Effect of inundative releases of predatory mites on pest mites on raspberry

Tuomo Tuovinen & Isa Lindqvist

MTT Agrifood Research Finland

Introduction

Raspberry as a high value crop: increasing area in Finland
Benefits of growing in tunnels: weatherproof, high quality berries
High inputs, low tolerance to pests
Integrated pest management, EU directives
Limited availability of effective pesticides

The main target pests in 2011-2013:

Two-spotted spider mite *Tetranychus urticae*
- harmful especially in warm seasons and in tunnels
- few acaricides in use in Finland

Raspberry leaf and bud mite *Phyllocoptes gracilis*
- harmful especially in cv. Glen Ample
- vector of Raspberry Leaf Blotch virus (RLBV)

Other pests: aphids, raspberry beetle,
raspberry cane midge

Methods: Experiment in 2011-2013

Tunnel and open field plots, plants in pots
Varieties Glen Ample and MaurinMakea
No pesticide treatments
Monitoring of aphids, raspberry beetle and raspberry cane midge
Weight and quality of yield

Biological control of mites

- 2011: introductions of *Phytoseiulus persimilis* and *Neoseiulus barkeri*
- 2012: introductions of *Neoseiulus cucumeris*
- 2013: introductions of *N. barkeri*, *N. cucumeris* and *Amblyseius swirskii*
    - N.barkeri+N.cucumeris / N.cucumeris / A.swirskii

Population dynamics of mites

- leaf samples, one leaf per plant, generative and vegetative shoots
- two – three weeks intervals
- direct microsopic inspection and/or wash and rinse method for extraction of mites

Experiment 2011

Predatory mites: ***Neoseiulus barkeri*** and ***Phytoseiulus persimilis***

Introductions of *P. persimilis*, 18-36 mites/plant (loose materials on leaves):

- tunnel: 22.6., 14.7. and 27.7., total of 90 mites/plant
- open field: 30.6., 22.7. and 10.8., total of 90 mites/plant

Introductions of *N. barkeri*, 70 mites/plant (in sachets of 500 mites):

- tunnel and open field: 15.7. and 5.8. , total of 140 mites/plant

Tunnel

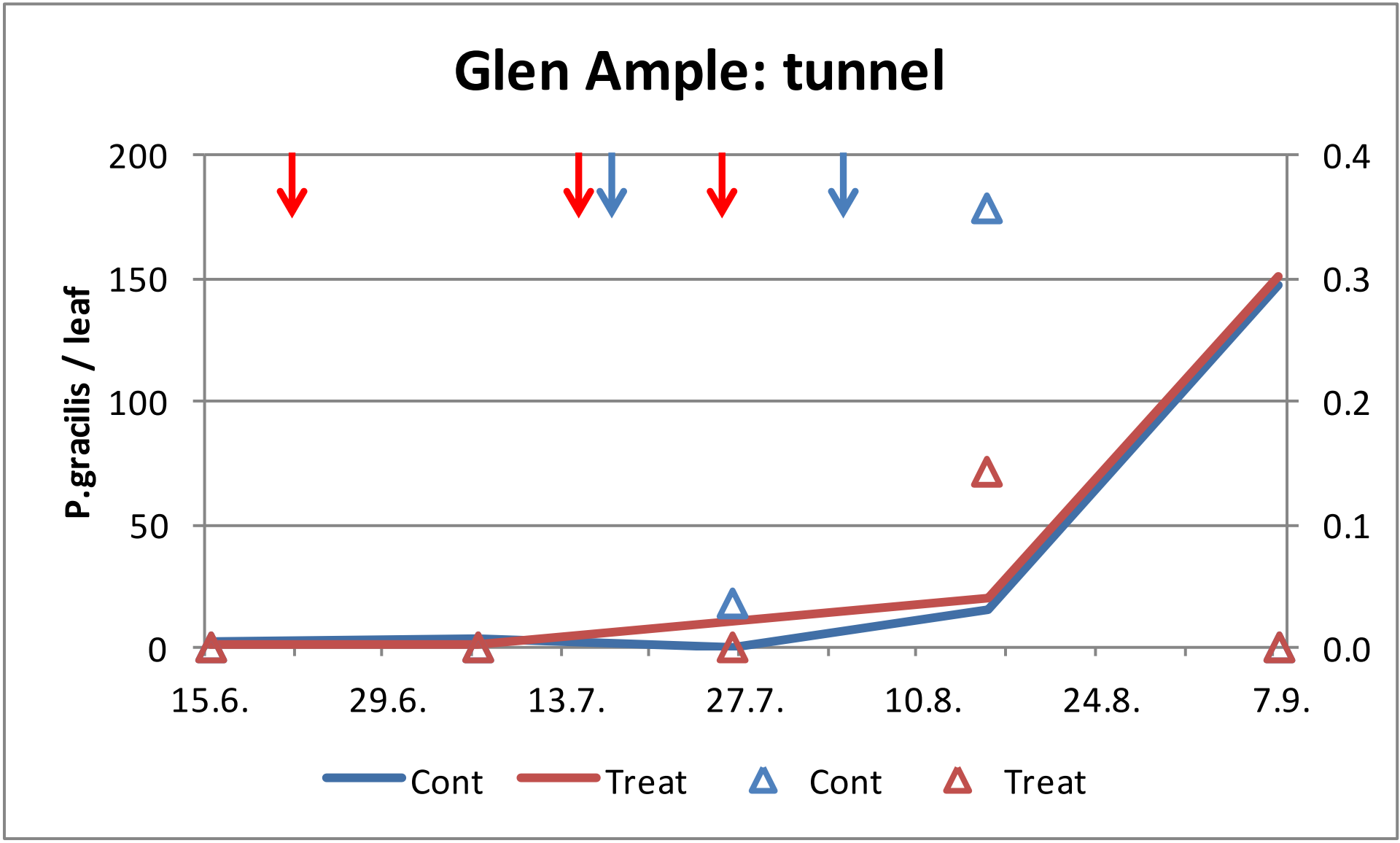
Open field

Results 2011:
Raspberry leaf and bud mite

Dynamics of *Phyllocoptes gracilis* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

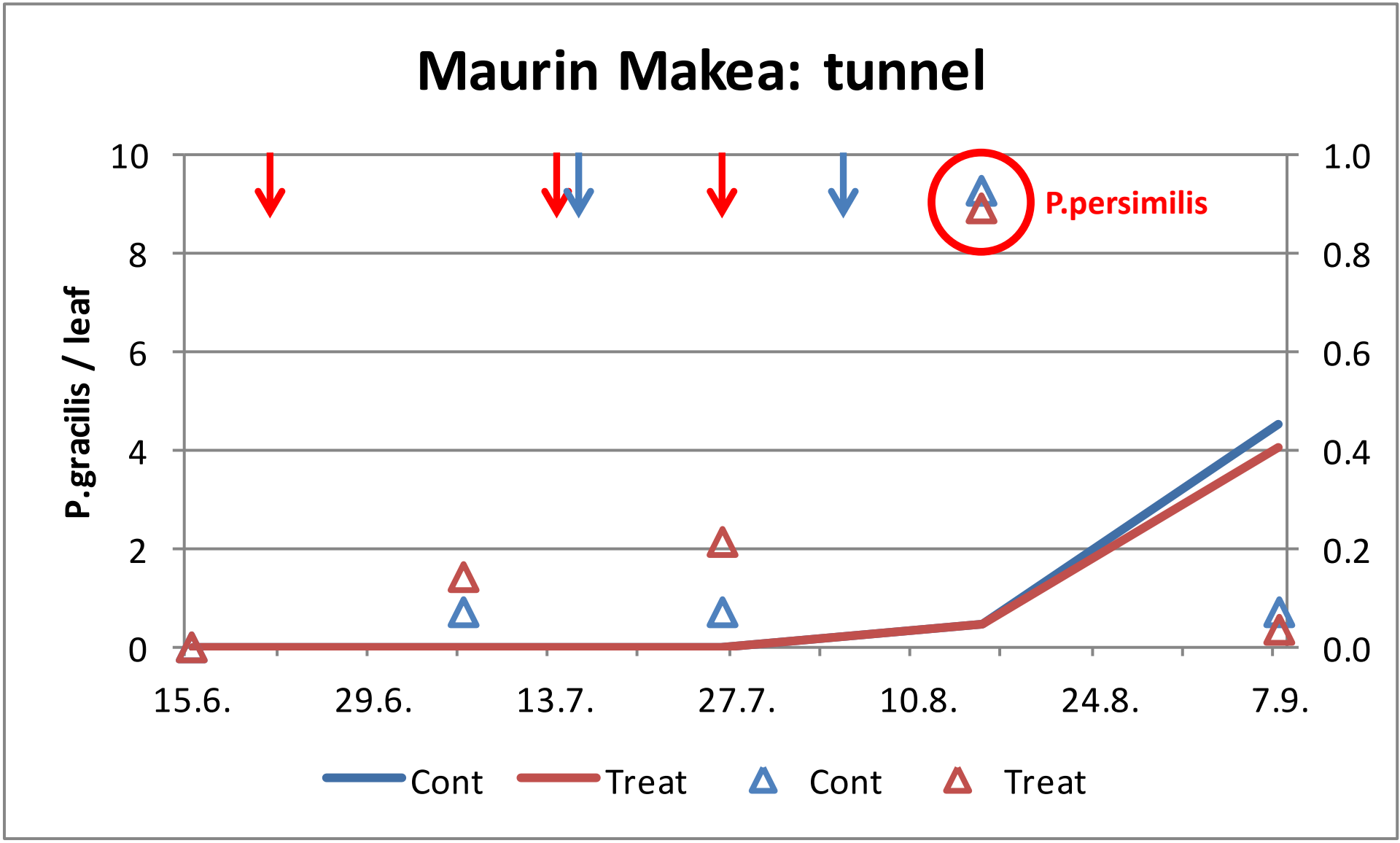
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Phyllocoptes gracilis* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

