

Scientific Note

Mites associated with *Byrsonima crassifolia* (L.) Kunth (Malpighiaceae) in the state of Pará, Brazil

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Abstract. The present study evaluated the mite fauna associated with nance, *Byrsonima crassifolia* (L.) Kunth, in the state of Pará, Eastern Amazon. Mites were collected from leaves of nance clones in the municipalities of Belém and Tomé-Açu from 2012 to 2014. The collected mites were mounted on microscope slides in Hoyer's medium. A total of 2,749 mites were collected, distributed in 32 species belonging to eight families, in addition to specimens of the suborder Oribatida, which represented 73% of the total collected. Eighteen species of predators of the families Ascidae, Cunaxidae, Phytoseiidae and Stigmaeidae are reported. Phytoseiidae was the most diverse family, with ten species, with a predominance of *Amblyseius aerialis* (Muma, 1955). Thirty-one mite species are new records in *B. crassifolia* in the state of Pará, and the Tydeidae *Afrottydeus kenyensis* (Baker, 1970) and *Pseudolorryia nicaraguensis* (Baker, 1970) are reported for the first time in Brazil.

Keywords: Acari, phytophagous, nance, predators.

The nance, *Byrsonima crassifolia* (L.) Kunth (Malpighiaceae), is a fruit tree native to the Amazon region. In Brazil, it is found more frequently in the North, Northeast and Central-West regions; the North region has the highest density and variety of natural populations (Nascimento & Carvalho 2016). This fruit tree is also dispersed in countries bordering the Brazilian Amazon and in Mexico, Central America and the Caribbean (Nascimento & Carvalho 2016).

In the Amazon and in the Brazilian Northeast, fruits of the nance tree are an important food resource for low-income rural populations and are consumed fresh or in the form of juice, ice cream, sweets, creams, jelly and liquor (Nascimento & Carvalho 2016). Due to the potential of nance, Embrapa Amazônia Oriental has been working on genetically improving *B. crassifolia* with the objective of identifying clones with superior agronomic characteristics (Gurgel & Carvalho 2016), leading to the need for knowledge of the arthropod complex associated with this fruit tree.

There are few reports on mites in *B. crassifolia*. In Central America, *Brevipalpus phoenicis* (Geijskes, 1939) *sensu lato* (Tenuipalpidae) was reported in this fruit tree (Ochoa et al. 1994). In Brazil, *Oligonychus peronis* Pritchard & Baker, 1955 (Tetranychidae) has been reported in the state of Ceará (Tuttle et al. 1977), mites belonging to the family Ascidae (*Lasioseius* sp.), Tarsonemidae (*Rhynchotarsonemus* sp.) and Tydeidae (*Lorryia formosa* Cooreman, 1958) have been reported in the state of Amapá (Mineiro et al. 2009), and *Iphiseiodes noronhensis* Da Costa, Silva & Ferla, 2017 (Phytoseiidae) has been reported in the state of Pará (Da-Costa et al. 2017). The objective of this study is to obtain more information on the mite fauna of the Eastern Amazon, specifically, to record the acarine species associated with the nance tree in Pará.

The field work was conducted at two experimental sites belonging to Embrapa Amazônia Oriental in the municipalities of Belém (01°26'09.2"S, 48°26'28.6"W) and Tomé-Açu (02°35'32.5"S,

48°21'45.4"W), in the Metropolitan and Northeast Pará mesoregions, respectively. The two sites had the same ten clones (Açu, Cristo, Guataçara, Igarapé-Açu, Maracanã 2, Santarém 1, Santarém 2, São José, Tocantins 1 and Tocantins 2), in addition to one additional clone in Tomé-Açu (Baião). Each clone was represented by five plants, spaced 5 x 4 m apart, without the application of chemical pesticides. The plants were five years old at the beginning of the samplings.

In the period from 2012 to 2014, four leaves (two apical and two median) were collected per plant (50 plants in Belém and 55 in Tomé-Açu), totaling 39 samplings in Belém (intervals of 20 to 40 days) and four samplings in Tomé-Açu (June and October 2012, October 2013 and September 2014). The larger number of samples in Belém was favored by distance and ease of access. In the laboratory, the material was examined under a stereomicroscope, and the mites present on the abaxial and adaxial leaf surfaces were collected and mounted on microscope slides in Hoyer's medium. The specimens were identified under an optical microscope (phase contrast) with the use species keys (André 1980; Lindquist 1986; Baker & Tuttle 1987; Chant & McMurtry 2007; Krantz & Walter 2009; Skvarla et al. 2014; Fan et al. 2016; Silva et al. 2016). The number of mites was analyzed in relation to constancy according to Bodenheimer (1955), and families were classified according to their frequency as constant (>50%), accessory (25<C≤50%) and accidental (<25%).

