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ARTIGO ORIGINAL

Edaphic mesofauna of land use systems in two soils in the State of Mato Grosso do Sul

Mesofauna edáfica de sistemas de uso da terra em dois solos do Estado do Mato Grosso do Sul

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ABSTRACT: Biological diversity is considered an important indicator of soil quality, being useful for the evaluation of ecosystems. Therefore, the purpose of this research was to evaluate the edaphic mesofauna of land use systems on Quartz-sand Neosol and Dystrophic Oxisoil in the State of Mato Grosso do Sul, located at 'Lagoa Grande' settlement, district of Itahum and at 'Embrapa' Western Agribusiness, respectively, both in the municipality of Dourados. At the 'Lagoa Grande' settlement, six systems of land use were evaluated: three agroforestry systems (SAF 1, 2 and 3), *Brachiaria decumbens* Stapf. pasture, conventional tillage system (CTS), and area with scrap of Native Cerrado Biome. At 'Embrapa', four systems were assessed: agroforestry system (SAF), *Brachiaria decumbens* Stapf. pasture, conventional tillage system (CTS), and scrap of native vegetation (forest). Soil samples were collected at four random replicates in 0-0 – 0.05 m depth. Mites and springtails were identified at family level to determine the Shannon-Weaner (H') diversity, Simpson (Is) diversity, and Pielou (J') equitability indexes. SAF 1 and 3, on Quartz-sand Neosol, were more diverse and, therefore, more sustainable regarding soil biological quality, featuring lower sustainability as pasture; on Distrofic Oxisoil, the conventional tillage system proved to be more sustainable, with SAF being the system with the lowest diversity of edaphic mesofauna. SAF grants more biological sustainability to Quartz-sand Neosol than to Dystrophic Oxisoil.

RESUMO: *A diversidade biológica é considerada um importante indicador de qualidade do solo, tornando-se útil na avaliação de agroecossistemas. O objetivo deste trabalho foi avaliar a mesofauna edáfica de sistemas de uso da terra em Neossolo Quartzarênico e Latossolo Vermelho distroférrico em Mato Grosso do Sul, localizados, respectivamente, no assentamento Lagoa Grande, Distrito de Itahum, e na Embrapa Agropecuária Oeste, ambos no município de Dourados. No assentamento Lagoa Grande, foram avaliados seis sistemas de uso: três sistemas agroflorestais (SAFs 1, 2 e 3); pastagem cultivada de Brachiaria decumbens Stapf.; sistema de plantio convencional (SPC), e área com fragmento de vegetação nativa do bioma Cerrado. Na Embrapa, foram avaliados quatro sistemas: sistema agroflorestal (SAF); pastagem cultivada de Brachiaria decumbens Stapf.; sistema de plantio convencional (SPC), e fragmento de vegetação nativa (mata). As amostras de solo em quatro repetições aleatórias por sistema foram coletadas na profundidade de 0-0,05 m. Ácaros e colêmbolos foram identificados em nível de família, para determinação dos índices de diversidade de Shannon-Weaner (H'), diversidade de Simpson (Is) e equitabilidade de Pielou (J'). Os SAFs 1 e 3, em Neossolo Quartzarênico, são mais diversos e, portanto, mais sustentáveis quanto à qualidade biológica do solo; diversamente, a pastagem destaca-se com a menor sustentabilidade. Em Latossolo Vermelho distroférrico, o sistema de plantio convencional mostra-se mais sustentável, sendo o SAF, o sistema com a menor diversidade de mesofauna edáfica. Os SAFs conferem maior sustentabilidade do ponto de vista biológico em Neossolo Quartzarênico do que em Latossolo Vermelho distroférrico.*

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1 Introduction

From the ecological point of view, the concept of sustainable agriculture should seek the coexistence of agricultural practices and environmental preservation of the landscape, and, especially, of the biodiversity and water sources, thereby reducing the negative aspects of agriculture (RHEINHEIMER; GONÇALVES; PELLEGRINI, 2003).

The utilization of inappropriate handling techniques is featured among these impacts, including the intensification of vegetation cover removal, which can affect the soil fauna, resulting in a sudden change in the ecological housing, because the amount of plant residue that serves as food to edaphic organisms is reduced in several agricultural practices (BRADY, 1989).