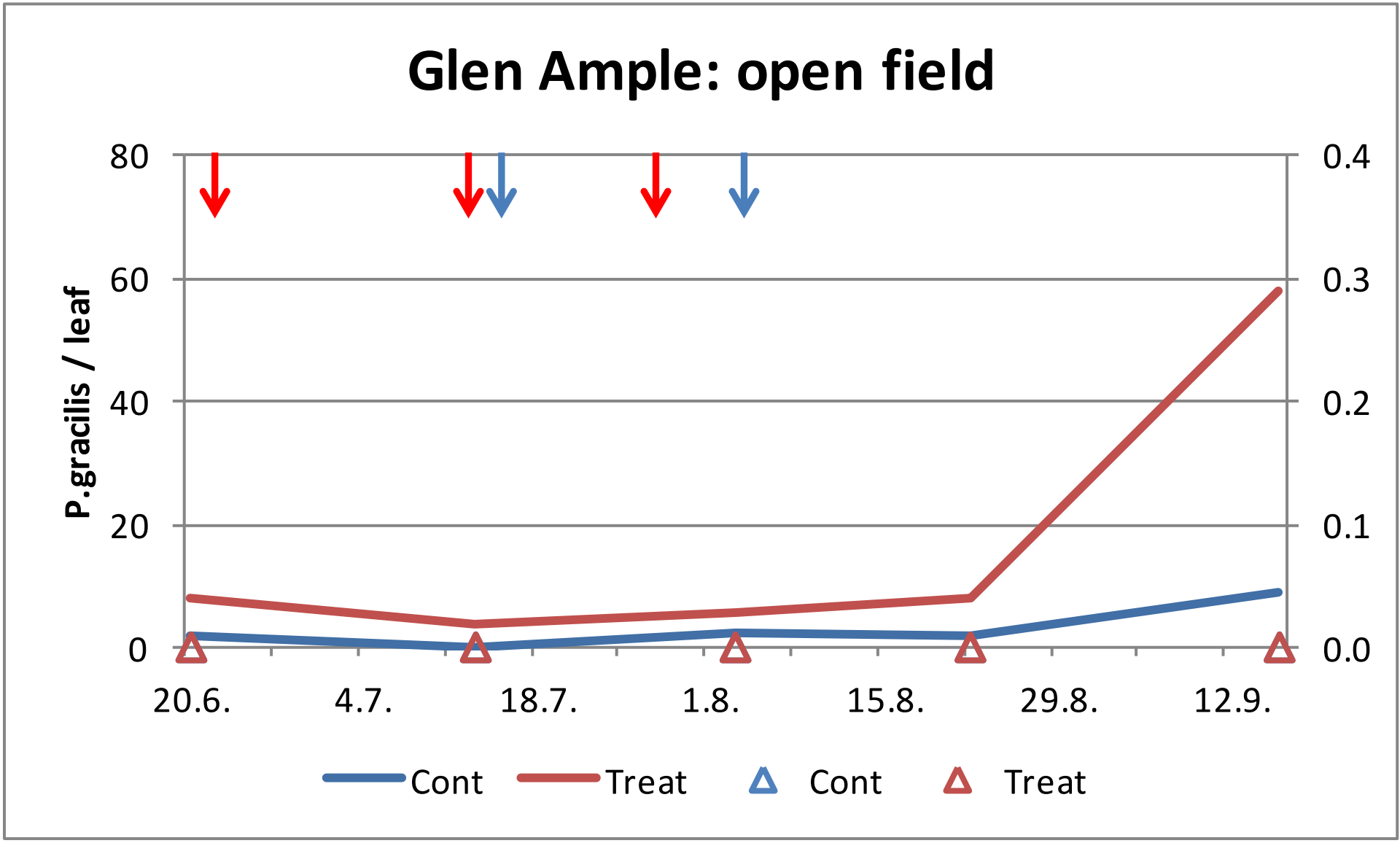
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Phyllocoptes gracilis* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

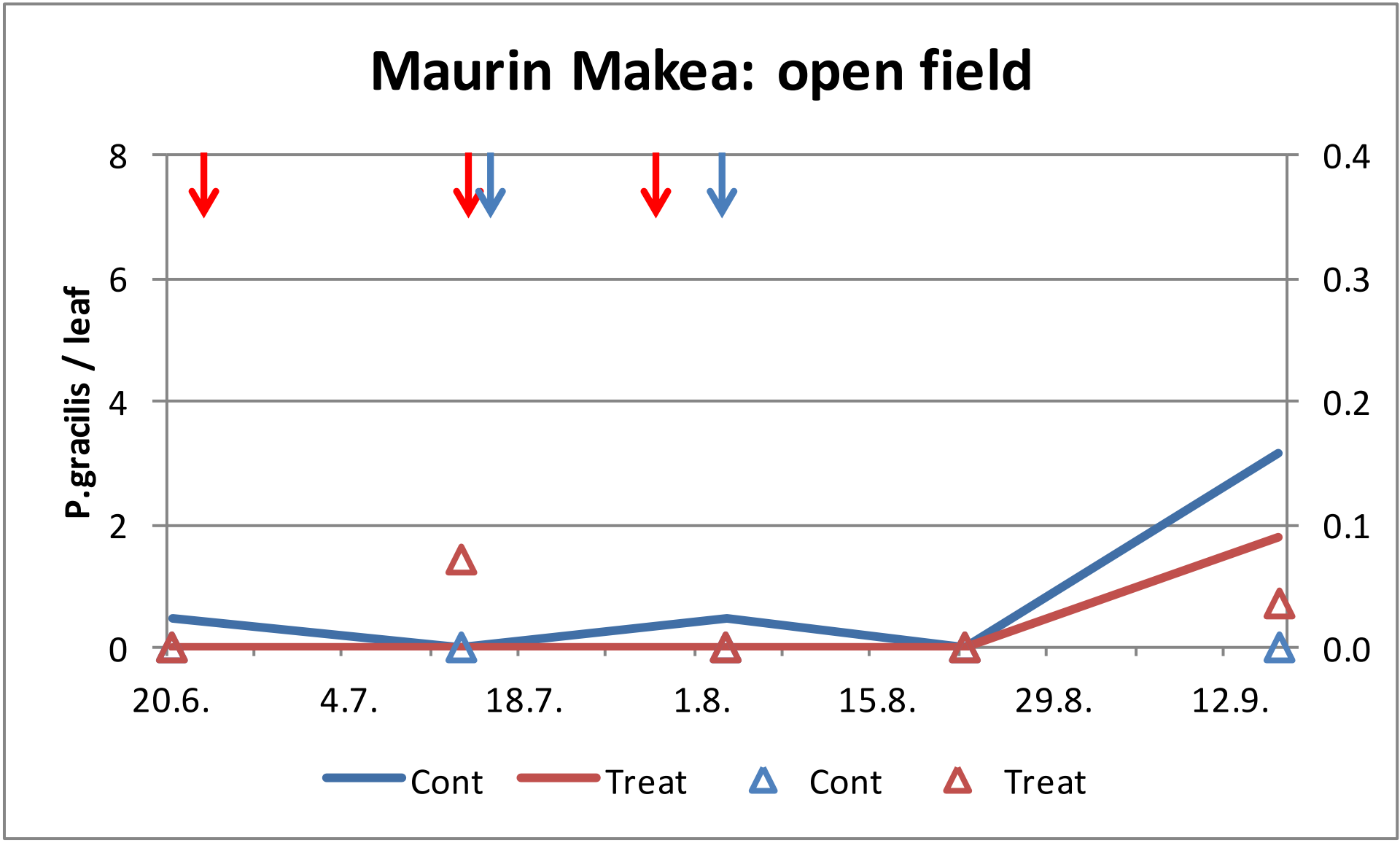
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Phyllocoptes gracilis* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

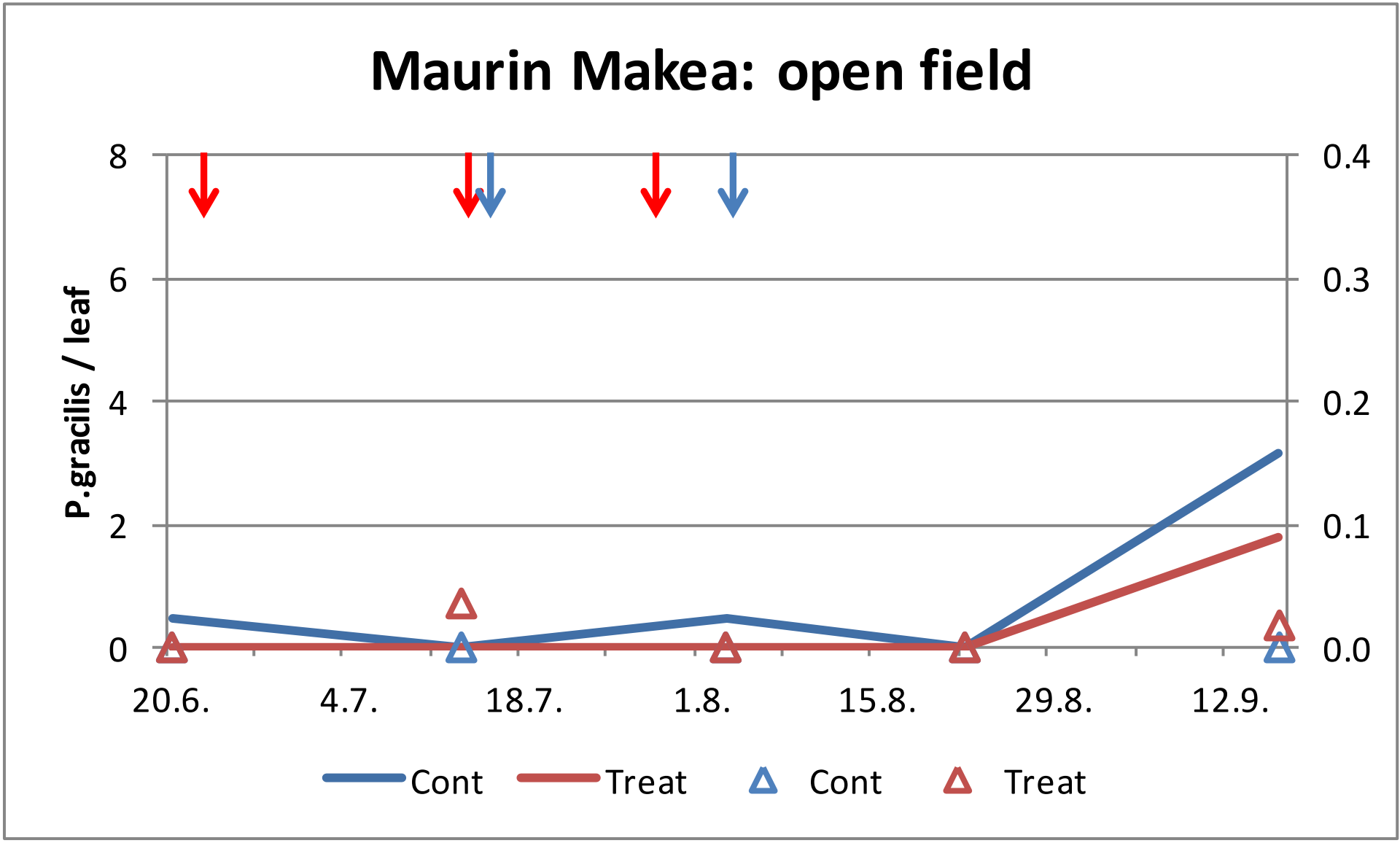
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Phyllocoptes gracilis* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

Triangles: no. of Phytoseiidae/leaf (right axis)