A total of 2,749 mites were collected (2,441 in Belém and 308 in Tomé-Açu), distributed in 32 species belonging to eight families, represented by phytophagous (Tenuipalpidae and Tetranychidae), predators (Ascidae, Cunaxidae, Phytoseiidae and Stigmaeidae) and families with feeding habit diversification according to the taxon (Tarsonemidae and Tydeidae); the suborder Oribatida had the highest number of mites, 2,008 specimens, representing 73% of the total collected (Tab. 1).

Table 1. Number of mites sampled in *Byrsonima crassifolia* in the municipalities of Belém and Tomé-Açu, state of Pará, Brazil, from 2012 to 2014.

Order	Family	Genus and species	FH ¹	Collection site		
				Belém	Tomé-Açu	
Mesostigmata	Ascidae	<i>Asca</i> sp.	P	81	1	
		Immatures and males	P	55	2	
	Phytoseiidae	<i>Amblyseius aerialis</i> (Muma, 1955)	P	41	37	
		<i>Amblyseius</i> sp.	P	0	1	
		<i>Iphiseiodes noronhensis</i> Da Costa, Silva & Ferla, 2017	P	3	8	
		<i>Paraamblyseius</i> sp.	P	0	1	
		<i>Paraphytoseius orientalis</i> (Narayanan, Kaur & Ghai, 1960)	P	12	0	
		<i>Paraphytoseius</i> sp.	P	1	1	
		<i>Proprioseiopsis</i> sp.1	P	0	5	
		<i>Proprioseiopsis</i> sp.2	P	0	1	
		<i>Typhlodromalus aripo</i> De Leon, 1967	P	0	1	
		<i>Typhlodromalus</i> sp.	P	1	0	
		Immatures and males	P	66	43	
		NI ²	P	0	3	
		Trombidiformes	Cunaxidae	<i>Armascirus brasiliensis</i> Den Heyer & Castro, 2012	P	1
<i>Cunaxoides</i> sp.	P			1	1	
<i>Neocunaxoides andrei</i> (Baker & Hoffmann, 1948)	P			2	0	
<i>Neocunaxoides</i> aff. <i>zuluensis</i>	P			1	0	
<i>Scutopalus</i> sp.	P			2	6	
<i>Scutopalus tomentosus</i> Rocha, Skvarla & Ferla, 2013	P			11	1	
Immatures	P			15	5	
Stigmaeidae	<i>Eustigmaeus</i> sp. nov.		P	8	0	
Tarsonemidae	<i>Fungitarsonemus</i> sp.		NK	1	0	
	<i>Neotarsonemoides</i> sp.1		NK	1	0	
	<i>Neotarsonemoides</i> sp.2		NK	2	3	
	<i>Tarsonemus</i> sp.		NK	2	0	
	<i>Xenotarsonemus</i> sp.		NK	3	0	
Tenuipalpidae	Immatures		NK	20	1	
	<i>Brevipalpus</i> sp.		Ph	2	0	
Tetranychidae	Immatures		Ph	16	3	
	<i>Tetranychus</i> sp.		Ph	18	36	
Tydeidae	<i>Afrotydeus kenyensis</i> (Baker, 1970)		NK	0	1	
	<i>Lorryia podocarpa</i> (Baker, 1968)		NK	28	0	
	<i>Lorryia turrialbensis</i> (Baker, 1968)		NK	11	0	
	<i>Lorryia tuttlei</i> (Baker, 1965)		NK	3	0	
	<i>Pretydeus henriandrei</i> Kazmierski, 1996		NK	47	0	
	<i>Pseudolorryia nicaraguensis</i> (Baker, 1970)		NK	2	0	
	<i>Triophtydeus</i> aff. <i>lebruni</i>		NK	1	0	
Sarcoptiformes	Oribatida*		Immatures	NK	116	6
			NI	NK	1867	141
Total				2441	308	

¹FH - Feeding habits; P - Predator; Ph - Phytophagous; NK - Not known; ²NI - Not identified; *Suborder

Oribatida (unidentified) and the families Ascidae, Phytoseiidae and Tydeidae were considered constant, Stigmaeidae was considered accidental, and the others were considered accessory families.