In this context, among the sustainable and agroecological alternative models, agroforestry systems (SAF) (DANIEL, 1999) that seek the formation of a new productive system whose dynamics leads to the increase of biodiversity should be highlighted (VAZ, 2000).

Since the use of different vegetation covers and tillage practices act directly on the soil fauna population (HOFFMANN et al., 2009), it is used as an important biological indicator of soil quality, being useful in the evaluation of degraded agroecosystems (WINK et al., 2005).

In the edaphic fauna, the mesofauna stands out, comprising organisms varying from 0.2 to 2.0 mm, including, for instance, mites, springtails and other insects (HOFFMANN et al., 2009).

The main activities of these organisms are the decomposition of organic matter, production of humus, cycling of nutrients and energy, and production of complexes that cause soil aggregation (HOFFMANN et al., 2009). In view of these benefits, diversity measures such as Shannon diversity and Pielou equitability indexes can serve as balance indicators of ecosystems, working as tools for their management (MACHADO et al., 2005).

Among the most representative soils of the Cerrado, Quartz-sand Neosol and Dystrophic Oxisoil stand out (PRADO, 2001). The first represents the soils with greater agricultural potential and environmental stability. However, because Quartz-sand Neosol is very sandy, it presents serious limitations regarding water and nutrient storage (SÁ, 2007), which reduces the occurrence and diversity of edaphic organisms.

The purpose of this research was to evaluate the edaphic mesofauna of land use systems on Quartz-sand Neosol and Dystrophic Oxisoil in the State of Mato Grosso do Sul.

2 Material and Methods

The land use systems studied in soil classified as Quartz-sand Neosol (EMBRAPA, 2006) are located at 'Lagoa Grande' settlement, district of 'Itahum', in Dourados, State of Mato Grosso do Sul, between 21° 59' 30" S and 22° 00' 00" S latitudes and 55° 19' 00" W and 55° 19' 45" W longitudes. The climate, according to Köppen's classification, is Cwa type with rainy season in summer and dry season in winter. The annual rainfall is irregular, ranging from 1,000 to 1,500 mm (FIETZ; FISCH, 2009).

Six land use systems were evaluated on this soil: three agroforestry systems named SAF 1, SAF 2 and SAF 3, *Brachiaria decumbens* Stapf. pasture, conventional tillage system (CTS) and area with scrap of Native Cerrado Biome, with the latter being used as reference because it is an equilibrium system with no history of human intervention.

SAF 1 was three years old and had been implanted in an area where there used to be *B. decumbens* Stapf. pasture for over 30 years, with signs of degradation. Before its implantation, plowing was performed and then, green manures such as *Canavalia Ensiformis*, sunnhemp, pigeon pea and velvet bean were cultivated in between trees for a year. Nowadays, this SAF presents arboreal vegetation comprising 31 species (HEID, 2011).

SAF 2 was four years old and had been implanted in an area where there used to be only arboreal and native shrub species. Subsequently, pineapple was planted and, between rows, new arboreal plants were introduced in a total of 64 species (HEID, 2011). There is still high density of brachiara grass in the area.

In the area where SAF 3 was implanted there used to be the production of other annual crops. First, corn was cultivated, then, manioc and sugarcane were planted remaining for 5 years, until the implantation of the SAF, which was three years old at the time of data collection, comprising 61 arboreal species such as fruit trees usually found in domestic orchards, besides coffee trees (HEID, 2011).

The *B. decumbens* grazing area was three years old and had been previously cultivated with sugarcane.

Rice, manioc, bean, corn, white sesame and Japanese bean had been planted in the CTS area. After the harvesting of these crops, sugarcane was cultivated for the last three years.

The land use systems studied in soil classified as Dystrophic Oxisoil are located at the experimental fields of 'Emprapa' Western Agribusiness in Dourados, State of Mato Grosso do Sul, between 22° 17' 00" S and 22° 17' 30" S latitudes and 54° 48' 30" W and 54° 49' 00" W longitudes. The climate, according to Köppen's classification, is Cwa type, with dry winter and rainy summer (AMARAL et al., 2000).

Four land use systems were evaluated in this soil: agroforestry system (SAF); *Brachiaria decumbens* Stapf. pasture; conventional tillage system (CTS) and scrap of native vegetation (forest), with the latter being used as reference because it is an equilibrium system with no history of human intervention.

