Faunistic Analysis of Soil Mites in Coffee Plantation

Patrícia de Pádua Marafeli[1], Paulo Rebelles Reis[2], Leopoldo Ferreira de Oliveira Bernardi[3], Pablo Antonio Martinez[4]

[1]Universidade Federal de Lavras - UFLA, Lavras, MG, Brazil. Entomology Postgraduate Program.
[2]Empresa de Pesquisa Agropecuária de Minas Gerais - EPAMIG Sul/EcoCentro, Lavras, MG, Brazil.
CNPq Researcher.
[3]Universidade Federal de Lavras - UFLA - Departamento de Biologia/DBI – Setor de Ecologia Aplicada, Lavras, MG. Brazil.
CAPES / PNPD scholarship holder.
[4]Universidad Nacional de La Plata, La Plata, Argentina.

***Abstract* —** *The soil-litter system is the natural habitat for a wide variety of organisms, microorganisms and invertebrates, with differences in size and metabolism, which are responsible for numerous functions. The soil mesofauna is composed of animals of body diameter between 100 μm and 2 mm, consisting of the groups Araneida, Acari, Collembola, Hymenoptera, Diptera, Protura, Diplura, Symphyla, Enchytraeidae (Oligochaeta), Isoptera, Chilopoda, Diplopoda and Mollusca. These animals, extremely dependent on humidity, move in the pores of the soil and at the interface between the litter and the soil. The edaphic fauna, besides having a great functional diversity, presents a rich diversity of species. As a result, these organisms affect the physical, chemical and, consequently, the biological factors of the soil. Therefore, the edaphic fauna and its activities are of extreme importance so that the soil is fertile and can vigorously support the vegetation found there, being spontaneous or cultivated. The composition, distribution and density of the edaphic acarofauna varies according to the soil depth, mites size, location and the season of the year. Edaphic mites are generally found in greater quantities in the organic matter layer than in the soil mineral. The subclass Acari is divided in seven orders being the Mesostigmata, Trombidiformes, Endeostigmata and Sarcoptiformes those that frequently occur in the soil. In the order Sarcoptiformes the suborder Oribatida (formerly Cryptostigmata) is one of the more numerous groups of soil arthropods, both in number of species and specimens. Considering the above facts, it was the objective of this work to know the acarofauna of the soil in a coffee plantation and rank the taxa in a decreasing way, by the use of faunistic analysis. The soil samples were taken in coffee plantation in the Experimental Station of EPAMIG, in São Sebastião do Paraíso, MG, Brazil, in two periods, end of dry and end of rainy season of the year 2013, and the extraction of edaphic mites of the soil mesofauna was done at the Laboratory of Acarology of EPAMIG Sul/EcoCentro, in Lavras, as well as other activities related to the study. The result show that edaphic mites of the cohort Astigmatina and suborder Oribatid are dominant in both periods studied, and can be worked to be an indicative of soil quality.*

Keywords* — *Agricultural acarology, Coffea arabica, Edaphic mites, Soil mites, Soil mesofauna.

I. INTRODUCTION

The edaphic fauna reflects the environmental conditions, and are the characteristics of habitat such as climate, soil type, amount of accumulated litter, amount of organic matter, type of soil management, among others, which determine the groups of the soil fauna that will be present and in what quantities [1].

The global knowledge of the richness of groups of soil organisms provides an indication of the ecological complexity of soil communities [2] [3].

The soil-litter system is the natural habitat for a wide variety of organisms, microorganisms and invertebrates, with differences in size and metabolism, which are responsible for numerous functions. The diversity of soil fauna is related to the great variety of resources and microhabitats that the soil-litter system offers, a mixture of highly compartmentalized aquatic and aerial phases, generating a mosaic of microclimatic conditions and thus favoring, therefore, a large number of associated functional groups [4] [5].

Soil biota can be classified as: (1) **Microfauna -** composed of protozoa, nematodes and rotifers, whose diameter varies from 4 to 100 μm, which act indirectly in the nutrient cycle, regulating bacterial and fungal populations; (2) **Mesofauna -** which is composed of animals of body diameter between 100 μm and 2 mm, consisting of the groups Araneida, Acari, Collembola,

Hymenoptera, Diptera, Protura, Diplura, Symphyla, Oligochaeta, Isoptera, Chilopoda, Diplopoda and Mollusca, and can be included small specimens from the Coleoptera order. These animals, extremely dependent on humidity, move in the pores of the soil and at the interface between the litter and the soil. Among the trophic levels of this group, it stands out its significant contribution in the regulation of the microbial population; (3) **Macrofauna -** composed of animals that present body diameter between 2 and 20 mm and can belong to almost all orders found also in the mesofauna, except Acari, Collembola, Protura and Diplura and including Annelida and Coleoptera. They are animals of great mobility and that play an important role in the transportation of materials, both for making nests and burrows, and for building galleries that reach varying depths in the soil. Its main functions are the fragmentation of the vegetal residue and its redistribution, the predation of other invertebrates and the direct contribution in the structuring of the soil [6] [7].

Because they are sensitive and react to changes induced by natural phenomena to the soil and their vegetal cover, as well as by anthropic activities, the populations and the diversity of the edaphic fauna can be used as bioindicators of the use of the soil or its fertility, giving a notion of its current state and changes induced by internal and external forces (biotic and abiotic) over time. Such disturbances alter the distribution of soil fauna as they alter the availability of food resources, modifying the intra and interspecific ecological interactions. As changes in the environment, is cited for example, epigeous species, i.e., those that are restricted to inhabit the topsoil, which are normally associated with the layer of litter, and therefore disappear with deforestation or larger soil disturbances such as the use of plow and chemical products [8].

The edaphic fauna, besides having a great functional diversity, presents a rich diversity of species. As a result, these organisms affect the physical, chemical and, consequently, the biological factors of the soil. Therefore, the edaphic fauna and its activities are of extreme importance so that the soil is fertile and can vigorously support the vegetation found there, being spontaneous or cultivated [9].

The edaphic mesofauna study has been directed to the evaluation of the influence of agricultural practices on its taxonomic units as a whole, particularly to numerically more representative groups such as mites and springtails [10].

The study of these organisms initially consists of their capture, identification and quantification of the components of the community in question. The literature found research that use different methods, adopted at the discretion of the researchers, taking into account mainly the study objectives and the practical procedures. The most commonly used method is the extraction of soil samples and subsequent removal of the organisms by use of collection funnel [11].

One of the used types of biological indicator of soil quality is the population monitoring of the edaphic mesofauna. Therefore, the determination of the mesofauna is a biological indicator of the quality of the organic residues in order to contribute to the evaluation of a soil management system [12].

Mites are members of the Arthropoda phylum, which comprise a vast array of terrestrial and marine invertebrates that share the features of jointed legs and a chitinous exoskeleton. The mites belong to the large and diversified subphylum Chelicerata, where the largest group is of the Arachnida class. The arachnids are terrestrial chelicerates, including the Acari subclass, which includes mites and ticks, and which differs from the other arachnids by the absence of apparent segmentation [13].

The mites have as much diversity of food and way of feeding as of localities where they live. Regarding food habits, the variation occurs even within each family, ranging from parasitic species of vertebrates and invertebrates to phytophagous and predatory species [13].

The composition, distribution and density of the edaphic acarofauna varies according to the soil depth, mites size, location and the season of the year [14 [15]. Edaphic mites are generally found in greater quantities in the organic matter layer than in the soil mineral fraction [16].

The subclass Acari is divided in seven orders being the Mesostigmata, Trombidiformes, Endeostigmata and Sarcoptiformes those that frequently occur in the soil. In the order Sarcoptiformes the suborder Oribatida (formerly Cryptostigmata) is one of the more numerous groups of soil arthropods, both in number of species and specimens [17] [18] [13].

Considering the aforementioned facts, it was the objective of this work to know the acarofauna of the soil in a coffee and forest plantation, as well as to classify by the use of faunistic analysis, in a decreasing way of occurrence, the found taxa.

