Acarologia is proudly non-profit, with no page charges and free open access

Please help us maintain this system by encouraging your institutes to subscribe to the print version of the journal and by sending us your high quality research on the Acari.

Subscriptions: Year 2023 (Volume 63): 450 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php
Previous volumes (2010-2021): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

Acarologia is under free license and distributed under the terms of the Creative Commons-BY
Phytoseiid mites of Martinique, with redescription of four species and new records (Acari: Mesostigmata)

Serge Kreiter\textsuperscript{a}, Ghais Zriki\textsuperscript{a}, Philippe Ryckewaert\textsuperscript{b}, Clovel Pancarte\textsuperscript{b}, Martial Douin\textsuperscript{a}, Marie-Stéphane Tixier\textsuperscript{a}

\textsuperscript{a} CBGP, Montpellier SupAgro, INRA, CIRAD, IRD, Univ Montpellier, Montpellier, France.
\textsuperscript{b} CIRAD, Campus Agro-environnemental Caraïbe, BP 214, 97285 Le Lamentin cedex 2, Martinique, France.

ABSTRACT

Authors report results of a study performed between May 2011 and September 2013 on cover plants tested for future uses in citrus orchards in Martinique. A total of twenty-two species of Phytoseiidae were found among which eight are very common in the West Indies. A catalogue of four new records for Martinique and three new records for the French West Indies is provided, with some information on their biology when available, and biogeography. Some considerations for six additional species, two rarely recorded in the West Indies and four already recorded and very common but with some new data and discussions, are also provided. Among these 13 species, four are re-described.

Keywords Survey, collection, taxonomy, systematics

Zoobank http://zoobank.org/2787B6F9-EDC7-427B-A64E-F5C1E3A8078E

Introduction

Several species in the family Phytoseiidae are important natural enemies controlling phytophagous mite and small insects in natural areas and crops all around the world (McMurtry and Croft 1997; McMurtry et al. 2013). This family is widespread all over the world and consists of 2,479 valid species dispatched in three subfamilies and 94 genera (Demite et al. 2017).

The Caribbean area constitutes one of the world’s hotspots of biodiversity. The hotspot of biodiversity concept was defined by Myers (1988) in order to identify the most immediately important areas for conservation of biodiversity. These hotspots hold high endemism levels and have lost at least 70 % of their original natural vegetation (Myers et al. 2000). The characterization of the phytoseiid mite diversity in the Caribbean area is thus contributing to this general topic of conservation. Nine species of phytoseiid mites were found in a first survey conducted in various locations in Guadeloupe and Martinique (Kreiter and Moraes 1997). In a second survey, 41 additional species were recorded from all islands of the French Antilles (Moraes et al. 2000), including three new species to science [\textit{Neoseiulus martinicensis} Moraes & Kreiter, \textit{Amblyseius neoarcus} (Moraes & Kreiter), and \textit{Metaseiulus (Metaseiulus) neoflumenis} Moraes & Kreiter]. In a third survey, conducted mainly in Guadeloupe and Martinique, six additional species were added to the French Antilles fauna, including a new species to science, \textit{Neoseiulus cecileae} Kreiter (Kreiter et al. 2006). The known number of species from the French Antilles was then of 56. Eleven new species for French Antilles were found from April 2008 to February 2011 during a fourth survey and a new species to Science, \textit{Transeius mariae-angeae} Kreiter was described (Mailloux et al. 2010; Kreiter et al. 2013).

In conclusion, a total of 67 species belonging to 22 genera were thus known at the beginning of the year 2011 from the French Antilles after these four surveys. These species
belong to the three subfamilies: Amblyseiinae with 51 species, Phytoseiinae with 4 species and Typhlodrominae with 12 species.

This paper focuses on results of a fifth survey carried out in Martinique from May 2011 to September 2013 mainly on plants used as cover-crop in citrus orchards in a framework of fruits diversification in the context of agroecology method enhancements.

**Materials and methods**

The study took place in Martinique between May 2011 and September 2013. Plant inhabiting mites were collected from plants used as cover-crops and tested with the aim to evaluate potentialities of these plants to harbour and to release phytoseiid mites in citrus orchards. These plants [Neonotonia wightii (Wight & Arn.) J.A. Lackey, Pueraria phaseoloides (Roxb.) Benth., Macroptilium atropurpureum (DC.) Urb. (the three plants belongs to the Fabaceae); Paspalum notatum Flügge cv. Pensacola (Poaceae)] were planted in experimental plots in CIRAD station, Le Lamentin (Martinique). Mites were collected on these plants and in some orchards on citrus trees and some of these plants when present. Depending on the plants considered, mites were directly collected on leaves or by using the leaf “dipping-shaking-washing-filtering” method of Boller (1984). Mites were then transferred with a fine brush into small plastic vials containing 70 % ethanol.

Plant species were identified according to the nomenclature developed in Fournet (2002).

Mites were then mounted on slides using Hoyer’s medium and identified using a phase and interferential contrast microscope (Leica DMLB, Leica Microsystèmes SAS, Nanterre, France).

Specimens collected in fields in Martinique within this survey were all identified and some type or additional material have been borrowed and studied: - the holotypes of Amblyseius terminatus Chant & Baker and of Typhlodromalus peregrinus (Muma) at the Smithsonian Institution, National Museum of Natural History, Washington DC, USA; - additional material of A. terminatus, the Canadian Collection of Insects, Ottawa, Canada; - the holotype of Typhlodromalus aripo De Leon at the Museum of Comparative Zoology, Invertebrate Zoology Collection in Harvard University, Cambridge, USA; - and the holotypes of Neoseiulus tunus (De Leon) and of N. neotunus (Denmark & Muma) and paratypes of T. aripo, the Florida Department of Agriculture, Gainesville, Florida, USA.

Characters of specimens of 14 species from Martinique and type and additional materials borrowed were measured using a graduate eyepiece (Leica, see above). Drawings of four species were made using a drawing tube attached to the microscope (Leica, see above).