SAF was implanted in an area that had been used for tillage for over 10 years. The area remained in fallow, with no soil tillage at all, for two years. Subsequently, the SAF that, at the time of data collection was two and a half years old and comprised 23 arboreal species (HEID, 2011), was implanted in lines. Pigeon pea green manure was cultivated between rows, remaining in the system for the first two years.

The grazing area was implanted 15 years ago. The conventional tillage area (CTS) was implanted in the 2008/2009 crop year, where soybean was cultivated (summer crop), and turnip (*Raphanus Sativus* L.) was cultivated for purposes of soil coverage in the winter of 2009, whereas, at the time of system evaluation, the area was in fallow.

The area with native vegetation (forest) was classified as Semideciduous Seasonal Forest. It was partially degraded due to selective extraction of taller trees; it has been regenerating, free of anthropic action, for over 20 years.

Samplings of edaphic mesofauna were performed in the land use systems in both soils in September 2009. The technique used included soil collection of four random samples in each system assessed, in 0-0.05 m depth, with the use of modified Berlese funnels with 0.22 dm^{-3} capacity.

The samples were packed in plastic bags to minimize moisture loss during transport. In the Entomology Laboratory at the College of Agricultural Sciences of the Federal University of Grande Dourados, the samples were arranged and installed on a display table furnished with 25 W light bulbs, which aimed to serve as light and heat sources.

The samples remained like that for seven days and, as soil lost humidity and became unfavorable to the presence of edaphic organisms, they sought the deeper layers of the samples stowed in the funnels, being, then, collected in preservative liquid (a solution consisting of 75% alcohol, 23% distilled water and 2% glycerin).

The screening and identification of organisms (in family levels) were carried out with the aid of a stereoscopic microscope, an optic microscope and identification keys specific to mites and springtails.

The immature organisms were also quantified and considered as new groups.

In the ecological behavior evaluation of the mesofauna, the total number of individuals present in each family was measured and the land use systems were compared by Shannon-Weaner (H') diversity, Simpson (Is) diversity and Pielou (J') equitability indexes (BROWER; ZAR, 1984).

For the calculation of these indexes, the sum of the number of families and individuals was used for the four samples collected in each land use system.

The Shannon (H') diversity index utilized was (Equation 1):

$$H' = \frac{N \times ln(N) - \sum_{i=l}^{n} [n_i \times ln(n_i)]}{N} \quad (1)$$

where: N = total number of sampled individuals; n = number of sampled families; n_i = number of individuals of the family i; ln = natural logarithm.

This index links the fullness of individuals to the uniformity between the families to determine which treatment presents the greatest diversity (ROVEDDER et al., 2009); there is considerable preference to its application utilizing the natural logarithm (ln).

Simpson (Is) diversity index was obtained through the following formulas (Equation 2):

$$Is = 1 - L \qquad L = \frac{\sum_{i=l}^{n} n_i (n_i - 1)}{N(N-1)} \quad (2)$$

where: N = total number of sampled individuals; n = number of sampled families; n_i = number of individuals of the family i.

Pielou (J') equitability index represents the ratio between the diversity of families found in the present sampling and the maximum diversity that the community will be able to reach (BROWER; ZAR, 1984), and it was calculated by the following formula (Equation 3):

$$J' = \frac{H'}{H'_{max}} \qquad H'_{max} = ln(n) \quad (3)$$

where: n = number of sampled families; H' = Shannon-Weaner index.

In the J' calculation of the land use systems located in Quartz-sand Neosol, the H'_{max} obtained by the native vegetation was utilized as reference for maximum diversity, once it is an equilibrium system with no history of human intervention.

3 Results and Discussion

In all study systems of Quartz-sand Neosol, the families of mites belonging to Cryptostigmata suborder were found in greater amounts and the families belonging to Astigmata and Prostigmata suborders occurred in smaller amounts (Table 1), this was also observed by Maribie et al. (2011) in Taita Taveta, Kenya, in different land use systems (corn, coffee, horticulture, napier grass, fallow, pine, cypress and native forest) and types of soil, including Neosols. Regarding springtails, the families belonging to Entomobryomorpha and Poduromorpha suborders were more plentiful (Table 1).

