PHYTOSEIIDAE INCREASE WITH POLLEN DEPOSITION ON CITRUS LEAVES

Authors: Villanueva, R. T., and Childers, C. C.

Source: Florida Entomologist, 87(4) : 609-611

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/0015-4040(2004)087[0609:PIWPDO]2.0.CO;2

PHYTOSEIIDAE INCREASE WITH POLLEN DEPOSITION ON CITRUS LEAVES

R. T. VILLANUEVA[1] AND C. C. CHILDERS[2]
[1]North Carolina State University, Mountain Horticultural Crops Research and Extension Center
455 Research Drive, Fletcher, NC 28732

[2]Entomology and Nematology Department, University of Florida, IFAS
Citrus Research and Education Center, 700 Experiment Station Road Lake Alfred, FL 33850

The Phytoseiidae can be classified into four categories based on feeding habits (McMurtry & Croft 1997). Type I phytoseiids are specialized predators of *Tetranychus* species (e.g., *Phytoseiulus* species). Type II phytoseiids are selective predators of tetranychid mites, *Galendromus*, some *Neoseiulus* species, and a few *Typhlodromus* species. Type III phytoseiids are generalist predators consisting mostly of *Typhlodromus* and *Amblyseius* species. Type IV phytoseiids are specialized pollen feeders/generalist predators such as *Euseius* species. The three most prevalent phytoseiid species on Florida citrus are *Euseius mesembrinus* (Dean), *Typhlodromalus peregrinus* (Muma) (Childers 1994), and *Iphiseiodes quadripilis* (Banks) (Villanueva & Childers, unpubl. data; Childers, unpubl. data). All three species can complete their life cycle on an exclusive pollen diet (Abou-Setta & Childers 1987; Peña 1992; Villanueva & Childers, unpubl. data). These studies demonstrated that the most abundant phytoseiids in Florida citrus are either type III or IV species. Furthermore, one peak of abundance in Florida coincides with flowering in *Citrus*, *Pinus* sp., and *Quercus* sp. Members of the genera *Pinus* and *Quercus* are commonly found around citrus orchards in uncultivated areas such as windbreaks or in densely planted stands for use as pulp or lumber. Pollen from these plants and species of weeds and shrubs accumulate on the adaxial surfaces of citrus leaves. These pollens can provide important food sources for phytoseiid mites. Studies on citrus in South Africa demonstrated a high correlation between early pollen availability and abundance of *Euseius addoensis addoensis* (van der Merwe and Ryke) (Grout & Richards 1992a,b). The objective of this study was to examine the relationship between pollen on grapefruit leaves and the number of phytoseiids present on these leaves during the period of citrus flowering.

Weekly leaf samples were taken from 10 (11-yr-old) ‘Ruby red’ grapefruit trees at the Citrus Research and Education Center in Lake Alfred between 2 February and 16 March 2001. The orchard had not received a pesticide application since September 2000. All 10 sampled trees were selected at random within one row and were spaced at least 25 m apart. Samples consisted of one terminal with 5 leaves damaged by citrus leaf miner [*Phyllocnistis citrella* Stainton (CLM) (Lepidoptera: Gracillariidae)] and one terminal with 5 leaves without damage per sample tree. Leaf terminals were taken to the laboratory and both phytophagous and predatory mite eggs and motiles were counted with a stereomicroscope.

One healthy leaf from each of the same trees was collected for pollen counts. A 5- to 7-cm long strip of transparent adhesive tape was placed along the middle vein on the adaxial surface of each leaf for 3 to 5 min and then removed. Each leaf was placed on a sheet of wax paper, labeled, and stored in the refrigerator until processed. Slides were prepared by placing 1-cm^2 pieces of tape individually on a slide with the adhesive part up. Prior to placement of the cover slip, a drop of dye was added consisting of 0.2 g of Trypan Blue in 200 ml of 50% glycerol (Addison et al. 2000), a formulation typically used for staining ascospores (Skaria & Tao 1996). The glycerol causes the pollen grains to swell slightly (Addison et al. 2000). A phase contrast microscope was used to count pollen grains at a magnification of 400×. The area for counting pollen grains was the field of view, approximately 1.13 mm^2 as calculated with a Hemacytometer Bright Line® (Reichert, Buffalo, NY). Five fields of view were counted for each 1 cm^2 of prepared area, yielding an estimate of the mean number of pollen grains per 1.13 mm^2. The first grain of pollen found while searching the slide was centered in the middle of the field of view and then all pollen grains in that field of view were counted. Pollen counts and the total number of phytoseiids present from leaf samples on the indicated dates were evaluated to determine correlations between the two factors.

