Papéis Avulsos de Zoologia
Museu de Zoologia da Universidade de São Paulo

ARTICLE

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.agroro@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 km^2 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-

Pap. Avulsos Zool., 2025; v.65: e202565016
https://doi.org/10.11606/1807-0205/2025.65.016
https://www.revistas.usp.br/paz
https://www.scielo.br/paz
Edited by: Carlos José Einicker Lamas
Received: 27/10/2024
Accepted: 27/02/2025
Published: 24/03/2025

ISSN On-Line: 1807-0205
ISSN Printed: 0031-1049
ISNI: 0000-0004-0384-1825

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

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

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".

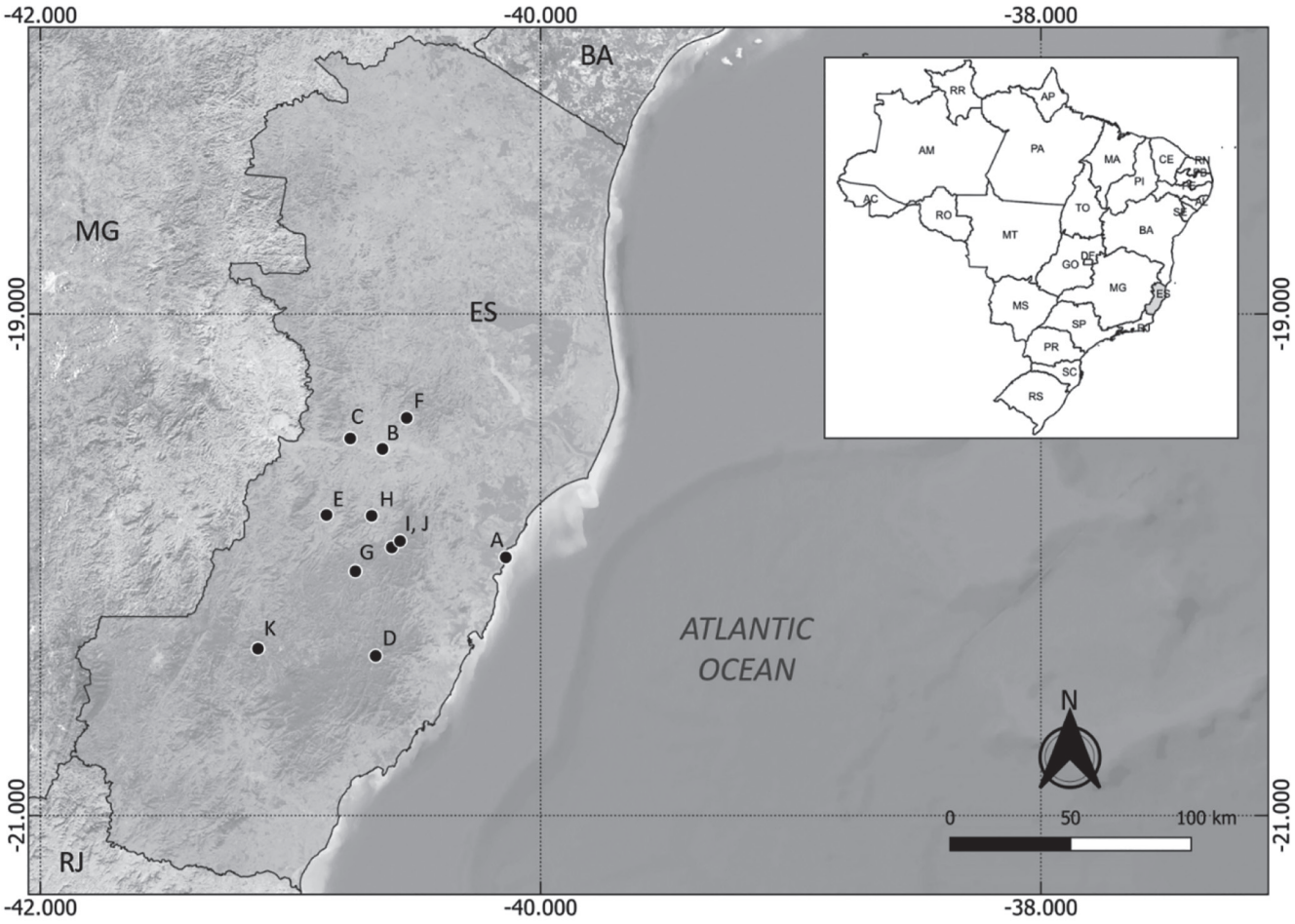

Figure 1. Sampling areas in Espírito Santo State, Brazil. Codes: (A) Aracruz; (B) Colatina (Area 1); (C) Colatina (Area 2); (D) Domingos Martins; (E) Itaguaçu; (F) Marilândia; (G) Santa Maria do Jetibá; (H) Santa Teresa (Area 1); (I) Santa Teresa (Area 2); (J) Santa Teresa (Area 3); (K) Venda Nova do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

AUTHORS' CONTRIBUTIONS: FAO, MSG, AMH and GFM: Field sampling and initial identification of the mites; AMH and GFM: Project design; PRD and GJM: Mite identification and manuscript writing; All authors: Review of the final version of the manuscript.
CONFLICT OF INTEREST: The authors declare no potential conflict of interest.
FUNDING INFORMATION: PRD received a schorlarship (PNPD) from the "Coordenação de Aperfeiçoamento de Pessoal de Nível Superior" (CAPES) (process 88882.314486/2013-0).
