ECOLOGY, BEHAVIOR AND BIONOMICS

Diversity of Edaphic Rhodacaroid Mites (Acari: Mesostigmata: Rhodacaroidea) in Natural Ecosystems in the State of São Paulo, Brazil

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Neotropical Entomology 33(4):547-555 (2004)

Diversidade de Ácaros Edáficos Rhodacaroidea (Acari: Mesostigmata) em Ecossistemas Naturais no Estado de São Paulo

RESUMO - Avaliou-se neste estudo a diversidade de ácaros Rhodacaroidea em amostras de folhedo e solo coletadas em ecossistemas conhecidos como "Mata Atlântica" e "Cerrado" do estado de São Paulo. O total de 969 Rhodacaroidea adultos foi coletado, 913 na Mata Atlântica e 56 no Cerrado. Foram encontrados representantes de três famílias de Rhodacaroidea: Ologamasidae, Rhodacaridae e Digamasellidae. Ologamasidae foi a mais numerosa na Mata Atlântica, enquanto Rhodacaridae foi a mais numerosa no Cerrado. Os Rhodacaroidea de ambos ecossistemas representaram 12 gêneros de Ologamasidae, dois de Rhodacaridae e um de Digamasellidae. O total de 13 gêneros foi encontrado em amostras de folhedo e sete em amostras de solo da Mata Atlântica. Os gêneros mais comuns neste ecossistema foram *Neogamasellevans* Loots & Ryke e *Ologamasus* Berlese, em folhedo, e *Rhodacarus* Oudemans, em solo. Foram coletadas 31 morfoespécies, sendo *Rhodacarus* sp.1, *Neogamasellevans* sp.1 e *Neogamasellevans* sp.6 as mais abundantes. Foram encontrados três gêneros de Rhodacaroidea em cada substrato do Cerrado, *Rhodacarus* e *Rhodacarellus* Willman sendo os mais abundantes. Das cinco morfoespécies encontradas neste ecossistema, a mais abundante foi *Rhodacarus* sp.1. As morfoespécies coletadas na Mata Atlântica apresentaram mais alta eqüitabilidade na freqüência de ocorrência quando comparadas àquelas do Cerrado, especialmente em amostras de folhedo. As espécies de planta amostradas na Mata Atlântica foram divididas em dois grupos distintos, de acordo com as morfoespécies de Rhodacaroidea a elas associadas: 1) *Astrocaryum aculeatissimum* (Schott), *Bactris setosa* Mert. e *Attalea dubia* (Mert.); e 2) *Syagrus romanzoffiana* (Cham.) e *Euterpe edulis* Mert.

PALAVRAS-CHAVE: Ácaro edáfico, ecologia, folhedo, solo, taxonomia

ABSTRACT - This study was conducted to evaluate the diversity of rhodacaroid mites in litter and soil samples from "Mata Atlântica" and "Cerrado", e ecosystems of the state of São Paulo, Brazil. A total of 969 adult rhodacaroids were collected, 913 in the Mata Atlântica and 56 in the Cerrado. Representatives of three rhodacaroid families were from: Ologamasidae, Rhodacaridae and Digamasellidae. Most numerous groups were ologamasids in the Mata Atlântica and rhodacarids in the Cerrado. Mites from both ecosystems represented 12 genera of Ologamasidae, two of Rhodacaridae and one of Digamasellidae. A total of 13 genera were found in litter samples and seven in soil samples of Mata Atlântica. The most common genera in this ecosystem were *Neogamasellevans* Loots & Ryke and *Ologamasus* Berlese in litter, and *Rhodacarus* Oudemans in soil samples. Thirty-one morphospecies were recovered, the most abundant being *Rhodacarus* sp.1, *Neogamasellevans* sp.1 and *Neogamasellevans* sp.6. Three rhodacaroid genera were found in each substrate of Cerrado, the most abundant being *Rhodacarus* and *Rhodacarellus* Willman. Of the five morphospecies found in this ecosystem, the most abundant was *Rhodacarus* sp.1. Morphospecies collected in Mata Atlântica displayed a higher equitability in frequency of occurrence than those of Cerrado, especially in litter samples. The plant species sampled in Mata Atlântica comprised two distinct groups in terms of the rhodacaroid morphospecies associated with them: 1) *Astrocaryum aculeatissimum* (Schott), *Bactris setosa* Mart. and *Attalea dubia* (Mart.); and 2) *Syagrus romanzoffiana* (Cham.) and *Euterpe edulis* Mart.