The area of native vegetation presented a total of 17 families (considering immature mites and springtails), totalizing 68 individuals (Figure 1). Among the agroforestry systems, SAF 1 presented the largest number of families (fifteen), with a total of 332 individuals; whereas SAF 2 presented only five families, with 83 individuals; and SAF 3, with thirteen families, totalized 104 individuals (Figure 1). All agroforestry systems, as well as native vegetation, presented higher density (occurrence) of immature individuals, which was especially greater in SAF 1 (Figure 1).

The pasture area presented only one family of mite (Parasitidae), with one individual, and the CTS area also showed low fullness, with one family of mite identified (Rhodacaridae) and a few immature individuals, totalizing five individuals (Figure 1).

In environments widely grazed, both by cattle trampling and/or use of heavy machinery, there was lower diversity and fullness of mesofauna organisms. On the other hand, this population tends to increase when increments of organic matter occur (MUSSURY et al., 2002).

When assessing the diversity of families by the Shannon-Weaner (H') index, the highest value was observed in the native vegetation area and the lowest in the pasture area (Table 2). These results confirm Hoffmann et al. (2009), who observed that tillage systems in hot and humid climate, including pasture, influenced the edaphic mesofauna, reducing its density and diversity in comparison to native forest areas.

Among the agroforestry systems, SAF 3 presented the greatest diversity (Table 2), followed by SAF 1 and SAF 2, in view of the superiority of immature individuals compared to the number of families identified in the last system (Figure 1), once diversity is connected to the ratio between the number of families and the distribution of the number of individuals among families.

According to Rovedder et al. (2009), the soil covers that provided the predominance of organisms in a given group, notably Colembolla and Hymenoptera, reduced the equality

Table 1. Families of mites and springtails and total number of individuals sampled in the agroforestry systems SAF 1, SAF 2 and SAF 3, pasture, conventional tillage system (CTS) and native vegetation (Native Veg.), located in the district of Itahum, in Dourados, State of Mato Grosso do Sul.

CLASSIFICATION	System	Total number of individuals
ARACHNID CLASS		
ACARIFORME ORDER		
Astigmata SUBORDER		
Acaridae	SAF 3	4
Carpoglyphidae	SAF 1	1
Saproglyphidae	SAF 1	1
Cryptostigmata SUBORDER		
Archeonothridae	SAF 1	1
Brachychthoniidae	Native Veg., SAF 1, 2, 3	68
Epilohmanniidae	Native Veg.	1
Haplochthoniidae	Native Veg., SAF 3	3
Haplozetidae	Native Veg.	1
Microzetidae	Native Veg., SAF 1	2
Multoribulidae	Native Veg.	1
Oppiidae	Native Veg., SAF 2	10
Phthiracaridae	Native Veg.	3
Plateremaeidae	Native Veg., SAF 1	2
Prostigmata SUBORDER		
Rhagidiidae	Native Veg., SAF 1, 2, 3	27
Tarsonemidae	SAF 1, 3	4
Tetranychidae	Native Veg.	1
PARASITIFORME ORDER		
Mesostigmata SUBORDER		
Arctacaridae	SAF 3	1
Ascidae	SAF 3	3
Macrochelidae	SAF 1	1
Parasitidae	Pasture, SAF 1, 3	9
Rhodacaridae	Native Veg., CTS, SAF 1, 2, 3	71
COLLEMBOLA CLASS		
ENTOMOBRYOMORPHA ORDER		
Entomobryidae	Native Veg., SAF 3	7
Isotomidae	Native Veg., SAF 1, 3	29
PODUROMORPHA ORDER		
Hypogastruridae	Native Veg.	1
Onychiuridae	Native Veg., SAF 1, 3	90
SYMPHYPLEONA ORDER		
Sminthurididae	SAF 1	6

Native Veg. – area with scrap of Native Cerrado Biome; SAF 1, SAF 2, SAF 3 – Agroforestry Systems.

between groups and, consequently, presented lower diversity indexes.

Through the Simpson (Is) diversity index, SAF 3, native vegetation and SAF 1, respectively, were superior (Table 2). The lowest values were found in CTS, SAF 2 and pasture (Table 2).

The Pielou (J') equitability index, calculated for the climax diversity estimate of systems, demonstrated that SAF 3 and SAF 1, respectively, were closer to native vegetation status (used as reference for maximum diversity); while SAF 2, CTS and pasture, with the lowest values, were still very far from acquiring satisfactory diversity of edaphic mesofauna (Table 2).