ACKNOWLEDGMENTS: To Antonio C. Lofego (UNESP, S.J. do Rio Preto, São Paulo) by making available a phase contrast microscope for the conduction of this study. To Felipe S.R. Amaral (UNESP S.J. do Rio Preto) for preparing the map of the sampling localities of this study. We thank the Federal Institute of Espírito Santo (Instituto Federal do Espírito Santo – IFES), Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES), Foundation for Research and Innovation Support of Espírito Santo (Fundação de Amparo à Pesquisa e Inovação do Espírito Santo – FAPES) and the National Council of Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq) for all support.

REFERENCES

Baldo, F.B.; Mineiro, J.L. de C. & Raga, A. 2018. Diversity and population dynamics of mites in peach and plum trees (Rosaceae) in the Southwest

State of São Paulo, Brazil. *International Journal of Acarology,* 44(2-3): 129-137. https://doi.org/10.1080/01647954.2018.1436589

Banks, N. 1904. A treatise on the Acarina or mites. *Proceedings U.S. National Museum,* 28(1382): 1-114. https://doi.org/10.5479/si.00963801.28-1382.1

Barbosa, M.F.C.; Demite, P.R.; Lofego, A.C.; Vasconcelos, G.N. de & Moraes, G.J. de. 2021. Further records of phytoseiid (Acari: Mesostigmata: Phytoseiidae) species for Brazil. *Entomological Communications,* 3: 1-4, ec03048. https://doi.org/10.37486/2675-1305.ec03048

Barroso, G.; Rocha, C.M. da; Moreira, G.F.; Hata, F.T.; Roggia, S.; Ventura, M.U.; Pasini, A.; Silva, J.E.P. da; Holtz, A.M. & Moraes, G.J. de. 2019. What is the southern limit of the distribution of red palm mite, *Raoiella indica* (Acari: Tenuipalpidae), in agricultural lands in Brazil? *Florida Entomologist,* 102(3): 581-585. https://doi.org/10.1653/024.102.0334

Blommers, L. 1974. Species of the genus *Amblyseius* Berlese, 1914, from Tamatave, east Madagascar (Acarina: Phytoseiidae). *Bulletin Zoologisch Museum Universiteit van Amsterdam,* 3(19): 143-155.

