# Mite Fauna (Arachnida: Acari) on Peach Cultivars in Presidente Prudente, São Paulo, Brazil

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# Abstract

This study aimed to determine the mite diversity, population dynamics and to conduct a fauna analysis in plantations from four peach varieties established in the municipality of Presidente Prudente, SP, Brazil. The mite fauna from 'Jóia 4', 'Ouromel 3', 'Regis' and 'Rei da conserva' cultivars over the rootstock Okinawa were determined from December 2002 to February 2006. Samples composed by 72 leaves were collected fortnightly from upper, middle and lower third of each tree and four trees per cultivar. A total of 3,084 mites were recovered during the experiment, with the following distribution: 2,638 phytophagous, 373 predators and 73 of unknown feeding habit. The mites recovered were related to 18 species from 12 mite families. *Aculus fockeui* (Eriophyidae) occurred sporadically, not causing symptoms on the canopy. Euseius citrifoluis was the most abundant species among the Phytoseiidae, with predominance on cultivar 'Regis'.

Keywords: mite fauna, mite diversity, *Prunus persica*, stone fruits

# 1. Introduction

Fruit plants are infested by several species of insects and mites, which in some cases are considered pests. The knowledge about the mite diversity can determine the degree of importance of phytophagous species and also of predatory species, as a scientific basis for the integrated pest management in several crops (Vasconcelos et al., 2005). It can also help in the evaluation of the species potential to become pests or natural enemies, foreseeing their impact on the environment (Moraes & Flechtmann, 2008).

The mite species are considered major pests on peaches, because their severe infestation destroys the superficial tissues of the leaves, which cause the loss of cell juice from the first tissue layers. This results in a color alteration, a yellowing or bronzing of the leaves, which provokes a qualitative and quantitative product reduction (Salles, 1998).

In Brazil, pest mite species that attack peach trees are the two-spotted spider mite (*Tetranychus urticae* Koch, 1836) (Tetranychidae), the red mites [*Panonychus ulmi* (Koch, 1836)] (Tetranychidae), and the peach silver mite [*Aculus cornutus* Banks, 1905)] (Eriophyidae) (Fletchmann, 1976; Santa-Cecília & Souza, 1997). In Mexico, *Eriophyes insidiousus* Keifer & Wilson, 1956 was recorded as a vector of a mosaic virus on peach trees (Oldfield & Creamer, 1995).

In a study about the mite diversity in Rosaceae, in the municipality of Capão Bonito, São Paulo, Brazil, Baldo (2012) referred to the occurrence of the mites *A. fockeui, T.urticae, Ricoseius loxocheles* De Leon, 1965 and *Euseius ho* De Leon, 1965, The author also found a positive correlation between climatic conditions and the

occurrence of phytophagous mites.

In another study on the population of predatory mites in peaches, especially the Phytoseiids family, Moraes et al. (1986) reported the occurrence of *Euseius concordis* (Chant, 1959), *Iphiseiodes zuluagai* Denmark & Muma, 1972, *Phytoseiulus macropilis* (Banks, 1904) and *Ricoseius loxocheles* (De Leon, 1965). The predatory mites were considered effective in the biological control of phytophagous mites on roses. Their occurrence may be influenced by cultural management, which affects their establishment in the plants when released in the field (Monteiro, 2002).

The introduction of peach orchards in Presidente Prudente, in the western region of São Paulo State, aimed at the diversification of fruit cropping for the family-based farm. The knowledge about the mites' fauna in peach plantations in the western São Paulo State is very much incipient. The present research aimed to determine the mite diversity, the population dynamics and to conduct a fauna analysis in peaches orchards in western São Paulo State, with the purpose to subsidize pest management.

## 2. Materials and Methods

The survey was conducted in the municipality of Presidente Prudente, São Paulo, Brazil (UTM N 7,545,288.76 m, E 459,930.31 m and 424.29 m elevation) from December 2002 to February 2006. The orchards were established in 2001 with four peach cultivars: 'Joia 4', 'Ouromel 3', 'Regis' and 'Rei da conserva'. All cultivars require less than 100 chilling hours and are commonly used by commercial growers. The plant spacing was of 6.0 x 3.0 m. Information on mite fauna on those cultivars was not available in literature.

Except for the application of insecticides and miticides, other cultural practices employed in this study were those recommended for conventional peach trees (Pereira et al., 2002), such as artificial dormancy break performed with hydrogen cyanamide (0.5% a.i.) + oil (1%), fruit thinning, fertilization, weed control (glyphosate, 0.5% a.i), green and dry pruning, and micro sprinkler irrigation.