Phytophagous mite species observed in this study included *Eutetranychus banksi* (McGregor), *Eotetranychus sexmaculatus* (Riley), *Phyllocoptruta oleivora* (Ashmead), and *Aculops pelekassi* (Keifer). The numbers of the two eriophyid species are combined as *P. oleivora* in Fig. 1. Known predacious species included *T. peregrinus* and *I. quadripilis* (two phytoseiids), and *Agistemus* sp.(Stigmaeidae). Phytoseiid numbers increased from 8 February to 16 March with significantly larger numbers of phytoseiids occurring on the mined leaves (Villanueva & Childers, unpubl. data). Most phytoseiid mites were found on 16 March, and included 55 *I. quadripilis* and 38 *T. peregrinus* (Fig. 1).

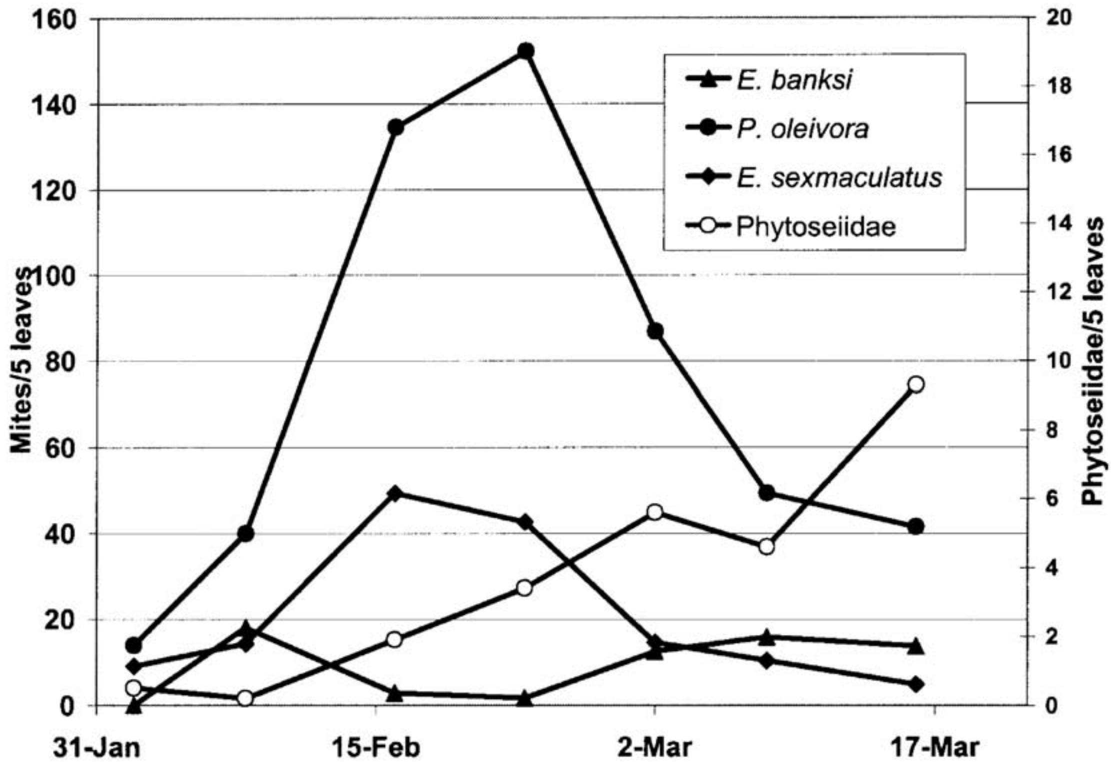

Fig. 1. Population densities of phytophagous mites in a grapefruit orchard in Lake Alfred.

