

Phytoseiid mites (Acari: Mesostigmata: Phytoseiidae) on wild and cultivated plants in Espírito Santo State, Brazil

Peterson Rodrigo Demite^{1,2,6}; Fernanda Atalane de Oliveira^{3,7}; Mylena da Silva Gomes^{3,8}; Gilberto José de Moraes^{4,9}; Anderson Mathias Holtz^{3,10} & Grazielle Furtado Moreira^{5,11}

¹ Universidade Federal de Mato Grosso, Instituto de Biociências, Centro de Biodiversidade, Programa de Pós-Graduação em Zoologia. Cuiabá, MT, Brasil.

² Instituto Federal de Educação, Ciência e Tecnologia de Roraima, Campus Bonfim. Bonfim, RR, Brasil (present address).

³ Instituto Federal de Educação, Ciência e Tecnologia do Espírito Santo, Campus Itapina. Colatina, ES, Brasil.

⁴ Universidade de São Paulo, Escola Superior de Agricultura "Luiz de Queiroz". Piracicaba, SP, Brasil.

⁵ FG Consultoria Agrícola. Bradowski, SP, Brasil.

⁶ ORCID: 0000-0001-6376-5463. E-mail: peterson_demite@yahoo.com.br (corresponding author)

⁷ ORCID: 0000-0001-8868-8863. E-mail: fer.agrora@gmail.com

⁸ ORCID: 0000-0002-7520-8979. E-mail: mylena.gomes21@gmail.com

⁹ ORCID: 0000-0002-5587-1781. E-mail: moraesg@usp.br

¹⁰ ORCID: 0000-0002-1374-1049. E-mail: anderson.holtz@ifes.edu.br

¹¹ ORCID: 0009-0003-1389-9641. E-mail: grabiologia@yahoo.com.br

Abstract. The Phytoseiidae family is considered the most important group of predatory mites, widely and effectively used in the biological control of pest mites and small insects, particularly thrips and whiteflies. This study aims to present the results of a survey of Phytoseiidae mites on wild and cultivated plants in the Espírito Santo State, Brazil. Twenty-four species across 11 genera from the three phytoseiid subfamilies were identified. The genus *Amblyseius* Berlese was the most diverse, comprising ten species, while *Iphiseiodes zuluagai* Denmark & Muma was the most common species, found on seven different plant species. Thirteen phytoseiid species and two genera (*Phytoseiulus* and *Transeius*) are reported here for the first time in this state.

Keywords. Atlantic Forest; Biodiversity; Predator; Survey.

INTRODUCTION

Phytoseiid mites are found worldwide, primarily on aerial parts of plants (Demite *et al.*, 2014; McMurtry *et al.*, 2015). Mites of this family are the most studied and successfully used predators in the biological control of pest mites and small insects, particularly thrips and whiteflies (McMurtry *et al.*, 2013). Phytoseiid mites can be mass-reared for commercial release due to their high reproductive rates and rapid development compared to their prey (Hoy, 2011). This family comprises about 3,000 described species, about 260 of which have been recorded in Brazil (Demite *et al.*, 2024; Lofego *et al.*, 2024).

The state of Espírito Santo covers approximately 46,000 km² in southeastern Brazil, bordered by the states of Bahia, Minas Gerais, and Rio de Janeiro (IBGE, 2021). This entire area was originally part of the Atlantic Forest (MMA, 2015), which, due to its high endemism and exceptional

loss of original habitat, is considered a biodiversity hotspot and a global conservation priority (Myers *et al.*, 2000).

To date, 25 species of phytoseiids have been recorded in Espírito Santo (El-Banhawy, 1984; Collier *et al.*, 2004; Fiaboe *et al.*, 2007; Barroso *et al.*, 2019; Carvalho *et al.*, 2019; Demite *et al.*, 2023, 2024; Lofego *et al.*, 2024). These studies involved collections across various regions of the state, focusing on both cultivated and wild plants. For instance, collections were made on cultivated plants such as papaya (Collier *et al.*, 2004), coconut, and other Arecaceae (Barroso *et al.*, 2019), as well as on various species of Solanaceae (Fiaboe *et al.*, 2007) and one species of Myrtaceae (Demite *et al.*, 2023). The first study conducted in the state, by El-Banhawy (1984), was carried out in the Sooretama Biological Reserve. Although this study did not report the host plants, except for a single plant (*Tipochena* sp.), it is likely that the plants were native, given the lo-

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cation. Despite the large number of locations surveyed, most species were reported on few hosts and in few locations. An exception is *Amblyseius compositus*, which was recorded on four species of Solanaceae across four different locations (Fiaboe *et al.*, 2007). The objective of this study was to conduct a survey of phytoseiid mites associated with wild and cultivated plants in Espírito Santo.