Chant and McMurtry’s (1994, 2007) concepts of the taxonomy of the family Phytoseiidae and the world catalogue database of Demite et al. (2017) were used for faunistical and biogeographical aspects. The chaetotaxy terminologies used in this paper followed those proposed by Lindquist and Evans (1965) as adapted by Rowell et al. (1978) for Phytoseiidae for dorsal and by Chant and Yoshida-Shaul (1991) for ventral idiosomal setae, respectively. Adenotaxy and poroidotaxy terminologies are those proposed by Athias-Henriot (1975).

Numbers of teeth on the fixed and movable cheliceral digits do not include the respective apical teeth. Setae not mentioned in the Results section should be considered as absent.

All measurements are given in micrometers (μm) and presented as the mean in bold followed by the range in parenthesis and if available, the measurement of holotype in italics.

According to Tixier (2012), at least 10 individuals when available were measured in order to have a good assessment of the variability.

Specimens of each species are deposited in the mite collections of Montpellier SupAgro conserved in UMR CBGP INRA/IRD/CIRAD/SupAgro.
The following abbreviations are used in this paper for morphological characters: **dsl** = dorsal shield length; **dsw** = dorsal shield width; **lis** = Largest inguinal sigilla (= “metapodal plate”) length; **lisw** = Largest inguinal sigilla (= “metapodal plate”) width; **sisl** = smallest inguinal sigilla (= “metapodal plate”) length; **vsl** = ventrianal shield length; **vsw** = ventrianal shield width at ZV2 and anus level; **scl** = spermatheca cervix length; **scw** = spermatheca cervix width; **fdl** = fixed digit length; **mdl** = movable digit length.

The following abbreviations are used in this paper for institutions: **CBGP** = Centre de Biologie pour la Gestion des Populations; **CIRAD** = Centre International de Recherche Agronomique pour le Développement; **CAEC** = Campus Agro-environnemental Caraïbe; **INRA** = Institut National de la Recherche Agronomique; **MSA** = Montpellier SupAgro, France; **UMR** = Unité Mixte de Recherche.

**Results and discussion**

A total of 22 species were found from May 2011 to September 2013 in these surveys. Eight species were already very well-known, very common in French West Indies, already recorded and sometimes re-described in previous papers (Kreiter and Moraes 1997; Moraes et al. 2000; Kreiter et al. 2006, 2013): *Arrenoseius urquharti* (Yoshida-Shaul & Chant), *Amblyseius aerialis* (Muma), *A. largoensis* (Muma), *A. tamatavensis* Blommers, *Euseius ovaloides* (Blommers), *Paraphytoseius orientalis* (Narayanan, Kaur & Ghai), *Phytoseiulus macropilis* (Banks) and *Phytoseius rex* De Leon. These species are very common everywhere in French West Indies and giving a very long list of new records has no interest. Measurements of individuals of these eight species are very close to those of original descriptions, of measurements given by several authors and especially very close to those already published in Kreiter and Moraes (1997), Moraes et al. (2000) and Kreiter et al. (2006, 2013).

A catalogue of the 14 remaining species is completed by the available information on the biology and the distribution, along with taxonomical data.

Six species are already known among which four [*Neoseiulus longispinosus* (Evans), *Neoseiulus tunus* (De Leon), *Proprioseiopsis mexicanus* (Garman) and *P. ovatus* (Garman)] are rather common but some interesting new data and new discussions are provided.

New locations for the two remaining very rarely collected species in the French Antilles (*Phytoseius bennetti* De Leon and *Typhlodromina subtropica* Muma & Denmark) are provided and *P. bennetti* is re-described.

Seven species are more remarkable. Three species are new for French West Indies [*Neoseiulus benjamini* (Schicha), *Neoseiulus paraibensis* (Moraes & McMurtry), *Transeius terminatus* (Chant & Baker) **new. comb.**]. Four others [*Amblyseius collaris* Karg, *Euseius sibelius* (De Leon), *Transeius aciculus* (De Leon) and *Typhlodromalus peregrinus* (Muma)] were already known from some islands but are mentioned from Martinique for the first time. *Transeius aciculus*, *T. terminatus* and *A. collaris* are re-described.

And finally, one species (*Phytoseius* sp.) probably new to Science is unfortunately not described in this paper because only one female was collected and with some broken legs, especially the two leg IV, which prohibit to our point of view any possible description of a new species (but many characters, especially spermatheca and ventrianal shield are totally original among the subfamily).
Subfamily Amblyseiinae Muma
Amblyseiinae Muma, 1961: 273.

Tribe Amblyseiini Muma
Amblyseiini, Muma, 1961: 68.

Subtribe Amblyseiina Muma
Amblyseiina Muma, 1961: 69.

Genus Transeius Chant and McMurtry
Transeius Chant & McMurtry, 2004: 181.

Transeius aciculus (De Leon)
Typhlodromips aciculus De Leon, 1967: 28; Moraes et al., 1986: 135; Moraes et al., 2004b: 205. Amblyseius aciculus, Moraes et al., 1991: 122; Transeius aciculus, Chant & McMurtry, 2004: 185; Chant & McMurtry, 2007: 71.

This species was described as a Typhlodromips and mentioned in this genus by Moraes et al. (2000) from various islands of French West Indies but not from Martinique. This species was then mentioned as a Transeius (Kreiter et al. 2006) but still from Guadeloupe. Only few specimens of T. aciculus were recorded during previous surveys. This is the first record of T. aciculus from Martinique and the first survey with a lot of specimens collected. It is found in the low vegetation, grasses, especially on companion plants in citrus orchards (Dubois, 2009; Mailloux et al. 2010). Species of the genus Transeius are considered as type III (generalist predators) by McMurtry et al. (2013) but the biology of that species remains totally unknown. The description of De Leon (1967) includes minute drawings, a poor description and is difficult to use for an accurate identification. There are no re-description with new details and new drawings for that species. We re-describe here Transeius aciculus (De Leon) with new measurements, new details on shapes of characters and new drawings.