Eggs and motiles of *E. sexmaculatus* were abundant during February and the phytoseiids likely preyed on them in addition to the pollen. The identified pollen types found on the grapefruit leave included *Quercus* sp., *Pinus* sp., *Citrus*, and other unidentified types. The highest counts of pollen observed on 8 March were for *Quercus* (6.7 ± 2.0, *n* = 50), on 16 February for *Pinus* sp., (6.9 ± 1.4, *n* = 50), on 16 March for *Citrus* (5.5 ± 0.9, *n* = 50), and on 8 March for unidentified pollen types (10.7 ± 1.6, *n* = 50). Grapefruit trees in this orchard bloomed between 2 and 16 March with most of the flowers completing anthesis by 16 March. The correlation between the number of pollen grains and phytoseiid mites was positive and highly significant ($P = 0.004$), yielding a Pearson correlation coefficient $r^2 = 0.83$, $n = 50$ (Statsoft, Inc. 2000). Both phytoseiid numbers (8.5 ± 0.5, *n* = 50) and pollen grains (22.0 ± 9.3, *n* = 50) increased between 2 February and 16 March (Fig. 2).

Our data show that the eriophyid population reached its peak by the end of February, whereas the phytoseiid population showed only a small incremental increase around the same time but reached its peak by mid March (Fig. 1). This is approximately one week after pollen grain counts were the highest. Others have reported increases in phytoseiid populations with pollen availability. Addison et al. (2000) observed that *T. pyri* abundance had a better correlation with early season pollen density in apple than with the abundance of its eriophyid mite prey, *Aculus schlechtendali* Nalepa. Similarly, when *Euseius tularensis* Congdon was released into navel orange orchards in California, the mite exhibited a greater population increase in orchards with a ground cover crop of mixed leguminous plants than in orchards without ground cover to serve as a pollen source (Grafton-Cardwell et al. 1999). The results shown here demonstrate the potential importance of citrus and non-citrus pollens in phytoseiid increase. The effect of pollen on the reduction of predation during prey abundance and/or as a food source for survival during times of prey scarcity remains to be studied. Further studies are needed to identify possible use of supplemental pollens either introduced into citrus orchard sites or grown as cover crop plants to sustain higher phytoseiid populations during April-May when eriophyoid and tetranychid mite populations often begin to increase.

We thank Sachindra Mondal for suggestions in taking pollen counts. Appreciation is extended to both J. P. Michaud and N. J. Fashing for reviewing an earlier draft of this manuscript. This research