KEY WORDS: Edaphic mite, ecology, litter, soil, taxonomy

Relatively little is left of the native vegetation of the ecosystems known as Mata Atlântica and Cerrado in the state of São Paulo, Brazil, mostly due to the conversion of these areas to agricultural use. The resultant reduction or loss of native vegetation has likely led to a concomitant loss of diversity of organisms normally harbored in these habitats. Included here are the many mite species inhabiting the underlying litter and mineral soil layers. Identification of the soil Acari and clarification of the roles that they may play in the Mata Atlântica and Cerrado are considered essential to understanding and preserving these endangered natural resources.

Mites are a member group of the Class Arachnida and comprise over 40,000 named species living in virtually any terrestrial, aquatic and marine habitat capable of supporting life (Krantz 1978, Walter & Proctor 1998). Soil and litter-inhabiting mites are highly diverse and ubiquitous, with the most conspicuous groups being the orders Oribatida and Mesostigmata (Wallwork 1970, 1983; Edwards, 1991; Krantz & Ainscough 1990). The mesostigmatic superfamily Rhodacaroidea comprises five families, three of which have strong ties to edaphic habitats, the Ologamasidae, Rhodacaridae and Digamasellidae (Lee 1970, Krantz 1978, Evans 1992). Lindquist (1979) tentatively listed the Halolaelapidae, a family of mites that favors wet organic substrates and coastal intertidal habitats, as a member group of the Rhodacaroidea and reaffirmed this affiliation in a later paper (Smith *et al.* 1998). A fifth family, the Laelaptonyssidae, is primarily termitophilous in Australasia and North America (Krantz 2000). Karg (1998) elevated Lee's rhodacarid subfamily Gamasiphinae to family status, but it is here considered a subfamily of Ologamasidae (Rhodacaridae *pars* of Lee 1970). Soil and litter rhodacarids and ologamasids are widely distributed (Krantz & Ainscough 1990) and many prey on other arthropods and on nematodes (Lee 1973, Krantz 1978, Walter 1986, Evans 1992, El-Banhawy 1999). Digamasellids are common in many ground surface habitats, but some species live as omnivores in bark beetle galleries and are phoretic on their beetle hosts (Lindquist 1975).

Lack of information on the nature of the Brazilian rhodacaroid fauna prompted the authors to initiate the study described in the following pages. The primary objectives of this study were to identify the edaphic rhodacaroid fauna of the Mata Atlântica and the Cerrado, two major agriculturally impacted ecosystems in the state of São Paulo, and to determine the degree of interrelationship between mite occurrence and plant groups that are dominant in these ecosystems.

Materials and Methods

Mites were sampled once during each season of the year 2000 in the following regions of each ecosystem: Mata Atlântica - Cananéia (24º53'45"S, 47º50'17"W), Pariquera-Açu (24º36'41"S, 47º53'23"W), Piracicaba (22º46'43"S, 47º49'32"W; 22º38'58"S, 47º48'31"W and 22º33'57"S, 47º57'28"W); Cerrado - Luiz Antonio (21º36'13"S, 47º47'17"W), Pirassununga (21º56'20"S, 47º28'26"W) and São Carlos (21º54'50"S, 47º49'21"W).

Litter and soil samples were collected beneath selected plants representing the most common species of a dominant and economically important plant family occurring in each ecosystem. In the Mata Atlântica, nine species of Arecaceae (palm plants) were considered in this study. However, because of the irregular distribution of those plants, only *Euterpe edulis* Mart. and *Syagrus romanzoffiana* (Cham.) were found and sampled in all regions. *Astrocaryum aculeatissimum* (Schott) and *Bactris setosa* Mart. were sampled only in Cananéia and Pariquera-Açu; *Attalea dubia* (Mart.) Burret, only in Pariquera-Açu; *Acrocomia aculeata* (Jacq.), *G. brevispatha* Barb. Rodr. and *S. oleracea* (Mart.) Becc., only in Piracicaba; and *Geonoma schottiana* Mart., only in Cananéia. In the Cerrado, eight species of Myrtaceae were considered in this study. Also for the irregularity of the distribution of those plants, only *Campomanesia pubescens* (DC.) Berg, *Myrcia guianensis* (Aubl.) DC. and *Psidium guajava* L. were found and sampled in all regions. *M. venulosa* DC. was sampled only in Pirassununga and São Carlos; *P. australe* Cambess, only in São Carlos; *P. guineense* (Aubl.) DC., only in Pirassununga, *P. cinereum* Mart. Ex DC. and *M. bella* Cambess, only in Luiz Antonio. Samples were taken from beneath three plants of each of the selected species in each region. A litter and a soil sample were taken from different points under each plant, at most 50 cm from its base.