**Description** (Table 1 and Figs. 1-2)

**Adult Female** (Table 1 and Fig. 1) (n = 13)

Dorsum (Fig. 1) — Dorsal shield 278 (263–310) long and 157 (138–168) wide, slightly reticulated on the anterior dorsum, with 5 solenostomes (gd2, 5, 6, 8 and 9), 7 pairs of poroids, 17 pairs of dorsal setae and 2 pairs of sub-lateral setae: j1 21 (20–23), j3 30 (25–33), j4 14 (13–15), j5 11 (10–13), j6 11 (10–13), J2 13 (10–13), J5 6 (5–8), z2 19 (18–20), z4 29 (28–35), z5 8, Z1 13 (10–15), Z4 56 (50–60), Z5 65 (60–70), s4 61 (58–63), S2 28 (25–33), S4 11 (10–13), S5 9 (8–10), r3 28 (25–30), R1 13 (10–15). All setae smooth except Z4 and Z5 which are serrated.

Peritreme (Fig. 1A) — Extending to the level of j1.

Venter (Fig. 1B) — All ventral shields smooth. Sternal shield not very large, with 3 pairs of setae and 2 pairs of pores; 1 pair (st4) out of the sternal shield, on a small metasternal shield with one pair of pores; posterior margin slightly concave. Distances between st1-st1 53 (50 – 55), st1-st3 56 (55 – 58), st2-st2 63 (60 – 65), st3-st3 69 (68 – 73), st4-st4 87 (73 – 100), st5-st5 65 (50 – 60). Two pairs of inguinal sigilla (called also “metapodal shields”) 17 (15 – 18), long and 5, wide for the largest, 12 (10 – 13), long and very thin for the smallest one. Ventrianal shield almost rectangular with 3 pairs of pre-anal setae (JVe1, JVe2 and JVe2) and one pair of large elliptical pre-anal solenostomes. Membrane surrounding ventrianal shield with 4 pairs of setae (ZVe1, ZVe3, JV4 and JV5) and 6 pairs of poroids (called also sometimes “platelets”);
Table 1. Comparisons of characters measurements of female specimens of *Transeius aciculus* collected in five different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (13) | Guadeloupe (3) | Dominican Rep. (6) | Types Trinidad (2) | Latin America (?) |
|------------|-----------------|----------------|-------------------|--------------------|--------------------|
| Dsl        | 278 (263-310)   | 256 (243-270) | 268 (252-290)     | 264-266            |
| Dsw        | 157 (138-168)   | 153 (146-162) | 160 (146-180)     | 151-156            |
| j1         | 21 (20-23)      | 20 (19-22)    | 23 (22-26)        | 19-22              |
| j3         | 30 (25-33)      | 28 (27-30)    | 34 (32-37)        | 31                 |
| j4         | 14 (13-15)      | 14 (13-14)    | 13 (12-16)        | 12                 |
| j5         | 11 (10-13)      | 12 (11-14)    | 13 (12-16)        | 7-10               |
| j6         | 11 (10-13)      | 10 (8-11)     | 14 (12-16)        | 7-10               |
| j2         | 13 (10-13)      | 9 (8-11)      | 14 (12-16)        | 10                 |
| j5         | 6 (5-8)         | 6 (5-8)       | 7                 | 5                  |
| z2         | 19 (18-20)      | 19 (16-22)    | 21 (20-21)        | 17-19              |
| z4         | 29 (28-35)      | 30 (27-32)    | 32 (28-36)        | 29-31              |
| z5         | 8               | 7 (5-8)       | 7 (6-8)           | 5                  |
| Z1         | 13 (10-15)      | 13 (11-14)    | 16 (15-18)        | 10-12              |
| Z4         | 56 (50-60)      | 52 (49-57)    | 55 (50-60)        | 50-55              |
| Z5         | 65 (60-70)      | 59 (57-62)    | 70 (68-73)        | 60-65              |
| s4         | 61 (58-63)      | 60 (58-61)    | 57 (52-62)        | 55-58              |
| S2         | 28 (25-33)      | 26 (22-32)    | 30 (28-32)        | 26-29              |
| S4         | 11 (10-13)      | 8 (7-8)       | 17 (14-20)        | 10-12              |
| S5         | 9 (8-10)        | 8 (7-8)       | 12 (10-15)        | 7                  |
| r3         | 28 (25-30)      | 26 (24-27)    | 22 (20-24)        | 24-26              |
| R1         | 13 (10-15)      | 12 (11-14)    | 16 (13-18)        | 10                 |
| St1-St1    | 53 (50-55)      |               |                   |                    |
| St1-St3    | 56 (55-58)      | 55 (54-57)    | 55                 |                    |
| St2-St2    | 63 (60-65)      | 64 (62-65)    | 62-65             |                    |
| St3-St3    | 56 (55-58)      |               |                   |                    |
| St4-St4    | 87 (78-100)     |               |                   |                    |
| St5-St5    | 56 (50-60)      | 52 (51-54)    | 55-58             |                    |
| Lsd        | 17 (15-18)      |               |                   |                    |
| Lsiw       | 5               |               |                   |                    |
| Sisl       | 12 (10-13)      |               |                   |                    |
| Vsl        | 93 (88-100)     | 94 (84-103)   | 93 (88-100)       | 82-94              |
| vsv ZV2    | 57 (50-60)      | 50 (49-54)    | 68 (65-70)        | 53-55              |
| vsv anus   | 54 (50-60)      | 50 (49-51)    | 53                 |                    |
| SgeII      | No macrosetae   | 18 (16-19)    | 17-19             |                    |
| SgeIII     | No macrosetae   | 17 (16-19)    | 17                 |                    |
| SII1II     | No macrosetae   | 14 (13-14)    | 14                 |                    |
| SgeIV      | 36 (33-38)      | 35 (32-38)    | 37 (35-43)        | 34-36              |
| StIIV      | 23 (20-25)      | 22 (21-22)    | 20 (18-22)        | 22-24              |
| StIV       | 42 (38-45)      | 40 (38-41)    | 42 (40-45)        | 38-41              |
| Sel        | 10 (8-13)       | 7 (5-8)       | 4-7               |                    |
| Scw        | 8 (7-8)         |               |                   |                    |
| Fdl        | 29 (28-30)      | 37 (36-38)    |                   |                    |
| teeth      | 15               | 12            |                   |                    |
| Mdl        | 35 (33-36)      | 35 (32-37)    |                   |                    |
| teeth      | 3                |               | 4                 |                    |