II. MATERIAL AND METHODS

2.1 Study site

The study was accomplished at the Experimental Station of the *Empresa de Pesquisa Agropecuária de Minas Gerais - EPAMIG Sul*, in the municipality of *São Sebastião do Paraíso*, MG, Brazil, in an already existing coffee plantation (*Coffea arabica* L.) cultivar Paraíso with six years' age, in the Dystroferric Red Latosol (Oxisol) soil type, in the spacing of 4.0 m between the lines and 0.70 m between the plants, and in a neighboring forest in the same soil type.

2.2 Experimental design

The experimental design was in randomized block with eight treatments, being seven in the coffee plantation and the eighth treatment in the forest, with three replications. The forest was an area located very close to the coffee plantation, with the same type of soil, and constituted of a subperenifolia tropical native forest, having been used as a reference treatment of the type of soil before the agricultural exploitation of the farm.

The samplings were made in 48 experimental plots, 42 in plots of coffee plantation and 6 in the forest, in each sampling period that corresponded to the end of dry season and end of rainy season in the region of the study.

The coffee experimental plots consisted of four lines, 50 plants/line, and the useful part of the plot being composed of the two central lines totaling 80 plants,40 plants/line, and the remaining other lines served as border.

2.3 Soil sampling

Two soil samplings, one at the end of the rainy season (June) and the other at the end of the dry season of the year in the study region (October of 2013), were used to quantify the edaphic mites in the soil mesofauna.

The soil samples were extracted by means of a cylindrical probe made of stainless steel with 50 mm internal diameter and 53 mm high (100 cm^3), known as a cylinder for collecting not deformed soil samples (*BRAVIFER - Indústria de Equipamentos e Assessoria Agronômica Ltda. ME).*

At each sampling time, two soil samples were extracted, one at 5 m from the beginning and the other at 5 m from the end of each plot and every time in the central position between the lines of coffee plants. In the forest, the samples were taken also at each sampling time and with the same cylindrical probe, 50 m from the border.

2.4 Extraction and identification of edaphic mites

The edaphic mites' extractions of the soil samples were performed by means of Berlese-Tüllgren funnel extractor [19] [11]. In the funnel, the samples were subjected to light and heat for seven days [20] to create a temperature and humidity gradient, making the environment unfavorable for the organisms present, forcing them down until they fall into a collector vial containing 70% alcohol.

After being extracted, the mites were counted and removed from the alcohol of the collector vial with the use of a fine paint-brush and with the assistance of a binocular stereomicroscope at 40x magnification, and after were mounted on a microscopy glass slide in Hoyer's medium and after being covered with a glass coverslip were identified with the use of a phase-contrast binocular microscope.

The mites' extraction from soil samples and their taxonomic identification were conducted in the Laboratory of Agricultural Acarology of EPAMIG Sul/Research Center in Ecological Management of Pests and Plant Diseases - EcoCenter, in the city of Lavras, Minas Gerais, Brazil.

The proposal presented by Lindquist, Krantz and Walter was used [13], with the elevation of suborder Endeostigmata to order, as suggested by Pepato and Klimov [21]. In addition, in order to better visualize the results, the order Sarcoptiformes was split in two groups, with the cohort Astigmatina [22] presented separately from the other species that belong to the suborder Oribatida.

2.5 Faunistic analysis

The obtained data were analyzed using the ANAFAU software, developed in the Department of Entomology, Phytopathology e. Agricultural Zoology of the Luiz de Quiroz College of Agriculture/University of São Paulo, Brazil, recommended for great

diversity of species [23] which allows to know the indexes of frequency, abundance, constancy and dominance of each taxon found [24].

III. RESULTS AND DISCUSSION

3.1 Soil samples from the end of rainy season

In the faunal analysis performed with soil mites collected at the end of the rainy season of 2013, the families Nanorchestidae (*Spelenorchestes* sp.), Alycidae (*Bimichaelia* sp.), Eupodidae (*Eupodes* sp.1, sp.2), Rhodacaridae (*Multidentorhodacarus* sp.), Tarsonemidae (*Tarsonemus* sp.), mites of the suborder Oribatida and hypopus phase (cohort Astigmatina, Family Acaridae, genus *Ryzopglyphus* sp.) [22] (OCONNOR, 2009) were the ones that presented species or morphospecies considered to be dominants (D), since they presented the maximum rates of faunistic classification, very abundant (ma), very frequent (MF) and constant (W) during the period in which the study was performed (Table 1).

The suborder Oribatida was the one that presented the largest number of species, 20 species and morphospecies in four families in the period. Of these, among others, the families Brachichthoniidae, Licnodamaeidae and the species *Galumna flabellifera*, *Berlezetes brasilizetoides*, *Sherolibates* sp., *Arcoppia* aff. *dechambrierorum* and *Suctobelbella* sp. presented as dominant (D), very abundant (ma), very frequent (MF) and constant (W) in the end of rainy period (Table 1). In most soils, oribatid mites are numerically dominat and the most diverse among microarthropods, especially among soil invertebrates [25].

TABLE 1
FAUNISTIC ANALYSIS FOR TAXA OF EDAPHIC MITES COLLECTED BETWEEN THE LINES OF THE COFFEE PLANTATION AND FOREST AT THE END OF THE RAINY SEASON OF 2013. SÃO SEBASTIÃO DO PARAÍSO, MG.

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Galumna flabellifera (Oribatida, Galumnidae)	138	4	D	ma	MF	W
Rizoglyphus sp. (Astigmatina, Acaridae) (Hypopus)	134	6	D	ma	MF	W
Scheloribates sp. (Oribatida, Scheloribatidae)	115	4	D	ma	MF	W
Oribatida, Licnodamaeidae	105	3	D	ma	MF	Y
Suctobelbella sp. (Oribatida, Suctobelbidae)	96	7	D	ma	MF	W
Eupodes sp.1 (Prostigmata, Eupodidae)	95	7	D	ma	MF	W
Arcoppia aff. dechambrierorum (Oribatida, Oppiidae)	81	5	D	ma	MF	W
Spelenorchestes sp. (Endeostigmata: Nanorchestidae)	78	5	D	ma	MF	W
Multidentorhodacarus sp.1 (Mesostigmata, Rhodacaridae)	67	6	D	ma	F	W
Oribatida, Brachichthoniidae	54	6	D	ma	MF	W
Tarsonemus sp. (Prostigmata, Heterostigmatina, Tarsonemidae)	48	6	D	ma	MF	W
Oribatida (immature) (sp.9) (Suborder)	46	5	D	ma	MF	W
Multidentorhodacarus sp.2 (Mesostigmata, Rhodacaridae)	39	5	D	ma	MF	W
Eremulus crispus (Oribatida, Eremulidae)	38	3	D	ma	MF	Y
Bimichaelia sp. (Endeostigmata, Alycidae)	37	5	D	ma	MF	W
Oribatida (immature) (sp.23) (Suborder)	37	8	D	ma	MF	W
Berlezetes brasilozetoides (Oribatida, Microzetidae)	36	6	D	ma	MF	W
Eupodes sp.2 (Prostigmata, Eupodidae)	32	5	D	ma	MF	W
Microdispidae (Prostigmata, Heterostigmata)	27	4	D	a	MF	W
Oplitis sp. (Mesostigmata, Uropodina, Oplitidae)	25	3	D	c	F	W
Epilohmannia pallida americana (Oribatida, Epilohmanniidae)	25	6	D	c	F	W
Oribatida (immature) (sp.47) (Suborder)	24	5	D	c	F	W
Prostigmata, Heterostigmata, Pygmephoridae	20	3	D	c	F	Y