Litter samples were collected within a frame of 15 x 15 cm placed randomly on the ground. All the material within the frame was placed in a plastic bag, which was then put into a cool box maintained at 12-21ºC for transport to the laboratory. Soil samples were collected between 0 and 5 cm from the surface in hollow metal cylinders (6.0 x 5.7 x 5.0 cm in external and internal diameter, and height, respectively). Each sample and the corresponding metal cylinder were placed in a plastic bag and transported to the laboratory as mentioned for the litter samples.

Mites were extracted from the soil and litter samples using modified Berlese-Tullgren equipment (Oliveira *et al.* 2001). A subsample of each litter sample was utilized for mite extraction in cases where the whole sample exceeded the capacity of the extracting unit (ca. 471 cm^3). Extraction was carried out over a period of three days, during which time the voltage of the lamps was increased daily until the temperature in the extracting unit reached ca. 55ºC.

Extracted Mesostigmata were mounted in Hoyer's medium (Krantz 1978). Rhodacaroids were separated from other groups and adults were identified to genera and morphospecies based primarily on the works of Lee (1966, 1970, 1973), Loots & Ryke (1967a, b), Evans & Till (1979), and Karg (1976, 1993, 1996, 2000). Representative samples of each morphospecies are deposited in the reference collection of Setor de Zoologia, Departamento de Entomologia, Fitopatologia e Zoologia Agrícola, ESALQ - Universidade de São Paulo, Piracicaba, State of São Paulo. Identification of described species and descriptions of new taxa collected during the course of this study will be the subject of a future paper.

Equitability of the frequencies of occurrence of morphospecies were determined using Pielou indexes (Odum 1988). Only the Arecaceae were considered in the analyses of similarities between plant species in relation to associated

rhodacaroid morphospecies, because of the relatively reduced number of those mites associated with the Myrtaceae. In this analysis, Mountford indexes were utilized (Mountford 1962, Southwood 1995). The most rare species were not considered in this study; only species represented by at least a total of 14 females in all collected samples were considered.

Results and Discussion

A total of 969 adult rhodacaroids were found. The majority of these were collected from the litter of the Mata Atlântica (Table 1), where 1.5-3.1 rhodacaroids were found per 100 cm^3 of that substrate. The number of mites was significantly higher in Cananeia than in other regions of this ecosystem. Rhodacaroids were rare in the litter of the Cerrado, where occurrence was no higher than 0.1 rhodacaroids per 100 cm^3. No rhodacaroids were found in the litter of Pirassununga, where the vegetation of the experimental site is considerably sparser than in other two regions of the Cerrado.

Table 1. Average numbers of adult (females and males) of Rhodacaroidea mites per 100 cm^3 (± SEM) of litter and soil collected in different localities of the state of São Paulo.

Region	Litter	Soil
	Mata Atlântica	
Cananéia	3.1 ± 0.09 a A	0.2 ± 0.00 a B
Pariquera-Açu	1.7 ± 0.17 b A	0.1 ± 0.00 a B
Piracicaba	1.5 ± 0.09 b A	1.7 ± 0.074 b B
	Cerrado	
Luiz Antônio	0.1 ± 0.00 a A	0.2 ± 0.01 a A
Pirassununga	0.0 ± 0.00 a A	0.2 ± 0.03 a A
São Carlos	0.1 ± 0.01 a A	0.1 ± 0.02 a A
Total	6.5 ± 0.36 A	2.5 ± 0.146 B

In a same line, averages followed by different capital letters are significantly different at 5% level (Tukey's test); for each substrate within an ecosystem, averages followed by different small case letters are significantly different at 5% level (Tukey's test) (n = 60).

The number of rhodacaroids in soil was typically very low in both ecosystems (0.1-0.2 mites per 100 cm^3), except for the region of Piracicaba where 1.7 rhodacaroids per 100 cm^3 were found. It is unclear as to why rhodacaroids were so much more common in samples from that region, but the number of oribatid mites (Oribatida) in the same samples was also higher than in other two regions (A.R. Oliveira, pers. comm.).

Rhodacaroids were significantly more abundant in the litter layer than in the soil of all three regions of the Mata Atlantica, but no significant differences were observed in this regard in the Cerrado. The abundance of rhodacaroids in the litter samples from the Mata Atlântica may be related to the thickness and diversity of the litter layer from which they were derived. A heavy litter layer would favor the development of abundant and diverse prey for these predators as suggested by Koehler (1997) for the whole Gamasina. Occurrence of these large rhodacaroid populations may also be related to climatic, physical and chemical factors in the underlying soil that favor their development.