Data from this study for Martinique, from Moraes *et al.* (2000) for Guadeloupe, from Ferragut *et al.* (2011) for Dominican Republic, from De Leon (1967) and Moraes *et al.* (1991) for holotype and one paratype from Trinidad, from Moraes *et al.* (1991) for Latin America (Colombia and Panama, no mention of number of specimen females measured).
Figure 1 *Transeius aciculus* female: A – Dorsal shield and peritreme; B – Ventral shields; C – Chelicera; D – Calyx of the spermatheca; E – Macrosetae on leg IV.
ventrianal shield long and smooth 93 (88 – 100) long, 57 (50 – 60) wide at level of anterior corners (Zv2) and 54 (50 – 60) wide at level of anus. Jv3 47 (40 – 50).

Chelicera (Fig. 1C) — Fixed digit 27 (25 – 28), with 9 teeth and movable digit 30 (29 – 30) with 3 teeth. Pilus dentilis not visible.

Spermatheca (Fig. 1D) — Spermatheca (called also “insemination apparatus”) pocular, 10 (8 – 13) long and 8 (7 – 8) large. Minor and major ducts visible on almost all specimens.

Legs (Fig. 1E) — Macrosetae on leg IV as other species of Transeius: SgeIV 36 (33 – 38), StIV 23 (20 – 25), StIV 42 (38 – 45). All macrosetae whip-like. Chaetotactic formula of genu II: 2-2/0, 2/1-1; genu III: 1-2/1, 2/0-1.

**Adult Male** (Table 1 and Fig. 2) (n = 3). In *italics* bold, measurements of a paratype male
the ventrianal shield with only one pair of setae (pairofporoids;ventrianal shield not fused with the peritremal shields. Membranes surrounding 3 anus, with 53 (Wight&Arn.) J.A.Lackey, 12♀♀ on wightii Transieus of smooth. Distances between Neonotonia CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25m), 48♀♀ + 2♂♂ on Chaetotactic formula of genu II and genu III with which are serrated. Z5 11 (10–13) 43 (43–48) 17 st3-st3, allmites collected between 08-01 and 18-09-2013. 1 ♂ on Pensacola; cv. Pensacola; allmites collected between 08-01 and 13-09-2013. 1 ♂ on Z5 11 (10–13) 43 (43–48) 17 st3-st3, allmites collected between 08-01 and 18-09-2013. 1 ♂ on Pensacola; cv. Pensacola; allmites collected between 08-01 and 13-09-2013. 1 ♂ on 1991). This species was described as an Amblyseius by Chant and Baker (1965), reported in this genus in the Phytoseiidae Database of Demite et al. (2017). We propose in this paper a new combination. This is the first record of this species for French Caribbean Islands. The description of Chant and Baker (1965) is now old, poor, with very minute drawings, difficult to use and there are no redescription with new drawings for that species. We re-describe here Transneius terminatus (Chant & McMurtry) new. comb. with new measurements, new details on the shape of some characters and new drawings. Species of the genus Transneius are considered as type III (generalist predators) by McMurtry et al. (2013) but the biology of this
species remains totally unknown.

**Description**

**Adult Female** (Fig. 3) (n = 5). In italics bold, measurements of the holotype.

Dorsum (Fig. 3A) — Dorsal shield 325 (322 – 350) 320 long and 199 (183 – 213) 200 wide, smooth, with no solenostomes, 6 pairs of poroids (identical in the holotype), 17 pairs of dorsal setae and 2 pairs of sub-lateral setae: j1 23 (21 – 23) 23, j3 31 (28 – 33) 28, j4 5 ?, j5 5 ?, j6 7 (5 – 8) ?, j7 7 (5 – 8) ?, J5 10 (9 – 10) 8, z2 12 (10 – 13) ?, z4 28 (23 – 33) 30, z5 5 ?, Z1 11 (10 – 13) 10, Z4 59 (55 – 60) 62, Z5 72 (68 – 75) 70, s4 50 (48 – 50) 50, S2 24 (20 – 25) 23, S4 12 (10 – 13) 10, S5 13 (10 – 15) 13, r3 26 (25 – 28) ? , R1 19 (18 – 20) 20. All setae smooth except Z4 and Z5 which are serrated (identical in the holotype).

Peritreme (Fig. 3A) — Extending to the level of j1 (identical in the holotype).

Venter (Fig. 3B) — All ventral shields slightly reticulated. Sternal shield not very large, with 3 pairs of setae and 2 pairs of pores; 1 pair (st4) out of the sternal shield, on a small metasternal shield with one pore; posterior margin slightly concave (identical in the holotype). Distances between st1-st1 54 (50 – 56) 53, st1-st3 56 (48 – 60) 60, st2-st2 63 (63 – 65) 65, st3-st3 75 (73 – 78) 73, st4-st4 72 (65 – 75) 68, st5-st5 71 (65 – 75) 68. Two pairs of inguinal sigilla (called also “metapodal shields”) 22 (20 – 23) 23 long and 3 3 wide for the largest, 10 (8 – 15) 13 long and very thin for the smallest one. Ventrianal shield pentagonal with 3 pairs of pre-anal setae, (JV1, JV2 and ZV2) and one pair of large elliptical pre-anal solenostomes. Membrane surrounding ventrianal shield with 4 pairs of setae (ZV1, ZV3, JV4 and JV5) and 5 pairs of poroids (called also “platelets”), the last one near the anus not visible on the same focus and thus not drawn on Figure 10; ventrianal shield 107 (100 – 113) 108 long, 94 (93 – 95) 90 wide at level of anterior corners and 69 (65 – 75) 70 wide at level of anus. JV5 53 (50 – 55) 50 long and smooth.

Chelicera (Fig. 3C) — Fixed digit 32 (30 – 33) 33 with 4 teeth 4 and movable digit 33 33 with 1 tooth. *Pilus dentilis* not visible.

