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Scientific Note

First report of the phytoseiid mite *Neoparaphytoseius charapa* Jiménez, McMurtry & Moraes, 2014 (Acari: Phytoseiidae) to Brazil, with notes on the occurrence of the genus

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Abstract. Phytoseiid mites collected on *Inga edulis* L. (Leguminosae) in three localities in the Amazonas State, Brazil, were identified as *Neoparaphytoseius charapa* Jiménez, McMurtry & Moraes, 2014. This is the first report of this species in Brazil. Notes on geographic occurrence and association of *Neoparaphytoseius* Chant & McMurtry, 2003 species with host plants are presented.

Keywords: Amazon Forest, diversity, Mesostigmata, Parasitiformes, predatory.

Phytoseiid mites are the most studied and successfully used predators in the biological control of pest mites as well as of small insects, especially of thrips and whiteflies (McMurtry et al. 2013). To date, more than 2,800 species in this family have been described, in almost 100 known genera (Demite et al. 2021). The genus *Neoparaphytoseius* Chant & McMurtry, 2003 has three known species, all registered in South America: *Neoparaphytoseius sooretamus* (El-Banhawy, 1984) and *N. caatinga* Silva, Silva & Moraes, 2021, both recorded in Brazil, and *N. charapa* Jiménez, McMurtry & Moraes, 2014, registered, so far, only in Peru. This study aimed to report the phytoseiid *N. charapa* for the first time in Brazil.

Leaf samples of many plant species including *Inga edulis* Mart. (Leguminosae) were collected in the field and taken to a laboratory for examination under a dissecting microscope. The phytoseiid specimens found were mounted on microscope slides in Hoyer's medium. After dried, they were examined under a phase-contrast microscope (Zeiss Axio Imager M3). Identification to genus level was done mostly based on Chant & McMurtry (2007). Later, the species identification was based on a key presented in Silva et al. (2021) and comparing with the morphological information provided in the original description of species. Measurements of taxonomically relevant structures were done with the use of a graded eyepiece.

The distribution map of *Neoparaphytoseius* species was created using Simplemappr (Shorthouse 2010) based on data obtained from literature and made available by some authors when these were not in the publications. Voucher specimens were deposited at the Acari Collection of Departamento de Ciências Biológicas, UNESP-Universidade Estadual Paulista, São José do Rio Preto, São Paulo, Brazil: Manaus (02°39'S; 60°03'W), 21 June 2019, A.C.C. Cavalcante collector (four females); 14 November 2019, R.B. Souza coll. (one female); Itacoatiara (03°06'S; 58°33'W), 12 July 2019, M.P. Duque and S.A. Amorim coll. (one female); Silves (02°57'S; 58°29'W), 16 December 2019, R.B. Souza coll. (four females); 06 March 2020 (one female and one male). All specimens were collected on *I. edulis.*

The phytoseiid identified was *Neoparaphytoseius charapa* (Fig. 1), described from Peru, associated with *I. edulis* leaves (Jiménez et al. 2014). The measurements recorded in the Brazilian specimens (females and a male) are very close to those reported in the original description (Tab. 1). A variation in the insertion of the *R1* setae was observed. In most specimens, the setal pair *R1* was located off the dorsal shield, in accordance with the original description. However, in one specimen, one of the setae of this pair was on the dorsal shield, and in another specimen, the two setae of this pair were on the dorsal shield.

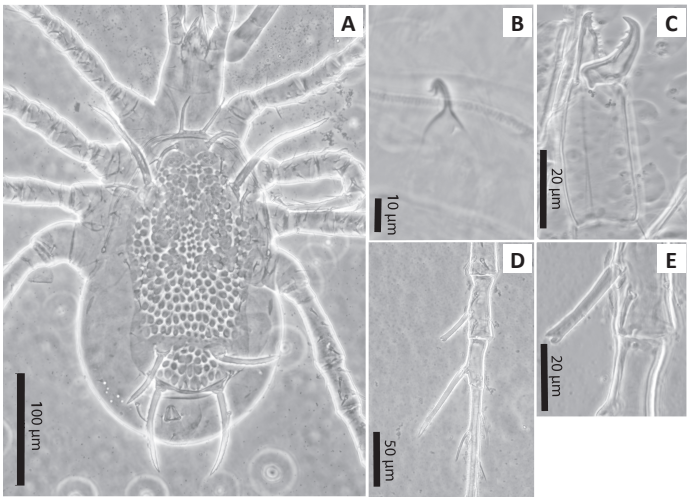

Figure 1. *Neoparaphytoseius charapa* Jiménez, McMurtry & Moraes, 2014: (A) Dorsal view; (B) Spermatheca; (C) Chelicera; (D) Femur, genu, tibia and tarsus (part) of leg IV; (E) Macroseta of the tibia of leg IV.