In order to obtain the complete mite diversity, samplings were performed every fifteen days by collecting 12 leaves from the upper, middle and lower thirds of the plant (both internal and external parts). A total of 72 leaves were collected biweekly from each tree, from four trees per cultivar, was collected to guarantee a representative sample, but without compromising the plants development. The samples were placed into paper bags and kept in polystyrene boxes containing ice to decrease the mite activity. The mite extraction was performed at the Plant Health and Quality Laboratory at "APTA Alta Sorocabana", in Presidente Prudente, SP, Brazil. To accomplish the extractions, the samples were placed individually in plastic containers and immersed for five minutes in a 70% alcohol solution and then stirred to displace the mites. The leaves were discarded and the solution was passed through a 0.038 mm sieve and the mites collected were transferred to 30 ml capacity glass vials for later screening and identification. No leaves were sampled between May and August, due to plant natural defoliation. The mites collected were mounted in Hoyer's medium for identification, except the eriophids, which were mounted in modified Berlese medium (Krantz, 1978). A representative sample of the species found was deposited at the "Geraldo Calcagnolo Mites Reference Collection", at Laboratory of Acarology, Biological Institute, Campinas, SP.

A faunistic analysis and the characterization of mites' occurrence (accidental, accessory and constant) and dominance indices (accidental, accessory and dominant) were conducted to determine the mite species importance status (Palma, 1975).

## 3. Results and Discussion

Eighteen mite species were recorded in our survey, and the species were related to 12 distinct mite families (Table 1). A total of 3,084 mites were collected: 2,638 phytophagous, 373 predators, and 73 mites with unknown eating habits.

Order	Family	Genus/Species	Food habit	
Astigmata	Acaridae Latreille, 1802	Tyrophagus sp.	Mycophagous	
	Winterschmidtiidae Oudemans, 1923	Czenspinskia sp.	Mycophagous	
Mesostigmata	Phytoseiidae Berlese, 1913	Amblyseius herbicolus (Chant, 1959)	Predator	
		<i>Euseius citrifolius</i> Denmark & Muma, 1970	Predator	
		<i>Euseius concordis</i> (Chant, 1959)	Predator	
		<i>Iphiseiodes zuluagai</i> Denmark & Muma, 1972	Predator	
			Predator	
Prostigmata	Bdellidae Dugès, 1834	Spinibdella sp.	Predator	
	Diptilomiopidae Keifer, 1944	Catarhynus sp.	Phytophagous	
	Cheyletidae Leach, 1815	Grallacheles sp.	Predator	
	Eriophyidae Nalepa, 1898	<i>Aculus fockeui</i> (Nalepa & Trouessart, 1891)	Phytophagous	
	Tarsonemidae Kramer, 1877	Fungitarsonemus sp.	Phytophagous	
		Tarsonemus sp.	Phytophagous	
	Tenuipalpidae Berlese, 1913	Brevipalpus phoenicis (Geijskes, 1939)	Phytophagous	
	Tetranychidae Donnadieu, 1875	<i>Mononychellus planki</i> (McGregor, 1950)	Phytophagous	
		Oligonychus sp.	Phytophagous	
		Tetranychus urticae	Phytophagous	
		Koch, 1836	rnytophagous	
	Tydeidae Kramer, 1877	Lorryia sp.	Mycophagous	
	Iolinidae	Homeopronematus sp.	Mycophagous	

Table 1. Mite species collected from peach leaves. Presidente Prudente, SP, Brazil. Dec/2002 to Feb/20	Aite species collected from peach leaves. Presidente Prudente, SI	P, Brazil	l. Dec/2002	to Feb/2006
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The occurrence of the phytophagous species *Aculus fockeui* (Nalepa & Trouessart, 1891) (Eriophyidae) was registered in all cultivars, with high populations captured in December 2002. In Rei da conserva cultivar, *A. fockeui* represented 63.4% of total individuals (1,572). In contrast, only 4.8% of the mites recovered from Ouromel 3 cultivar (120) were *A. fockeui* was (Table 2). Another eriophyid, *Catarhynus* sp. was detected in very low number (Table 1). *A. fockeui* is reported in several regions around the world as the major peach-associated mite (Kondo & Hiramatsu, 1999; Ferreira & Carmona, 1997; Kunugi et al., 1993), causing decrease in fruit weight, sugar content (Kunugi et al., 1993; Kondo & Hiramatsu, 1999), defoliation and reduced plant vigor, and resulting in poor fruit quality in subsequent years (Kondo & Hiramatsu, 1999). Contradictorily observations made elsewhere in the world, in the present study there were no detected visual symptoms associated with the occurrence of this mite. Eichelberger et al. (2011) also reported that *A. fockeui* has little relevance in peach orchards in Rio Grande do Sul.