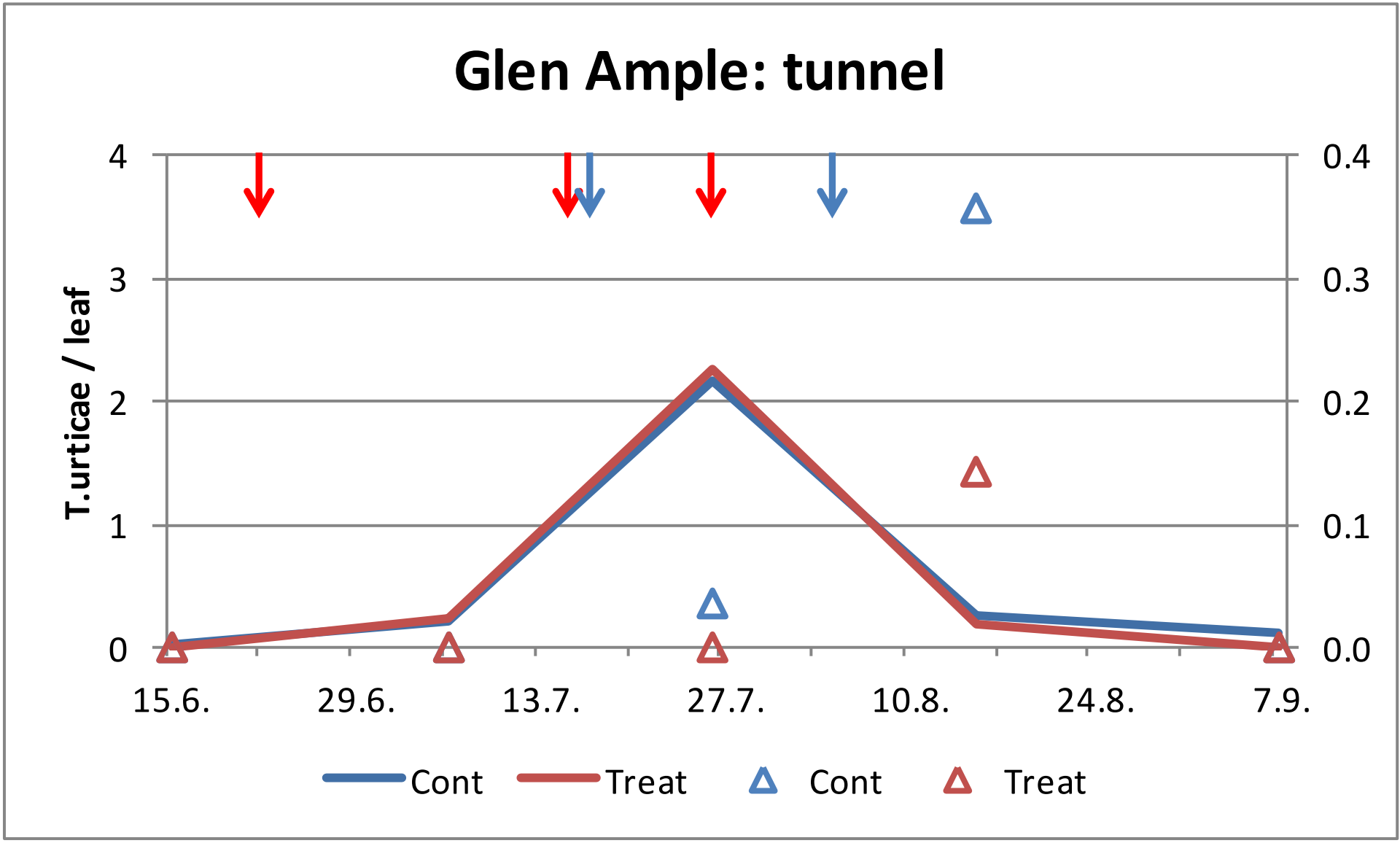
Results 2011:

Two-spotted spider mite

Dynamics of *Tetranychus urticae* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

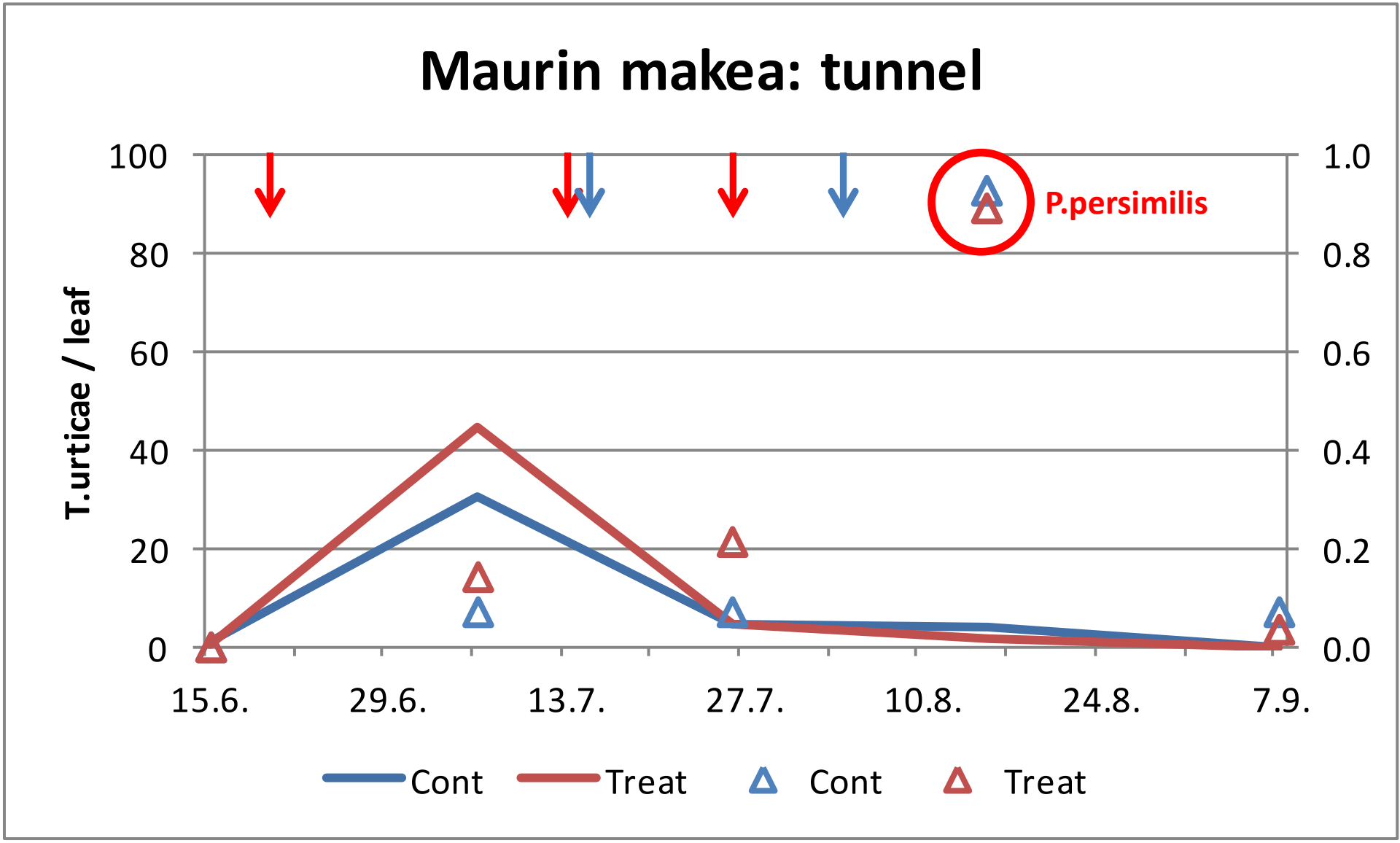
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Tetranychus urticae* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

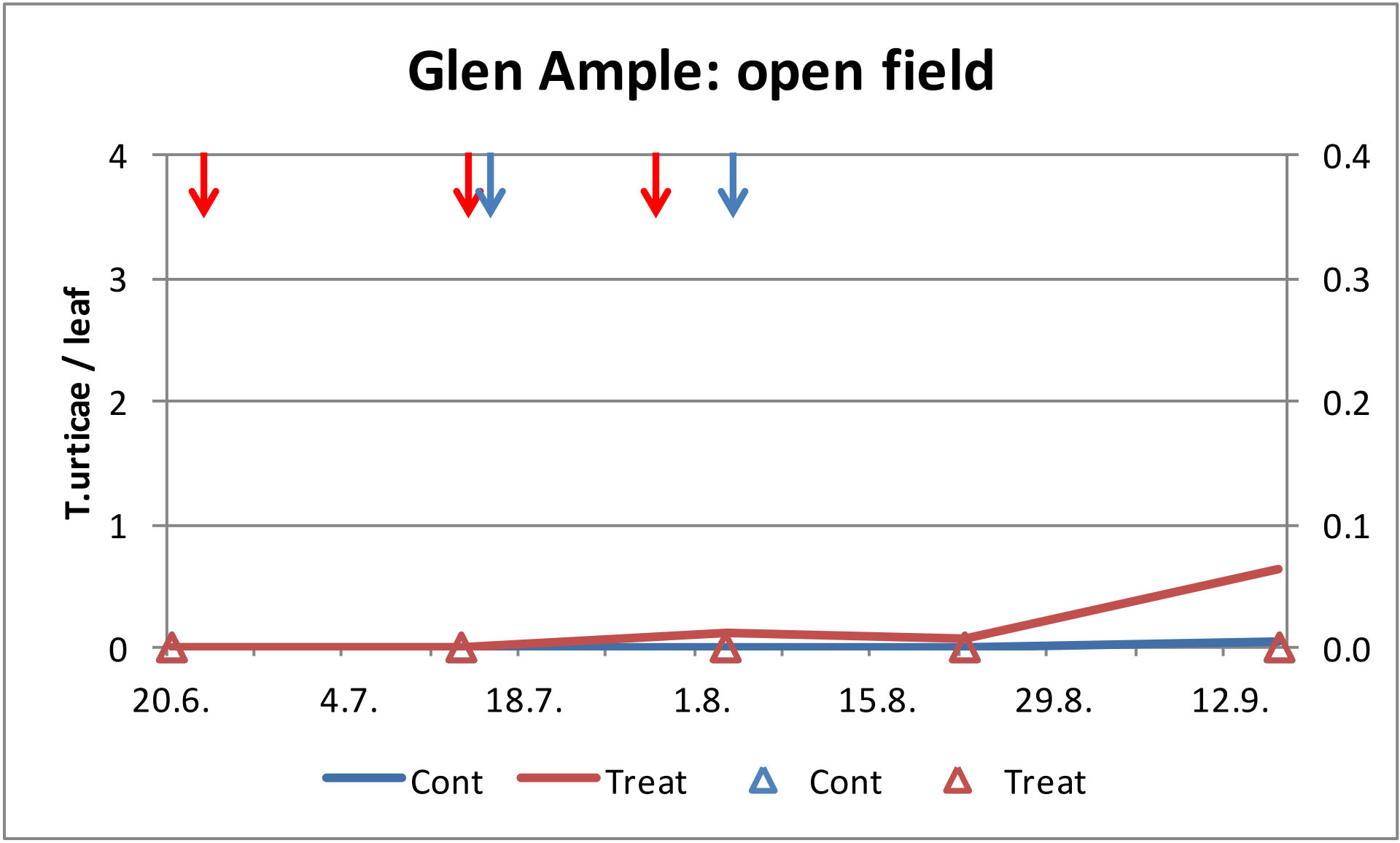
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Tetranychus urticae* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

