Control of Twospotted Spider Mite (*Tetranychus urticae* Koch) in Florida with single and combination treatments of *Phytoseiulus persimilis*, *Neoseiulus californicus*, and Acramite®

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Strawberry Production in Florida

- Ranks 2nd behind CA
- Produces 100% of the domestically grown winter strawberries
- 7,100 acres
- $178 million value

Twospotted Spider Mite (TSSM)

- *Tetranychus urticae* Koch
- Life cycle takes ~19 days and females can lay up to 100 eggs
- Five stages: egg, six-legged larvae, protonymph, deutonymph, and adult
- Greenish-yellow and red forms

- Optimal conditions for development are high temperatures (up to 38°C) and low humidity

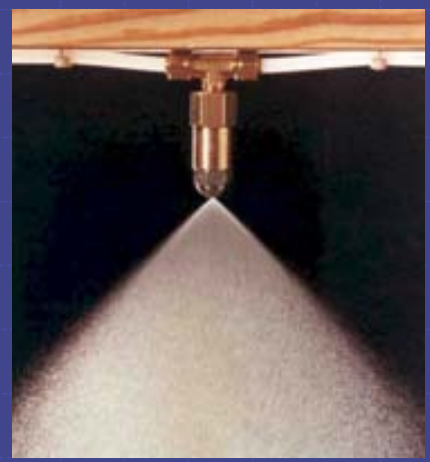
TSSM Damage

Cultural Control of TSSM

- Plant mite-free transplants
- Sanitation
  - Plant residue can harbor TSSM populations
- Irrigation

Chemical Control of TSSM

- Miticides
  - Agri-Mek® (Abamectin)
  - Savey® (Hexythiazox)
  - Acramite 50WP® (Bifenazate)
  - Brigade® (Bifenthrin)
  - Vendex® (Fenbutatin-oxide)



Phytoseiulus persimilis Athias-Henriot

- Feed almost exclusively on tetranychid mites
- Short developmental time, a nonfeeding larval stage, and a high rate of fecundity

Neoseiulus californicus McGregor

- Prefer tetranychid mites but can subsist on other foods
- Short developmental time and a high rate of fecundity
- Larvae are facultative feeders

Goal

- To evaluate two predatory mite species and a reduced-risk miticide for control of TSSM in Florida strawberries

Greenhouse Studies

- Objective
  - To conduct controlled greenhouse experiments comparing the effectiveness of the predatory mites *P. persimilis* and *N. californicus,* as well as a combination of the two predatory mites and Acramite for control of TSSM

Methods

- Colony
  - A TSSM colony reared on strawberries was maintained in the laboratory to ensure that only TSSM predisposed to strawberries were used in the experiments