As in the original description, all specimens were collected in association with *I. edulis* leaves. *Inga edulis* is a plant native to the Amazon that has pubescent leaves (with trichomes) and extrafloral nectaries on the petioles. The other two species of the genus have also been reported in plants with leaves with trichomes. *Neoparaphytoseius sooretamus* has already been reported on species of Malpighiaceae (*Byrsonima intermedia* A. Juss.: Rezende & Lofego 2011), Myrtaceae (*Eugenia stipitata* McVaugh: Vasconcelos & Silva 2015), Rosaceae

Table 1. Measures of the original description of *Neoparaphytoseius charapa* Jiménez, McMurtry & Moraes, 2014 and measures of specimens collected in Amazonas state, Brazil.

Character	Female		Character	Male	
	Jiménez et al. (2014)	This study		Jiménez et al. (2014)	This study
	Peru (n= 3)	Brazil (n = 10)		Peru (n= 1)	Brazil (n= 1)
DSL	336 (331-343)	329 (320-340)	**DSL**	257	265
DSW	175 (167-182)	172 (165-180)	**DSW**	134	130
j1	51 (47-55)	53 (50-57)	***j1***	42	41
j3	44 (35-50)	41 (35-47)	***j3***	39	33
j4	5	5 (5-7)	***j4***	5	6
j5	5	5 (5-7)	***j5***	5	5
j6	5	5 (5-6)	***j6***	5	5
J2	5	6 (5-7)	***J2***	5	6
J5	5	5 (5-6)	***J5***	5	6
z2	17 (15-18)	20 (16-22)	***z2***	14	16
z4	7 (6-8)	8 (6-11)	***z4***	8	8
z5	5	6 (5-7)	***z5***	5	6
Z1	8	10 (9-11)	***Z1***	6	8
Z4	81 (75-85)	83 (77-86)	***Z4***	50	49
Z5	107 (98-115)	111 (104-120)	***Z5***	70	0,63
s4	145 (122-158)	145 (135-152)	***s4***	109	105
S2	17 (15-18)	19 (17-21)	***S2***	10	12
S5	26 (20-30)	27 (26-31)	***S5***	15	14
r3	35 (35-36)	39 (36-43)	***r3***	25	27
R1	14 (13-15)	15 (13-16)	***R1***	10	12
st1-st3	64 (62-67)	66 (62-69)	***st1-st3***		
st2-st2	69 (68-70)	71 (67-74)	***st2-st2***		
st5-st5	85 (78-90)	74 (70-80)	***st5-st5***		
VSL	108 (105-110)	119 (108-130)	**VSL**	103	101
VSWant	82 (80-84)	81 (75-88)	**VSWant**	172	170
VSWpost		73 (69-80)	**VSWpost**		75
JV5		35 (32-42)	***JV5***		17
calyxL	10 (10-11)	10 (9-11)	**sprmtdL**	18	19
FDL	30 (30-31)	30 (28-31)	**FDL**	21	23
FDteeth	11	9 to 11	**FDteeh**	7	8
MDL	27 (26-28)	30 (29-31)	**MDL**	20	20
MDteeth	3	3	**MDteeth**	1	1
StilV	39 (37-40)	40 (36-43)	***StilV***	27	30
StIV	82 (78-85)	88 (80-96)	***StIV***	61	68

DSL: Dorsal shield length; DSW: Dorsal shield width; VSL: Ventrianal shield length; VSWant: Ventrianal shield width at level *JV2*; VSWpost: Ventrianal shield width at level anus; calyxL: calyx of spermatheca length; sprmtdL: shaft of spermatodactyl length; FDL: Fixed digit length; MDL: Movable digit length.