Three species of Tetranychidae were identified (Table 2). *Mononychellus planki* (McGregor, 1950) were found in larger quantities than other spider mites. In Rei da conserva cultivar, 61.4% of total mites sampled were *M. planki*. *Brevipalpus phoenicis* (Geijskes, 1939) were recovered mainly on 'Regis' and 'Jóia 4' cultivars (68.80%)

and 25.50% respectively).

Spacias	% occurrence on peach cultivars					
Species	Jóia 4	Jóia 4 Ouromel 3 Re		Rei da conserva		
Phytophagous						
Aculus fockeui	84.60%	79.74%	44.78%	89.17%		
Mononychellus planki	0.14%	0.14% 10.93%		3.52%		
Tetranychus urticae	1.63%	2.65%	3.57%	0.79%		
Brevipalpus phoenicis	0.54%	0.33%	3.57%	0.11%		
Oligonychus sp.	0.14%	0.00%	0.00%	0.00%		
Homeopronematus sp.	1.08%	0.99%	0.55%	0.28%		
Predators						
Euseius citrifolius	10.57%	40.07%	30.22%	5.10%		
Euseius concordis	0.95%	3.31%	7.14%	0.34%		
Iphiseiodes zuluagai	0.00%	0.00%	0.82%	0.00%		
Unknown food habits						
Lorryia sp.	0.00%	0.66%	0.27%	0.06%		
Tyrophagus sp.	0.14%	4.30%	1.10%	0.57%		
Czenspinskia sp.	0.27%	33.00%	3.57%	0.06%		

Table 2. Percentage distribution of mite species occurring on four peach cultivars. Presidente Prudente, SP, Brazil. Dec/2002 to Feb/2006

Montes et al. (2010, 2011) reported a greater diversity of phytophagous mites on peach cultivars Talismã, Doçura 2, Dourado 2, Tropical, Aurora 1 and Aurora 2, planted in Presidente Prudente: Diptilomiopidae, Eriophyidae, Tarsonemidae, Tenuipalpidae and Tetranychidae. The authors also reported the occurrences of predator mites from the Ascidae, Phytoseiidae, Bdellidae, Cheyletidae and Erythraeidae families. Constrasting results were obtained in Pelotas and Bento Gonçalves counties, RS, where *P. ulmi* and *T. urticae* were the most abundant species detected on three peach cultivars in conventional and integrated management systems (Cunha et al., 2010).

In Italy, Castagnoli & Nannelli (1987) found high densities of *A. fockeui* in a peach orchard, but these authors did not find apparent damage, probably due to biological control by predators mites. However, according to Ashihara et al. (2004), injuries on the peach leaves caused by *A. fockeui* reduce the sugar content of the fruit, promoting intense leaf fall just after harvesting. The resurgence of *A. fockeui* registered there was probably due to the negative effects of synthetic phyrethroid on predator mites.

In Toscana (Italy), 20 mite species have been reported in peach trees, especially the phytophagous *A. fockeui*, *Orthotydeus kochi* (Oudemans, 1929), *Pronematus ubiquitus* (McGregor, 1923) and the predator *Amblyseius andersoni* (Chant, 1957), *A. stipulates* (Athias-Henriot, 1960) and *Agistemus collyerae* Gonzales-Rodrigues, 1963. Although *A. fockeui* occurred at high densities (200 mites/leaf), there were no signs of damage, probably due to the action of predators (Castagnoli & Nanelli, 1987). In India, Putatunda et al. (2000) reported the occurrence of 90 species of mites in various fruits, including peaches, with the dominance of Tenuipalpidae , Tetranychidae and Phytoseiidae.

Among the predators collected in our study, Cheyletidae and Phytoseiidae species were reported (Table 1). The highest species richness and numbers of individuals registered was from the Phytoseiidae family.

The population of predators, specially *E. citrifolius*, may explain the low population levels of phytophagous mites. On Regis cultivar, which had the lowest incidence (6.6%) among the four cultivars, the highest population of *I. zuluagai* (100%) and *E. concordis* (53.10%) was recovered (Table 3).