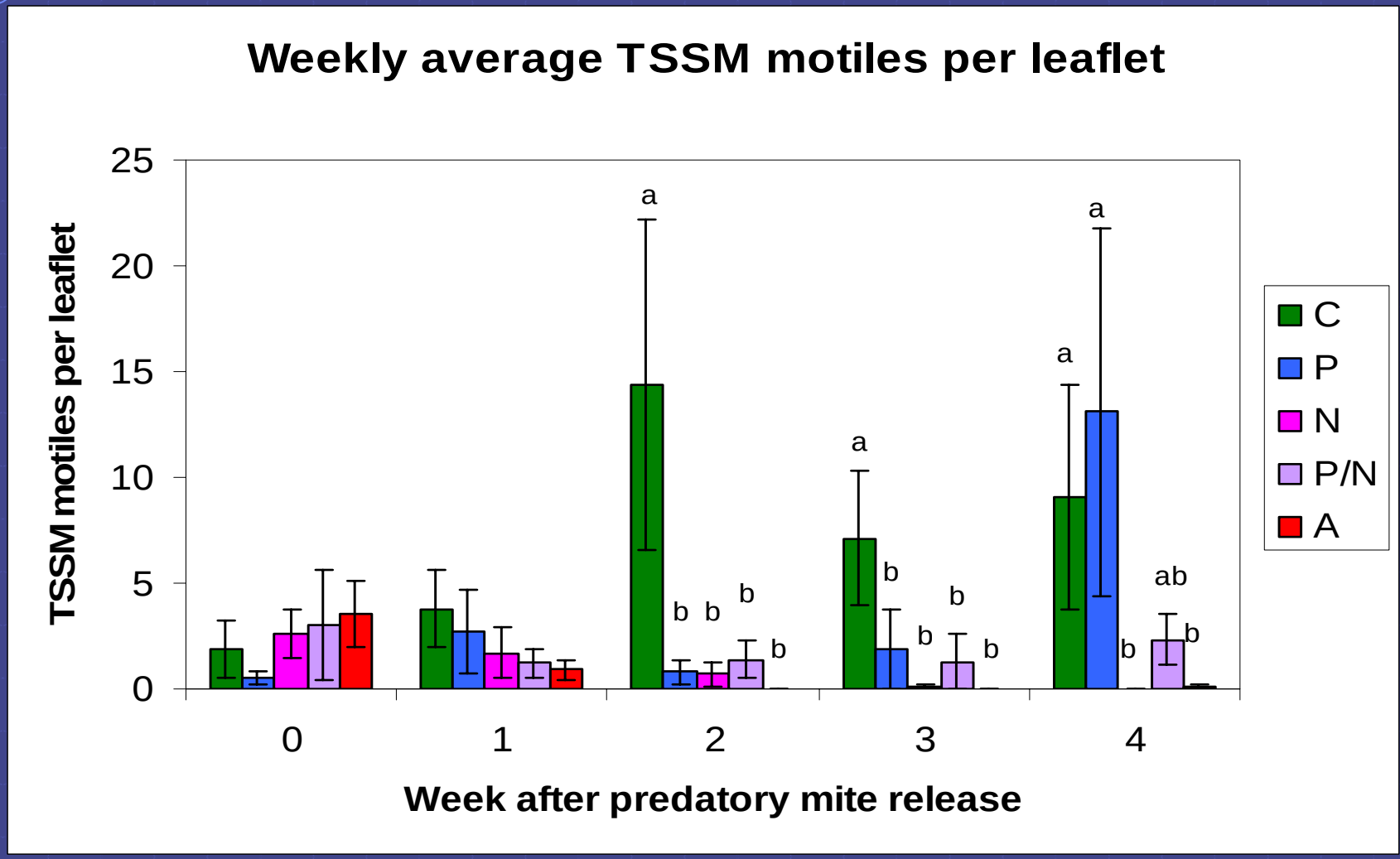
Methods

- Experimental Setup
  - 10 TSSM were released onto each of 25 plants and allowed to multiply for 1-2 weeks
  - After these two weeks one leaflet from each plant was sampled
  - Treatments were applied after the initial sample was taken