Spermatheca (Fig. 3D) — Spermatheca (called also “insemination apparatus”) saccular, 19 (15 – 20) 20 long and 5 5 large. Minor and major ducts visible on few specimens.

Legs (Fig. 3E) — Macrosetae on legs IV: SgeIV 41 (40 – 43) 40, StiIV 23 (20 – 25) 23, StiV 51 (50 – 53) 53. All macrosetae whip-like. Chaetotactic formula of genu II: 2-2/0, 2/1-0, genu III: 1-2/1, 2/0-1 (identical in the holotype).

**Adult male.** Unknown before and not collected during this study.

Specimens examined — **Lamentin**, CIRAD-CAEC station (long. 14°37’N, lat. 60°58’O, alt. 25 m), 1 ♀ on *N. wightii*, 06-03-2013; **Sainte-Anne**, Conseil Général (long. 14°26’N, lat. 60°52’O, alt. 26 m), 2 ♀♀ *N. wightii*, 9-X-2012; **Saint-Esprit**, Mrs Solis’ farm (long. 14°33’N, lat. 60°55’O, alt. 46 m), 1 ♀ on lime trees *[Citrus latifolia* (Tanaka ex Yu.Tanaka) Tanaka, family Rutaceae], 20-10-2011; **Le Lorrain**, M. Trepon’s farm (long. 14°49’N, lat. 61°50’O, alt. 117 m), 1 ♀ on various weeds in a citrus orchard, 25-11-2012; **Saint-Pierre**, Habitation Parmasse (long. 14°75’N, lat. 61°94’O, alt. 284 m), 1 ♀ on various weeds in a citrus orchard *[Citrus sinensis* (L.) Osbeck, Rutaceae], 30-11-2011.

We have also examined: one holotype female on one slide with label: Managa, San Pedro, Honduras, 01-02-1959 on *Baltimora recta* L., J.G. Matthes (USNM n° 30008), 3 ♀♀ (and additionally: 1 ♀ of *Typhlodromalus aripo* De Leon, 2 Astigmatina and 3 Thysanoptera on the same slide) borrowed to the National Museum of Natural History; 2 ♀♀ on two slides with label: Belize, Toledo district, near Upper Bladen Branch Rivers, sapling, climax forest, 11-11-1965, borrowed to the Canadian National Collection. Notice that they were identified as *T. terminatus* but are actually 2 ♀♀ of the genus *Amblyseius*, of the species group *chiapensis*, probably *cupulus* Denmark & Muma but this must be confirmed.
Figure 3 *Transeius terminatus* female: A – Dorsal shield and peritreme; B – Ventral shields; C – Chelicera; D – Calyx of the spermatheca; E – Macrosetae on leg IV.
Remarks — The measurements of the five specimens collected in Martinique are very close to the measurements of original specimens collected in Manaca, San Pedro, Honduras, on *Baltimora recta* L. (Asteraceae) by Chant and Baker (1965). This species was mentioned in the Moraes *et al.* (1986)’s catalogue of the family Phytoseiidae and in the Denmark *et al.* (1999)’s catalogue of Phytoseiidae of Central America as *Typhlodromalus terminatus* and in Chant and McMurtry (2004, 2007), in Prasad (2012) and in the phytoseiid Database of Demite *et al.* (2017) as *Amblyseius terminatus*. Examination of the holotype has shown that this species is actually neither an *Amblyseius* nor a *Typhlodromalus* but a real *Transeius sensu* Chant and McMurtry (2004) and that our specimens are similar to the holotype and belong to this genus. Macrosetae are actually not present on all legs but only on leg IV and the ratio length seta $s_4$ / length $S_2$ is much less than 2.7. We are proposing a new combination, *Transeius terminatus* (Chant and Baker) new comb.

Genus *Amblyseius* Berlese

*Amblyseius* Berlese, 1914: 143.

*Amblyseius collaris* Karg

*Amblyseius collaris* Karg, 1983: 317; Moraes *et al.*, 1986: 11; Denmark & Muma, 1989: 48; Moraes *et al.*, 2004b: 20; Chant & McMurtry, 2004: 201; Chant & McMurtry, 2007: 78.

This species was already known from Guadeloupe but only recorded with one female (Moraes *et al.* 2000). This is the first record of *A. collaris* from Martinique. Species of the genus *Amblyseius* are considered as type III (generalist predators) by McMurtry *et al.* (2013) but the biology of that species remains totally unknown. The description of Karg (1983) and of Denmark and Muma (1989) are quite poor in details, difficult to use for an accurate identification and there are no re-description with new drawings and new details for that species. We re-describe here *Amblyseius collaris* Karg with new measurements, new details on the shape of some characters and new drawings.

**Description** (Table 2 and Fig. 4)

**Adult Female** (Fig. 4) (n = 3)

Dorsum (Fig. 4A) — Dorsal shield 371 (364 – 375) long and 272 (262 – 280) wide, smooth, with no visible solenostomes and pairs of poroids, 17 pairs of dorsal setae and 2 pairs of sub-lateral setae: $j_1$ 29 (28 – 30), $j_3$ 37 (36 – 37), $j_4$ 5, $j_5$ 5, $j_6$ 5, $j_2$ 9 (6 – 10), $j_5$ 8, $z_2$ 13, $z_4$ 5, $z_5$ 5, $Z_1$ 8, $Z_4$ 176 (175 – 178), $Z_5$ 356 (346-362), $s_4$ 133 (130 – 135), $S_2$ 6 (5 – 8), $S_4$ 12 (12 – 13), $s_5$ 6 (5 – 8), $r_3$ 10, $R_1$ 15 (10 – 20). All setae smooth.

Peritreme (Fig. 4A) — Extending to the level of $j_1$.