Protogamasellus mica (Mesostigmata, Ascidae)	18	5	D	c	F	W
Cultroribula zicsii (Oribatida, Astegistidae)	18	2	D	c	F	Y
Protogamasellus sigillophorus (Mesostigmata, Ascidae)	17	4	D	c	F	W
Asca sp.1 (Mesostigmata, Ascidae)	16	3	D	c	F	W
Lamellobates molecula (Oribatida, Austrachipteriidae)	16	2	D	c	F	Y
Oribatida, Phthiracaridae	16	4	D	c	F	W
Rhizoglyphus sp. (Astigmatina, Acaridae)	15	4	D	c	F	W
Ramusella (*Insculptoppia*) sp. (Oribatida, Oppiidae)	14	1	D	c	F	Z
Scutacarus sp. (Prostigmata, Heterostigmata, Scutacaridae)	14	3	D	c	F	Y
Mesostigmata, Gamasina, Uropodina (sp.2) (Cohort)	13	4	D	c	F	W

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Prostigmata, Bdelloidea, Cunaxidae (sp.1)	13	5	D	c	F	W
Mesostigmata, Gamasina, Ologamasidae, (sp.2)	12	3	D	d	PF	W
Rhodacarellus sp. (Mesostigmata, Rhodacaridae)	12	4	D	d	PF	W
Torpacarus ommitens paraguayensis (Oribatida, Lohmanniidae)	12	1	D	d	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.4) (Cohort)	11	3	D	d	PF	Y
Oribatida (immature) (sp.25) (Suborder)	11	3	D	d	PF	Y
Mesostigmata, Gamasina, Ologamasidae (sp.1)	9	1	D	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.3) (Cohort)	9	1	D	r	PF	Z
Striatoppia sp. (Oribatida, Oppiidae)	9	4	D	r	PF	W
Nanorchestes sp. (Endeostigmata, Nanorchestidae)	8	4	D	r	PF	W
Eohypochthonius sp. (Oribatida, Hypochthoniidae)	8	1	D	r	PF	Z
Oribatida (immature) (sp.3) (Suborder)	8	8	D	r	PF	W
Oribatida (immature) (sp.14) (Suborder)	8	3	D	r	PF	W
Pseudoparasitus sp. (Mesostigmata, Laelapidae)	6	1	D	r	PF	Z
Prostigmata, Heterostigmata, Scutacaridae (sp.1)	5	3	ND	r	PF	Y
Gaeolaelaps sp.1 (Mesostigmata, Laelapidae)	4	2	ND	r	PF	W
Eremobelba zicsii (Oribatida, Eremobelbidae)	4	1	ND	r	PF	Z
Oppiella nova (Oribatida, Oppiidae)	4	1	ND	r	PF	Z
Tectocepheus velatus (Oribatida, Tectocepheidae)	4	2	ND	r	PF	Y
Stigmaeus sp. (Prostigmata, Eleutherengona, Stigmaeidae)	4	2	ND	r	PF	Y
Prostigmata, Tydeidae	4	2	ND	r	PF	Y
Alycus sp. (Endeostigmata, Alycidae)	3	1	ND	r	PF	Z
Proctolaelaps paulista (Mesostigmata, Ascidae)	3	2	ND	r	PF	W
Mesostigmata, Gamasina, Uropodina (sp.1) (Cohort)	3	1	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.7) (Cohort)	3	2	ND	r	PF	Y
Oribatida (immature) (sp.29) (Suborder)	3	1	ND	r	PF	Z
Lohmanniidae, Oribatida	3	3	ND	r	PF	Y

Prostigmata, Tydeoidea, Ereynetidae	3	2	ND	r	PF	Y
Prostigmata, Eupodina, Rhagidiidae (sp.1)	3	2	ND	r	PF	Y
Mesostigmata, Gamasida, Eviphidae	2	1	ND	r	PF	Z
Proprioseiopsis sp.2 (Mesostigmata, Gamasina, Phytoseiidae)	2	1	ND	r	PF	Z
Rhodacarus sp. (Mesostigmata, Rhodacaridae)	2	2	ND	r	PF	Y
Mesostigmata, Trachytidae	2	2	ND	r	PF	Y
Tyrophagus sp. (Astigmatina, Acaridae)	2	2	ND	r	PF	Y
Rysotritia peruensis (Oribatida, Euphthiracaridae)	2	1	ND	r	PF	Z

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Oribatida (immature) (sp.22) (Suborder)	2	1	ND	r	PF	Z
Oribatida (immature) (sp.8) (Suborder)	2	2	ND	r	PF	Y
Quadroppia circumita (Oribatida, Quadroppiidae)	2	1	ND	r	PF	Z
Bdella sp.1 (Prostigmata, Eupodina, Bdellidae)	2	1	ND	r	PF	Z
Prostigmata, Bdelloidea, Cunaxidae (sp.3)	2	1	ND	r	PF	Z
Rhagidia sp.2 (Prostigmata, Eupodina, Rhagidiidae)	2	1	ND	r	PF	Z
Rhaphignatus sp. (Prostigmata, Raphignathidae)	2	1	ND	r	PF	Z
Mesostigmata, Gamasina, Ameroseiidae	1	1	ND	r	PF	Z
Asca sp.2 (Mesostigmata, Ascidae)	1	1	ND	r	PF	Z
Protogamasellus sp.2 (Mesostigmata, Ascidae)	1	1	ND	r	PF	Z
Cosmolaelaps sp.1 (Mesostigmata, Laelapidae)	1	1	ND	r	PF	Z
Typhlodromus sp.1 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Podocinum sp. (Mesostigmata, Podocinidae)	1	1	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.9) (Cohort)	1	1	ND	r	PF	Z
Adelphacarus sp. (Oribatida, Aphelacaridae, Adelphacaridae syn.)	1	1	ND	r	PF	Z
Fosseremus quadripertitus (Oribatida, Damaeolidae)	1	1	ND	r	PF	Z
Brachioppia sp. (Oribatida, Oppiidae)	1	1	ND	r	PF	Z
Bdella sp.2 (Prostigmata, Eupodina, Bdellidae)	1	1	ND	r	PF	Z
Mexecheles sp. (Prostigmata, Eleutherengona, Cheyletidae)	1	1	ND	r	PF	Z
Cryptognathus sp. (Prostigmata, Cryptognathidae)	1	1	ND	r	PF	Z
Mesostigmata, Digamaselidae	1	1	ND	r	PF	Z
Prostigmata, Erythraeidae	1	1	ND	r	PF	Z
Prostigmata, Erythraeidae (sp.) (adult)	1	1	ND	r	PF	Z
Astigmatina, Pyemotidae	1	1	ND	r	PF	Z
Rhagidia sp.3 (Prostigmata, Eupodina, Rhagidiidae)	1	1	ND	r	PF	Z
Prostigmata, Heterostigmata, Scutacaridae (sp2)	1	1	ND	r	PF	Z
Total	1.788					

[1] Dominance: D - dominant, ND - non - dominant. Laroca and Meilke method [26], Moraes et al. [23].
[2] Abundance: ma - very abundant, a - abundant, c - common, d - dispersed, r - rare.
[3] Frequency: PF - little frequent, MF - very frequent, F - frequent.
[4] Constancy: W - constant, Y - accessory, Z - accidental.

3.2 Soil samples from the end of dry season

By the end of the dry season of 2013, the families Acaridae (*Rhyzoglyphus* sp.), Oplitidae (*Oplitis* sp.) and Eupodidae (*Eupodes* sp.1), the suborder Oribatida, the cohort Uropodina (sp.2) and the hypopus phase (cohort Astigmatina, Family Acaridae, genus *Ryzopglyphus* sp.) were the most favored. The oribatid were represented by 28 species and morphospecies and five families. The oribatid *Scherolibates* spp., *Galumna flabellifera*, *Arcoppia aff. dechambrierorum*, *Epilohmannia pallida americana*, *Eremulus crispus*, *Berlezetes brasilozetoides*, *Suctobelbella* sp. and the family Licnodomaeidae were the most representative, being dominant (D), very abundant (ma), very frequent (MF) and constant (W) during the evaluation of the end of dry season (Table 2).

TABLE 2
FAUNISTIC ANALYSIS FOR TAXA OF EDAPHIC MITES COLLECTED BETWEEN THE LINES OF THE COFFEE PLANTATION AND FOREST AT THE END OF THE DRY SEASON OF 2013. SÃO SEBASTIÃO DO PARAÍSO, MG.