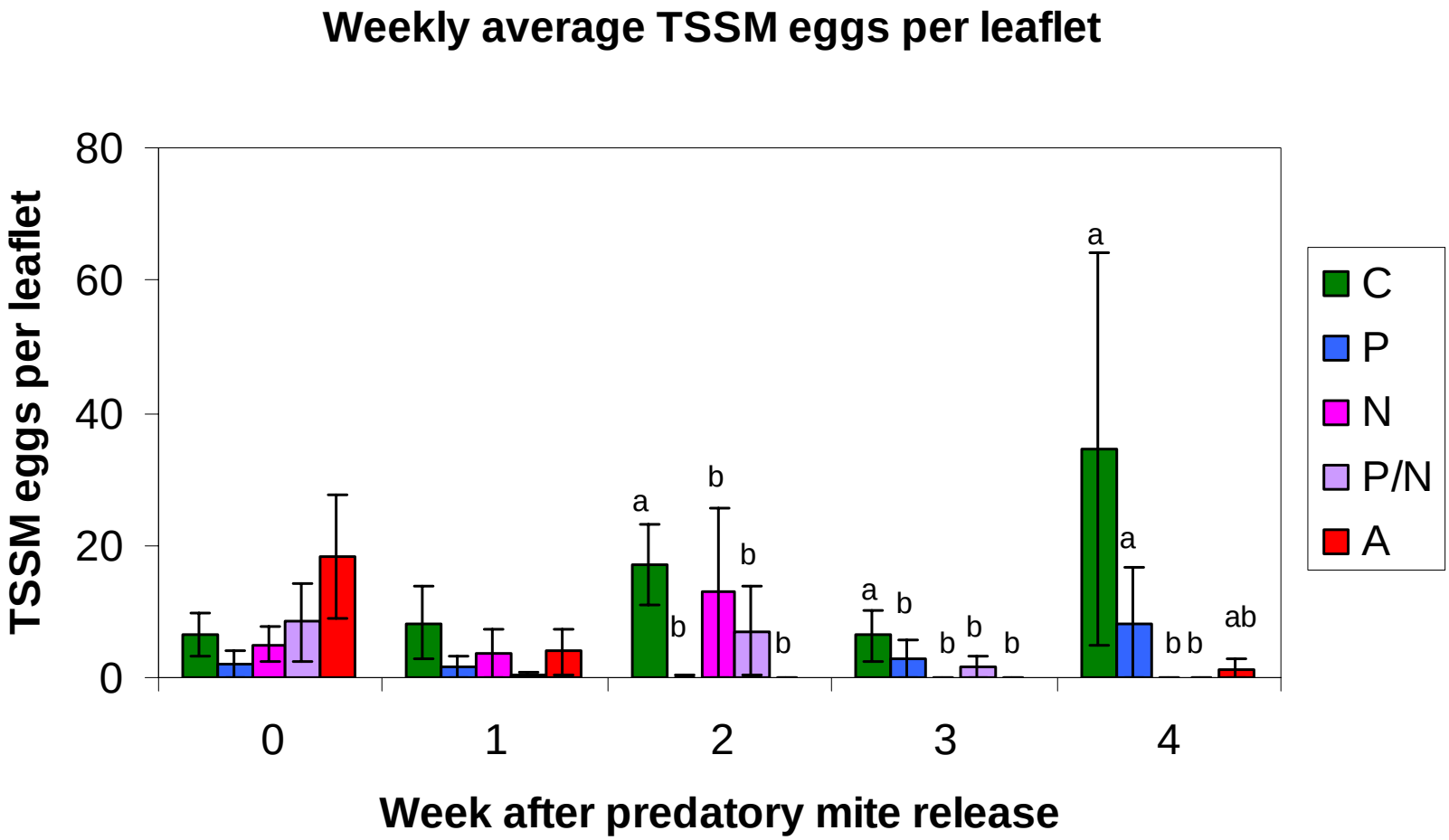
Methods

- Setup
  - Completley randomized block design
  - 5 replicates of 5 treatments:
    - Control
    - *P. persimilis* (10 per plant)
    - *N. californicus* (10 per plant)
    - Acramite
    - *P. persimilis/N. californicus* (5 each per plant)
  - Two trials

Results


Weekly average TSSM motiles per leaflet
TSSM motiles per leaflet
25
20
15
10
5
0
a
b b b b
a
b b b b
a
a
b
ab b
0
1
2
3
4
Week after predatory mite release
C
P
N
P/N
A

Results


Weekly average TSSM eggs per leaflet
TSSM eggs per leaflet
80
60
40
20
0
0
1
2
3
4
Week after predatory mite release
C
P
N
P/N
A
a
b
b
b
a
b
b
b
a
a
b b
ab

Results

- *P. persimilis vs. P. persimilis/N. caifornicus*
  - Motiles: $t = 0.16$, df = 71, $p = 0.8701$
  - Eggs: $t = 0$, df = 78, $p = 1$
- *N. californicus vs. P. persimilis/N. caifornicus*
  - Motiles: $t = 0$, df = 78, $p = 1$
  - Eggs: $t = -0.92$, df = 63.1, $p = 0.3619$