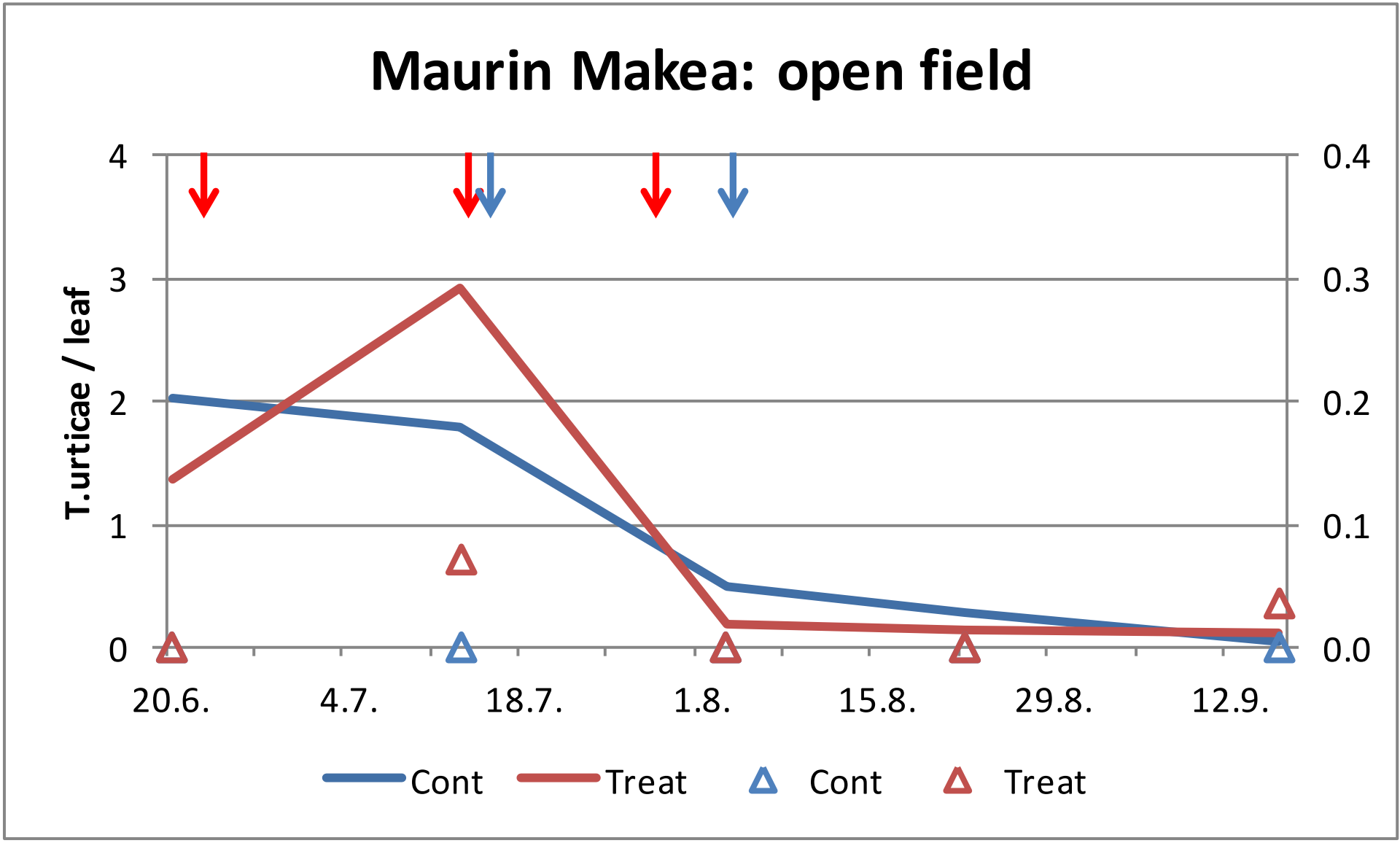
Triangles: no. of Phytoseiidae/leaf (right axis)



Dynamics of *Tetranychus urticae* population in 2011

Blue arrows: releases of *N. barkeri* / Red arrows: releases of *P. persimilis*

Triangles: no. of Phytoseiidae/leaf (right axis)



Conclusions 2011:

Raspberry leaf and bud mite

- Slow release method for *N. barkeri* did not work
- RLBM increased quickly in tunnel in Glen Ample
- No control effect was noticed
- Practically no *N. barkeri* was found in leaf samples

Two-spotted spider mite

- TSM increased more in Maurin Makea
- *P. persimilis* was effective against TSM
- *P. persimilis* was present in tunnel especially in late season
- Naturally occurring cecidomyiid and staphylinid larvae had some role in tunnel

Experiment 2012

Predatory mite: *Neoseiulus cucumeris*

Introductions at two weeks intervals, 220 predators/plant (60 ml)

Six times, total of 1300 predatory mites/plant

- 22.5., 31.5., 14.6., 28.6., 12.7. and 26.7.

Released in plastic triangle 'predator cottages'

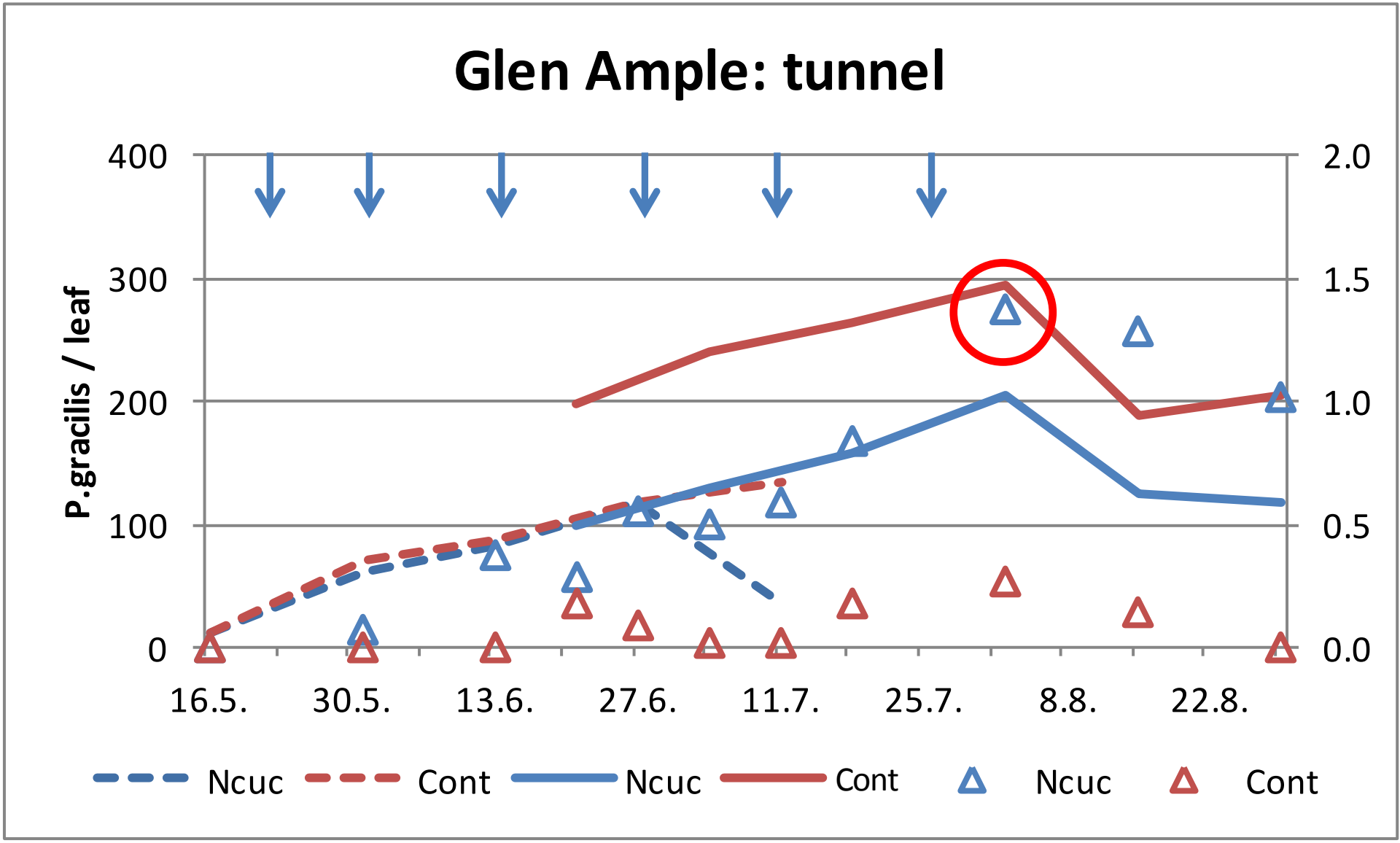
Results 2012:
Raspberry leaf and bud mite

Dynamics of *Phyllocoptes gracilis* population in 2012

Dash lines: generative shoots, solid lines: vegetative shoots

Arrows: releases of *N. cucumeris* 220/plant

Triangles: no. of Phytoseiidae/leaf (right axis)