Agricultural practices, such as monoculture of sugarcane in CTS and *B. decumbens* in pasture, decisively influence the population of organisms. The environmental modifications caused by these types of crops reduce the amount and variety of vegetal residues that serve as food for edaphic organisms and may decrease the density and diversity of fauna compared to natural ecosystems (HOFFMANN et al., 2009, SOCARRÁS; ROBAINA, 2011).

Despite the diversity of species, SAF 2 presented, as previously mentioned, high density of brachiaria grass

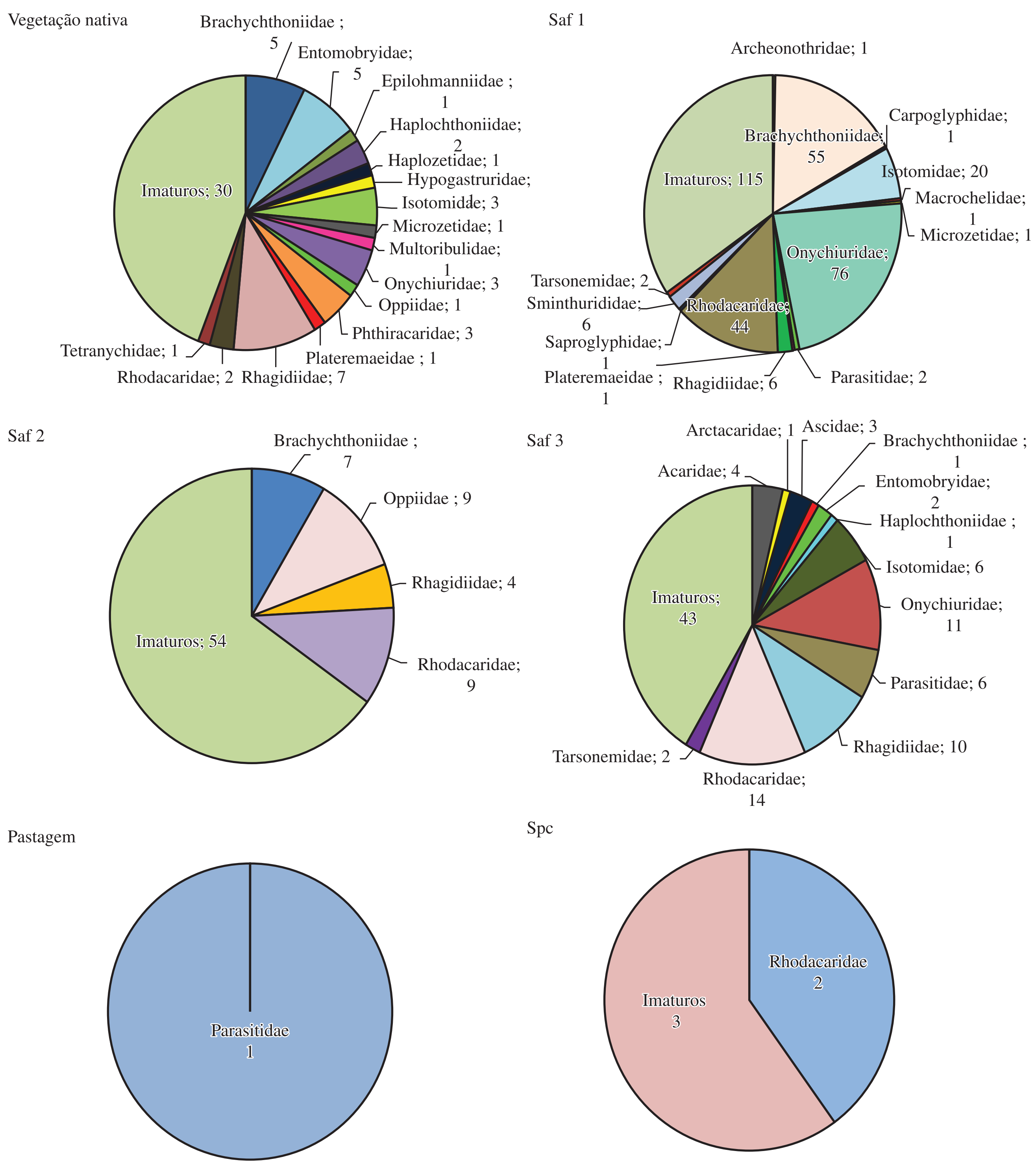

Figure 1. Distribution of families of mites and sprigtails in agroforestry systems SAF 1, SAF 2 and SAF 3, pasture, conventional tillage system (CTS) and native vegetation, located in the district of Itahum, in Dourados, State of Mato Grosso do Sul. Native Vegetation – area with scrap of Native Cerrado Biome; SAF 1, SAF 2, SAF 3 – Agroforestry Systems.

uniformly distributed in advanced stage of development, providing high cover of the soil. Thus, the variety of vegetal residues originated by this system is also reduced, causing, consequently, the decrease of the edaphic fauna.

Given this, it is possible to state that SAF 3 and SAF 1, because they present soil cover formed by vegetal residues of diversified species, were the agroforestry systems with the greatest mesofauna diversity. This demonstrates the greater sustainability regarding the biological quality of the soil of these systems, since the variety of mites and springtails can be used as bioindicators of environmental conditions (LOPES ASSAD, 1997).

Similar to the study systems located on Quartz-sand Neosol, the families of mites belonging to the Cryptostigmata suborder were found in greater number in Distrofic Oxisoil, while the ones belonging to the Prostigmata and Mesostigmata suborders were found in smaller number (Table 3).