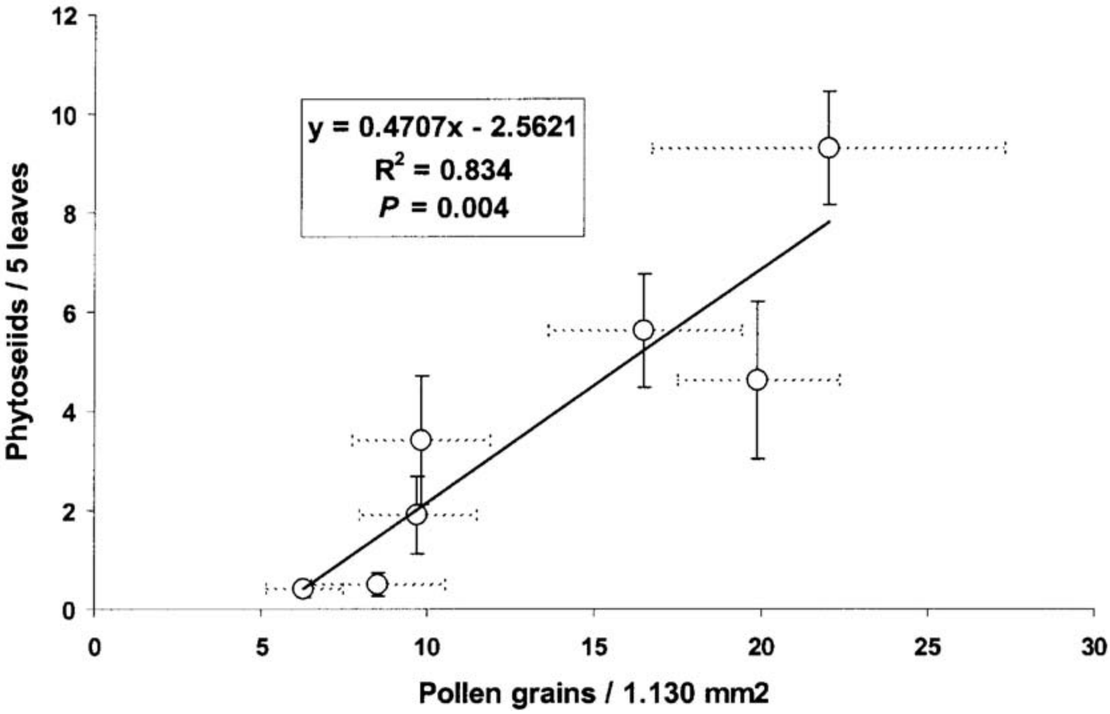

Fig. 2. Relationship between number of Phytoseiidae motiles (± SEM) per 5 leaves per tree and number of pollen grains (± SEM) per 1.13 mm^2 per 5 units per leaf per sample tree on grapefruit between 2 February and 16 March 2001.

was supported by the Florida Agricultural Experiment Station, and approved for publication as Journal Series No. R-09968.

Summary

A positive correlation was found between numbers of phytoseiids and numbers of pollen grains on grapefruit leaves in this study. One or more pollens are important food sources for many phytoseiid species. Pollens of *Citrus* sp., *Pinus* sp., *Quercus* sp., and other plants coincided with increases in phytoseiid numbers in the field. The dominant phytoseiid species, *I. quadripilis* and *T. peregrinus*, are generalists that can be reared in the laboratory on exclusive diets of pollen from the ice plant, *Malephora crocea* (Jacquin).

References Cited

ABOU-SETTA, M. M., AND C. C. CHILDERS. 1987. Biology of *Euseius mesembrinus* (Acari: Phytoseiidae): Life tables on ice plant pollen at different temperatures with notes on behavior and food range. Exp. Appl. Acarol. 3: 123- 130.

ADDISON, J. A., J. M. HARDMAN, AND S. J. WALDE. 2000. Pollen availability for predaceous mites on apple: spatial and temporal heterogeneity. Exp. Appl. Acarol. 24: 1-18.

CHILDERS, C. C. 1994. Biological control of phytophagous mites on Florida citrus utilizing predatory arthropods, pp. 255-288 *In* D. Rosen, F. D. Bennet, and J. L. Capinera [eds.], Pest Management in the Subtropics, Intercept, Andover, UK.

GRAFTON-CARDWELL, E. E., Y. OUYANG, AND R. L. BUGG. 1999. Leguminous cover crops to enhance population development of *Euseius tularensis* (Acari: Phytoseiidae) in citrus. Biol. Control 16: 73-80.

GROUT, T. G., AND G. I. RICHARDS. 1992a. *Euseius addoensis addoensis*, an effective predator of citrus thrips, *Scirtothrips aurantii*, in the eastern Cape Province of South Africa. Exp. Appl. Acarol. 15: 1-13.

GROUT, T. G., AND G. I. RICHARDS. 1992b. The dietary effect of windbreak pollens on longevity and fecundity of a predacious mite *Euseius addoensis addoensis* (Acari: Phytoseiidae) found in citrus orchards in South Africa. Bull. Entomol. Res. 82: 317-320.

MCMURTRY, J. A., AND B. A. CROFT. 1997. Life styles of phytoseiid mites and their roles as biological control agents. Annu. Rev. Entomol. 42: 291-321.

PEÑA, J. 1992. Predator-prey interactions between *Typhlodromalus peregrinus* and *Polyphagotarsonemus latus*: Effects of alternative prey and other food resources. Florida Entomol. 75: 241-248.

SKARIA, M., AND Z. TAO. 1996. A leaf disk clearing and staining technique to quantify ascospores of *Mycosphaerella citri* in young citrus leaves. Subtrop. Plant Sci. 48: 16-18.

STATSOFT, INC. 2000. Statistica for Windows. Tulsa, OK.