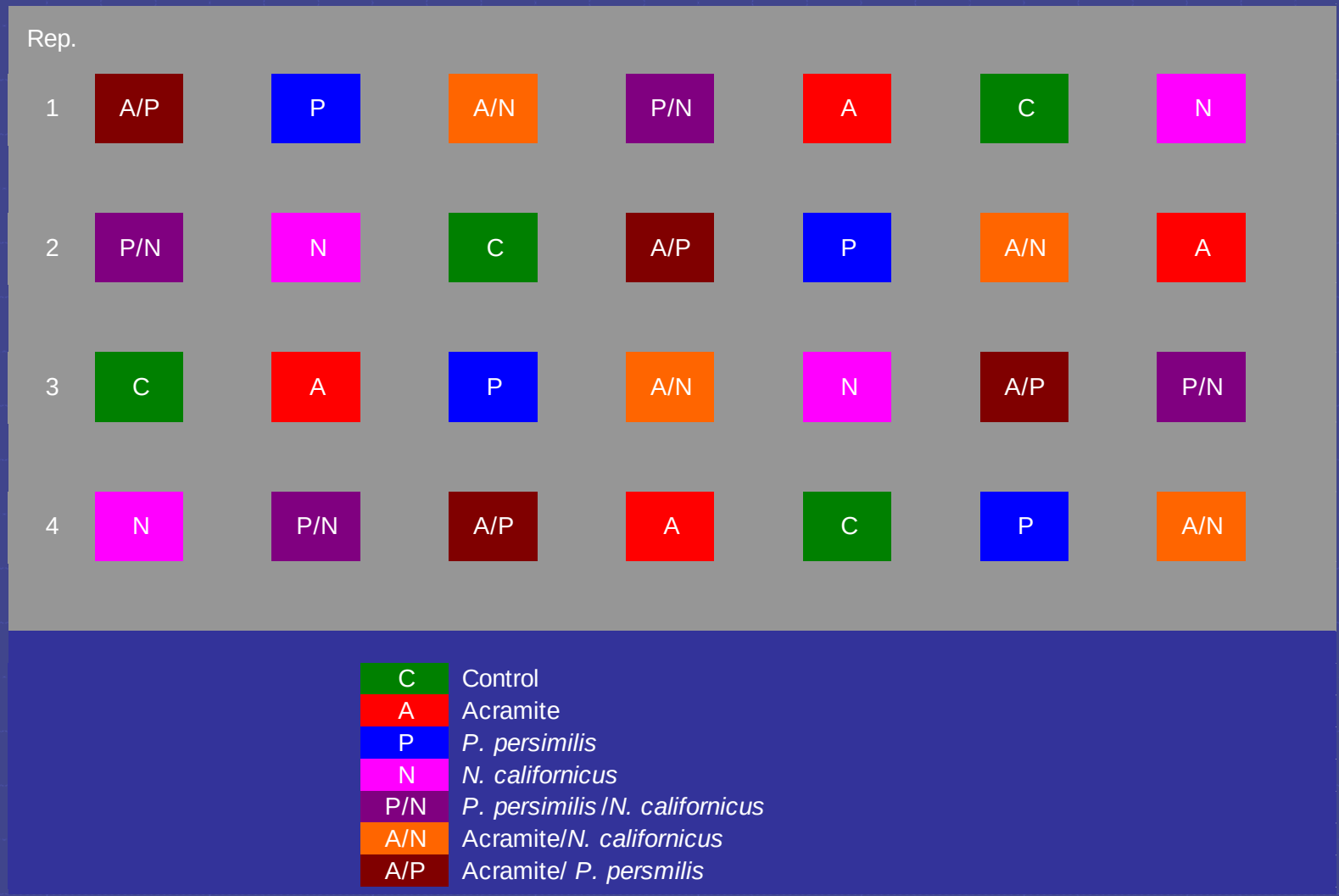
Conclusions

- TSSM populations on several *P. persimilis* plants increased at week 4, whereas TSSM populations on the *N. californicus* plants remained low
- Acramite appears to be highly effective in controlling TSSM populations
- The *P. persimilis/N. californicus* combination treatment also