		% of mites on peach cultivars in relation to the total collected in					
Species	Total of mites	all four cultivars					
	collected (n°)	Jóia 4	Ouromel 3	Régis	Rei of conserva		
Phytophagous							
Aculus fockeui	2479	25.20%	4.80%	6.60%	63.40%		
Mononychelus planki	101	0.99%	31.70%	5.90%	61.40%		
Tetranychus urticae	35	34.30%	14.30%	17.10%	34.30%		
Brevipalpus phoenicis	16	25.00%	6.30%	68.80%	0.00%		
Oligonychus sp.	1	100.00%	0.00%	0.00%	0.00%		
Predators							
Iphyseiodes zuluagai	3	0.00%	0.00%	100.00%	0.00%		
Euseius citrifolius	317	19.90%	29.30%	26.80%	24.00%		
Euseius concordis	49	14.30%	20.40%	53.10%	12.20%		

Table 3. Percentage of major mites occurred on peach cultivars in relation to the total collected. Presidente Prudente, SP, Brazil. Dec/2002 to Feb/2006

(n) - number

In the area of the present study, earlier occupied by citrus orchards, Sato et al. (1994) identified six species of phytoseiid mites during 1990/1991 growing season, especially *I. zuluagai*, *E. citrifolius* and *E. concordis*. In the current study, *E. citrifolius*, *E. concordis* and *I. zuluagai* occurred with a frequency of 10.27%, 1.59% and 0.10% of the total mites collected. In Pelotas and Bento Gonçalves, RS, Cunha et al. (2010) found six Phytoseiidae and one Stigmaiidae species, with dominance of *Neoseiulus californicus* (McGregor, 1954) and *Euseius brazilii* (El-Benhawy, 1975). Ferla and Moraes (2000) recorded the occurrence of *Cunaxoides* sp., *E. alatus* DeLeon, 1966, *E. brazilii*, *E. citrifolius* and *E. concordis* on peach trees (RS).

In Italy, Castagnoli & Nannelli (1987), reported the predators *O. kochi* and *P. ubiquitus*, (Tydeidae), *A. andersoni* and *E. stipulatus* (Phytoseiidae) and *A. collyerae*. (Stigmaeidae) on peaches.

Table 4. Faunistic analysis of the main phytophagous and predator mites occurring on peach cultivars, Presidente Prudente, SP, Brazil. Dec/2002 to Feb/2006

Spacing	Jóia 4		Ouromel 3		Régis		Rei da conserva	
Species	Ν	Status	Ν	Status	Ν	Status	Ν	Status
Phytophagous								
Aculus fockeui	624	Ι	120	Ι	163	Ι	1572	С
Mononychellus planki	1	R	32	Ι	6	R	62	Ι
Tetranychus urticae	12	R	5	R	6	R	12	С
Brevipalpus phoenicis	4	R	1	R	11	Ι	•	
Predators								
Euseius citrifolius	63	С	93	С	85	С	76	Ι
Euseius concordis	7	R	10	Ι	26	Ι	6	R

N: total of individuals

Status of species (C): common; (I): intermediate; (R): rare

The highest species richness of phytophagous mites was observed in Jóia 4 cultivars (six species), followed by 'Ouromel 3', 'Rei da conserva' and 'Regis', with five species each. *B. phoenicis* showed a preference for 'Regis'

#### cultivar (Table 3).

*A. fockeui* was constant in Rei da conserva cultivar and intermediate in the remaining cultivars (Table 4), representing more than 80% of the total mites. The occurrence of *M. planki* (the most abundant species in the beginning of the study in December 2002) became intermediate for all cultivars along the study, while the occurrence of *T. urticae* was constant for Rei da conserva cultivar (Table 4).

In Portugal, Ferreira & Carmona (1997) recorded 27 mite species: seven phytophagous, eleven predators and nine designated as indifferent. The most representative phytophagous populations were *A. fockeui* (41.6%) and *Tetranychus cinnabarinus* (Boisduval, 1987) (20%), which in contrast with our study observations, it caused silvering of the foliage by the first species, and tanning, by the second species, respectively.

Studies about phytophagous and predator mites population on soil cover plants should be accomplished to clarify the role of other plant species as alternative hosts, as well as essays to determine pesticide with little effect on predator mites, in order to support the management of mites incidence on peach.

# 4. Conclusion

Eighteen mite species belonging to 12 families were detected on peach cultivars in Presidente Prudente, western Sao Paulo State, with the predominance of the phytophagous species *A. fockeui* and the predator *E. citrifolius*.

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