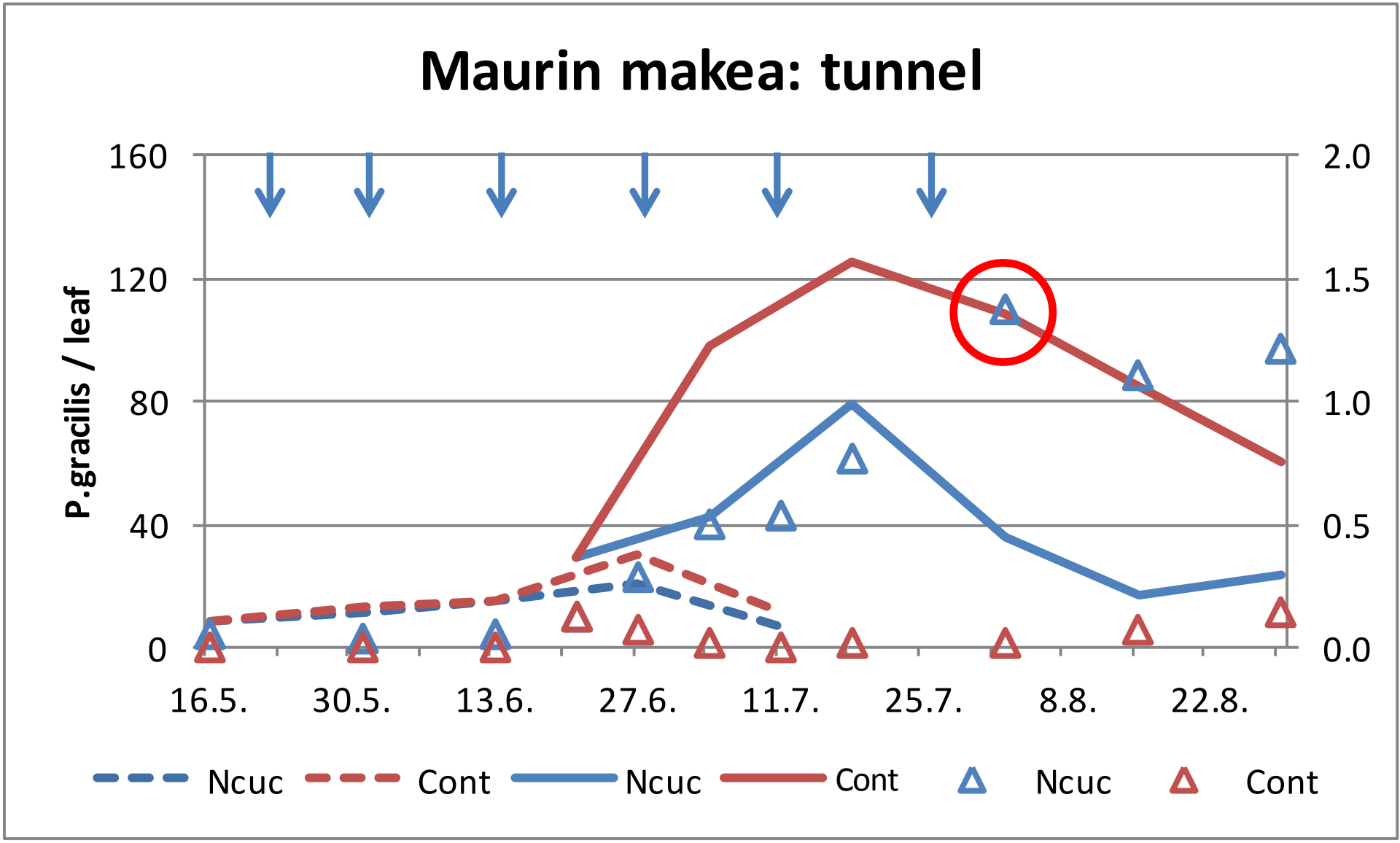


Dynamics of *Phyllocoptes gracilis* population in 2012

Dash lines: generative shoots, solid lines: vegetative shoots

Arrows: releases of *N. cucumeris* 220/plant

Triangles: no. of Phytoseiidae/leaf (right axis)

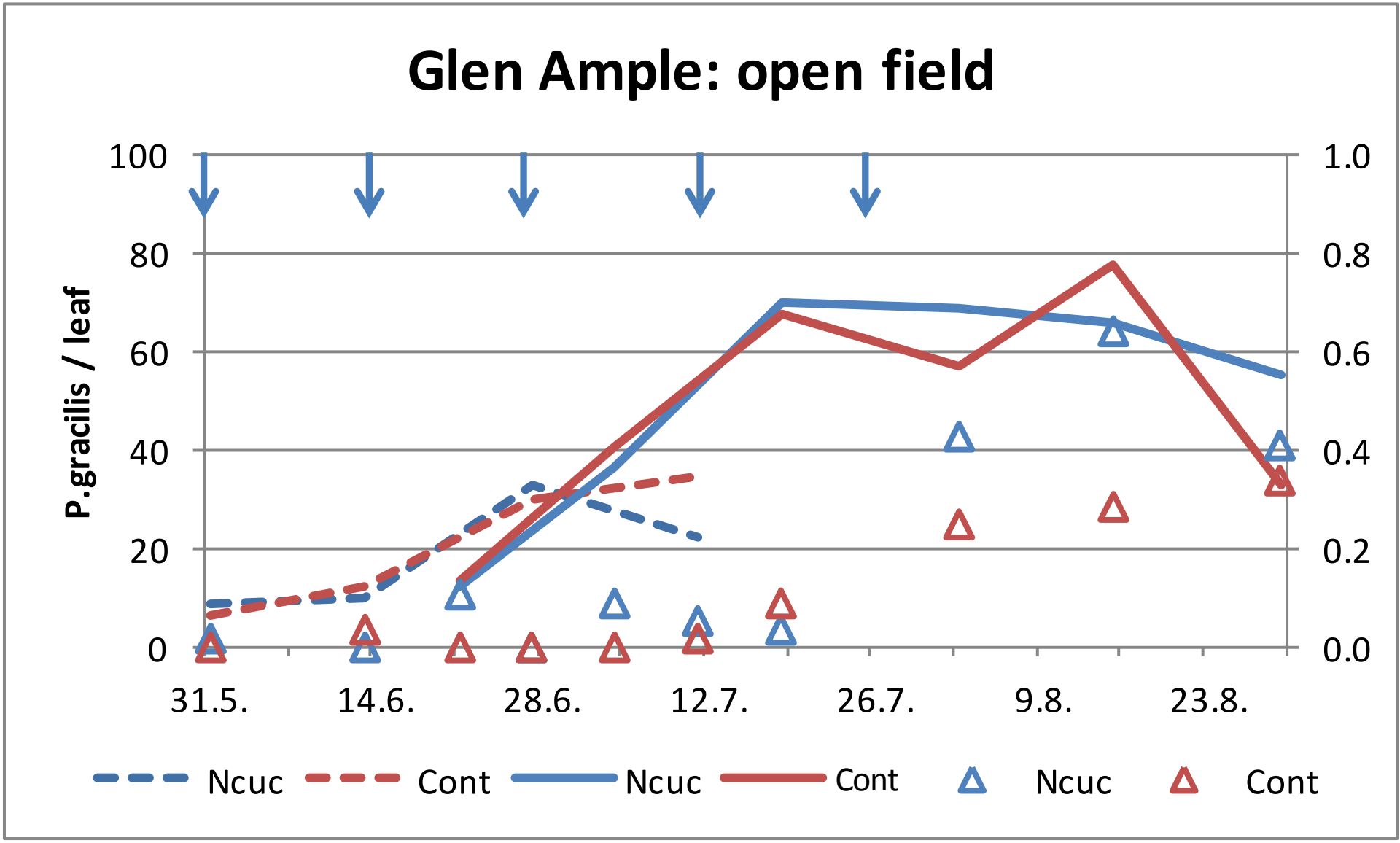


Dynamics of *Phyllocoptes gracilis* population in 2012

Dash lines: generative shoots, solid lines: vegetative shoots

Arrows: releases of *N. cucumeris* 220/plant

Triangles: no. of Phytoseiidae/leaf (right axis)