Groups of Rhodacaroids. Ologamasid and rhodacarid mites were found in litter and soil samples of both ecosystems. A single digamasellid was found in this study, in the Mata Atlântica (Table 2). Ologamasids were considerably more abundant than rhodacarids in litter samples, especially in the Mata Atlântica where rhodacarids were rare. In soil samples, however, rhodacarids comprised approximately 1/3 of the rhodacaroids collected in the Mata Atlântica and more than 95% of those collected in the Cerrado. Representatives of 12 genera of Ologamasidae, two of Rhodacaridae and one of Digamasellidae were found.

A total of 13 rhodacaroid genera were identified from soil and litter in the Mata Atlântica (Table 2). Six of these were represented only in the litter. *Neogamasellevans* Loots and Ryke was the most numerous genus in both litter and soil samples, numbering over 50% of the rhodacaroids found in each of these substrates. The most common genera encountered almost exclusively in litter or soil were *Ologamasus* Berlese (ca. 21% of the total) and *Rhodacarus* Oudemans (ca. 35% of the total), respectively. Also very abundant in the litter were mites of an undescribed genus, listed as "New genus 1" in Table 2 (ca. 13% of the total).

Thirty-one rhodacaroid morphospecies were identified from the Mata Atlântica, 18 of which were found only in the litter and two only in the soil (Fig. 1). The most abundant morphospecies were *Rhodacarus* sp.1, *Neogamasellevans* sp.1 and *Neogamasellevans* sp.6, each of which comprising ca. 10% of the rhodacaroids found in the Mata Atlântica. The most abundant morphospecies in litter were *Neogamasellevans* sp.1 and *Neogamasellevans* sp.6. The most frequently encountered soil morphospecies was *Rhodacarus* sp.1, with *Neogamasellevans* sp.8 a distant second.

Four genera were recovered from the Cerrado, with two occurring exclusively in litter and two only in soil samples. The number of litter rhodacaroids in Cerrado samples was quite small compared with that found in the Mata Atlântica, and did not allow for consistent analysis of group predominance in this substrate. The number of rhodacaroids in soil samples also was relatively low. Most were of the genus *Rhodacarus* (ca. 64% of the total), followed by *Rhodacarellus* Willmann (ca. 32% of the total).

Morphospecies diversity was considerably lower in the Cerrado samples than in those of the Mata Atlântica, as expected from the much lower number of rhodacaroids in that ecosystem. Two were found in the litter, and three others in the soil (Fig. 1). The most abundant soil morphospecies was *Rhodacarus* sp.1, accounting for over 60% of the rhodacaroids found.

The shape and structure of the body of ologamasids, the predominant rhodacaroids found in this study, may preordain their greater abundance in the litter. Most ologamasid species are moderately large and have a holonotal dorsal shield and pronounced general sclerotization of the idiosoma (Lee 1970). These characteristics may limit the ability of many ologamasids to explore the minute interstices beneath the soil surface. It is

Table 2. Total numbers and corresponding percentages (in parentheses) of adult (females and males) of Rhodacaroidea found in samples of litter and soil in the Mata Atlântica and Cerrado ecosystems of the state of São Paulo in the year 2000.

Families and genera	Mata Atlântica		Cerrado	
	Litter	Soil	Litter	Soil
Ologamasidae	739 (99.2)	91 (65.5)	9 (75.0)	2 (4.5)
Neogamasellevans	389 (52.2)	77 (55.5)	8 (66.7)	0 (0.0)
Ologamasus	159 (21.3)	5 (3.6)	1 (8.3)	0 (0.0)
Notogamasellus	21 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)
Hydrogamasellus	3 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)
Afrogamasellus	0 (0.0)	0 (0.0)	0 (0.0)	2 (4.5)
Gamasiphoides	34 (4.6)	5 (3.6)	0 (0.0)	0 (0.0)
Gamasiphis	3 (0.4)	1 (0.7)	0 (0.0)	0 (0.0)
New genus 1	95 (12.8)	2 (1.4)	0 (0.0)	0 (0.0)
New genus 2	7 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)
New genus 3	5 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)
New genus 4	20 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)
New genus 5	3 (0.4)	1 (0.7)	0 (0.0)	0 (0.0)
Rhodacaridae	5 (0.7)	48 (34.5)	3 (25.0)	42 (95.5)
Rhodacarus	5 (0.7)	48 (34.5)	3 (25.0)	28 (63.6)
Rhodacarellus	0 (0.0)	0 (0.0)	0 (0.0)	14 (31.8)
Digamasellidae	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Digamasellus	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Total	745 (100.0)	139 (100.0)	12 (100.0)	44 (100.0)

suspected that at least some of the ologamasids taken from soil samples were actually living in the transition zone between the soil and the litter layers, where their structure and size would not pose a problem. Van den Berg & Ryke (1967) and Mineiro & Moraes (2001) also found ologamasids to be the predominant mesostigmatic mites in the litter (but not in the soil), of natural tropical ecosystems.