MATERIAL AND METHODS

Surveys were conducted from June 2017 to June 2018 in 11 localities in Espírito Santo (Fig. 1, Table 1). Sampled included leaves and branches from both native and cultivated plants, collected in both anthropic and natural environments. Plant material was collected using pruning shears and stored in paper bags, which were then placed inside plastic bags and kept in coolers with ice. In the laboratory, the material was examined under stereomicroscope (minimum magnification of 40×). Mites were mounted on microscope slides using Hoyer’s medium and dried in an oven at 56°C for 7 to 10 days. Morphological identification of specimens was performed using a phase contrast and differential interference contrast microscope (Leica DMR1000), based

Table 1. Localities in which samples were taken for evaluation of phytoseiids fauna in Espírito Santo State, Brazil.

Localities	Geographical Coordinates
Aracruz	19°58'15"S; 40°08'22"W
Colatina (Area 1)	19°32'18"S; 40°37'57"W
Colatina (Area 2)	19°29'48"S; 40°45'40"W
Domingos Martins	20°21'50"S; 40°39'35"W
Itaguaçu	19°48'07"S; 40°51'23"W
Marilândia	19°24'53"S; 40°32'09"W
Santa Maria do Jetibá	20°01'35"S; 40°44'27"W
Santa Teresa (Area 1)	19°48'18"S; 40°40'33"W
Santa Teresa (Area 2)	19°55'53"S; 40°35'43"W
Santa Teresa (Area 3)	19°54'20"S; 40°33'44"W
Venda Nova do Imigrante	20°20'06"S; 41°07'49"W

on identification keys (Chant & McMurtry, 1994, 2007; Lofego *et al.*, 2024), taxonomic reviews, and original species descriptions.

In the “Material Examined” section, the following details are provided: locality, host plant, collection date, and the number of recorded adult specimens (females and/or males). Voucher specimens of the collected species are deposited in the Mite Collection at the “Laboratório de Acarologia, UNESP – Universidade Estadual Paulista, São José do Rio Preto, São Paulo”.