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Rizoglyphus sp. (Astigmatina, Acaridae) (Hypopus)	492	17	D	ma	MF	W
Scheloribates sp. (Oribatida, Scheloribatidae)	164	7	D	ma	MF	W
Suctobelbella sp. (Oribatida, Suctobelbidae)	154	7	D	ma	MF	W
Oplitis sp. (Mesostigmata, Uropodina, Oplitidae)	153	16	D	ma	MF	W
Galumna flabellifera (Oribatida, Galumnidae)	133	7	D	ma	MF	W
Oribatida, Licnodamaeidae	118	7	D	ma	MF	W
Rizoglyphus sp. (Astigmatina, Acaridae)	91	6	D	ma	MF	W
Eupodes sp.1 (Prostigmata, Eupodidae)	73	7	D	ma	MF	W
Arcoppia aff. dechambrierorum (Oribatida, Oppiidae)	60	7	D	ma	MF	W
Epilohmannia pallida americana (Oribatida, Epilohmanniidae)	52	8	D	ma	MF	W
Eremulus crispus (Oribatida, Eremulidae)	40	6	D	ma	MF	W
Berlezetes brasilozetoides (Oribatida, Microzetidae)	34	6	D	ma	MF	W
Mesostigmata, Gamasina, Uropodina (sp.2) (Cohort)	32	4	D	ma	MF	W
Prostigmata, Heterostigmata, Pygmephoridae	27	2	D	c	F	Y
Cultroribula zicsii (Oribatida, Astegistidae)	25	5	D	c	F	W
Spelenorchestes sp. (Endeostigmata: Nanorchestidae)	22	6	D	c	F	W
Protogamasellus mica (Mesostigmata, Ascidae)	20	5	D	c	F	W
Tarsonemus sp. (Prostigmata, Heterostigmatina, Tarsonemidae)	20	4	D	c	F	W
Oribatida (immature) sp.47 (Suborder)	19	5	D	c	F	W
Oribatida, Phthiracaridae	18	5	D	c	F	W
Protogamasellus sigillophorus (Mesostigmata, Ascidae)	16	3	D	c	F	Y
Oribatida (immature) (sp. 9) (Suborder)	16	7	D	c	F	W
Ramusella (*Insculptoppia*) sp. (Oribatida, Oppiidae)	16	4	D	c	F	W
Multidentorhodacarus sp.1 (Mesostigmata, Rhodacaridae)	15	5	D	c	F	W
Mesostigmata, Gamasina, Uropodina (sp.3) (Cohort)	15	4	D	c	F	W
Prostigmata, Bdelloidea, Cunaxidae (sp.1)	15	6	D	c	F	W
Gaeolaelaps sp.1 (Mesostigmata, Laelapidae)	13	4	D	c	F	W
Proctolaelaps paulista (Mesostigmata, Ascidae)	13	4	D	c	F	W
Mesostigmata, Gamasina, Uropodina (sp.4) (Cohort)	13	3	D	c	F	W
Mesostigmata, Gamasina, Uropodina (sp.5) (Cohort)	13	4	D	c	F	W
Oribatida (immature) (sp. 23) (Suborder)	13	6	D	c	F	W

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Mesostigmata, Gamasina, Ologamasidae (sp.1)	12	4	D	c	F	W
Rostrozetes foveolatus (Oribatida, Haplozetidae)	12	2	D	c	F	Y
Tectocepheus velatus (Oribatida, Tectocepheidae)	12	3	D	c	F	Y
Winterschmidtiidae, Astigmata	12	2	D	c	F	Y
Striatoppia sp. (Oribatida, Oppiidae)	11	5	D	c	F	W
Bimichaelia sp. (Endeostigmata, Alycidae)	9	4	D	c	F	W
Multidentorhodacarus sp.2 (Mesostigmata, Rhodacaridae)	9	2	D	c	F	Y
Oribatida (immature) (sp.25) (Suborder)	9	4	D	c	F	W
Nothrus aff. monticola (Oribatida, Nothridae)	9	1	D	c	F	Z
Xylobates capucinus (Oribatida, Haplozetidae)	9	2	D	c	F	W
Mesostigmata, Gamasina, Uropodina (sp.1) (Cohort)	8	4	D	d	PF	W
Nanorchestes sp. (Endeostigmata, Nanorchestidae)	7	4	D	d	PF	W
Rhodacarellus sp. (Mesostigmata, Rhodacaridae)	7	2	D	d	PF	Y
Lamellobates molecula (Oribatida, Austrachipteriidae)	7	4	D	d	PF	W
Oribatida, Brachichthoniidae	7	3	D	d	PF	W
Malacoangelia sp. (Oribatida, Hypochthoniidae)	7	1	D	d	PF	Z
Graptoppia sp. (Oribatida, Oppiidae)	7	1	D	d	PF	Z
Neosuctobelba transitoria (Oribatida, Suctobelbidae)	7	3	D	d	PF	W
Cosmolaelaps sp.3 (Mesostigmata, Laelapidae)	6	2	D	r	PF	Y
Mesostigmata, Laelapidae (sp.1)	6	2	D	r	PF	Y
Prostigmata, Heterostigmatina, *Scutacaridae* (sp.1)	6	4	D	r	PF	W
Gaeolaelaps sp.2 (Mesostigmata, Laelapidae)	5	2	ND	r	PF	Y
Hypoaspis sp.1 (Mesostigmata, Laelapidae)	5	2	ND	r	PF	Y
Mesostigmata, Gamasina, Uropodina, Trachytidae	5	2	ND	r	PF	Y
Tyrophagus sp. (Astigmatina, Acaridae)	5	4	ND	r	PF	W
Eremobelba zicsii (Oribatida, Eremobelbidae)	5	2	ND	r	PF	Y
Acrotritia (*Rysotritia*) *peruensis* (Oribatida, Euphthiracaridae)	5	2	ND	r	PF	Y
Oribatida (immature) (sp.14) (Suborder)	5	5	ND	r	PF	W
Microppia minus (Oribatida, Oppiidae)	5	1	ND	r	PF	Z
Mesostigmata, Dermanyssina, Digamasellidae	5	4	ND	r	PF	W
Asca sp.1 (Mesostigmata, Ascidae)	4	3	ND	r	PF	Y
Mesostigmata, Gamasina, Ologamasidae (sp.2)	4	3	ND	r	PF	Y
Proprioseiopsis sp.2 (Mesostigmata, Gamasina, Phytoseiidae)	4	2	ND	r	PF	Y
Rhodacarus sp. (Mesostigmata, Rhodacaridae)	4	2	ND	r	PF	Y
Pseudoamerioppia barrancensis paraguayensis (Oribatida, Oppiidae)	4	3	ND	r	PF	Y