Phytophagous mites were represented only by *Brevipalpus* sp. (Tenuipalpidae) and *Tetranychus* sp. (Tetranychidae), corresponding to 2.7% of the mites collected. The plants showed no symptoms of damage caused by phytophagous mites during the collection period.

The highest abundance of predators was recorded for Phytoseiidae (124 specimens in Belém and 101 in Tomé-Açu), with a predominance of *Amblyseius aerialis* (Muma, 1955) (78 specimens), representing 34.7% of Phytoseiidae, followed by *Paraphytoseius orientalis* (Narayanan, Kaur & Ghai, 1960) (12) and *I. noronhensis* (11). The other species were represented by one to five specimens. The highest richness of Phytoseiidae was found in Tomé-Açu (eight species), albeit there were only four collections. A predominance of *A. aerialis* has also been reported in citrus (*Citrus sinensis* L. Osbeck) and coconut (*Cocos nucifera* L.) in the state of Amazonas (Bobot et al. 2011; Cruz et al. 2015; Ferreira et al. 2018). Among the Phytoseiidae sampled, *Typhlodromalus aripo* De Leon, 1967 and *P. orientalis* are reported for the first time in the state of Pará and, together with the other species, except for *I. noronhensis*, are the first records on *B. crassifolia*.

Regarding the other families of predators, Ascidae and Stigmaeidae were represented by *Asca* sp. and *Eustigmaeus* sp. nov., respectively, while for Cunaxidae, six species belonging to four genera and to the subfamilies Cunaxinae (*Armascirus*) and Cunaxoidinae (*Cunaxoides*, *Neocunaxoides* and *Scutopalus*) were found.

Ascidae are found in the most diverse habitats, such as plants, soil, moss, and leaf litter (Britto et al. 2017). The performance of studies to evaluate the potential of species of *Asca* Heyden, 1826, as biological pest control agents was emphasized by Britto et al. (2017). Stigmaeidae was the family with the lowest number of specimens collected in this study, represented by *Eustigmaeus* sp. nov.. In Brazil, there are reports of the species *Eustigmaeus bryonemus* Flechtmann, 1985, *E. microsegnis* (Chaudhri, 1965), *E. oliveirai* Paktinat-Saeij & Bagheri, 2016 and *E. piracicabensis* Paktinat-Saeij & Bagheri, 2016, all in the state of São Paulo (Fan et al. 2016). Regarding the predators of the family Cunaxidae, *Scutopalus tomentosus* Rocha, Skvarla & Ferla, 2013 was previously reported in coconut groves in Pará (Wurlitzer et al. 2020).

Five Tarsonemidae species belonging to the genera *Fungitarsonemus* Cromroy, 1958, *Neotarsonemoides* Kaliszewski, 1984, *Tarsonemus* Canestrini & Fanzago, 1876 and *Xenotarsonemus*

Beer, 1954 were identified. Although they are frequently found, few ecological studies have been conducted to clarify the ecological role played by Tarsonemidae species in their host plants. According to Lofego et al. (2018), bioecological studies are needed to understand the role of *Xenotarsonemus* in the natural environments and in agroecosystems.

Seven Tydeidae species were identified, including *Pretydeus henriandrei* Kazmierski, 1996 (47 specimens) and *Lorryia podocarpa* (Baker, 1968) (28), with the highest number of specimens. Tydeidae was the third most abundant group. The following Tydeidae species have been previously reported in Brazil: *P. henriandrei* and *Lorryia tuttlei* (Baker, 1965) in Rio Grande do Sul, *L. podocarpa* in the states of Amazonas, Bahia, Rio Grande do Sul, Rondônia and São Paulo, and *L. turrialbensis* (Baker, 1968) in Acre, Alagoas, Amazonas, Bahia, Maranhão, Mato Grosso, Pernambuco and São Paulo (Silva et al. 2016; Horn et al. 2018; Nuvoloni et al. 2020). Therefore, these species are new species records for the state of Pará and in *B. crassifolia*. *Afrottydeus kenyensis* (Baker, 1970) has been reported in Kenya, and *Pseudolorryia nicaraguensis* (Baker, 1970) has been recorded in Nicaragua and Mexico (Silva et al. 2016; Monjarás-Barrera et al. 2019); these two species are reported for the first time in Brazil.