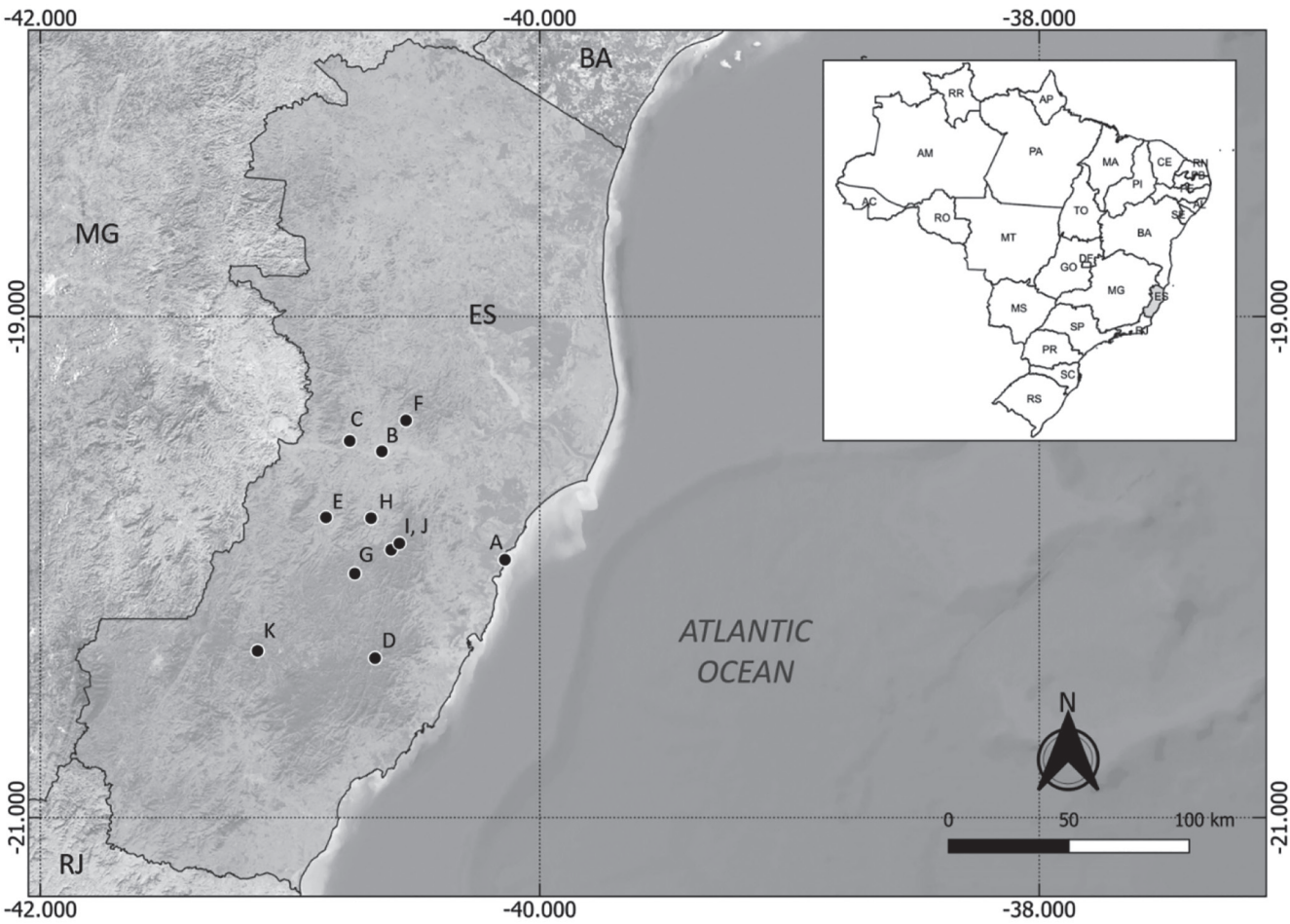


Figure 1. Sampling areas in Espírito Santo State, Brazil. Codes: (A) Aracruz; (B) Colatina (Area 1); (C) Colatina (Area 2); (D) Domingos Martins; (E) Itaguaçu; (F) Marilândia; (G) Santa Maria do Jetibá; (H) Santa Teresa (Area 1); (I) Santa Teresa (Area 2); (J) Santa Teresa (Area 3); (K) Venda Nova do Imigrante.

RESULTS AND DISCUSSION

Twenty-four species of eleven genera of the three phytoseiid subfamilies were registered, as cited subsequently.

Amblyseiinae

Amblyseius acalyphus Denmark & Muma, 1973

Amblyseius acalyphus Denmark & Muma, 1973: 243.

Material examined: Colatina (Area 1): *Citrus reticulata* Blanco cv. Clementina (Rutaceae), 20/XII/2017 (1 ♀); *Citrus sinensis* (L.) Osbeck (Rutaceae), 29/VI/2017 (1 ♀); *Musa x paradisiaca* L. (Musaceae), 26/VI/2017 (1 ♀); **Venda Nova do Imigrante:** *Syzygium jambos* (L.) Alston (Myrtaceae), 22/XII/2017 (1 ♀).

Remarks: This is the first record of this species in the state.

Amblyseius aerialis (Muma, 1955)

Amblyseiopsis aerialis Muma, 1955: 264.

Material examined: Colatina (Area 1): *C. sinensis*, 21/VI/2017 (1 ♀), 16/XI/2017 (1 ♀), *M. paradisiaca*, 29/VI/2017 (1 ♀); *Psidium guajava* L. (Myrtaceae), 08/XI/2017 (1 ♀), *Ricinus communis* L. (Euphorbiaceae), 26/VI/2017 (1 ♀); **Santa Tereza (Area 1):** *Plinia cauliflora* (Mart.) Kausel (Myrtaceae), 22/XII/2017 (1 ♀).