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Rhagidia sp.1(Prostigmata, Eupodina, Rhagidiidae)	4	2	ND	r	PF	Y
Mesostigmata, Gamasina, Eviphidae	3	3	ND	r	PF	Y
Mesostigmata, Gamasina, Uropodina (sp.6) (Cohort)	3	3	ND	r	PF	Y
Astigmatina (Cohort)	3	1	ND	r	PF	Z
Eohypochthonius sp. (Oribatida, Hypochthoniidae)	3	1	ND	r	PF	Z
Tegeozetes sp. (Oribatida, Tectocepheidae)	3	1	ND	r	PF	Z
Prostigmata, Erythraeidae	3	2	ND	r	PF	Y
Protigmata, Heterostigmata, Microdispidae	3	2	ND	r	PF	Y
Prostigmata, Eupodina, Rhagidiidae (sp.1)	3	3	ND	r	PF	Y
Prostigmata, Heterostigmata, *Scutacaridae* (sp.2)	3	2	ND	r	PF	Y
Stigmaeus sp. (Prostigmata, Eleutherengona, Stigmaeidae)	3	3	ND	r	PF	Y
Asca sp.2 (Mesostigmata, Ascidae)	2	2	ND	r	PF	Y
Asca sp.3 (Mesostigmata, Ascidae)	2	2	ND	r	PF	Y
Cosmolaelaps sp.1 (Mesostigmata, Laelapidae)	2	2	ND	r	PF	Y
Gaeolaelaps sp.3 (Mesostigmata, Laelapidae)	2	1	ND	r	PF	Z
Hypoaspis sp.3 (Mesostigmata, Laelapidae)	2	1	ND	r	PF	Z
Chelaseius sp. (Mesostigmata, Phytoseiidae)	2	1	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.10) (Cohort)	2	1	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.7) (Cohort)	2	2	ND	r	PF	Y
Mesostigmata, Gamasina, Uropodina (sp.9) (Cohort)	2	1	ND	r	PF	W
Fosseremus quadripertitus (Oribatida, Damaeolidae)	2	1	ND	r	PF	Z
Oribatida (immature) (sp.22) (Suborder)	2	1	ND	r	PF	Z
Oribatida (immature) (sp.29) (Suborder)	2	1	ND	r	PF	Z
Oppiella nova (Oribatida, Oppiidae)	2	1	ND	r	PF	Z
Prostigma, Anystina, Anystidae	2	2	ND	r	PF	Y
Ctenacarus sp. (Oribatida, Ctenacaridae)	2	1	ND	r	PF	Z
Rhagidia sp.3 (Prostigmata, Eupodina, Rhagidiidae)	2	1	ND	r	PF	Z
Scutacarus sp. (Prostigmata, Heterostigmata, Scutacaridae)	2	2	ND	r	PF	Y
Prostigmata, Eleutherengona, Stigmaeidae (sp.1)	2	2	ND	r	PF	Y
Alycus sp. (Endeostigmata, Alycidae)	1	1	ND	r	PF	Z
Mesostigmata, Gamasina, Ameroseiidae	1	1	ND	r	PF	Z
Cosmolaelaps sp.2 (Mesostigmata, Laelapidae)	1	1	ND	r	PF	Z
Stratiolaelaps sp. (Mesostigmata, Laelapidae)	1	1	ND	r	PF	Z
Mesostigmata, Gamasina, Macrochelidae (sp 1)	1	1	ND	r	PF	Z
Pseudoparasitus sp. (Mesostigmata, Laelapidae)	1	1	ND	r	PF	Z

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Neoseiulus sp. (Gamasina, Mesostigmata)	1	1	ND	r	PF	Z
Proprioseiopsis sp.3 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Proprioseiopsis sp.4 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Typhlodromus sp.2 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Podocinum sp. (Mesostigmata, Podocinidae)	1	1	ND	r	PF	Z
Protogamasellopsis sp. (Mesostigmata, Gamasina, Rhodacaridae)	1	1	ND	r	PF	Z
Astigmatina, Histiostomatidae	1	1	ND	r	PF	Z
Oribatida (immature) (sp.3) (Suborder)	1	1	ND	r	PF	Z
Oribatida, Lohmanniidae	1	1	ND	r	PF	Z
Papillacarus sp. (Oribatida, Lohmanniidae)	1	1	ND	r	PF	Z
Oribatida, Oppiidae (sp.)	1	1	ND	r	PF	Z
Brasilobates bipilis (Oribatida, Xylobatidae)	1	1	ND	r	PF	Z
Quadroppia circumita (Oribatida, Quadroppiidae)	1	1	ND	r	PF	Z
Zetorchestes schusteri (Oribatida, Zetorchestidae)	1	1	ND	r	PF	Z
Prostigmata, Caligonellidae	1	1	ND	r	PF	Z
Mexecheles sp. (Prostigmata, Eleutherengona, Cheyletidae)	1	1	ND	r	PF	Z
Prostigmata, Bdelloidea, Cunaxidae (sp.5)	1	1	ND	r	PF	Z
Prostigmata, Tydeoidea, Ereynetidae	1	1	ND	r	PF	Z
Eupodes sp.2 (Prostigmata, Eupodidae)	1	1	ND	r	PF	Z
Rhagidia sp.2 (Prostigmata, Eupodina, Rhagidiidae)	1	1	ND	r	PF	Z
Prostigmata, Eupodina, Rhagidiidae (sp.2)	1	1	ND	r	PF	Z
Prostigmata, Eleutherengona, Stigmaeidae (sp.2)	1	1	ND	r	PF	Z
Total	2.247					

[1]Dominance: D - dominant, ND - non - dominant. Laroca and Meilke method [26], Moraes et al. [23].
[2] Abundance: ma - very abundant, a - abundant, c - common, d - dispersed, r - rare.
[3] Frequency: PF - little frequent, MF - very frequent, F - frequent.
[4] Constancy: W - constant, Y - accessory, Z - accidental.

3.3 Soil samples from the end of rainy season plus end of dry season

In the analysis performed on the total of mites found at the end of the rainy season plus those found at the end of the dry period of 2013, the families Nanorchestidae (*Spelenorchestes* sp.), Oplitidae (*Oplitis* sp.), Acaridae (*Rhyzoglyphus* sp.), Alycidae (*Bimichaelia* sp.), cohort Astigmatina (in the hypopus phase), Eupodidae (*Eupodes* sp.1), Rhodacaridae (*Multidentorhodacarus* sp.1), Pygmephoridae, Tarsonemidae (*Tarsonemus* sp.), the cohort Uropodina (sp.2) and the suborder Oribatida, presented the maximum rates of faunistic classification, dominant (D), very abundant (ma), very frequent (MF) and constant (W), that is, in the sum of the two samples made (Table 3).

Regarding the dominance, it was verified that of the total of 139 Suborder, cohort, family, genus, species collected, 71 were considered dominant (D). Dominant species have the capacity to modify an impact received from the environment for their own benefit, which may lead to the appearance or disappearance of other species [24].

Regarding the classification of abundance, 105 species, subspecies and families were categorized as rare (r). However, even though they are rare, they are important because they have a high influence on the diversity of ecosystems. The substitutions of species and arrangements in the abundance are part of the development of the ecosystem in search of the equilibrium [27].

In the classification of constancy, 90 species, subspecies and families were accidental (Z). Many species presented small numbers of specimens, and these specimens did not present constancy in the samples. The large number of accidental species associated to the high diversity index, show a balanced environment where interspecific and intraspecific competitions can determine species behavior [28].

TABLE 3

FAUNISTIC ANALYSIS FOR TAXA OF EDAPHIC MITES COLLECTED BETWEEN THE LINES OF THE COFFEE PLANTATION AND FOREST AT THE END OF THE DRY SEASON PLUS THOSE FOUND AT THE END OF THE RAINY SEASON OF 2013. SÃO SEBASTIÃO DO PARAÍSO, MG.

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Rizoglyphus sp. (Astigmatina, Acaridae) (Hypopus)	626	23	D	ma	MF	W
Scheloribates sp. (Oribatida, Scheloribatidae)	279	11	D	ma	MF	W
Galumna flabellifera (Oribatida, Galumnidae)	271	11	D	ma	MF	W
Suctobelbella sp. (Oribatida, Suctobelbidae)	250	14	D	ma	MF	W
Oribatida, Licnodamaeidae	223	10	D	ma	MF	W
Oplitis sp. (Mesostigmata, Uropodina, Oplitidae)	178	19	D	ma	MF	W
Eupodes sp.1 (Prostigmata, Eupodidae)	168	14	D	ma	MF	W
Arcoppia aff. dechambrierorum (Oribatida, Oppiidae)	141	12	D	ma	MF	W
Rhizoglyphus sp. (Astigmatina, Acaridae)	106	10	D	ma	MF	W
Spelenorchestes sp. (Endeostigmata: Nanorchestidae)	100	11	D	ma	MF	W
Multidentorhodacarus sp.1(Mesostigmata, Rhodacaridae)	82	11	D	ma	MF	W
Eremulus crispus (Oribatida, Eremulidae)	78	9	D	ma	MF	W
Epilohmannia pallida americana (Oribatida, Epilohmanniidae)	77	14	D	ma	MF	W
Berlezetes brasilozetoides (Oribatida, Microzetidae)	70	12	D	ma	MF	W
Tarsonemus sp. (Prostigmata, Heterostigmata, Tarsonemidae)	68	10	D	ma	MF	W
Oribatida (immature) (sp.9) (Suborder)	62	12	D	ma	MF	W
Oribatida, Brachichthoniidae	61	9	D	ma	MF	W
Oribatida (immature) (sp.23) (Suborder)	50	14	D	ma	MF	W
Multidentorhodacarus sp.2 (Mesostigmata, Rhodacaridae)	48	7	D	ma	MF	Y
Prostigmata, Heterostigmata, Pygmephoridae	47	5	D	ma	MF	Y
Bimichaelia sp. (Endeostigmata, Alycidae)	46	9	D	ma	MF	W
Mesostigmata, Gamasina, Uropodina (sp.2) (Cohort)	45	8	D	ma	MF	W