Venter (Fig. 4B) — All ventral shields smooth. Sternal shield not very large, with 3 pairs of setae and 2 pairs of pores; 1 pair ($st_4$) out of the sternal shield, on a small metasternal shield with one pore; posterior margin straight. Distances between $st_1-st_1$ 62 (60 – 63), $st_1-st_3$ 65 (63 – 67), $st_2-st_2$ 75, $st_3-st_3$ 83 (80 – 85), $st_4-st_4$ 84 (78 – 93), $st_5-st_5$ 78 (75 – 80). Two pairs of inguinal sigilla (called also “metapodal shields”) 22 long and 5 wide for the largest, 18 (15 – 20) long and 2 for the smallest one. Ventrianal shield pentagonal with 3 pairs of pre-anal setae ($JV_1$, $JV_2$ and $ZV_2$) and one pair of elliptical pre-anal solenostomes. Membrane surrounding ventrianal shield with 3 pairs of setae ($ZV_1$, $ZV_3$, $JV_4$ and $JV_3$) and 5 pairs of poroids (called also “platelets”), the last one near the anus not visible on the same focus and thus not drawn on Figure 15; ventrianal shield 116 (113 – 120) long, 94 (92 – 95) wide at level of anterior corners and 75 wide at level of anus. $J_5$ 74 (72 – 75) long and smooth.

Chelicera (Fig. 4C) — Fixed digit 29 (28 – 30) with 15 teeth and movable digit 35 (33 – 36) with 3 teeth. *Pilus dentilis* not visible.
Table 2. Comparisons of character measurements of female specimens of *Amblyseius collaris* collected in three different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (3) | Venezuela (1) | Costa Rica (2) |
|------------|----------------|---------------|----------------|
| Dsl        | 371 (364-375)  | 360           | 370 (350-390)  |
| Dsw        | 272 (262-280)  | 266           | 292 (283-300)  |
| j1         | 29 (28-30)     | 28            | 34 (33-34)     |
| j3         | 37 (36-37)     | 36            | 39 (38-40)     |
| j4         | 5              | 5             | 5              |
| j5         | 5              | 5             | 6              |
| j6         | 5              | 5             | 6              |
| J2         | 9 (6-10)       | 6             | 9 (7-10)       |
| J5         | 8              | 8             | 9 (8-10)       |
| z2         | 13             | 12            | 14             |
| z4         | 5              | 6             | 8 (7-10)       |
| z5         | 5              | 5             | 6              |
| Z1         | 8              | 11            | 8 (7-8)        |
| Z4         | 176 (175-178)  | 157           | 190            |
| Z5         | 356 (346-362)  | 330           | 385 (380-390)  |
| s4         | 133 (130-135)  | 125           | 138 (130-145)  |
| S2         | 6 (5-8)        | 11            | 11             |
| S4         | 12 (12-13)     | 10            | 12 (10-13)     |
| S5         | 6 (5-8)        | 11            | 12 (10-13)     |
| r3         | 10             | 12            | 9 (8-10)       |
| R1         | 15 (10-20)     | 10            | 10             |
| St1-St1    | 62 (60-63)     |               |                |
| St1-St3    | 65 (63-67)     | 66 (63-68)    |                |
| St2-St2    | 75             |               | 78 (75-80)     |
| St3-St3    | 83 (80-85)     | 80 (78-80)    |                |
| St4-St4    | 84 (78-93)     |               |                |
| St5-St5    | 78 (75-80)     | 79 (78-80)    |                |
| Lisl       | 22             |               |                |
| Lsiw       | 5              |               |                |
| Sisl       | 18 (15-20)     |               |                |
| Vsl        | 116 (113-120)  |               | 130            |
| vsw ZV2    | 94 (92-95)     |               | 100            |
| Vsw anus   | 75             |               | 95             |
| Sgel       | 47 (45-48)     | 52 (49-54)    |                |
| SgelII     | 36 (35-37)     | 43 (41-45)    |                |
| SgelIII    | 64 (63-65)     | 72 (68-78)    |                |
| StIII      | 45 (43-48)     | 50 (48-52)    |                |
| SgelIV     | 150 (144-155)  | 137           | 163 (160-165)  |
| StIV       | 96 (94-98)     | 86            | 111 (100-112)  |
| StV        | 72 (70-75)     | 70            | 73 (70-76)     |
| scl        | 24 (22-25)     | 25            | 20             |
| scw        | 4 (3-5)        |               |                |
| Fdl        | 29 (28-30)     | 37 (36-38)    |                |
| teeth      | 15             | 12            |                |
| Mdl        | 35 (33-36)     | 35 (32-37)    |                |
| teeth      | 3              | 4             |                |

Data from this study for Martinique, from Karg (1983) and Denmark and Muma (1989) for Venezuela, and from Castro *et al.* (2010) for Costa Rica.
Figure 4 Amblyseius collaris female: A – Dorsal shield and peritreme; B – Ventral shields; C – Chelicera; D – Calyx of the spermatheca; E – Macrosetae on leg IV.
Spermatheca (Fig. 4D) — Spermatheca (called also “insemination apparatus”) fundibular, 24 (22–25) long and 5 (3–5) wide. Minor and major ducts visible on the three specimens.

Legs (Fig. 4E) — Macrosetae on all legs: SgeI 47 (45–48), SgeII 36 (35–37), SgeIII 45 (43–48), StiIII 45 (43–48), SgeIV 150 (144–155), StiIV 96 (94–98), StIV 72 (70–75). All macrosetae whip-like. Genua 2 and 3 with seven setae. Chaetotactic formula of genu II: 2-2/0, 0/2-1; genu III: 1-2/1, 2/0-1.

Adult male — Unknown and no males were collected during the survey.

Specimens examined — Lamentin, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 1 ♀ on P. phaseoloides, 4-12-2012; Saint-Joseph, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 1 ♀ on possibly (not sure) Teramnus labialis (L.f.) Spreng. (Fabaceae), 20-10-2011; Saint-Joseph, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 1 ♀ on Citrus leaves (C. sinensis et C. latifolia), 17-07-2012.

Previous record — Brazil (Amazonas), Costa Rica, Guadeloupe, USA (Florida), Venezuela.