significantly reduces TSSM numbers, but is not any better than releasing either species alone

Field Study

- 2004/2005
- Objective
  - To conduct field experiments to study competition between two predatory mite species, as well as their interaction with Acramite for control of TSSM

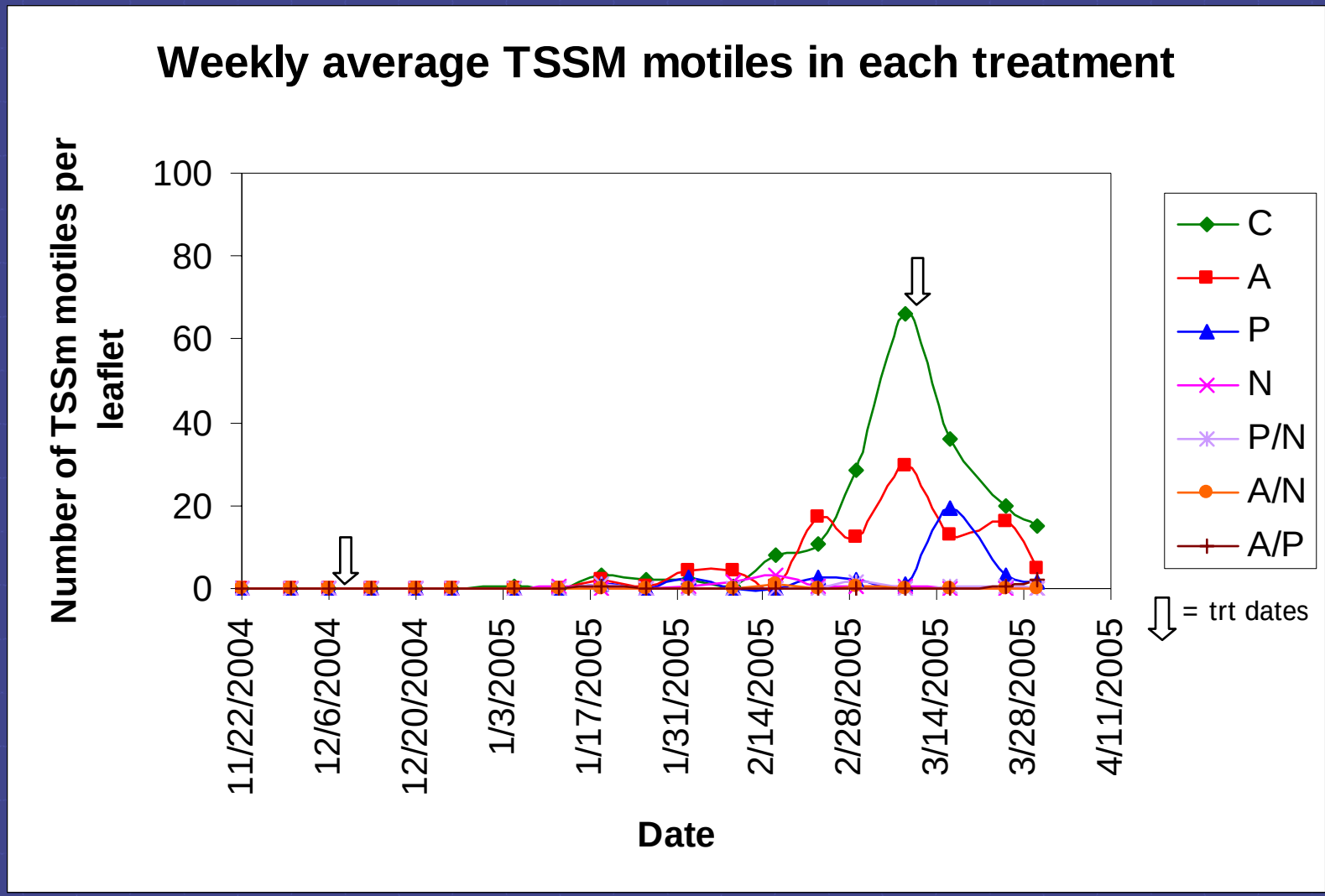
Methods (Citra, FL)