Remarks: This is the first record of this species in the state.

Amblyseius chiapensis De Leon, 1961

Amblyseius chiapensis De Leon, 1961: 85.

Material examined: Domingos Martins: *P. guajava*, 22/XII/2017 (3 ♀♀); *Wodyetia bifurcata* A.K. Irvine (Arecaceae), 22/XII/2017 (1 ♀); **Itaguaçu:** unidentified weed, 06/V/2018 (2 ♀♀).

Remarks: This species was previous reported in the state by Barroso et al. (2019).

Amblyseius compositus Denmark & Muma, 1973

Amblyseius compositus Denmark & Muma, 1973: 240.

Material examined: Santa Maria do Jetibá: unidentified wild plant 1, 22/XII/2017 (1 ♀).

Remarks: This species was previous reported in the state by Fiaboe et al. (2007).

Amblyseius euterpes Gondim Jr. & Moraes, 2001

Amblyseius euterpes Gondim Jr. & Moraes, 2001: 68.

Material examined: Aracruz: *Sapium glandulosum* (L.) Morong. (Euphorbiaceae), 24/IV/2018 (2 ♀♀).

Remarks: This is the first record of this species in the state.

Amblyseius herbicolus (Chant, 1959)

Typhlodromus (Amblyseius) herbicolus Chant, 1959: 84.

Material examined: Domingos Martins: *Roystonea oleracea* (Jacq.) O.F. Cook (Arecaceae), 22/XII/2017 (1 ♀); *W. bifurcata*, 22/XII/2017 (1 ♀); **Santa Teresa (Area 2):** unidentified native plant 2, 22/XII/2017 (4 ♀♀); **Santa Teresa (Area 3):** unidentified wild plant 3, 19/VI/2018 (2 ♀♀) and wild plant 4, 19/VI/2018 (2 ♀♀).

Remarks: This is the first record of this species in the state.

Amblyseius largoensis (Muma, 1955)

Amblyseiopsis largoensis Muma, 1955: 266.

Material examined: Colatina (Area 1): *Banisteriopsis caapi* (Spruce ex Griseb.) Morton (Malpighiaceae), 26/VI/2017 (1 ♀); *Manihot esculenta* Crantz (Euphorbiaceae), 22/VI/2017 (1 ♀); **Santa Tereza (Area 1):** *Mangifera indica* L. (Anacardiaceae), 22/XII/2017 (2 ♀♀).

Remarks: This species was previous recorded in the state by Barroso et al. (2019).

Amblyseius operculatus De Leon, 1967

Amblyseius operculatus De Leon, 1967: 26.

Material examined: Aracruz: *Pseudobombax grandiflorum* (Cav.) A. Robyns (Malvaceae), 24/IV/2018 (2 ♀♀); *Bactris vulgaris* Barb. Rodr. (Arecaceae), 24/VI/2018 (1 ♀); **Santa Teresa (Area 3):** unidentified wild plant 5, 19/VI/2018 (2 ♀♀).

Remarks: This is the first record of this species in the state.

Amblyseius riodocei El-Banhawy, 1984

Amblyseius riodocei El-Banhawy, 1984: 136.

Material examined: Aracruz: *Calyptanthus* sp. (Myrtaceae), 24/IV/2018 (1 ♀).

Remarks: This species was previously recorded in the state by El-Banhawy (1984) and Demite et al. (2023).

***Amblyseius tamatavensis* Blommers, 1974**

Amblyseius tamatavensis Blommers, 1974: 144.

Material examined: **Colatina (Area 1):** *Coffea arabica* L. (Rubiaceae), 20/VI/2017 (1 ♀); *M. paradisiaca*, 22/VI/2017 (1 ♀); **Itaguaçu:** *Crotalaria pumila* Ortega (Leguminosae), 06/V/2018 (1 ♀); **Santa Teresa (Area 3):** *Carica papaya* L. (Caricaceae), 19/VI/2018 (1 ♀).

Remarks: This species was previously reported in state by Collier et al. (2004) and Barroso et al. (2019).

