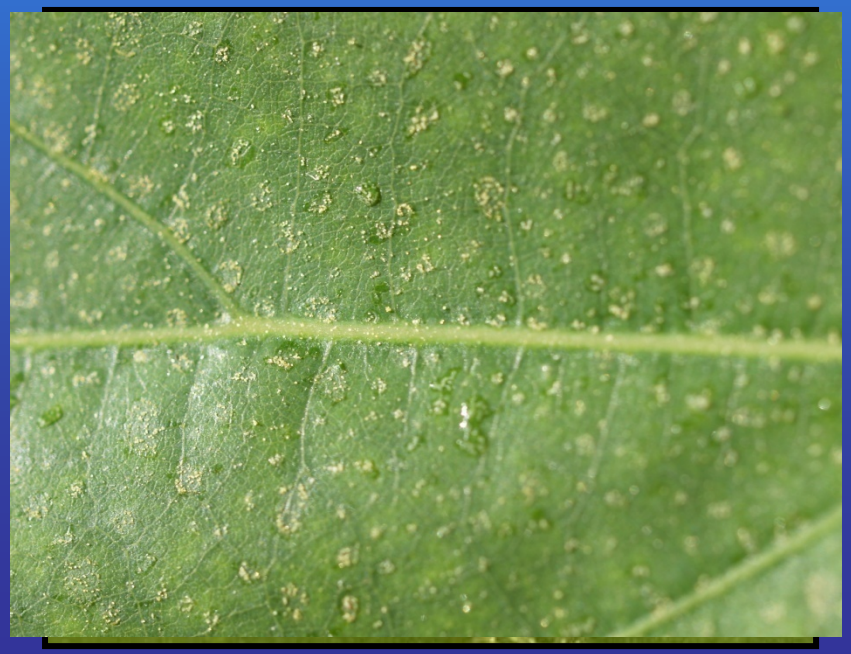


O. perseae

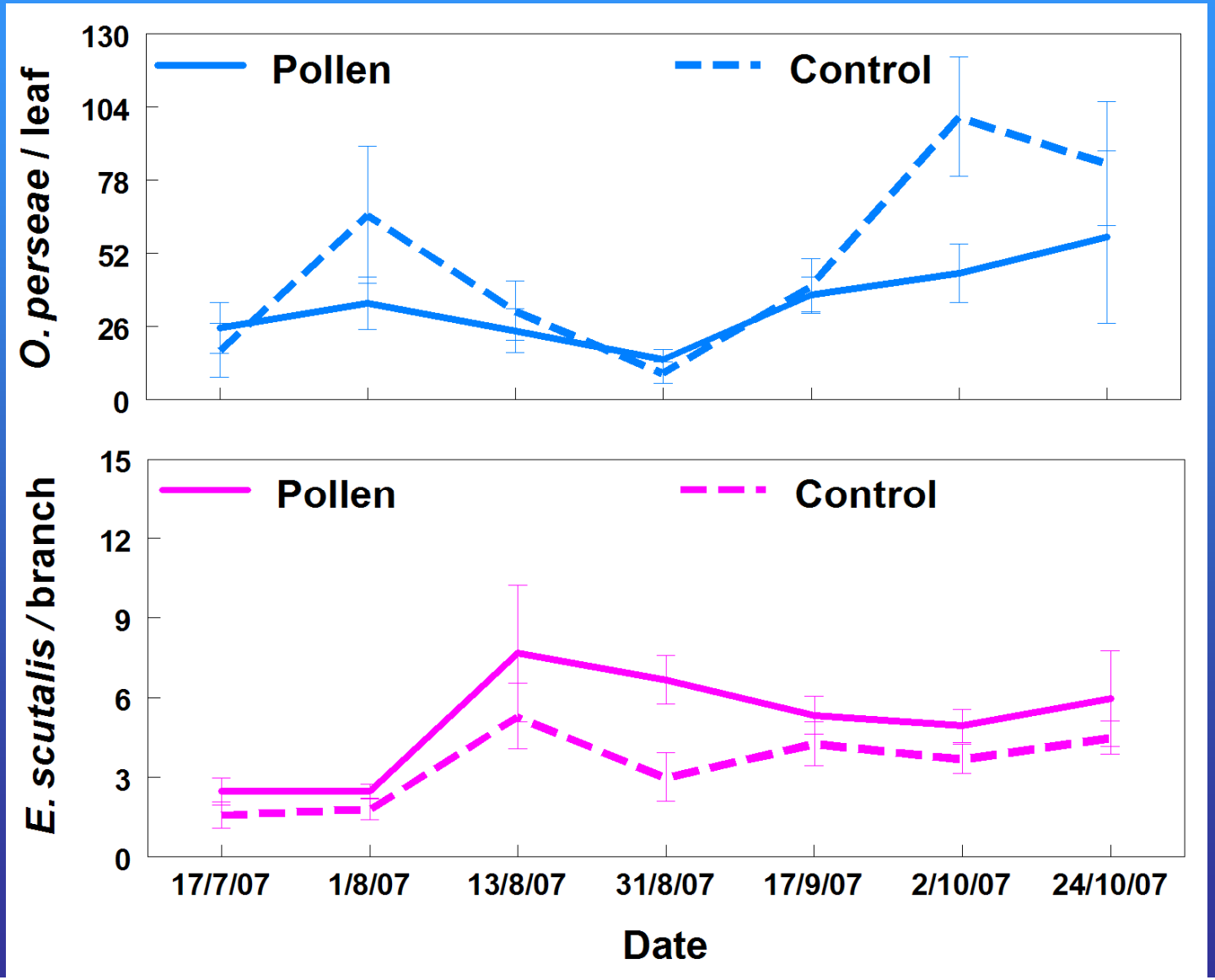
E. scutalis

Pollen application, field trial

Pollen applications - technique



Field exp. - Pest and predatory mites bi-monthly applications of pollen from July



2. Evaluation of *E. scutalis* with and without pollen provision/application - Summary

- In our seedling experiment pollen provision significantly enhanced persea mite control and substantially increased *E. scutalis* populations.
- In the field trial, while there was a clear trend of lower pest and higher predator populations when pollen was applied, differences were only significant on one sampling date.
- More studies are needed to determine the amount of pollen necessary for pest control.

3. Identify other indigenous predators for persea mite control

- Field monitoring of persea mite revealed a large proportion of torn nests, implying the possible involvement of additional predator species in pest predation.
- With the aim of identifying these species, generalist predators were collected bi-monthly in beating tray samples, in the spring and summer of 2006, in an organic avocado orchard where no pesticide applications were applied.
- Candidate species were exposed to 1 day-old nests on leaf discs and predation was evaluated 48 hrs later.

Green lace wing
Chrysoperla carnea

Dusty wing
Conwentzia sp.

Creontiades pallidus

predatory thrips

Conclusion – Objectives 1-3

- The releases of the exotic *N. californicus* did not contribute substantially to persea mite biological control, nor did they allow for the establishment of this predator in the orchard.
- In seedling experiments when pollen was provided *Euseius scutalis* reduced persea mite populations but when pollen provision was discontinued *E. scutalis* left the plants and *O. perseae* mite populations increased.
- Nest-tearing predators are playing a role in persea mite control.

4. Develop conservation techniques to enhance the level of control provided by indigenous phytoseiid predators

- Develop methodologies for conserving pollen feeding predators in the field.
  - To determine what pollen levels are needed, seedling and then field studies will be conducted by applying pollen with our prototype pollen applicator.
  - Cover crops such as Rhodes Grass will be evaluated.

Pollen releasing plants-Rhodes grass

Develop conservation techniques to enhance the level of control provided by indigenous nest tearing predators

- We will continue to monitor the phenology of generalist insect predators with the aim of identifying the key biological control agents responsible for nest tearing.
- Once identified we will explore the possibilities of conserving and augmenting these predators.

Acknowledgements

- We are indebted to the avocado growers that participated and assisted in the field trials.
- Chief Scientist of Agriculture and to the Plant Production and Marketing Board of Israel for funding this project.