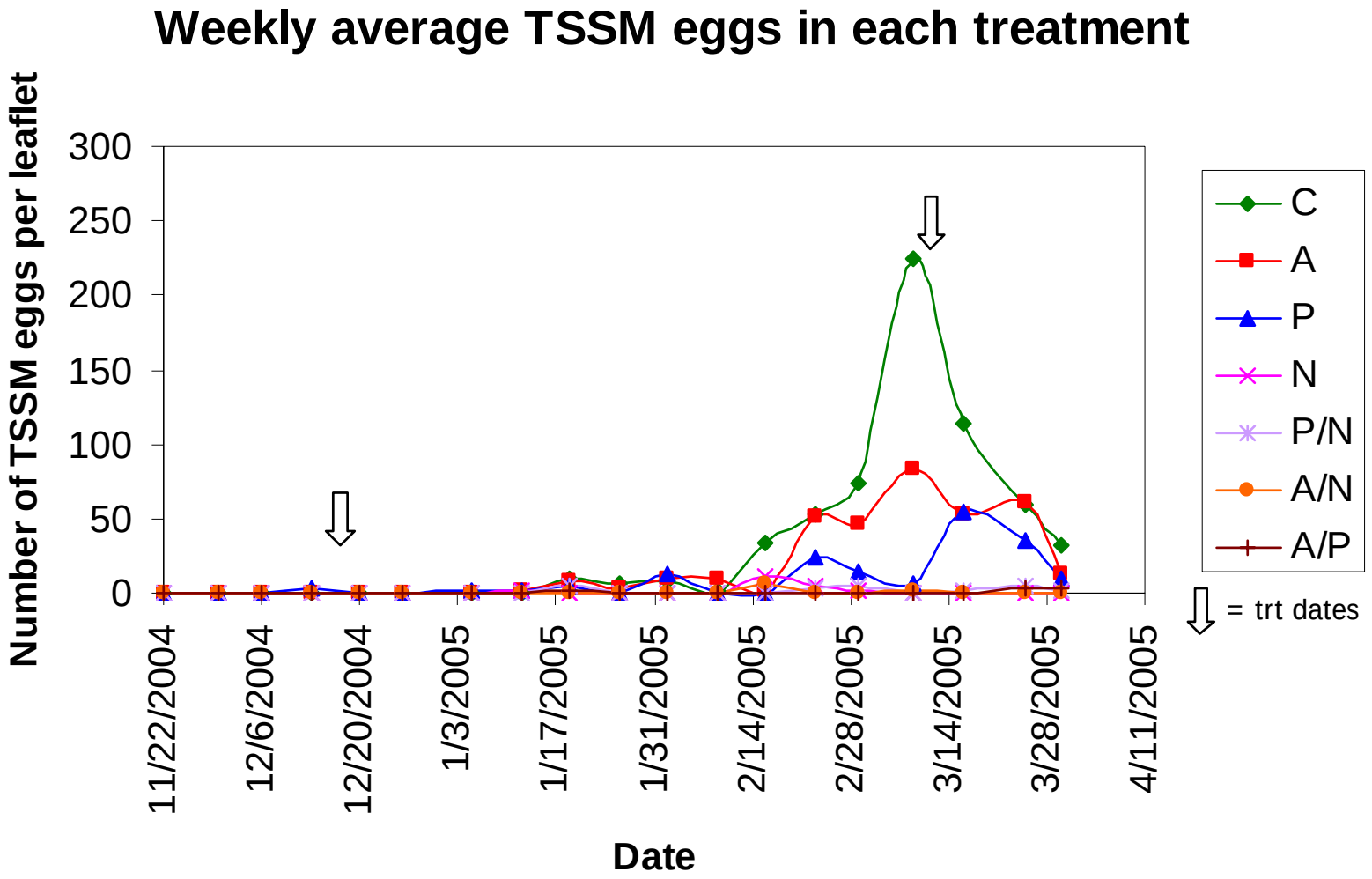
Methods

- Samples were taken once per week starting on 11/22/2004
  - 1 leaflet per row (6 leaflets per plot)
- Dates treatments were applied
  - 12/9/2004
  - 3/10/2005

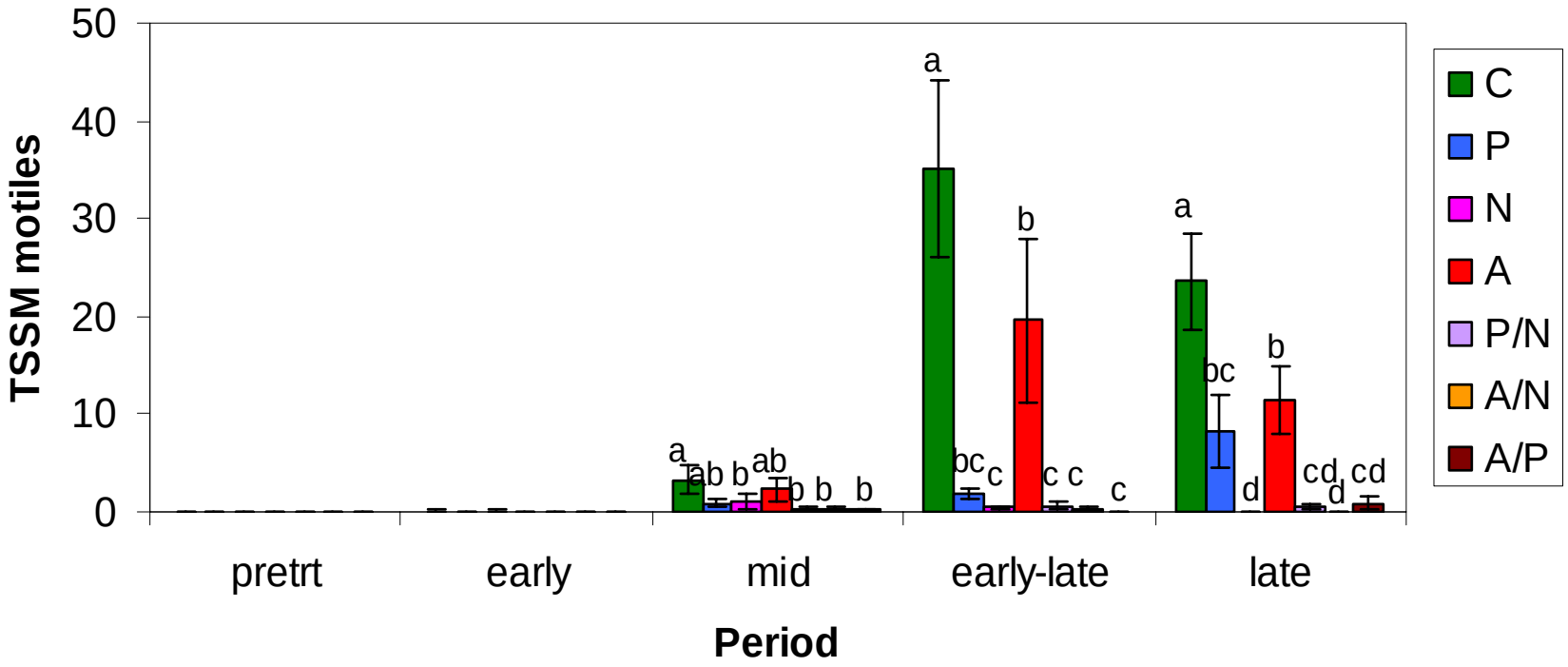
Results


Weekly average TSSM motiles in each treatment
Number of TSSm motiles per leaflet
100
80
60
40
20
0
11/22/2004
12/6/2004
12/20/2004
1/3/2005
1/17/2005
1/31/2005
2/14/2005
2/28/2005
3/14/2005
3/28/2005
4/11/2005
Date
C
A
P
N
P/N
A/N
A/P
= trt dates