Carvalho, A.N. de; Argolo, P.S.; Ferragut, F.; Moraes, G.J. de; Beaulieu, F.; Navia, D. & Oliveira, A.R. 2019. New morphological data for *Leonseius regularis* (De Leon) (Acari: Phytoseiidae) and a description of a new species of the genus from Brazil. *Systematic and Applied Acarology,* 24(11): 2119-2132. https://doi.org/10.11158/saa.24.11.7

Castro, T.M.M.G. de & Moraes, G.J. de. 2010. Diversity of phytoseiid mites (Acari: Mesostigmata: Phytoseiidae) in the Atlantic Forest of São Paulo. *Systematics and Biodiversity,* 8(2): 301-307. https://doi.org/10.1080/14772001003801375

Chant, D.A. 1959. Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of thirty-eight new species. *The Canadian Entomologist,* 61(12): 1-166. https://doi.org/10.4039/entm9112fv

Chant, D.A. & McMurtry, J.A. 1994. A review of the subfamilies Phytoseiinae and Typhlodrominae (Acari: Phytoseiidae). *International Journal of Acarology,* 20(4): 223-310. https://doi.org/10.1080/01647959408684022

Chant, D.A. & McMurtry, J.A. 2007. *Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata).* West Bloomfield, Indira Publishing House.

Collier, K.F.S.; De Lima, J.O.G. & Albuquerque, G.S. 2004. Predacious mites in papaya (*Carica papaya* L.) orchards: in search of a biological control agent of phytophagous mite pests. *Neotropical Entomology,* 33(6): 799-803. https://doi.org/10.1590/S1519-566X2004000600020

De Leon, D. 1961. Eight new *Amblyseius* from Mexico with collection notes on two other species (Acarina: Phytoseiidae). *Florida Entomologist,* 44(2): 85-91. https://doi.org/10.2307/3492318

De Leon, D. 1965. Ten new species of *Phytoseius (Pennaseius)* from Mexico, Trinidad, and British Guiana with a key to species (Acarina: Phytoseiidae). *Entomological News,* 76(1): 11-21.

De Leon, D. 1967. *Some mites of the Caribbean Area. Part I. Acarina on plants in Trinidad, West Indies.* Lawrence, Allen Press Inc.

Demite, P.R.; McMurtry, J.A.; Moraes, G.J. de. 2014. Phytoseiidae Database: a website for taxonomic and distributional information on phytoseiid mites (Acari). *Zootaxa,* 3795(5): 571-577. https://doi.org/10.11646/zootaxa.3795.5.6

Demite, P.R.; Moraes, G J. de; McMurtry, J.A.; Denmark, H.A. & Castilho, R. de C. 2024. Phytoseiidae Database. Available: http://www.lea.esalq.usp.br/phytoseiidae. Access: 29/08/2024.

Demite, P.R.; Santos, J.C. & Holtz, A.M. 2023. Rediscovery and complementary description of *Amblyseius riodocei* El-Banhawy, 1984 (Acari: Phytoseiidae). *Entomological Communications,* 5: 1-4, ec05007. https://doi.org/10.37486/2675-1305.ec05007

Denmark, H.A. & Muma, M.H. 1970. Some phytoseiid mites of Paraguay (Phytoseiidae: Acarina). *Florida Entomologist,* 53(4): 219-227. https://doi.org/10.2307/3493192

Denmark, H.A. & Muma, M.H. 1972. Some Phytoseiidae of Colombia (Acarina: Phytoseiidae). *Florida Entomologist,* 55(1): 19-29. https://doi.org/10.2307/3493637

Denmark, H.A. & Muma, M.H. 1973. Phytoseiid mites of Brazil (Acarina: Phytoseiidae). *Revista Brasileira de Biologia,* 33(2): 235-276.

El-Banhawy, E.M. 1984. Description of some phytoseiid mites from Brazil (Acarina: Phytoseiidae). *Acarologia,* 25(2): 125-144.