The abundance of Rhodacaridae in the soil layers of both the Cerrado and Mata Atlântica may relate to their relatively small size, light sclerotization and freely articulated body parts, all of which allow them to move easily in the confined interstitial spaces between soil particles (Lee 1970, Krantz & Ainscough 1990). Rhodacaroids have been reported to inhabit deep soil layers (Krantz 1978) even in soils with low organic matter contents (Koehler 1991, 1997). Similarly, rhodacarids have been found in much larger numbers than ologamasids in temperate forest soils (Van den Berg & Ryke 1967, Evans *et al*. 1968, Price 1973, Crossley Jr. *et al*. 1992, Coleman & Crossley Jr. 1996, Barendse *et al*. 2002). However, Smith *et al.* (1998) reported a slightly higher number of ologamasid than of rhodacarid mites in the Montane Cordillera Ecozone of Canada. The low numbers of rhodacarids observed in this study agree with the data obtained recently by Mineiro & Moraes (2001). In that study, the authors recovered only a few rhodacarids from soil and from litter layers in a rubber tree (*Hevea brasiliensis* Müll. Arg.) plantation in Piracicaba (SP).

Krantz (1978) noted that digamasellids are widely distributed at the soil surface and in organic substrates, feeding on collembolans, nematodes, eggs of other arthropods and, possibly, on fungi. Smith *et al.* (1998) mentioned digamasellids as the most numerous rhodacaroid mites in the Montane Cordillera Ecozone of Canada. Mites of that family were rare in the areas where this study was conducted. Similarly, no digamasellids were found by Mineiro & Moraes (2001) in the study referred to above.

The difference in numbers of rhodacaroid genera collected in this study under Arecaceae and Myrtaceae is likely related to differences in prey quantity and diversity in the respective collecting areas. These factors may be related to the quantity and quality of organic matter (litter in different stages of decomposition) under the canopy of each selected plant, which in turn are function of the characteristics of the plant selected for study, and of its close neighbors. Thus, by being closer together and more diverse than those of the Cerrado, plants of the Mata Atlântica deposit a denser layer of organic matter on the soil surface . In addition, the Arecaceae of the Mata Atlântica usually grow under other plant species, which add their litter to the underlying soil. The influence of neighboring plants apparently is less significant in the Cerrado where the plants are usually scattered. The less dense vegetation results in a smaller amount and diversity of organic material under each plant, reducing the quantity and diversity of prey and,