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	Number of specimens	Number of samples in which was recorded (n = 48)	D[1]	A[2]	F[3]	C[4]
Cultroribula zicsii (Oribatida, Astegistidae)	43	7	D	a	MF	Y
Oribatida (immature) (sp.47) (Suborder)	43	10	D	a	MF	W
Protogamasellus mica (Mesostigmata, Ascidae)	38	10	D	c	F	W
Oribatida, Phthiracaridae	34	9	D	c	F	W

Protogamasellus sigillophorus (Mesostigmata, Ascidae)	33	7	D	c	F	Y
Eupodes sp.2 (Prostigmata, Eupodidae)	33	6	D	c	F	Y
Ramusella (Inculptoppia) sp. (Oribatida, Oppiidae)	30	5	D	c	F	Y
Prostigmata, Heterostigmata, Microdispidae	30	6	D	c	F	Y
Prostigmata, Bdelloidea, Cunaxidae (sp.1)	28	11	D	c	F	W
Mesostigmata, Gamasina, Uropodina (sp.3) (Cohort)	24	5	D	c	F	Y
Mesostigmata, Gamasina, Uropodina (sp.4) (Cohort)	24	6	D	c	F	Y
Lamellobates molecula (Oribatida, Austrachipteriidae)	23	6	D	c	F	Y
Mesostigmata, Gamasina, Ologamasidae (sp.1)	21	5	D	c	F	Y
Asca sp.1 (Mesostigmata, Ascidae)	20	6	D	c	F	Y
Oribatida (immature) (sp.25) (Suborder)	20	7	D	c	F	Y
Striatoppia sp. (Oribatida, Oppiidae)	20	9	D	c	F	W
Rhodacarellus sp. (Mesostigmata, Gamasina, Rhodacaridae)	19	6	D	c	F	Y
Proctolaelaps paulista (Mesostigmata, Ascidae)	16	6	D	d	PF	Y
Mesostigmata, Gamasina, Ologamasidae (sp.2)	16	6	D	d	PF	Y
Tectocepheus velatus (Oribatida, Tectocepheidae)	16	5	D	d	PF	Y
Scutacarus sp. (Prostigmata, Heterostigmata, Scutacaridae)	16	5	D	d	PF	Y
Nanorchestes sp. (Endeostigmata, Nanorchestidae)	15	8	D	d	PF	W
Gaeolaelaps sp.1 (Mesostigmata, Laelapidae)	13	4	D	r	PF	Y
Mesostigmata, Gamasina, Uropodina (sp.5) (Cohort)	13	4	D	r	PF	Y
Oribatida (immature) (sp.14) (Suborder)	13	8	D	r	PF	W
Rostrozetes faveolatus (Oribatida, Haplozetidae)	12	2	D	r	PF	Z
Torpacarus ommitens paraguayensis (Oribatida, Lohmanniidae)	12	1	D	r	PF	Z
Winterschmidtiidae, Astigmata	12	2	D	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.1) (Cohort)	11	5	D	r	PF	Y
Prostigmata, Heterostigmata, Scutacaridae (sp.1)	11	7	D	r	PF	Y
Eremobelba zicsii (Oribatida, Eremobelbidae)	9	3	D	r	PF	Z
Oribatida (immature) (sp.3) (Suborder)	9	9	D	r	PF	W
Xylobates capucinus (Oribatida, Haplozetidae)	9	2	D	r	PF	Z
Nothrus aff. monticola (Oribatida, Nothridae)	9	1	D	r	PF	Z
Eohypochthonius sp. (Oribatida, Hypochthoniidae)	8	1	D	r	PF	Z

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	**Number of specimens**	**Number of samples in which was recorded (n = 48)**	**D[1]**	**A[2]**	**F[3]**	**C[4]**
Pseudoparasitus sp. (Mesostigmata, Laelapidae)	7	2	D	r	PF	Z
Mesostigmata, Gamasina, Uropodina, Trachytidae	7	4	D	r	PF	Y
Tyrophagus sp. (Astigmatina, Acaridae)	7	6	D	r	PF	Y
Rysotritia peruensis (Oribatida, Euphthiracaridae)	7	3	D	r	PF	Z
Malacoangelia sp. (Oribatida, Hypochthoniidae)	7	1	D	r	PF	Z

Neosuctobelba transitoria (Oribatida, Suctobelbidae)	7	3	D	r	PF	Z
Graptoppia sp. (Oribatida, Oppiidae)	7	1	D	r	PF	Z
Stigmaeus sp. (Prostigmata, Eleutherengona, Stigmaeidae)	7	5	D	r	PF	Y
Cosmolaelaps sp.3 (Mesostigmata, Laelapidae)	6	2	D	r	PF	Z
Mesostigmata, Laelapidae (sp.1)	6	2	D	r	PF	Z
Proprioseiopsis sp.2(Mesostigmata, Gamasina, Phytoseiidae)	6	3	D	r	PF	Z
Rhodacarus sp. (Mesostigmata, Rhodacaridae)	6	4	D	r	PF	Y
Oppiella nova (Oribatida, Oppiidae)	6	2	D	r	PF	Z
Prostigmata, Eupodina, Rhagidiidae (sp.1)	6	5	D	r	PF	Y
Mesostigmata, Gamasina, Eviphidae	5	4	ND	r	PF	Y
Cosmolaelaps sp.2 (Mesostigmata, Laelapidae)	5	3	ND	r	PF	Z
Gaeolaelaps sp.2 (Mesostigmata, Laelapidae)	5	2	ND	r	PF	Z
Hypoaspis sp.1 (Mesostigmata, Laelapidae)	5	2	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.7) (Cohort)	5	4	ND	r	PF	Y
Oribatida (immature) (sp.29) (Suborder)	5	2	ND	r	PF	Z
Microppia minus (Oribatida, Oppiidae)	5	1	ND	r	PF	Z
Prostigmata, Bdelloidea, Cunaxidae (sp.5)	5	4	ND	r	PF	Y
Alycus sp. (Endeostigmata, Alycidae)	4	2	ND	r	PF	Z
Oribatida (immature) (sp. 22) (Suborder)	4	2	ND	r	PF	Z
Oribatida, Lohmanniidae	4	4	ND	r	PF	Y
Pseudoamerioppia barrancensis paraguayensis (Oribatida, Oppiidae)	4	3	ND	r	PF	Z
Prostigmata, Tydeoidea, Ereynetidae	4	3	ND	r	PF	Z
Prostigmata, Erythraeidae	4	3	ND	r	PF	Z
Rhagidia sp.1(Prostigmata, Eupodina, Rhagidiidae)	4	2	ND	r	PF	Z
Prostigmata, Heterostigmata, *Scutacaridae* (sp.2)	4	3	ND	r	PF	Z
Prostigmata, Tydeidae	4	N	ND	r	PF	Z
Asca sp.2 (Mesostigmata, Ascidae)	3	3	ND	r	PF	Z
Cosmolaelaps sp.1 (Mesostigmata, Laelapidae)	3	3	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.6) (Cohort)	3	3	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.9) (Cohort)	3	2	ND	r	PF	Z