Evans, G.O. & Macfarlane, D. 1962. A new mites of the genus *Phytoseius* Ribaga (Acari: Mesostigmata). *Annals and Magazine of Natural History, Serie 13,* 4(46): 587-588. https://doi.org/10.1080/00222936108651183

Fiaboe, K.K.M.; Gondim Jr., M.G.C.; Moraes, G.J. de; Ogol, C.K.P.O. & Knapp, M. 2007. Surveys for natural enemies of the tomato red spider mite *Tetranychus evansi* (Acari: Tetranychidae) in northeastern and southeastern Brazil. *Zootaxa,* 1395: 33-58. https://doi.org/10.11646/zootaxa.1395.1.2

Garman, P. 1958. New species belonging to the genera *Amblyseius* and *Amblyseiopsis* with keys to *Amblyseius, Amblyseiopsis,* and *Phytoseiulus. Annals of the Entomological Society of America,* 51: 69-79. https://doi.org/10.1093/aesa/51.1.69

Gondim Jr., M.G.C. & Moraes, G.J. de. 2001. Phytoseiid mites (Acari: Phytoseiidae) associated with palm trees (Arecaceae) in Brazil. *Systematic and Applied Acarology,* 6: 65-94. https://doi.org/10.11158/saa.6.1.11

Hoy, M.A. 2011. *Agricultural Acarology. Introduction to Integrated Mite Management.* Boca Raton, CRC Press.

Instituto Brasileiro de Geografia e Estatística (IBGE). 2021. *Mapa político do Brasil, escala 1:2.500.000.* Available: https://geoftp.ibge.gov.br/cartas_e_mapas/mapas_do_brasil/politico/brasil_politico2500k_2021/brasil_politico2500k_2021.pdf. Access: 29.i.2023.

Lofego, A.C.; Barbosa, M.F. de C.; Demite, P.R. & Moraes, G.J. de. 2024. Phytoseiidae (Acari: Mesostigmata) of the subfamily Amblyseiinae from Brazil. *Zootaxa,* 5439(1): 001-306. https://doi.org/10.11646/zootaxa.5439.1.1

McMurtry, J.A.; Famah Sourassou, N. & Demite, P.R. 2015. The Phytoseiidae (Acari: Mesostigmata) as biological control agents. *In:* Carrilo, D.; Moraes, G.J. de & Peña, J.E. (Eds.). *Prospects for Biological Control of Plant Feeding Mites and other Harmful Organisms,* pp. 133-149. Cham, Springer. https://doi.org/10.1007/978-3-319-15042-0_5

McMurtry, J.A.; Moraes, G.J. de & Famah Sourassou, N. 2013. Revision of the lifestyles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. *Systematics & Applied Acarology,* 18(4): 297-320. https://doi.org/10.11158/saa.18.4.1

Mineiro, J.L. de C.; Castro, T.M.M.G. de & Moraes, G.J. de. 2011. Description of a new species and complementary description of a known species of *Iphiseiodes* De Leon (Acari: Phytoseiidae). *Zootaxa,* 2876: 30-34. https://doi.org/10.11646/zootaxa.2876.1.3

Ministério do Meio Ambiente (MMA). 2015. *Mapa de vegetação nativa na área de aplicação da Lei Nº 11.428/2006 – Lei da Mata Atlântica (ano base 2009).* Brasília, FUNCATE.

Moraes, G.J. de & Mesa, N.C. 1988. Mites of the family Phytoseiidae (Acari) in Colombia, with descriptions of three new species. *International Journal of Acarology,* 14(2): 71-88. https://doi.org/10.1080/01647958808683790

Moraes, G.J. de; Barbosa, M.F.C. & Castro, T.M.M.G. de. 2013. Phytoseiidae (Acari: Mesostigmata) from natural ecosystems in the State of São Paulo, Brazil. *Zootaxa,* 3700(3): 301-347. https://doi.org/10.11646/zootaxa.3700.3.1

Muma, M.H. 1955. Phytoseiidae (Acarina) associated with citrus in Florida. *Annals of the Entomological Society of America,* 48(4): 262-272.

Myers, N.; Mittermeier, R.A.; Mittermeier, C.G.; Da Fonseca, G.A. & Kent, J. 2000. Biodiversity hotspots for conservation priorities. *Nature,* 403 (6772): 853-858. https://doi.org/10.1038/35002501

Published with the financial support of the "Programa de Apoio às Publicações Científicas Periódicas da Universidade de São Paulo"