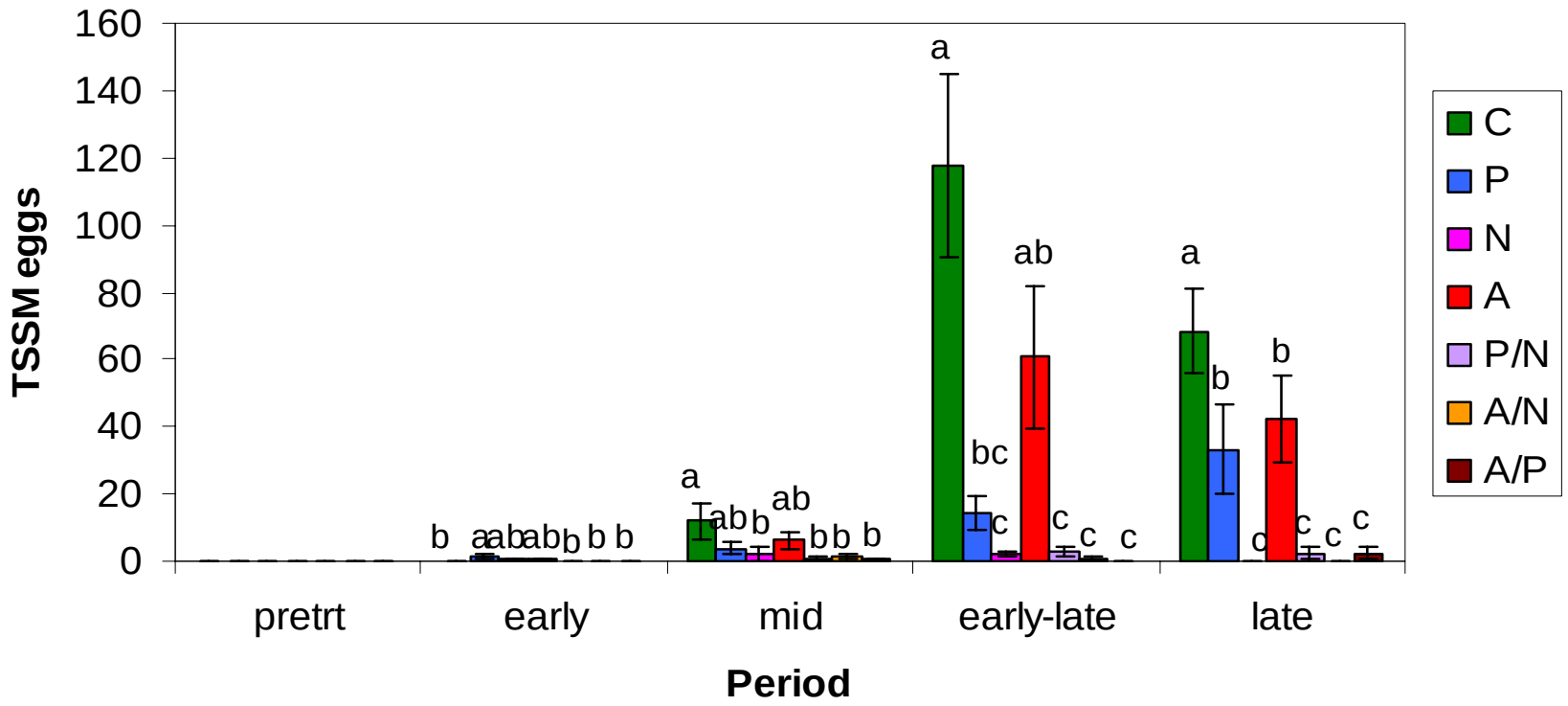
Results


Weekly average TSSM eggs in each treatment
Number of TSSM eggs per leaflet
300
250
200
150
100
50
0
11/22/2004
12/6/2004
12/20/2004
1/3/2005
1/17/2005
1/31/2005
2/14/2005
2/28/2005
3/14/2005
3/28/2005
4/11/2005
Date
C
A
P
N
P/N
A/N
A/P
= trt dates

Results


Average TSSM motiles in five periods during the 2004/2005 season
TSSM motiles
50
40
30
20
10
0
pretrt
early
mid
early-late
late
Period
a
ab
b
ab
b
b
b
a
bc
c
b
c
c
c
a
bc
d
b
cd
d
cd
C
P
N
A
P/N
A/N
A/P