Regarding springtails, the families from the Entomobryomorpha suborder were more plentiful (Table 3), as noticed by Ribeiro-Troian, Baldissera and Hartz (2009), when evaluating forest environments formed by *Pinus* spp., *Eucalyptus* spp. and *Araucaria angustifolia* plantations and remaining native rain forest areas.

The forest area presented 14 families (considering immature mites and springtails), with a total of 108 individuals. The agroforestry system (SAF), with 13 families, totalized 171 mesofauna representatives (Figure 2), while the pasture area, with the same number of families, presented 108 individuals, coincident to the forest area. The greatest number of families (23) and representatives (308 individuals) were registered in the CTS area (Figure 2).

The agroforestry system (SAF), pasture and conventional tillage system (CTS) presented greater density (occurrence) of immature individuals, and abundance of the Isotomidae springtail family was verified in the forest area (Figure 2). It is worth mentioning that springtails are largely distributed and abundant in the sacking (ANTONIOLLI et al., 2006).

When analyzing the diversity of families by the Shannon-Weaner (H'), it was possible to observe superiority for the CTS area, followed by the forest and pasture areas (Table 4). The SAF presented smaller diversity (Table 4), which can be related to the very high density of immature organisms and Isotomide, respectively, compared to the other families (Figure 2). Thus, the H' index is maximum when the subjects

Table 2. Shannon-Weaner (H') index, Simpson (Is) index and Pielou (J') index for SAF 1, 2 and 3, pasture, conventional tillage system (CTS) and native vegetation (Native Veg.), located in the district of Itahum, in Dourados, State of Mato Grosso do Sul.

System	Index		
	H'	Is	J'
Native Veg.	2.096	0.786	0.740
SAF 1	1.751	0.781	0.618
SAF 2	1.116	0.550	0.394
SAF 3	1.941	0.788	0.685
Pasture	0.000	0.000	0.000
CTS	0.673	0.600	0.238

Native Veg. – area with scrap of Native Cerrado Biome; SAF 1, SAF 2, SAF 3 – Agroforestry Systems.