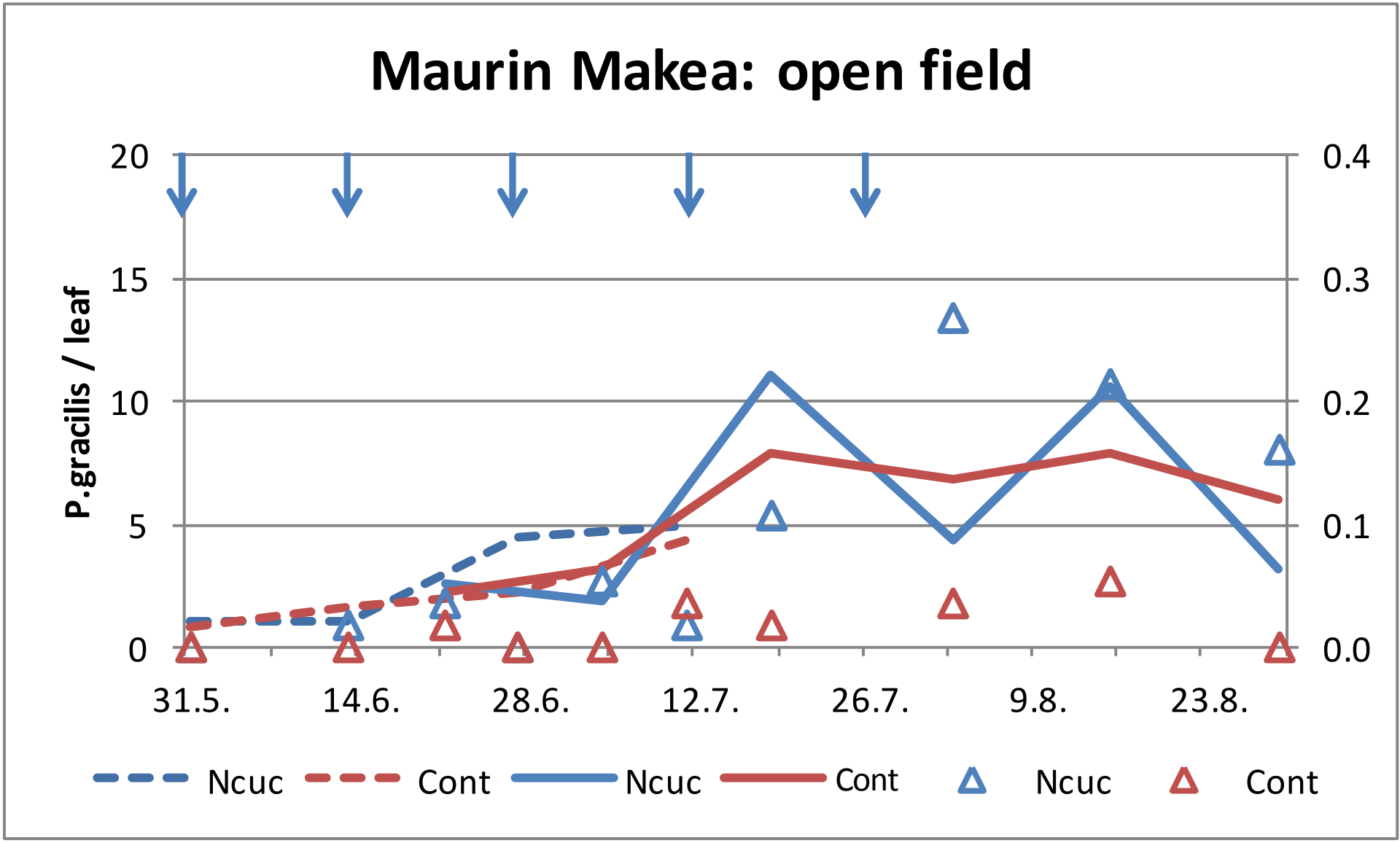


Dynamics of *Phyllocoptes gracilis* population in 2012

Dash lines: generative shoots, solid lines: vegetative shoots

Arrows: releases of *N. cucumeris* 220/plant

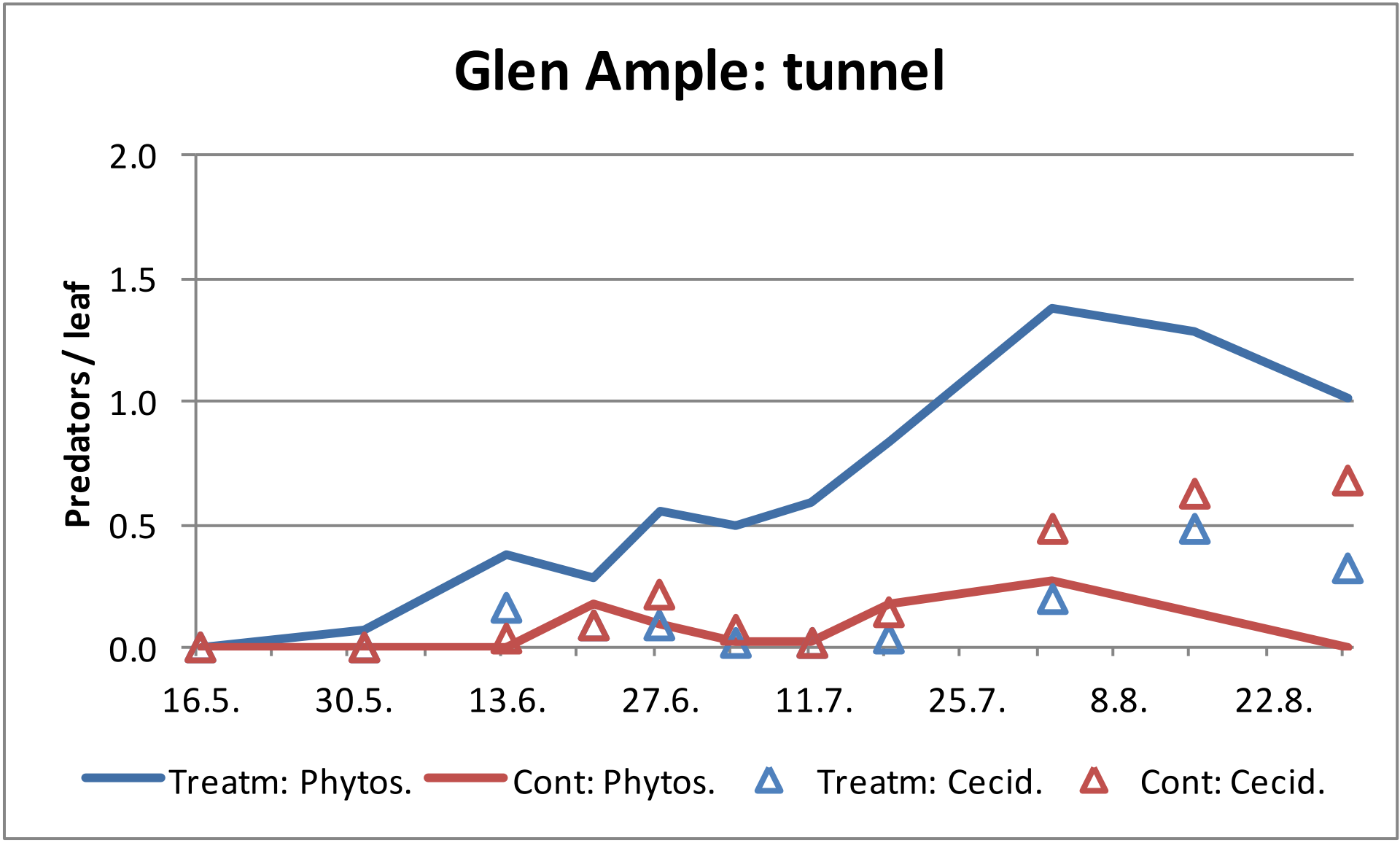
Triangles: no. of Phytoseiidae/leaf (right axis)