In this study, in addition to the evident predominance of Oribatida in *B. crassifolia*, 18 species of predators of the families Ascidae, Cunaxidae, Phytoseiidae and Stigmaeidae are reported. Except *I. noronhensis*, the other 31 species sampled are new species records in *B. crassifolia* in the state of Pará, and among these, *A. kenyensis* and *P. nicaraguensis* (Tydeidae) are reported for the first time in Brazil.

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Authors' contributions

ACSN and AOA conducted the field and laboratory work. ACSN prepared the manuscript. ACSN, JLCM, NJF, TMMGC, GLS, and ACL identified the mites and revised the manuscript.

References

- André, H. M. (1980) A generic revision of the family Tydeidae (Acari: Actinedida). IV. Generic descriptions, keys and conclusion. *Annales de la Société royale zoologique de Belgique*, 116: 103-168.
- Baker, E. W.; Tuttle, D. M. (1987) *The False Spider Mites of Mexico (Tenuipalpidae: Acari)*. Technical Bulletin N° 1706. Springfield: U.S. Department of Agriculture.
- Bobot, T. E.; Franklin, E.; Navia, D.; Gasnier, T. R. J.; Lofego, A. C.; Oliveira, B. M. (2011) Mites (Arachnida, Acari) on *Citrus sinensis* L. Osbeck orange trees in the State of Amazonas, Northern Brazil. *Acta Amazonica*, 41(4): 557-566. doi: [10.1590/S0044-59672011000400013](https://doi.org/10.1590/S0044-59672011000400013)
- Bodenheimer, R. S. (1955) *Precis d'écologie animale*. Paris: Payot.
- Britto, E. P. J.; Barreto, M. R.; Moraes, G. J. de (2017) Description of the a new species of *Asca* Heyden (Acari: Ascidae), from Mato Grosso, northwestern Brazil. *International Journal of Acarology*, 43(4): 286-290. doi: [10.1080/01647954.2017.1293731](https://doi.org/10.1080/01647954.2017.1293731)
- Chant, D. A.; McMurtry, J. A. (2007) *Illustrated keys and diagnoses for the genera and sub-genera of the Phytoseiidae of the World*. West Bloomfield: Indira Publishing House.
- Cruz, W. P.; Krug, C.; Vasconcelos, G. J. N.; Moraes, G. J. de (2015) Diversity of mites associated with *Raoiella indica* (Acari: Prostigmata) on coconut palms in the central region of the Brazilian Amazonia, with emphasis on the predaceous Phytoseiidae (Acari: Mesostigmata). *Systematic & Applied Acarology*, 20(8): 875-886. doi: [10.11158/saa.20.8.4](https://doi.org/10.11158/saa.20.8.4)
- Da-Costa, T.; Silva, G. L.; Ferla, N. J. (2017) A new species of *Iphiseiodes* De Leon (Acari: Phytoseiidae) from Brazil. *Systematic & Applied Acarology*, 22(9): 1489-1494. doi: [10.11158/saa.22.9.13](https://doi.org/10.11158/saa.22.9.13)
- Fan, Q.; Flechtmann, C. H. W.; Moraes, G. J. de (2016) Annotated catalogue of Stigmaeidae (Acari: Prostigmata), with a pictorial key to genera. *Zootaxa*, 4176(1): 001-199. doi: [10.11646/zootaxa.4176.1.1](https://doi.org/10.11646/zootaxa.4176.1.1)
- Ferreira, C. T.; Krug, C.; Garcia, M. V. B.; Moraes, G. J. (2018) Leprosis mite and other mite species (Acari) associated to orange groves in Brazilian Central Amazon. *Systematic & Applied Acarology*, 23(3): 449-462. doi: [10.11158/saa.23.3.4](https://doi.org/10.11158/saa.23.3.4)
- Gurgel, F. L.; Carvalho, J. E. U. (2016) Recursos genéticos e pré-melhoramento do murucizeiro. In: Gurgel, F. L. (Ed.), *O murucizeiro [Byrsonima crassifolia (L.) H.B.K.]: avanços no conhecimento e ações de pré-melhoramento*, pp. 27-40. Brasília: Embrapa.