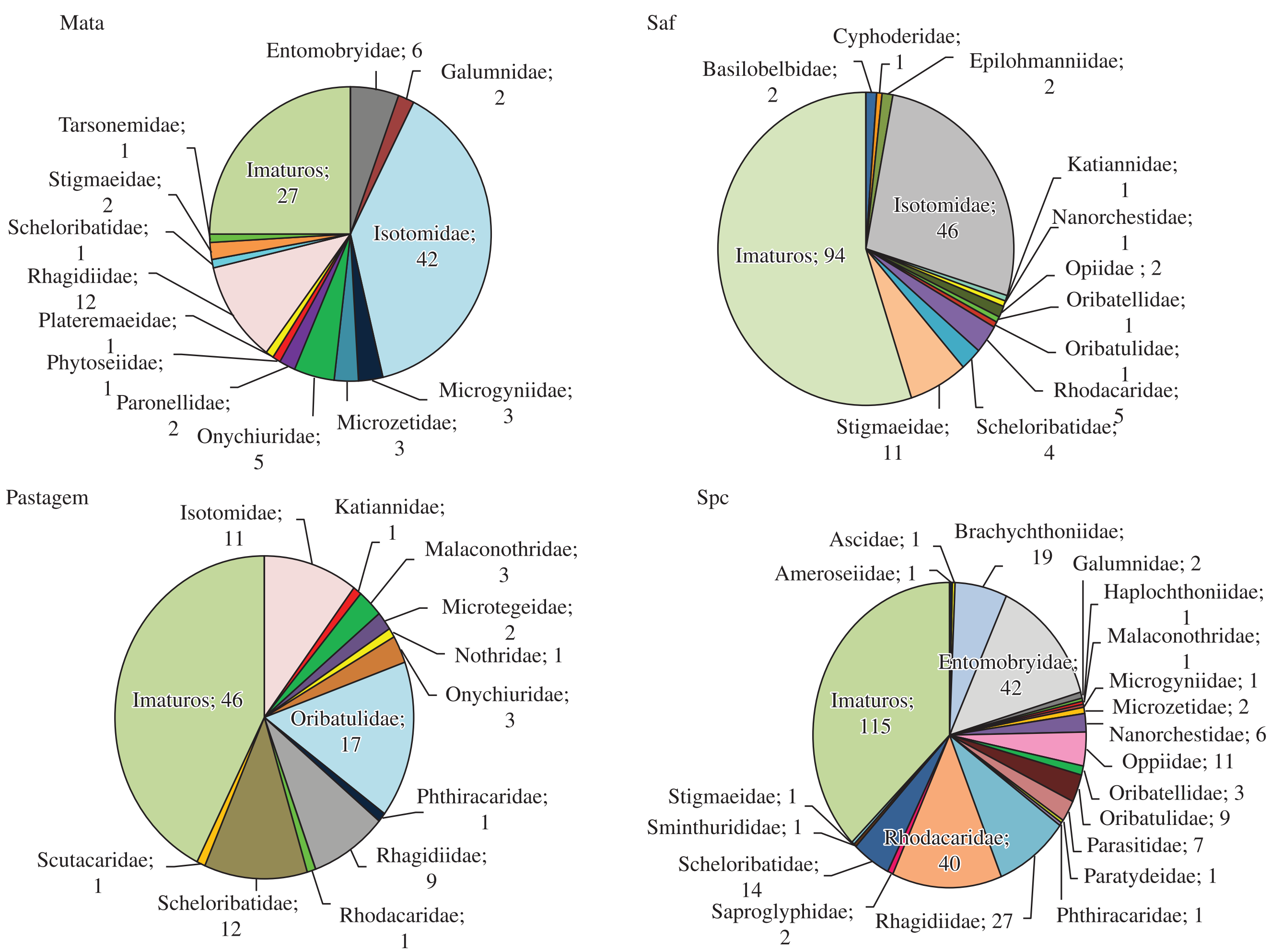

Figure 2. Distribution of families of mites and sprigtails in agroforestry system (SAF), pasture, conventional tillage system (CTS) and forest**,** located at 'Embrapa' Western Agribusiness, in Dourados, State of Mato Grosso do Sul. Forest – Semideciduous Seasonal Forest area; SAF – Biodiverse Agroforestry Systems.

Table 3. Families of mites and springtails and total number of individuals sampled in the agroforestry system SAF, pasture, conventional tillage system (CTS) and forest, located at 'Embrapa' Western Agribusiness, in Dourados, State of Mato Grosso do Sul.