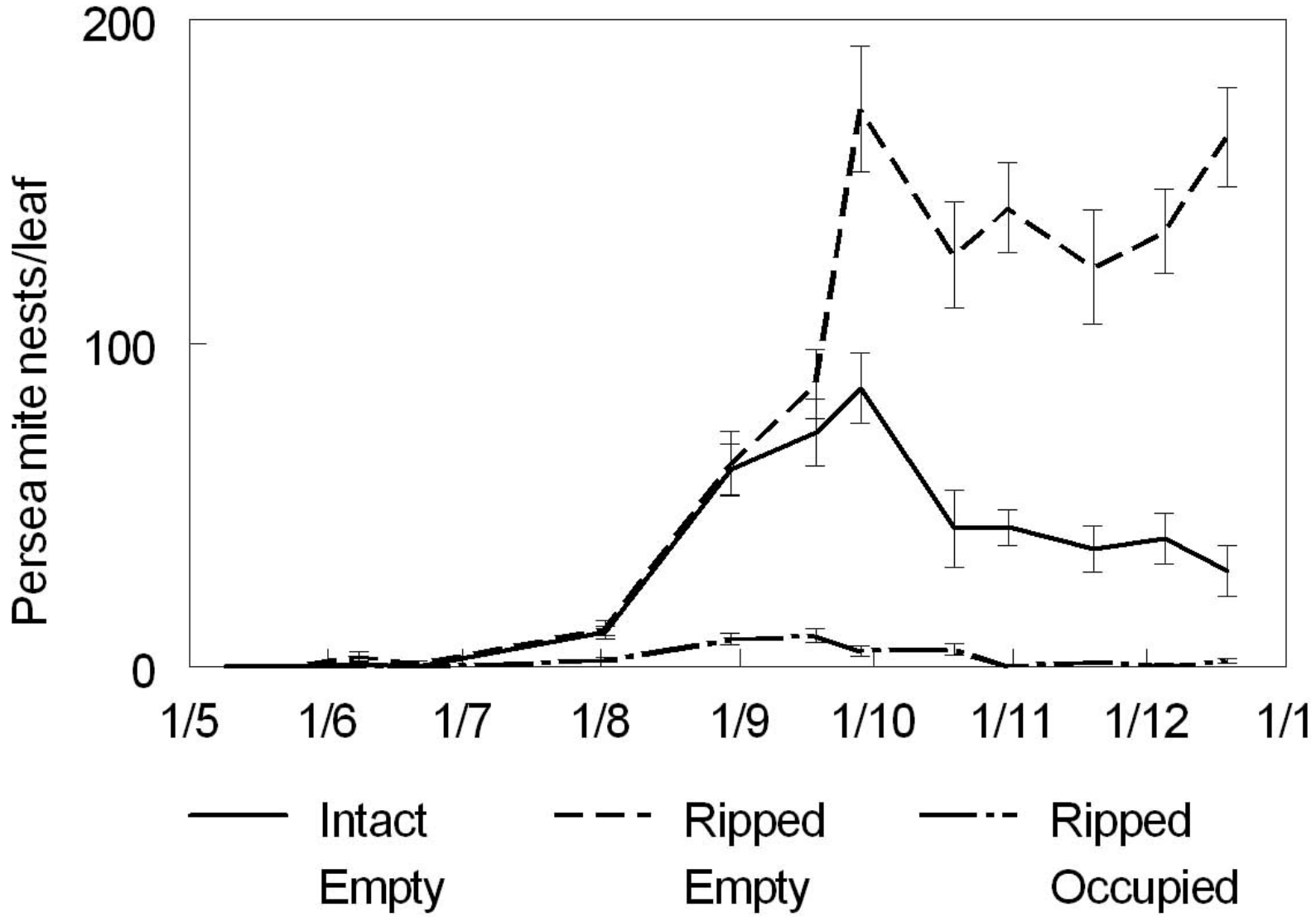
Research team

HUJI

Questions – Food for thought

What quantitative effects do nest tearing predators have?

To determine the impact of these nest tearing predators, the proportions of abandoned intact nests, ripped nests with and without live mites, were assessed in an organic orchard.



Mean number per leaf (plus/minus standard errors) of abandoned intact nests, ripped nests with and without live mites in an organic orchard.

Questions - 2

- Could indigenous insect tearing predators facilitate predation of indigenous phytoseiid predators.

- Could inter-specific competition between indigenous and exotic phytoseiid predators prevent the establishment of exotic predators?