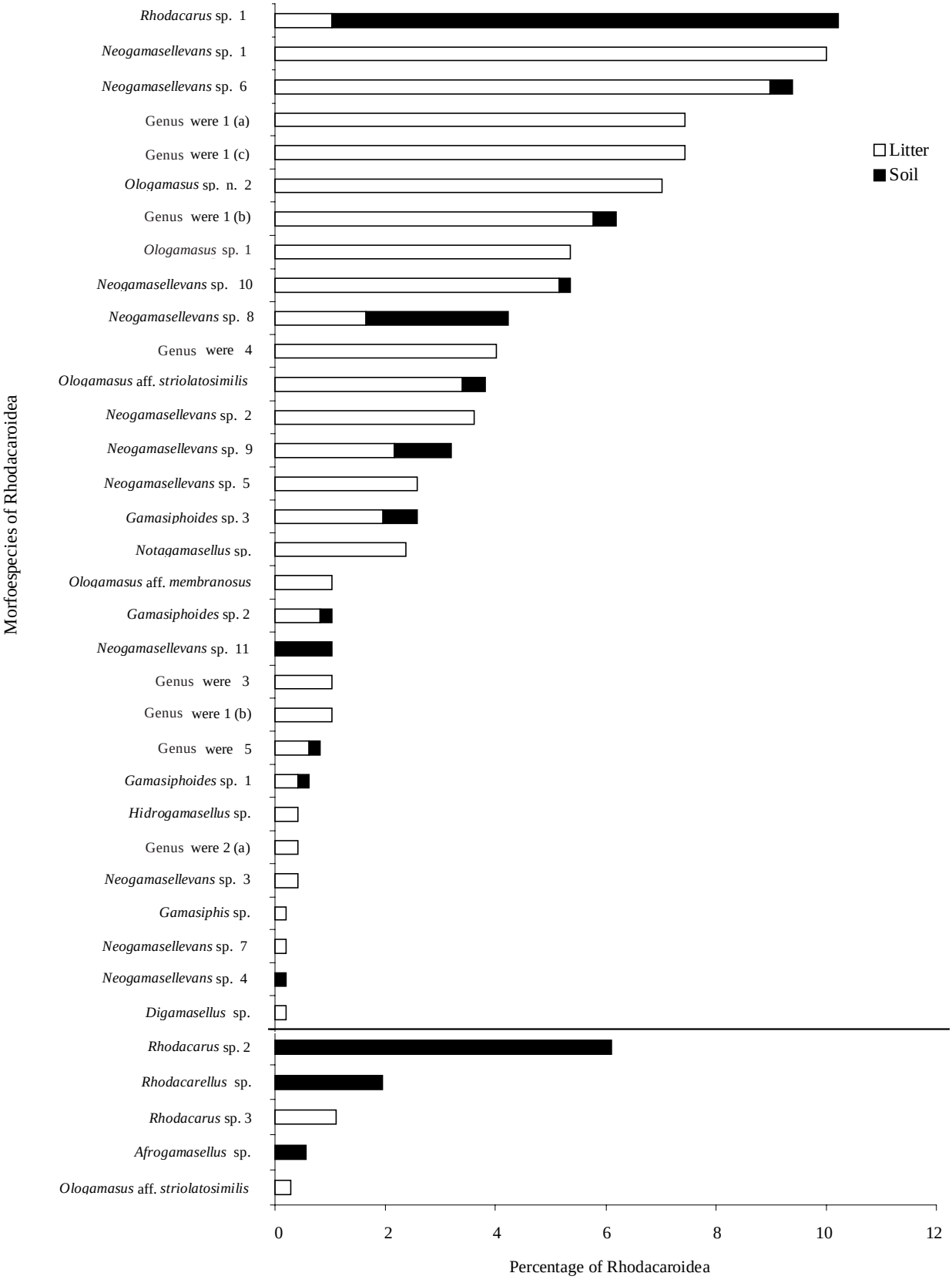

Figure 1. Proportions and absolute numbers (to the right of each column) of the morphospecies of Rhodacaroidea collected in samples of litter and soil taken from the Mata Atlântica and Cerrado of the state of São Paulo.

consequently, their rhodacaroid predators. Considerable reduction in the number of gamasid species was reported by Karg (1967) by removing the litter of an experimental site. The type of soil and the nutrient composition also seem to be determining factors in the predominance of some rhodacaroid genera in different habitats. Lee (1973) concluded that species of the ologamasid *Athiasella* Lee prefer clay soil, with high nutrient contents, whereas species of *Gamasellus* Berlese, of the same family seem to be confined to sandy soils, with low nutrient contents.

Dominance-Diversity Curves. The evenness of occurrence frequencies of rhodacaroid morphospecies was higher in the Mata Atlântica than in the Cerrado, as evidenced by the lesser inclination of its dominance curve (Fig. 2). The corresponding Pielou indexes were 0.872 and 0.701, respectively (Odum 1988).

In areas where stress factors are more intense, diversity indexes tend to be smaller, i.e., the abundance of the most common species tend to increase whereas the abundance of rarer species tend to diminish up to a point in which some of the rarer species may become extinct (Odum 1988). Diversity dominance curves may be used to evaluate the degree of disturbance of a given community. Natural or man-made stresses tend to produce steeper curves (Whittaker 1965, 1972). Diversity dominance components in the present study indicated that the edaphic mites in the Mata Atlântica are subjected to less stress than in the Cerrado, as suggested by the correspondingly less steep dominance curve. Stress factors to which the mites in this study were subjected could correspond to the much less dense and diverse vegetation in the locations where the study was conducted in the Cerrado. Another factor may be related to the level of precipitation. It is possible that moisture stress in the Cerrado, where rain is concentrated in the summer months, reduces the number of rhodacaroid taxa that could otherwise survive even at low densities in this ecosystem.

In the Mata Atlântica samples, in which rhodacaroids were more numerous, the degree of uniformity in frequencies of morphospecies occurrence was higher in the litter than in the soil (Fig. 3). Corresponding Pielou indexes were 0.868 and 0.628, respectively, a pattern that indicates a smaller degree of stress in litter substrates. Here, the most important stress factor probably was soil saturation during especially rainy periods. High humidity always was maintained longer in the soil than in overlying litter layers. Actually, litter plays an important role in the retention of humidity in the soil. It is for this reason that mulching is commonly used to reduce soil water evaporation in agricultural plantings.

Similarities Between Arecaceae Species in Relation to Associated Rhodacaroid Mites. Two groups of palm species were distinguished based on the rhodacaroid morphospecies collected under each species (Fig 4). The first of these (Group 1) is composed of A. *aculeatissimum*, *B. setosa* and *A. dubia*. A subgroup including the first two palm species may be distinguished within Group 1. Group 2 comprises *E. edulis* and *S. romanzoffiana*. Other palm species (*G. schottiana, G. brevispatha* and *S. oleracea*) did not form a group, nor did they combine logically with either Group 1 or 2. This indicates that very few of their associated morphospecies were also found under palms of either of the two groups.