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	**Number of specimens**	**Number of samples in which was recorded (n = 48)**	**D[1]**	**A[2]**	**F[3]**	**C[4]**
Fosseremus quadripertitus (Oribatida, Damaeolidae)	3	2	ND	r	PF	Z
Eohypochthonius sp. (Oribatida, Hypochthoniidae)	3	1	ND	r	PF	Z
Astigmatina (Cohort)	3	1	ND	r	PF	Z
Quadroppia circumita (Oribatida, Quadroppiidae)	3	2	ND	r	PF	Z
Tegeozetes sp. (Oribatida, Tectocepheidae)	3	1	ND	r	PF	Z
Rhagidia sp.2 (Prostigmata, Eupodina, Rhagidiidae)	3	2	ND	r	PF	Z

Rhagidia sp.3(Prostigmata, Eupodina, Rhagidiidae)	3	3	ND	r	PF	Z
Mesostigmata, Gamasina, Ameroseiidae	2	2	ND	r	PF	Z
Asca sp.3 (Mesostigmata, Ascidae)	2	2	ND	r	PF	Z
Gaeolaelaps sp.3 (Mesostigmata, Laelapidae)	2	1	ND	r	PF	Z
Hypoaspis sp.3 (Mesostigmata, Laelapidae)	2	1	ND	r	PF	Z
Chelaseius sp. (Mesostigmata, Phytoseiidae)	2	2	ND	r	PF	Z
Podocinum sp. (Mesostigmata, Podocinidae)	2	2	ND	r	PF	Z
Mesostigmata, Gamasina, Uropodina (sp.10) (Cohort)	2	1	ND	r	PF	Z
Oribatida (immature) (sp.8) (Suborder)	2	2	ND	r	PF	Z
Bdella (sp.1) (Prostigmata, Eupodina, Bdellidae)	2	1	ND	r	PF	Z
Prostigmata, Bdelloidea, Cunaxidae (sp.3)	2	1	ND	r	PF	Z
Rhaphignatus sp. (Prostigmata, Raphignathidae)	2	1	ND	r	PF	Z
Prostigma, Anystina, Anystidae	2	2	ND	r	PF	Z
Ctenacarus sp. (Oribatida, Ctenacaridae)	2	1	ND	r	PF	Z
Prostigmata, Eleutherengona, Stigmaeidae (sp.1)	2	2	ND	r	PF	Z
Protogamasellus sp.2 (Mesostigmata, Ascidae)	1	1	ND	r	PF	Z
Stratiolaelaps sp. (Mesostigmata, Laelapidae)	1	1	ND	r	PF	Z
Mesostigmata, Gamasina, Macrochelidae (sp1)	1	1	ND	r	PF	Z
Proprioseiopsis sp.3 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Proprioseiopsis sp.4 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Typhlodromus sp.1 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Typhlodromus sp.2 (Mesostigmata, Gamasina, Phytoseiidae)	1	1	ND	r	PF	Z
Neoseiulus sp. (Gamasina, Mesostigmata)	1	1	ND	r	PF	Z
Protogamasellopsis sp. (Mesostigmata, Gamasina, Rhodacaridae)	1	1	ND	r	PF	Z
Adelphacarus sp. (Oribatida, Aphelacaridae, Adelphacaridae syn.)	1	1	ND	r	PF	Z
Astigmatina, Histiostomatidae	1	1	ND	r	PF	Z
Brachioppia sp. (Oribatida, Oppiidae)	1	1	ND	r	PF	Z
Oribatida, Oppiidae (sp.)	1	1	ND	r	PF	Z
Brasilobates bipilis (Oribatida, Xylobatidae)	1	1	ND	r	PF	Z

Continua…

Continuação

Taxa (Suborder, cohort, family, genus and species)	**Number of specimens**	**Number of samples in which was recorded (n = 48)**	**D[1]**	**A[2]**	**F[3]**	**C[4]**
Papillacarus sp. (Oribatida, Lohmanniidae)	1	1	ND	r	PF	Z
Bdella (sp.2) (Prostigmata, Eupodina, Bdellidae)	1	1	ND	r	PF	Z
Mexecheles sp. (Prostigmata, Eleutherengona, Cheyletidae)	1	1	ND	r	PF	Z
Cryptognathus sp. (Prostigmata, Cryptognathidae)	1	1	ND	r	PF	Z

Mesostigmata, Digamaselidae	1	1	ND	r	PF	Z
Prostigmata, Erythraeidae (sp.) (adulto)	1	1	ND	r	PF	Z
Astigmatina, Pyemotidae	1	1	ND	r	PF	Z
Prostigmata, Eupodina, Rhagidiidae (sp.2)	1	1	ND	r	PF	Z
Zetorchestes schusteri (Oribatida, Zetorchestidae)	1	1	ND	r	PF	Z
Prostigmata, Eleutherengona, Caligonellidae	1	1	ND	r	PF	Z
Prostigmata, Eleutherengona, Stigmaeidae (sp.2)	1	1	ND	r	PF	Z
Total	4.035					

[1]Dominance: D - dominant, ND - non - dominant. Laroca and Meilke method [26], Moraes et al. [23].
[2]Abundance: ma - very abundant, a - abundant, c - common, d - dispersed, r - rare.
[3]Frequency: PF - little frequent, MF - very frequent, F - frequent.
[4]Constancy: W - constant, Y - accessory, Z - accidental.

Oribatid mites generally have little capacity in response short term environmental changes, i.e., their populations decline rapidly when habitats are altered, a feature that may allow their use to detect environmental degradation [29] [30]. Changes in the dominance structure of a soil microarthropods community may be a pre-indicator of environmental stress [31].

The decrease of oribatid mites number in the soil can compromise, in medium and long term, the processes of decomposition and mineralization of organic matter, affecting the quality of the soil and, consequently, the entire ecological system. Mite debris provides a large area for decomposition and, in turn, is an integral part of the soil structure, with direct or indirect effects on the formation and maintenance of soil structure [29].

The species *Oplitis* sp. (Mesostigmata, Uropodina, Oplitidae) was found in all samples, however, this species was most representative at the end of the dry season of 2013. The oribatid mites of the family Oppiidae, which in this work were found both at the end of the dry season and at the end of the rainy season, are considered environmentally insensitive, and are commonly found in disturbed habitats [32].

IV. CONCLUSIONS

There is a difference in the abundance of soil mites when compared the end of the dry period with the end of the rainy season, and the end of the dry period is generally more favorable to the edaphic mite community.

The cohort Astigmatina (family Acaridae) followed by the suborder Oribatida of mites, present the largest numbers of edaphic species, both at the end of the dry period and at the end of the rainy season, and can be worked to be an indicative of the soil quality.

ACKNOWLEDGEMENT

To *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* - Coordination of Improvement of Higher Level Personnel-CAPES, and *Conselho Nacional de Desenvolvimento Científico e Tecnológico* - National Council for Scientific and Technological Development - CNPq and for granting scholarships.

To Dr. Pavel Klimov, University of Michigan, USA, for the identification of Acaridae family mites; Dr. Antônio Carlos Lofego, from the State University of São Paulo, Campus of São José do Rio Preto, São Paulo, Brazil, for identification of the mites of the Tarsonemidae family.

REFERENCES

[1] Baretta, D.; Ferreira, C.S.; Sousa, J.P. and Cardoso, E.J.B.N. 2008. Colêmbolos (Hexapoda: Collembola) como bioindicadores de qualidade do solo em áreas com *Araucaria angustifolia.* Revista Brasileira de Ciência do Solo, Viçosa, **32** (n.spe.):2.693-2.699. http://dx.doi.org/10.1590/S0100-06832008000700012

[2] Fialho, J.S.; Gomes, V.F.F.; Oliveira, T.S. and Silva Júnior, J.M.T. 2006. Indicadores da qualidade do solo em áreas sob vegetação natural e cultivos de bananeira na Chapada do Apodi-CE. Revista Ciência Agronômica, Fortaleza, **37** (3):250-257.