Results


Average TSSM eggs in five periods during the 2004/2005 season
TSSM eggs
160
140
120
100
80
60
40
20
0
pretrt
early
mid
early-late
late
Period
C
P
N
A
P/N
A/N
A/P

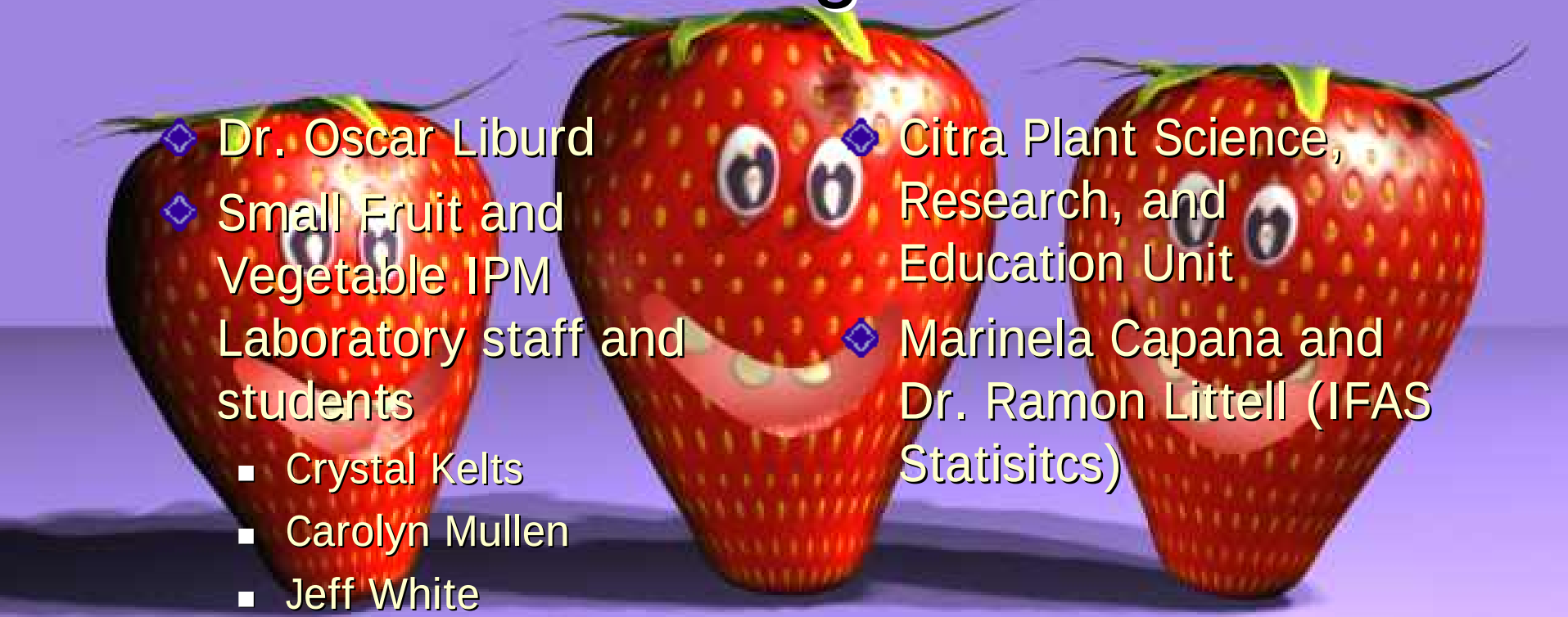
Results

- *P. persimilis*, *P. persimilis/N. californicus*, and Acramite*/P. persimilis* treatments
  - Motiles: F = 1.79, df = 2,171, p = 0.1693
  - Eggs: F = 2.32, df = 2,171, p = 0.1014
- *N. californicus*, *P. persimilis/N. californicus*, and Acramite*/N. californicus* treatments
  - Motiles: F = 1.04, df = 2,171, p =0.3547
  - Eggs: F =0.90, df = 2,171, p = 0.4089

Conclusions

- As in the laboratory experiment,TSSM populations in the *P. persimilis* plots increased in the late season, whereas TSSM populations in the *N. californicus* plots remained low
- Acramite is very effective if applications are timed and applied properly. Two applications are needed to give season long control
- Both Acramite*/N. californicus* and Acramite*/P. perisimilis* treatments effectively controlled TSSM
- Releasing both species in combination does not appear to be an economical strategy since it is not any better than using *N. californicus* alone

Acknowledgements



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