Comparison of Phytoseiidae and Cecidomyiidae in 2012

Lines: Phytoseiid active stages

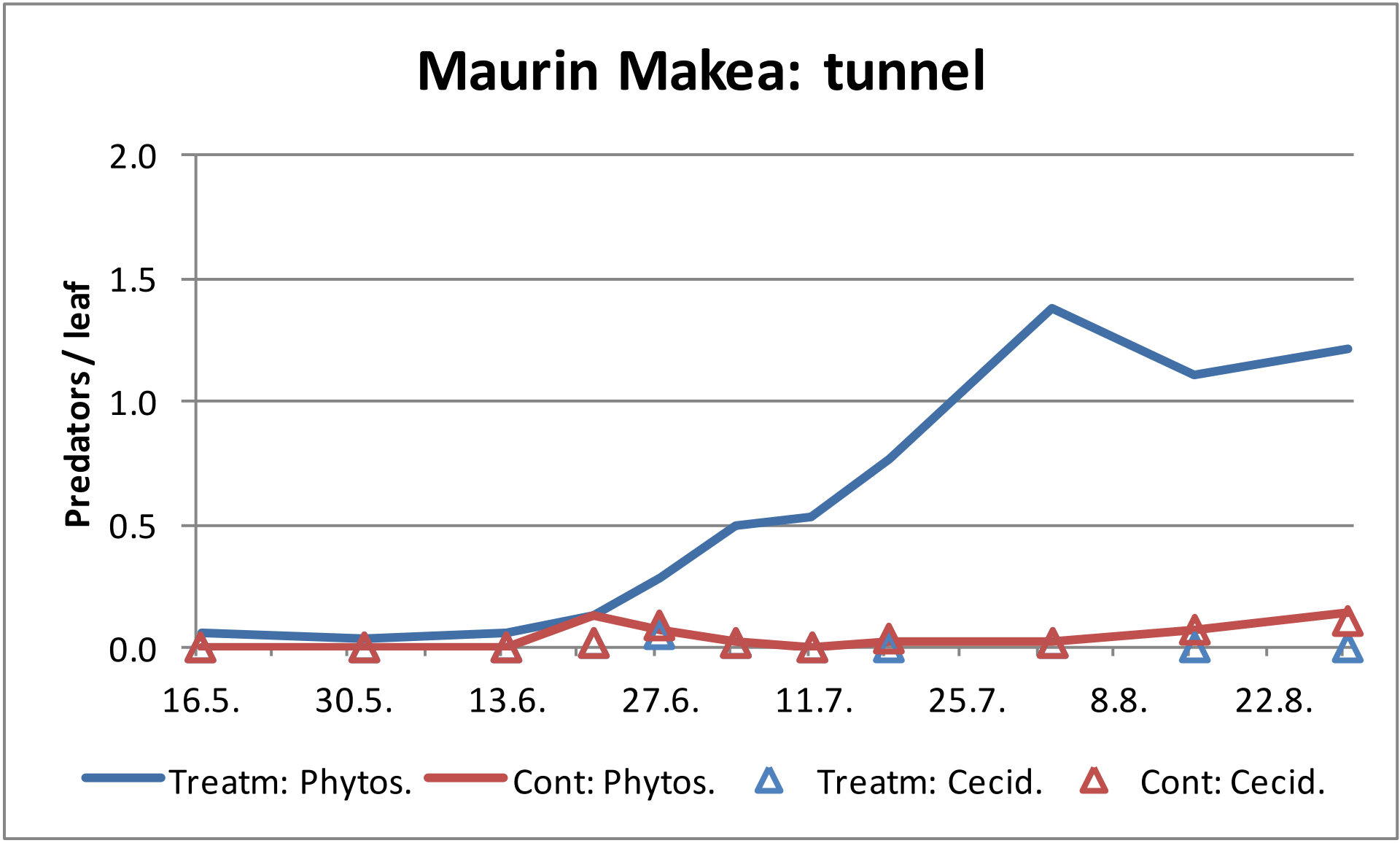
Triangles: Cecidomyiid larvae



Comparison of Phytoseiidae and Cecidomyiidae in 2012

Lines: Phytoseiid active stages

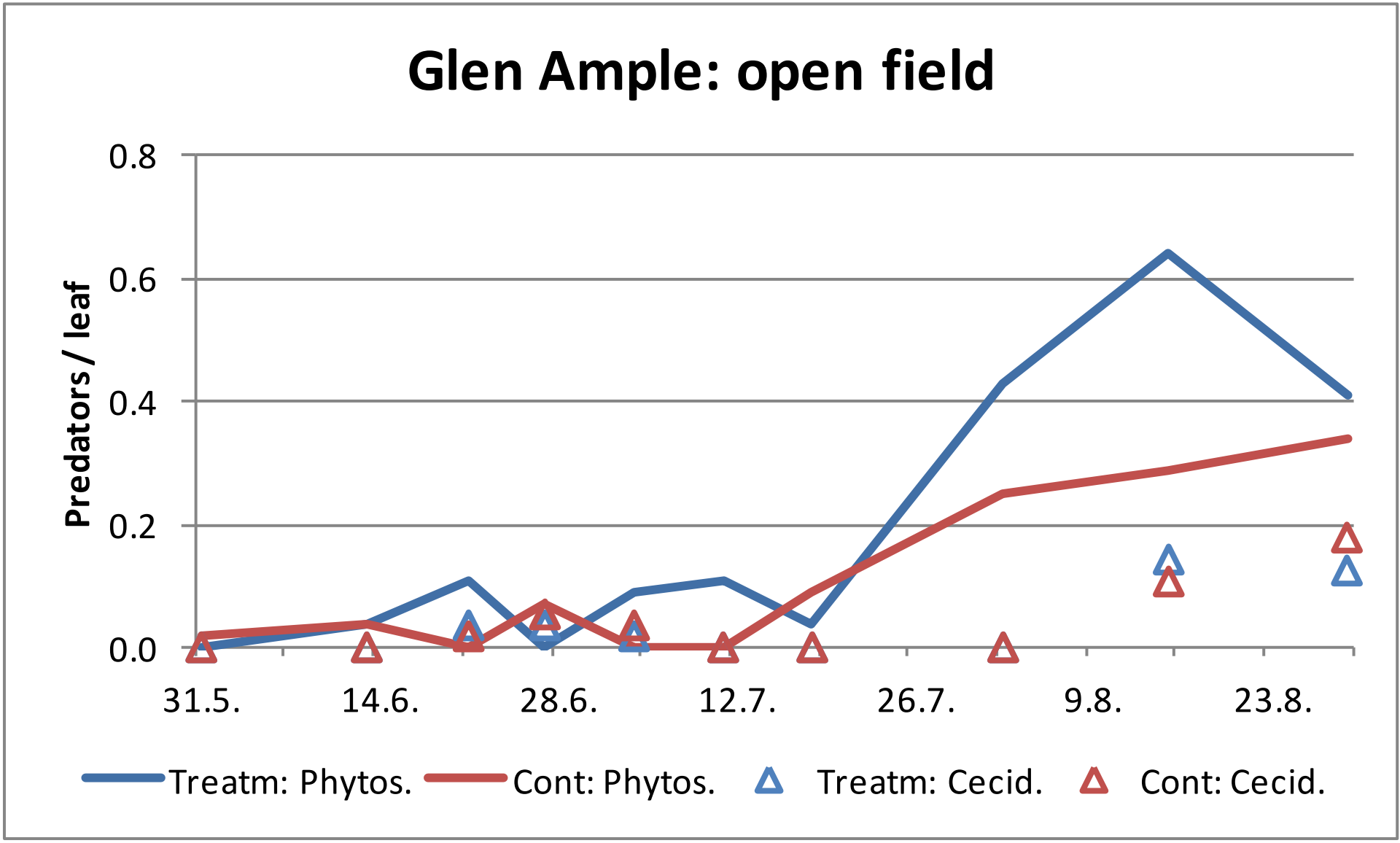
Triangles: Cecidomyiid larvae



Comparison of Phytoseiidae and Cecidomyiidae in 2012

Lines: Phytoseiid active stages

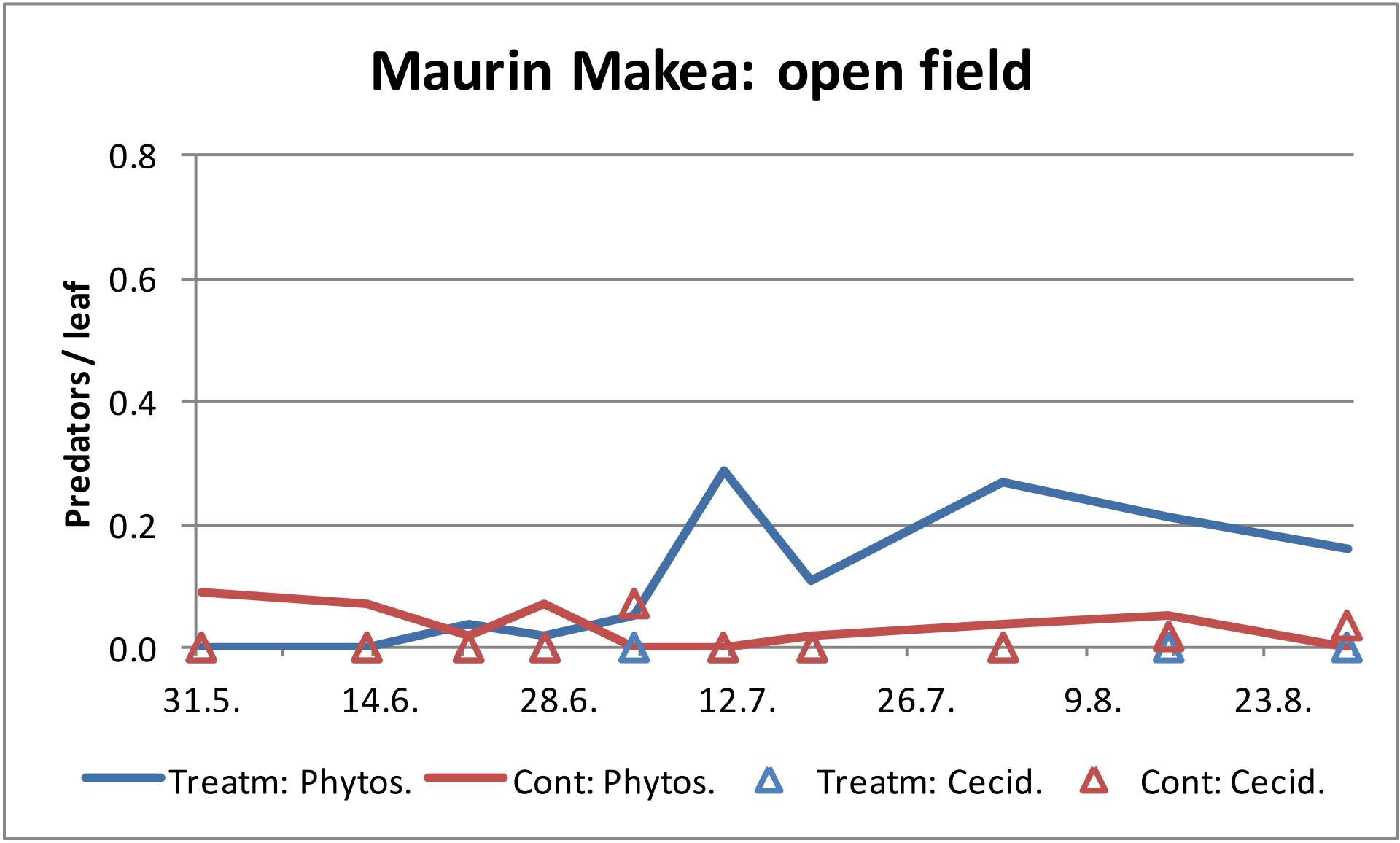
Triangles: Cecidomyiid larvae



Comparison of Phytoseiidae and Cecidomyiidae in 2012

Lines: Phytoseiid active stages

Triangles: Cecidomyiid larvae



Conclusions 2012:

Raspberry leaf and bud mite

- The ’cottage ’slow release method for *N. cucumeris* worked
- RLBM had spread all over the areas in tunnel and open field
- RLBM control by *N. cucumeris* ca. 50% in tunnel
- In open field no control effect was noticed

Two-spotted spider mite

- Low population of TSM all the season, 1-2/leaf, max. 4 mites/leaf
- Same number both in treated and control plots
- Low level of naturally occurring cecidomyiid larvae
- Lower temperature compared to 2011 or 2013

Experiment 2013

Treatments:

1. *Neoseiulus barkeri + Neoseiulus cucumeris* (4 x 220+220/plant)
2. *N. cucumeris* (4 x 220/plant)
3. *Amblyseius swirskii* (4 x 220/plant)
4. Untreated control

Each treatment in different tunnel / open field area

Introductions: 29.5., 19.6., 17.7., 8.8. , 220/plant each time

Released as loose materials in plastic triangle 'predator cottages'

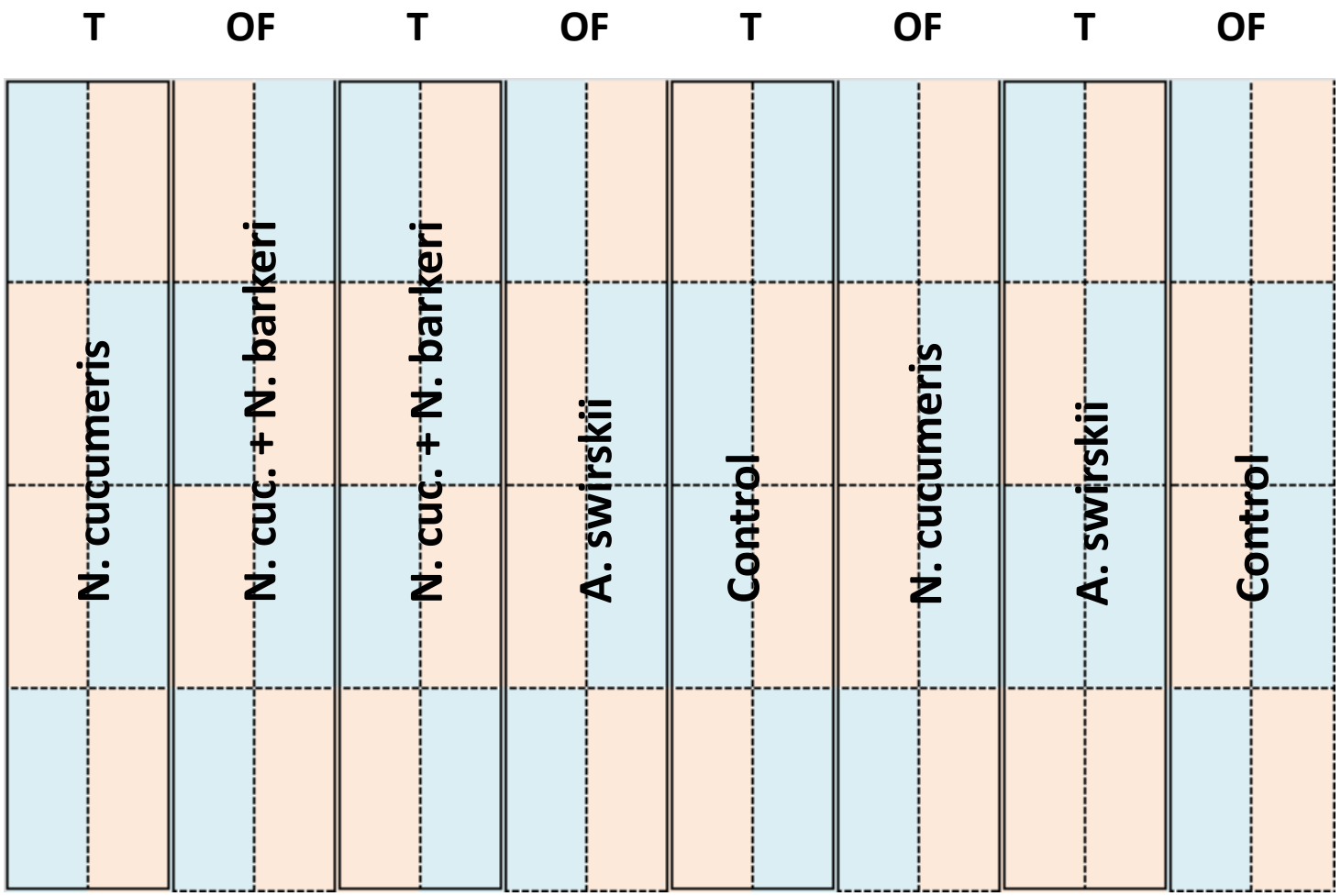
Preliminary results only of Glen Ample in tunnel