[3] Stork, N.E. and Eggleton, P. 1992. Invertebrates as determinants and indicators of soil quality. American Journal of Alternative Agriculture, Greenbelt, **7**, (1-2):38-47. https://doi.org/10.1017/S0889189300004446

[4] Lavelle, P. 1996. Diversity of soil fauna and ecosystem function. Biology International, Oxford, **33:**3-16. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.491.2284&rep=rep1&type=pdf

[5] Lavelle, P.; Blanchart, E.; Martin, A.; Spain, A.V. and Martin, S. 1992. Impact of soil fauna on the properties of soils in the humid tropics. Paris, Ecole Normale Supkieure. 29p. (Special Publication, 29). http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.470.1874&rep=rep1&type=pdf

[6] Swift, M.J.; Heal, O.W. and Anderson, J.M. 1979. Decomposition in terrestrial ecosystems. Berkeley, University of California Press. 372p.

[7] Wardle, D.A. and Lavelle, P. 1997. Linkages between soil biota, plant litter quality and decomposition, p. 107-124. In: Cadisch, G. and Giller, K.E., Eds., Driven by nature: plant litter quality and decomposition. Cambridge, CAB International. 409p.

[8] Pereira, R.C.; Albanez, J.M. and Mamédio, I.M.P. 2012. Diversidade da meso e macrofauna edáfica em diferentes sistemas de manejo de uso do solo em Cruz das Almas – BA. **Magistra**, Cruz das Almas, **24** (n.spe.):63-76.

[9] Correia, M.E.F. 2002. Potencial de utilização dos atributos das comunidades de fauna e de grupos de invertebrados como bioindicadores do manejo de ecossistemas. Seropédica, Embrapa Agrobiologia. 23 p. (Documentos, 175).

[10] Assad, M.L.L. 1997. Fana do solo, p.363-444. In: Vagas, M.A.T. and Hungria, M., Eds., Biologia dos solos de cerrado. Planaltina, Embrapa CPAC. 524p.

[11] Sandler, R.; Falco, L.B.; Ciocco, C.; Luca, R. and Coviella, C.E. 2010. Eficiencia del embudo Berlese-Tullgren para extracción de artrópodos edáficos em suelos arguidoles típicos de la província de Buenos Aires. Ciencia del Suelo, Buenos Aires, **28** (1):56-66.

[12] Huber, A.C.L.K. and Morselli, T.B.G.A. 2011. Estudo da mesofauna (ácaros e colêmbolos) no processo da vermicompostagem. Revista da FZVA**,** Uruguaiana, **18** (2):12-20.

[13] Krantz, G.W. and Walter, D.E., Eds., 2009. A manual of acarology. 3rd ed. Lubbock, Texas Tech University Press. 807p.

[14] Coleman, D.C. and Crossley Júnior, D.A. 1996. Fundamentals of soil ecology. San Diego, Academic Press. 205p.

[15] Wallwork, J.A. 1970. Ecology of soil animals. England, McGraw-Hill. 283p.

[16] Petersen, H. and Luxton, M. 1982. A comparative analysis of soil fauna populations and their role in decomposition processes. Oikos, Copenhagen, **39** (3):287-388. 1982. http://www.jstor.org/stable/3544689

[17] Paschoal, A.D.; Monteiro, A.R.; Ferraz, L.C.C.B. and Inomoto, M. M. 1996. Fundamentos de zoologia agrícola e parasitologia: animais do meio rural e sua importância. Piracicaba, ESALQ - Departamento de Zoologia. 98p.

[18] Oliveira, A.R. 1999. Efeito do *Baculovirus anticarsia* sobre Oribatida edáficos (Arachnida: Acari) na cultura da soja. 1999. 69 f. Dissertação. (Mestrado em Zoologia) - Instituto de Biociências, Universidade de São Paulo, São Paulo, Brasil.

[19] Mineiro, J.L.C. and Moraes, G.J. 2002. Actinedida e Acaridida (Arachnida: Acari) edáficos de Piracicaba, Estado de São Paulo. Neotropical Entomology, Londrina, **31** (1):67-73. http://dx.doi.org/10.1590/S1519-566X2002000100010

[20] Rieff, G.G.; Machado. R.G.; Stroschein, M.R.D. and Sá, E.L.S. 2010. Diversidade e famílias de ácaros e colêmbolos edáficos em cultivo de eucalipto e áreas nativas. Current Agricultural Science and Technology *formerly* Revista Brasileira de Agrociências, Pelotas, **16** (1-4):57-61. http://periodicos.ufpel.edu.br/ojs2/index.php/CAST/

[21] Pepato, A.R. and Klimov, P.B. 2015. Origin and higher-level diversification of acariform mites – evidence from nuclear ribosomal genes, extensive taxon sampling, and secondary structure alignment. BMC Evolutionary Biology, **15** (178): 1-20. https://doi.org/10.1186/s12862-015-0458-2

[22] Oconnor, B.M. 2009. Cohort Astigmatina, p.565-657. In: Krantz, G.W. and; Walter, D.E., Eds., A manual of acarology. 3rd. ed. Lubbock, Texas Tech University Press. 807p.

[23] Moraes, R.C.B.; Haddad, M.L.; Silveira Neto, S. and Reyes, A.E.L. 2003. Software para análise faunística - ANAFAU. In: Simpósio Nacional de Controle Biológico - SICOMBIOL, 8., 2003, São Pedro, São Paulo, Brasil. Anais... São Pedro, Sociedade Entomológica do Brasil - ESALQ/USP. p.195.

[24] Silveira Neto, S.; Nakano, O.; Barbin, D. and Villa Nova, N.A. 1976. Manual de ecologia dos insetos. São Paulo, Agronômica Ceres. 419p.

[25] Norton, R.A. and Behan–Pelletier, V. 2009. Suborder Oribatida, p.430-564. In: Krantz, G.W. and Walter, D.E., Eds., A manual of acarology. 3rd. ed. Lubbock, Texas Tech University Press. 807p.

[26] Laroca, S. and Mielke, O.H.H. 1975. Ensaio sobre ecologia de comunidade em Sphingidae na Serra do Mar, Paraná, Brasil (Lepidoptera). Revista Brasileira de Biologia, **35**:1-19.

[27] Souto, P.C. 2006. Acumulação e decomposição da serapilheira e distribuição de organismos edáficos em área de caatinga na Paraíba, Brasil. 2006. 150f. Tese (Doutorado em Agronomia) - Universidade Federal da Paraíba, Paraíba, Areia, Brasil.

[28] Bernardi, O.; Garcia, M.S.; Silva, E.J.E.; Zazycki, L.C.F.; Bernardi, D. and Finkenauer, E. 2011. Levantamento populacional e análise faunística de Lepidoptera em *Eucalyptus* spp. no município de Pinheiro Machado, RS. Ciência Florestal, Santa Maria, **21** (4):735-744. http://www.redalyc.org/articulo.oa?id=53421707012

[29] Behan-Pelletier, V.M. 1999. Oribatid mite biodiversity in agroecossistems: role for bioindication. Agricultural, Ecossystem & Environmental, Oxford, **74** (1-3):411-423. https://doi.org/10.1016/S0167-8809(99)00046-8

[30] Ducatti, F. 2002. Fauna edáfica em fragmentos florestais em áreas reflorestadas com espécie da mata atlântica. 2002. 70p. Dissertação (Mestrado em Recursos Florestais) - Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo, São Paulo, Piracicaba, Brasil.

[31] Hågvar, S. 1994. Log-normal distribution of dominance as an indicator of stressed soil microarthropod communities? Acta Zoologica Fennica, **195**:71-80.

[32] Aoki, J. 1979. Difference in sensitivities of oribatid families to environmental change by human impacts. European Journal of Soil Biology *formerly* Revue D'Écologie et de Biologie du Sol, Paris, **16**:415-422.