- Horn, T. B.; Granich, J.; Körbes, J. H.; Silva, G. L.; Ferla, N. J. (2018) Mite fauna (Acari) associated with the poultry industry in different laying hen management systems in Southern Brazil: a species key. *Acarologia*, 5(1): 140-158. doi: [10.24349/acarologia/20184233](https://doi.org/10.24349/acarologia/20184233)
- Krantz, G. W.; Walter, D. E. (2009) *A Manual of Acarology*. 3rd. Edition, Lubbock: Texas Tech University Press.
- Lindquist, E. E. (1986) The world genera of Tarsonemidae (Acari: Heterostigmata): a morphological, phylogenetic, and systematic revision, with a reclassification of family-group taxa in the Heterostigmata. *Memoirs of the Entomological Society of Canada*, 136: 1-517.
- Lofego, A. C.; Cavalcante, A. C. C.; Demite, P. R. (2018) Two new species of *Xenotarsonemus* (Acari: Tarsonemidae) from the Atlantic Forest, Brazil. *Neotropical Entomology*, 47: 271-280. doi: [10.1007/s13744-017-0556-5](https://doi.org/10.1007/s13744-017-0556-5)
- Mineiro, J. L. C.; Silva, W. R.; Silva, R. A. (2009) Ácaros em fruteiras e outras plantas no Estado do Amapá. *Biota Neotropica*, 9(2): 103-106. doi: [10.1590/S1676-06032009000200009](https://doi.org/10.1590/S1676-06032009000200009)
- Monjarás-Barrera, J. I.; Chacón-Hernandez, J. C.; Silva, G. L.; Johann, L.; Silva, O. S.; Landeros-Flores, J.; Vanoye-Eligio, V.; Reyes-Zepeda, F.; Ferla, N. J. (2019) Mites associated to chile piquín (*Capsicum annuum* L. var. *glabriusculum*) in two Protect Natural Areas in Northeastern México. *Systematic & Applied Acarology*, 24(12): 2537-2551. doi: [10.11158/saa.24.12.17](https://doi.org/10.11158/saa.24.12.17)
- Nascimento, W. M. O.; Carvalho, J. E. U. (2016) Propagação do murucizeiro. In: Gurgel, F. L. (Ed.), *O murucizeiro [Byrsonima crassifolia (L.) H.B.K.]: avanços no conhecimento e ações de pré-melhoramento*, pp. 9-25. Brasília: Embrapa.
- Nuvoloni, F. M.; Mondin, A. S.; Feres, R. J. F. (2020) Review of *Lorryia* Oudemans, 1925 (Acari: Tydeidae: Tydeinae) associated with *Hevea* spp. in Brazil. *International Journal of Acarology*, 46(4): 235-240. doi: [10.1080/01647954.2020.1760931](https://doi.org/10.1080/01647954.2020.1760931)
- Ochoa, R.; Aguilar, H.; Vargas, C. (1994) *Phytophagous mites of Central America: an illustrated guide*. Turrialba: CATIE.
- Silva, G. L.; Metzeltin, M. H.; Silva, O. S.; Ferla, N. J. (2016) Catalogue of the mite family Tydeidae (Acari: Prostigmata) with the world key to the species. *Zootaxa*, 4135(1): 001-068. doi: [10.11646/zootaxa.4135.1.1](https://doi.org/10.11646/zootaxa.4135.1.1)
- Skvarla, M. J.; Fisher, J. R.; Dowling, A. P. G. (2014) A review of Cunaxidae (Acariformes, Trombidiformes): histories and diagnoses of subfamilies and genera, keys to world species, and some new locality records. *ZooKeys*, 418: 1-103. doi: [10.3897/zookeys.418.7629](https://doi.org/10.3897/zookeys.418.7629)
- Tuttle, D. M.; Baker, E. W.; Sales, F. M. (1977) Spider mites (Tetranychidae: Acarina) of the state of Ceará, Brazil. *International Journal of Acarology*, 3(1): 1-8. doi: [10.1080/01647957708683070](https://doi.org/10.1080/01647957708683070)
- Wurlitzer, W. B.; Noronha, A. C. S.; Johann, L.; Ferla, N. J.; Silva, G. L. (2020) A new species of *Armscirus* and description of the male of *Scutopalus tomentosus* from Brazil (Acari: Cunaxidae). *Systematic & Applied Acarology*, 25(5): 857-868. doi: [10.11158/saa.25.5.7](https://doi.org/10.11158/saa.25.5.7)