***Euseius citrifolius* Denmark & Muma 1970**

Euseius citrifolius Denmark & Muma, 1970: 222.

Material examined: **Santa Teresa (Area 2):** unidentified wild plant 4, 19/VI/2018 (2 ♀♀).

Remarks: This is the first record of this species in the state.

***Euseius concordis* (Chant, 1959)**

Typhlodromus (Amblyseius) concordis Chant, 1959: 69.

Material examined: **Colatina (Area 1):** *R. communis*, 23/VI/2017 (1 ♀), 17/XI/2017 (1 ♀); *Zea mays* L. (Poaceae), 15/XI/2017 (1 ♀); **Domingos Martins:** *P. guajava*, 22/XII/2017 (1 ♀), *W. bifurcata*, 22/XII/2017 (1 ♀); **Itaguaçu:** *C. pumila*, 06/V/2018 (3 ♀♀); unidentified weed, 06/V/2018 (3 ♀♀); **Santa Tereza (Area 3):** *C. papaya*, 19/VI/2018 (2 ♀♀).

Remarks: This species was previously recorded in the Espírito Santo by Barroso et al. (2019).

***Iphiseiodes matatlanticae* Mineiro, Castro & Moraes, 2011**

Iphiseiodes matatlanticae Mineiro et al., 2011: 31.

Material examined: **Santa Tereza (Area 3):** unidentified wild plant 5, 19/VI/2018 (1 ♀).

Remarks: This is the first record of this species in the state.

***Iphiseiodes zuluagai* Denmark & Muma, 1972**

Iphiseiodes zuluagai Denmark & Muma, 1972: 23.

Material examined: **Colatina (Area 1):** *B. caapi*, 26/VI/2017 (1 ♀); *C. sinensis*, 20/VI/2017 (1 ♀); 21/VI/2017 (1 ♀), 26/VI/2017 (1 ♀), 28/VI/2017 (2 ♀♀), 16/XI/2017 (1 ♂), 17/XI/2017 (1 ♀), 28/XI/2017 (1 ♀); *Coffea canephora* Pierre ex A. Froehner, 06/VI/2017 (1 ♀), 17/XI/2017 (1 ♀); *Litchi chinensis* Sonn. (Sapindaceae), 28/VI/2017 (1 ♂); *R. communis*, 23/VI/2017 (2 ♀♀);

Colatina (Area 2): *C. canephora*, 20/VI/2017 (1 ♀), 14/XI/2017 (1 ♀), 20/XI/2017 (1 ♀); **Domingos Martins:** *Prunus persica* (L.) Batsch (Rosaceae), 22/XII/2017 (1 ♀); *P. guajava*, 22/XII/2017 (1 ♀ and 1 ♂); **Marilândia:** *C. canephora*, 07/XI/2017 (2 ♀♀).

Remarks: This is the first record of this species in the state.

***Neoseiulus idaeus* Denmark & Muma, 1973**

Neoseiulus idaeus Denmark & Muma, 1973: 266.

Material examined: **Colatina (Area 1):** *C. papaya*, 21/VI/2017 (1 ♀); *R. communis*, 21/VI/2017 (1 ♀); **Colatina (Area 2):** *M. esculenta*, 19/XII/2017 (1 ♀).

Remarks: This species was previously recorded in the state by Collier et al. (2004).

***Neoseiulus transversus* Denmark & Muma, 1973**

Neoseiulus transversus Denmark & Muma, 1973: 267.

Material examined: **Colatina (Area 2):** *C. sinensis*, 08/XI/2017 (1 ♀).

Remarks: This is the first record of this species in the state.

***Phytoseiulus macropilis* (Banks, 1904)**

Laelaps macropilis Banks, 1904: 59.

Material examined: **Colatina (Area 1):** *C. sinensis*, 16/VI/2017 (1 ♀); **Colatina (Area 2):** *R. communis*, 22/VI/2017 (1 ♀); **Santa Tereza (Area 3):** unidentified native plant 6, 16/VI/2018 (1 ♀).

Remarks: This is the first record of this species in the state.

***Proprioseiopsis ovatus* (Garman, 1958)**

Amblyseiopsis ovatus Garman, 1958: 78.