CLASSIFICATION	System	Total number of individuals
ARACHNIDA CLASS		
ACARIFORME ORDER		
Astigmata SUBORDER		
Saproglyphidae	CTS	2
Cryptostigmata SUBORDER		
Basilobelbidae	SAF	2
Brachychthoniidae	CTS	19
Epilohmanniidae	SAF	2
Galumnidae	Forest, CTS	4
Haplochthoniidae	CTS	1
Malaconothridae	Pasture, CTS	4
Microtegeidae	Pasture	2
Microzetidae	Forest, CTS	5
Nothridae	Pasture	1
Opiidae	SAF, CTS	13
Oribatellidae	SAF, CTS	4
Oribatulidae	SAF, Pasture, CTS	27
Phthiracaridae	Pasture, CTS	2
Plateremaeidae	Forest	1
Scheloribatidae	Forest, SAF, Pasture, CTS	31
Prostigmata SUBORDER		
Nanorchestidae	SAF, CTS	7
Paratydeidae	CTS	1
Rhagidiidae	Forest, Pasture, CTS	48
Scutacaridae	Pasture	1
Stigmaeidae	Forest, SAF, CTS	14
Tarsonemidae	Forest	1
PARASITIFORME ORDER		
Mesostigmata SUBORDER		
Ameroseiidae	CTS	1
Ascidae	CTS	1
Microgyniidae	Forest, CTS	4
Parasitidae	CTS	7
Phytoseiidae	Forest	1
Rhodacaridae	SAF, Pasture, CTS	46
COLLEMBOLA CLASS		
ENTOMOBRYOMORPHA ORDER		
Cyphoderidae	SAF	1
Entomobryidae	Forest, CTS	48
Isotomidae	Forest, SAF, Pasture	99
Paronellidae	Forest	2
PODUROMORPHA ORDER		
Onychiuridae	Forest, Pasture	8
SYMPHYPLEONA ORDER		
Katiannidae	SAF, Pasture	2
Sminthurididae	CTS	1

Forest – Semideciduous Seasonal Forest area; SAF – Biodiverse Agroforestry Systems.

Table 4. Shannon-Weaner (H') index, Simpson (Is) index and Pielou (J') index for the SAF, pasture, conventional tillage system (CTS) and forest**,** located at 'Embrapa' Western Agribusiness, in Dourados, State of Mato Grosso do Sul

System	Index		
	H'	Is	J'
Forest	1.855	0.773	0.703
SAF	1.356	0.623	0.529
Pasture	1.828	0.769	0.713
CTS	2.126	0.811	0.678

Forest – Semideciduous Seasonal Forest area; SAF – Biodiverse Agroforestry Systems.

of study hold the same number of individuals and are close to their minimum value if the individuals show lower equality (IBÁÑEZ et al., 1995).

By means of the Simpson (Is) diversity index, the same results were verified through the previous index (H'), with CTS and SAF being the systems of the greatest and smallest diversity, respectively (Table 4).

The Pielou (J') equitability index demonstrated that the pasture and forest areas, followed closely by the CTS area, were closer to their maximum diversities than the SAF (Table 4).

The greatest family diversity indexes found in CTS may be related to the fact that the area was planted with turnip (*Raphanus Sativus* L.) green manure, just before sample collection, which may have served as food source and, therefore, favored the maintenance and multiplication of individuals. In addition, the vegetal cover can contribute to greater moisture retention and temperature softening of the soil (ROSSI et al., 2007), contributing to the development of the edaphic biota (ROVEDDER et al., 2009).

Mites and springtails are distributed in the soil in accordance with environmental and edaphic factors (MELO; LIGO, 1999) and, when organic fertilization is applied, these organisms can act more intensely in the decomposition and nutrient cycling processes (CULIK; SOUZA; VENTURA, 2002).

The low indexes observed in the SAF area can be explained by the time of implantation of this system (just two and a half years), when compared to the others, which are older. Given this, the SAF area needs a longer period of time before it can foment greater diversity of mesofauna in the soil, improving sustainability from the biological point of view and, consequently, from the environmental one as well. That is what is expected, once the systems implanted at 'Embrapa' Western Agribusiness are located on better quality soils than those at the Lagoa Grande settlement and, in this case, as previously discussed, data from the native vegetation and the three SAF studied have proved to be better than the conventional tillage and pasture.

4 Conclusions

SAF 1 and SAF 3, on Quartz-sand Neosol are more diverse and, therefore, more sustainable regarding the biological quality of the soil, while pasture is noteworthy for the lower sustainability. On Dystrophic Oxisoil, CTS has proved to be more sustainable, with SAF being the system with the lowest edaphic mesofauna diversity. The agroforestry systems (SAF) grant greater sustainability from the biological point of view on Quartz-sand Neosol than on Dystrophic Oxisoil.

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