Similarities between palm species in relation to their associated rhodacaroids seem to a certain extent to be connected to prevailing climatic conditions in the sampling areas. In Group 1, *A. aculeatissimum* and *B. setosa* were sampled in Pariquera-Açu and Cananéia regions, whereas *A. dubia* was sampled only in the Pariquera-Açu region. On the other hand, both components of Group 2 were sampled in all regions where the study was conducted. The three palm species

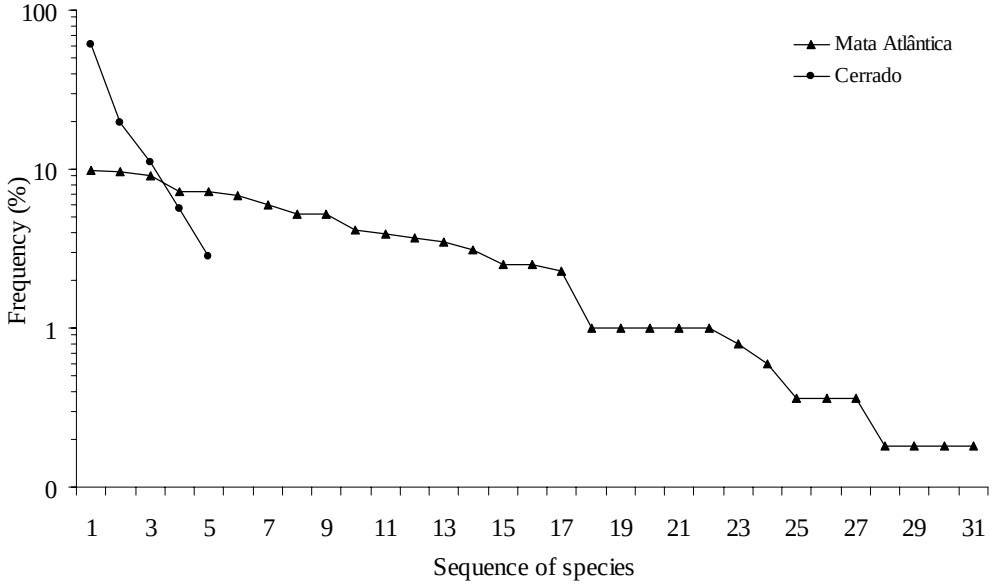

Figure 2. Curves of the frequency of occurrence of Rhodacaroidea mite species collected in the Mata Atlântica and Cerrado ecosystems of the state of São Paulo (based on 516 and 36 specimens collected in those respective ecosystems).

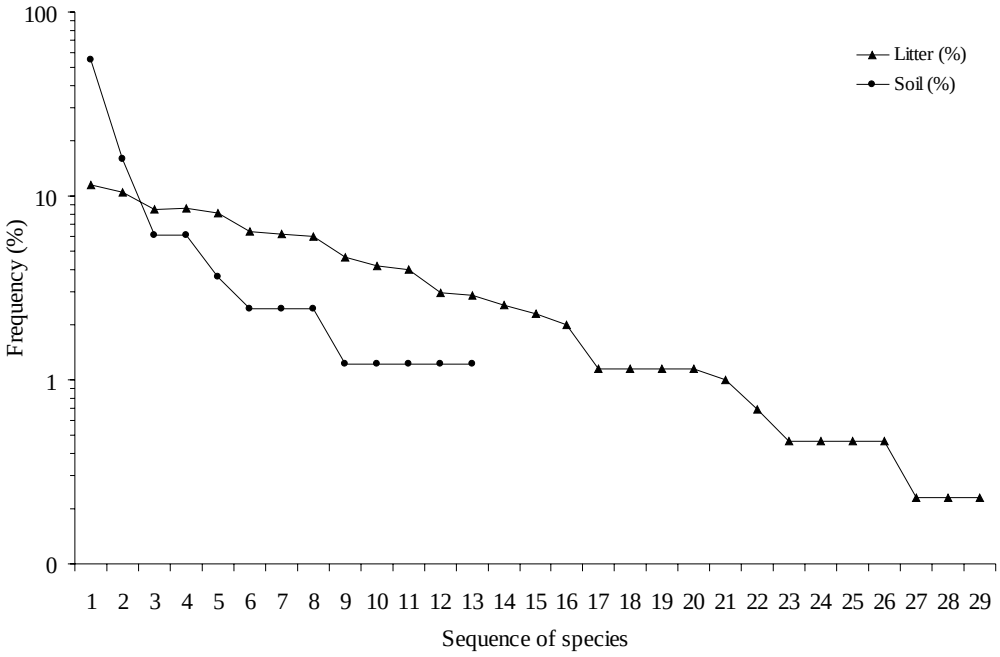

Figure 3. Curves of the frequency of occurrence of Rhodacaroidea mite species collected in litter and soil samples of the Mata Atlântica ecosystem of the state of São Paulo (based on 433 and 83 specimens collected in those respective substrates).