Material examined: **Colatina (Area 2):** *P. guajava*, 01/VI/2017 (1 ♀); **Itaguaçu:** unidentified weed, 06/V/2018 (1 ♀).

Remarks: This is the first record of this species in the state.

***Transeius bellottii* (Moraes & Mesa, 1988)**

Amblyseius bellottii Moraes & Mesa, 1988: 75.

Material examined: **Itaguaçu:** unidentified weed, 06/V/2018 (3 ♀♀).

Remarks: This is the first record of this species in the state.

***Typhlodromalus aripo* De Leon, 1967**

Typhlodromalus aripo De Leon, 1967: 21.

Material examined: Colatina (Area 2): *Capsicum frutescens*, 20/XII/2017 (1 ♀); **Itaguaçu:** unidentified weed, 06/V/2018 (2 ♀♀).

Remarks: This species was previously recorded in the state by Collier et al. (2004).

***Typhlodromips constrictatus* El-Banhawy, 1984**

Typhlodromips constrictatus El-Banhawy, 1984: 134.

Material examined: Aracruz: *Palicourea* sp. (Rubiaceae), 24/IV/2018 (2 ♀♀).

Remarks: This species was previously recorded in the Espírito Santo by El-Banhawy et al. (1984).

Phytoseiinae***Phytoseius guianensis* De Leon, 1965**

Phytoseius (*Pennaseius*) *guianensis* De Leon 1965: 18.

Material examined: Itaguaçu: unidentified weed, 06/V/2018 (1 ♀ and 1 ♂).

Remarks: This species was previously recorded in the state by Fiaboe et al. (2007).

***Phytoseius intermedius*
Evans & MacFarlane, 1962**

Phytoseius (*Dubininellus*) *intermedius* Evans & MacFarlane, 1962: 588.

Material examined: Colatina (Area 1): *L. chinensis*, 16/XI/2017 (1 ♀); Colatina (Area 2): *C. sinensis*, 14/XI/2017 (1 ♀), *L. chinensis*, 02/X/2017 (1 ♀); Santa Tereza (Area 2): *L. chinensis*, 31/VI/2017 (1 ♀).

Remarks: This is the first record of this species in the state.

Typhlodrominae***Leonseius elbanhawyi*
Carvalho, Ferragut & Oliveira, 2019**

Leonseius elbanhawyi Carvalho et al., 2019: 2126.

Material examined: Santa Tereza (Area 2): unidentified wild plant 7, 19/VI/2018 (1 ♀).

Remarks: This species was recorded in the Espírito Santo State by Carvalho et al. (2019) of material previously identified as *Leonseius regularis* (De Leon, 1965) in El-Banhawy (1984).

Some species such as *A. euterpes*, *A. riodocei*, *I. matatlanticae* and *L. elbanhawyi* were previously reported only in areas of the Atlantic Forest biome: *A. euterpes* was previously reported in the states of Pernambuco and São Paulo (Gondim Jr. & Moraes, 2001; Castro & Moraes, 2010; Moraes et al., 2013); *I. matatlanticae* was previously reported in the states of São Paulo and Minas Gerais (Mineiro et al., 2011; Baldo et al., 2018; Barbosa et al., 2021); *L. elbanhawyi* was reported in the states of Bahia and Espírito Santo (Carvalho et al., 2019) and *A. riodocei* reported only for Espírito Santo (original description: El-Banhawy, 1984; Demite et al., 2023).

Iphiseiodes zuluagai Denmark & Muma was the most common species, collected on seven plant species. Thirteen phytoseiid species and two genera (*Phytoseiulus* Evans and *Transeius* Chant & McMurtry) are reported for the first time in Espírito Santo. Considering the results of this and previous studies, *Amblyseius* has been the most diverse genus in the state (with a total of ten species), followed by *Phytoseius* (four), as well as *Euseius*, *Neoseiulus* and *Proprioseiopsis* (three species each).

Twenty-five phytoseiid species were previously known from Espírito Santo (El-Banhawy, 1984; Collier et al., 2004; Fiaboe et al., 2007; Barroso et al., 2019; Lofego et al., 2024). With this study, thirteen additional species are reported. However, given the luxuriant vegetation, it is expected that these numbers are considerably lower than the actual number of species in the state.

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