Remarks — Measurements of the three females collected (Table 2) fit very well with the measurements of the holotype female (Karg 1983; Denmark and Muma 1989) except for slightly longer s4, Z4 and Z5 and SgeIV and StIV. These are the longest setae and variations are always more important (Tixier 2012). Measurements (Table 2) fit also very well with measurements of specimens collected in Costa Rica (Castro et al. 2010) except in this case shorter s4, Z4 and Z5 and SgeIV and StIV in specimens from Martinique. These long setae may be very variable for the genus Amblyseius and at least for that species.

Subtribe Proprioseiopsina Chant and McMurtry
Proprioseiopsina Chant & McMurtry, 2004: 219.

Genus Proprioseiopsis Muma
Proprioseiopsis Muma, 1961: 277.

Proprioseiopsis mexicanus (Garman)
Amblyseius mexicanus Garman, 1958: 75.
Amblyseius mexicanus, Moraes & McMurtry, 1983: 134.
Proprioseiopsis mexicanus, Muma & Denmark, 1970: 48; Denmark & Muma, 1973: 237; Moraes et al., 1986: 118; Kreiter & Moraes, 1997: 379; Moraes et al., 2004b: 181; Chant & McMurtry, 2005a: 13; Chant & McMurtry, 2007: 89.

This species was already known from all islands of French West Indies (Kreiter & Moraes 1997; Moraes et al. 2000, Kreiter et al. 2006; Mailloux et al. 2010) but it was found only in very large number during a previous study on companion plant in Guadeloupe (Mailloux et al. 2010) and in an actual study in La Réunion (Le Bellec, unpublished data). This species seems to be very abundant on weeds in the lower vegetation. Phytoseiid mites of the genus Proprioseiopsis have been found mainly in ground surface, humus, litter, soil, moss or on grass (Muma and Denmark 1970; McMurtry et al. 2015). Proprioseiopsis mexicanus population increase when fed Tetranychus urticae Koch eggs (Mégevand et al. 1993) and this species seems to be a good predator of thrips (Kreiter, unpublished data). It is one of the prevailing phytoseiid species on citrus orchards in Alabama (Fadamiro et al. 2009). Denmark and Evans (2011) mentioned that the species can be reared on T. urticae and Oligonychus pratensis (Banks) and is associated with Bryobia praetiosa Koch, Bryobia sp. and Panonychus ulmi (Koch). It was also found in association with Tetranychus evansi Baker & Pritchard (Furtado et al. 2018, Acarologia 58(2): 366-407; DOI 10.24349/acarologia/20184248 379).
et al. 2014) but mentioned as a poor predator of that species. The biology of this species is however almost unknown.

Specimens examined — 25 ♀♀ + 3 ♂♂ in total (12 ♀♀ + 3 ♂♂ measured). **Lamentin**, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 4 ♀♀ + 2 ♂♂ on *P. notatum*, 11 ♀♀ + 1 ♂ on *N. wightii*, 1 ♀ on *M. atropurpureum* collected between 18-VI and 19-09-2012, and 1 ♀ on *P. phaseoloides* collected 20-08-2013; **Saint-Joseph**, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 3 ♀♀ on citrus leaves (*C. sinensis et C. latifolia*), 1-07-2012; **Saint-Joseph**, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 1 ♀ on possibly (not sure) *T. labialis*, 20-10-2011; **Le Lorrain**, Mr. Trepon’s farm (long. 14°49′N, lat. 61°50′O, alt. 117 m), 2 ♀♀ on various weeds in a citrus orchard, 25-11-2012; **Saint-Pierre**, Habitation Parnasse (long. 14°75′N, lat. 61°94′O, alt. 284 m), 1 ♀ on various weeds in a citrus orchard, 30-11-2011; **Le François**, Mr. Peronnet’s farm, La Digue François (long. 14°34′N, lat. 61°53′O, alt. 59 m), 1 ♀ on leaves of lime trees *C. latifolia*.

Previous record — Australia, Benin, Brazil (Bahia, Maranhão, Mato Grosso do Sul, Paraiba, Pernambuco, Rondonia, São Paulo), Canada (Northwest Territories, Ontario, Quebec), China (Jiangxi), Colombia, Costa Rica, Cuba, Galapagos, Ghana, Guadeloupe, Hawaii, Jamaica, Kenya, Madagascar, Martinique (only 2 ♀♀ in Kreiter et al. 2006), Mexico, New Zealand, Nicaragua, Panama, Peru, Réunion Island, Saudi Arabia, Taiwan, United Arab Emirates, USA (Alabama, Arizona, California, Florida, Georgia, Iowa, Kansas, Louisiana, Maryland, Minnesota, Missouri, New Jersey, North Carolina, Ohio, Pennsylvania, Texas, West Virginia, Wisconsin).

Remarks — Measurements of the twelve females (Table 3) fit very well with the those of the holotype female except for slightly longer *s4*, *Z4* and *Z5*. Measurements of females (Table 3) fit also very well with those of the specimens collected in Peru (Guanilo et al. 2008a) except shorter *j3* and longer *Z5* in specimens from Martinique. This is the same for male measurements (Table 4) with additionally shorter *s4*, *Z4* and *Z5* in specimens from Martinique.

**Proprioseiopsis ovatus** (Garman)

*Amblyseius ovatus* Garman, 1958: 78.

*Proprioseiopsis ovatus*, Moraes et al., 1986: 121; Moraes et al., 2004b: 184; Chant & McMurtry, 2005a: 15; Chant & McMurtry, 2007: 89.

*Amblyseiulus cannaensis* Muma, 1962: 4, synonymy according to Denmark & Evans, 2011: 214.

*Amblyseius cannaensis*, Moraes & McMurtry, 1983: 132; Moraes & Mesa, 1988: 77; Moraes et al., 1991: 126.

*Proprioseiopsis cannaensis*, Muma & Denmark, 1970: 38; Kreiter & Moraes, 1997: 379.