Experimental field arrangement 2013

- 7 plants/plot

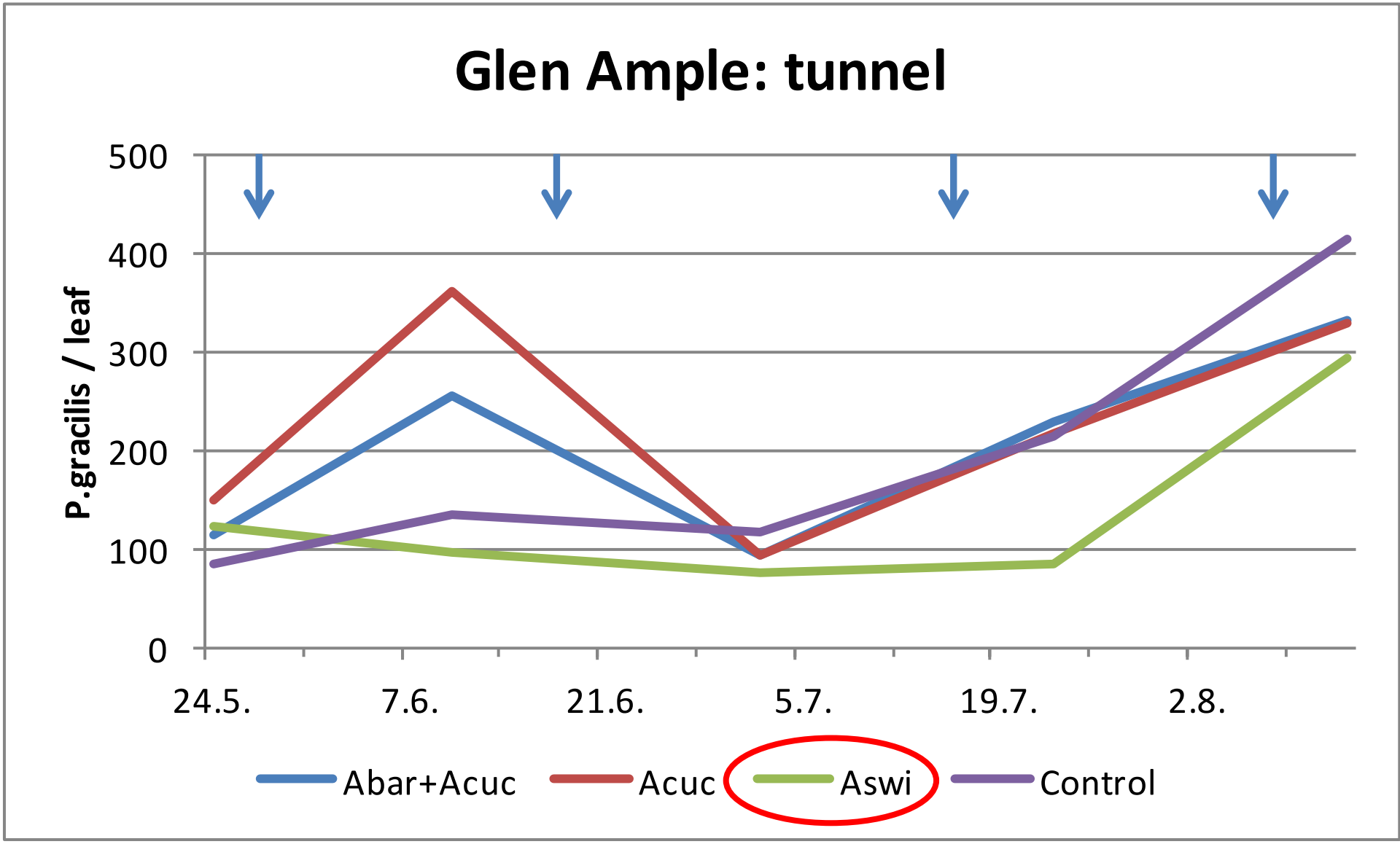
Blue: Glen Ample

Pink: Maurin Makea



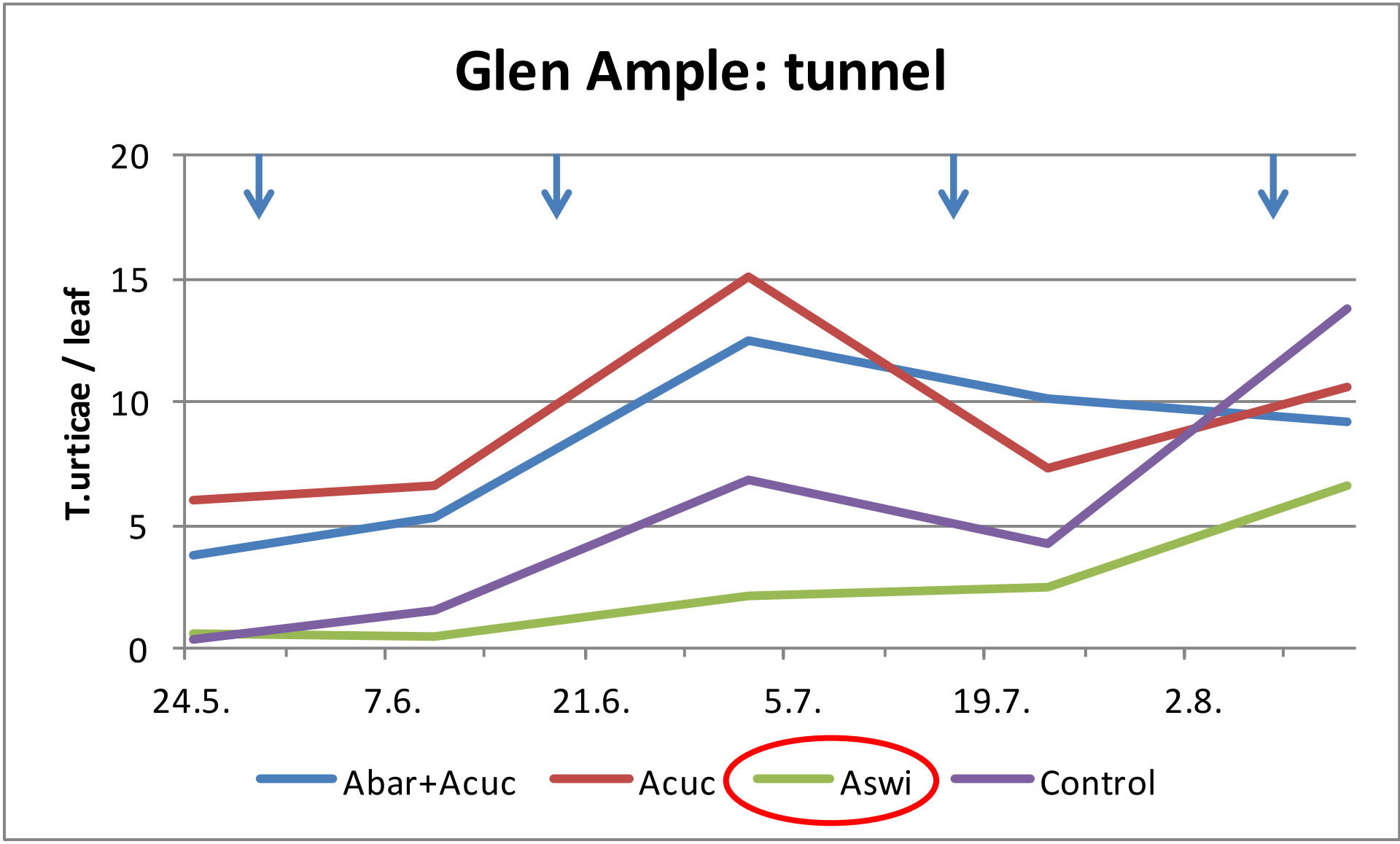
Dynamics of ***Phyllocoptes gracilis*** population in 2013

Arrows: releases of predatory mites, 220/plant



Dynamics of ***Tetranychus urticae*** population in 2013

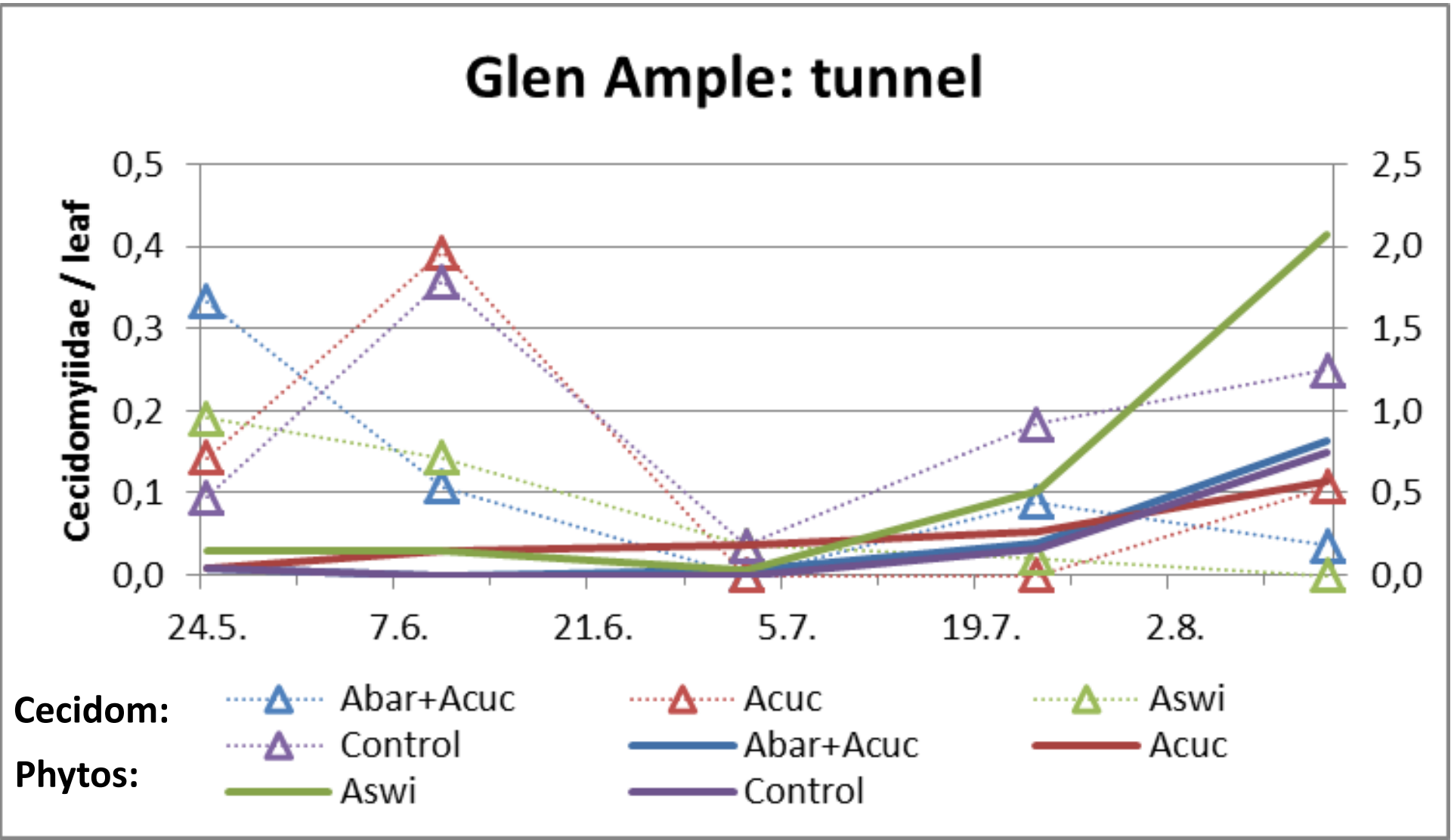
Arrows: releases of predatory mites, 220/plant



Comparison of Phytoseiidae and Cecidomyiidae in 2013

Solid lines, right axis: **Phytoseiid** active stages

Triangles, left axis: **Cecidomyiid** larvae



Conclusions 2013 (Glen Ample in tunnel):

Raspberry leaf and bud mite

- The ’cottage ’slow release method worked better
- High initial population of RLBM in all plots
- Cecidomyiid larvae present before releases of phytoseiids
- Best RLBM control by *A. swirskii* ?

Two-spotted spider mite

- Variable TSM numbers in the beginning
- Effect of cecidomyiids remarkable
- Best control by *A. swirskii* ?

Experimental field arrangement

- 7 plants/plot

Blue: Glen Ample

Pink: Maurin Makea

Occurrence of symptoms of RLBV in the area (20.8.2013)

- no. of plants with symptoms

T		OF		T		OF		T		OF		T		OF	
6	0	0	0	0	0	5	0	0	2	3	0	1	0	0	0
0	2	2	0	0	0	0	5	3	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	2	0	0	4	0	0	0	0
2	0	0	0	0	1	1	0	0	7	1	0	0	0	0	0

First obseravation in 2011

THANK YOU

Acknowledgements:

Rikala foundation