(*Rubus brasiliensis* Mart. and *R. urticifolius* Poir: Moraes et al. 2013), and Solanaceae (*Solanum grandiflorum* Ruiz & Pav., *S. paniculatum* L., *S. stramonifolium* Jacq. and *Solanum* sp.: Rosa et al. 2005; Fiaboe et al. 2007); *N. caatinga* has been reported on Euphorbiaceae (*Croton blanchetianus* Baill.: Silva et al. 2021). Mites of the genus *Neoparaphytoseius* probably fit the classification of McMurtry et al. (2013) as subtype-IIIa, which includes generalists associated with pubescent leaves. Species of the genera *Kampimodromus* Nesbitt, 1951 and *Paraphytoseius* Swirski & Schechter, 1961, which belong to the same tribe (Kampimodromini), are also classified in this subtype. Species of this subtype have the idiosoma typically small and laterally compressed that apparently aids them in moving between leaf trichomes (Duso 1992; Walter 1992; Karban et al. 1995; Kreiter et al. 2002; 2003; Tixier et al. 2007). According to McMurtry et al. (2013), these phytoseiids are characterized by having some dorsal setae thick and usually serrated. These morphological characteristics allow these mites to colonize microhabitats not occupied by large phytoseiids, preventing competition and escaping predation by these latter mites (Seelmann et al. 2007), and allowing them to take advantage of the presence of prey that prefers the same habitat.

Neoparaphytoseius charapa is now recorded in Brazil and Peru (Fig. 2). In both countries, this species was registered in the Amazon Forest biome. On the other hand, *N. sooretamus* was recorded in several locations in Brazil, from the state of São Paulo to the state of Amazonas, in areas of Cerrado (Rezende & Lofego 2011), Amazon Forest (Vasconcelos & Silva 2015) and Atlantic Forest (El-Banhawy 1984; Zacarias & Moraes 2001; Furtado et al. 2005; Rosa et al. 2005; Fiaboe et al. 2007; Castro & Moraes 2010; Moraes et al. 2013).

Neoparaphytoseius caatinga, a recently described species, was recorded in an area of the Caatinga biome, in the state of Alagoas (Silva et al. 2021).

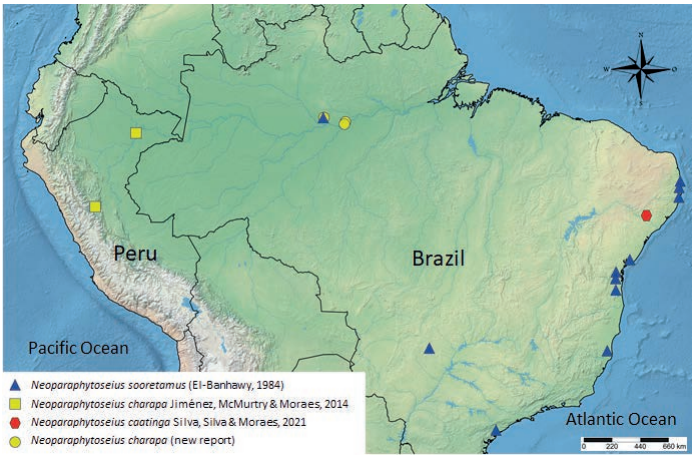

Figure 2. Geographical distribution of species of *Neoparaphytoseius* Chant & McMurtry, 2003. Source: *Neoparaphytoseius caatinga* Silva, Silva & Moraes, 2021 - Silva et al. (2021); *Neoparaphytoseius charapa* Jiménez, McMurtry & Moraes, 2014 - Jiménez et al. (2014); *Neoparaphytoseius sooretamus* (El-Banhawy, 1984) - El-Banhawy (1984), Zacarias & Moraes (2001), Furtado et al. (2005), Rosa et al. (2005), Fiaboe *et al.* (2007), Castro & Moraes (2010), Rezende & Lofego (2011), Moraes et al. (2013) and Vasconcelos & Silva (2015).

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Authors' Contributions

RBS, MPD and SAA conducted the fieldwork. RBS, ACCC and PRD identified the mites. RBS, MPD, SAA, ACCC and IRG prepared the manuscript. All authors revised the final version of the manuscript.

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