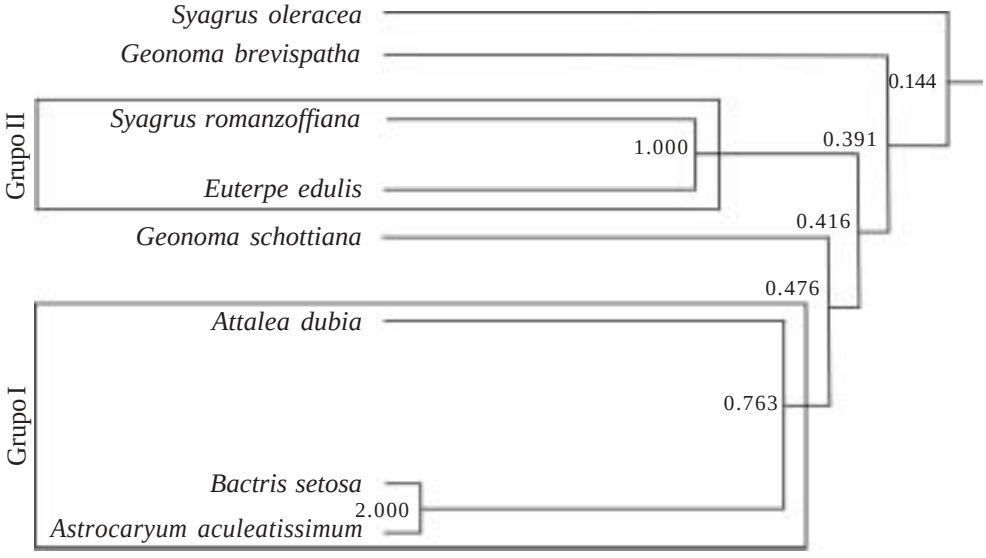

Figure 4. Mountford indexes and groups of plants of the family Arecaceae from Mata Atlântica of the state of São Paulo, according to the number of shared species of Rhodacaroidea mites.

that did not group with other plants were each sampled in a single region: *G. schottiana* only in the Cananéia region, and *G. brevispatha* and *S. oleraceae* only in Piracicaba region.

Factors other than climatic conditions may also have influenced plant group parameters. Although sampled only in the Piracicaba region, the rhodacaroid faunas of *G. brevispatha* and *S. oleracea* were rather distinct in relation to each other and in relation to that of other palms sampled in the same region (*S. romanzoffiana* and *E. edulis*). *S. oleracea* is morphologically very different from *G. brevispatha*, and this may have somehow caused the difference in rhodacaroid species composition beneath these plants. Similarly, basic differences in plant hosts may have led to the rhodacaroid fauna associated with *G. schottiana*, sampled only in Cananéia, being distinct from that of other palms sampled in the same region.

The distinction between the two *Geonoma* species and the other palm species in relation to their associated rhodacaroids suggests that the plants exert a considerable

effect on these organisms. This effect is particularly interesting, given that rhodacaroid mites are proven or putative predators. It would be expected that the effect of the diversity of the neighboring plants could significantly dilute the effect of *Geonoma* species sampled in this work, small plants (Lorenzi 1996) which in this study were invariably growing underneath many other plant species. However, the results obtained in this study indicated that this was not the case.

Some of the genera identified in this study contain species reported as prospective predators of soil pest organisms (Ito 1971, Imbriani & Mankau 1983. Of particular interest in terms of this study are species of *Neogamasellevans* and *Ologamasus*, which were found to be much more abundant than species of other genera. Future work should include biological observations on these forms to determine the significance of their role as predators of soil mite and nematode pests, including the main groups of nematodes found in areas where sampling was conducted. Such studies may lead to utilization of ologamasid species as control agents of undesirable soil organisms.

Acknowledgments

We are grateful to A.R. Oliveira, L.V.F. Silva and A.P.N. Tomasella for collecting and preparing the specimens used in this study. To C.H.W. Flechtmann, S. Silveira Neto, J.L. de C. Mineiro and U.S. da Cunha for their help at different stages of the development of this research. This work was supported by the State of São Paulo Research Foundation (FAPESP) and by BIOTA/FAPESP – The Biodiversity Virtual Institute Program (www.biotasp.org.br).

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Received 07/10/03. Accepted 15/02/04.