This species was already known from Guadeloupe, Marie-Galante and Martinique (Kreiter & Moraes 1997; Moraes et al. 2000; Mailloux et al. 2010) but misidentified as *P. mexicanus*. This species was found in very large number only during a previous study on companion plant in Guadeloupe (Mailloux et al. 2010) and in a recent study in La Réunion (Le Bellec, unpublished data). In other habitats, this species seems to be very rare. This species like *P. mexicanus* seems to be abundant on weeds in the lower vegetation. Denmark and Evans (2011) indicated that this species is associated with *O. pratensis* and *Brevipalpus* sp. It was found in association with *T. evansi* (Furtado et al. 2014) but mentioned as poor predator of that species. The biology of this species is totally unknown.

Specimens examined — 36 ♀♀ in total (11 measured). **Lamentin**, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 10 ♀♀ on *N. wightii*, 1 ♀ on *M. atropurpureum* and 1
Table 3 Comparisons of character measurements of female specimens of *Proprioseiopsis mexicanus* collected in six different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (12) | Guadeloupe (5) | Brazil (2) | Holotype (1) | Cuba (?) | Peru (6) |
|------------|-----------------|----------------|------------|--------------|-----------|----------|
| Dsl        | 337 (312-369)   | 335 (331-339)  | 325-350    | 355          | 375 (372-380) |
| Dsw        | 205 (186-257)   | 224 (212-241)  | 195-215    | 216          | 243 (220-258) |
| j1         | 22 (19-24)      | 19 (15-22)     | 21-22      | 22           | 25        |
| j3         | 30 (28-31)      | 30 (24-34)     | 30-31      | 28           | 38 (35-40) |
| j4         | 5 (3-6)         | 5 (4-7)        | 5          | 6            | 5 (5-6)   |
| j5         | 5 (4-6)         | 5 (4-7)        | 5          | 5            | 5 (3-7)   |
| j6         | 6 (5-7)         | 5 (5-6)        | 6          | 7            | 8         |
| J5         | 10 (6-14)       | 9 (9-10)       | 9-10       | 7            | 9         |
| z2         | 14 (13-15)      | 12 (11-14)     | 12         | 14           | 19 (18-20) |
| z4         | 10 (8-11)       | 10             | 11-12      | 10           | 12 (10-12) |
| z5         | 5 (4-5)         | 4 (4-5)        | 4          | 5            | 5         |
| Z1         | 7 (6-8)         | 6 (5-7)        | 9          | 6            | 8 (8-9)   |
| Z4         | 78 (66-83)      | 74 (72-76)     | 64-70      | 73           | 82 (76-85) |
| Z5         | 108 (95-131)    | 103 (97-110)   | 85-93      | 98           | 99 (90-105) |
| s4         | 63 (53-68)      | 59 (56-65)     | 49-52      | 56           | 65 (60-68) |
| S2         | 9 (8-10)        | 9 (8-10)       | 8-9        | 8            | 10        |
| S4         | 9 (8-10)        | 9 (8-10)       | 10         | 8            | 10 (10-11) |
| S5         | 10 (8-11)       | 9 (9-12)       | 10         | 8            | 9 (8-10)  |
| r3         | 13 (13-16)      | 11 (9-14)      | 14-16      | 13           | 21 (19-23) |
| R1         | 9 (7-10)        | 9 (8-10)       | 10-11      | 7            | 11 (10-13) |
| St1-St1    | 49 (45-52)      |                |            |              |           |
| St1-St3    | 58 (55-62)      | 60 (58-62)     | 57-60      | 60           | 60 (58-63) |
| St2-St2    | 61 (57-64)      | 68 (65-74)     | 64-65      | 62-67        | 66 (63-68) |
| St3-St3    | 69 (62-71)      |                |            |              |           |
| St4-St4    | 70 (64-74)      |                |            |              |           |
| St5-St5    | 62 (58-69)      | 66 (64-72)     | 65-70      | 65           | 83 (78-88) |
| Lisl       | 23 (21-26)      |                |            |              |           |
| Lsiw       | 6 (5-7)         |                |            |              |           |
| Sisl       | 12 (10-16)      |                |            |              |           |
| Vsl        | 102 (95-120)    | 108 (103-114)  | 102-108    | 110-115      | 118 (115-123) |
| vsw ZV2    | 91 (83-100)     | 92 (86-97)     | 92-95      | 89-98        | 100 (93-105) |
| vsw anus   | 75 (68-81)      | 85 (80-89)     | 80         | 72-77        | 91 (90-93) |
| JV5        | 68 (62-76)      |                | 60-65      | 72           | 68 (62-75) |
| SgelII     | 23 (21-24)      | 23 (20-24)     | 21-22      | 24           | 29 (28-30) |
| SgelIII    | 26 (21-28)      | 24 (23-25)     | 23         | 24           | 28        |
| SgelIV     | 52 (46-55)      | 49 (48-51)     | 45         | 54           | 55 (53-58) |
| StIV       | 32 (25-35)      | 32 (27-36)     | 26         | 32           | 32 (30-33) |
| StIV       | 59 (53-67)      | 56 (51-60)     | 55         | 62           | 57 (55-58) |
| Sel        | 4 (4-5)         | 9 (6-10)       | 5-7        | 5-7          | 8 (7-10)  |
| Sew        | 29 (27-32)      | 33 (29-38)     | 29         | 31           | 37 (35-38) |
| teeth      | 8               | 8               | 8          | 9            | 9         |
| Mdl        | 33 (31-34)      | 31 (29-32)     | 31         | 34           | 37 (33-40) |

Data from this study for Martinique, from Kreiter and Moraes (1997) for Guadeloupe, from Lofego et al. (2009) for Brazil, from Moraes and McMurtry (1983) for the holotype, from Moraes and McMurtry (1983) and Moraes et al. (1991) for Cuba, and from Guanilo et al. (2008a) for Peru.
Table 4 Comparisons of character measurements of male specimens of *Proprioseiopsis mexicanus* collected in three different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (3) | Guadeloupe (1) | Peru (1) |
|------------|----------------|----------------|---------|
| Dsl        | 243-253        | 279            | 288     |
| Dsw        | 153-164        | 194            | 193     |
| j1         | 18             | 17             | 20      |
| j3         | 24-27          | 24             | 35      |
| j4         | 4              | 5              | 5       |
| j5         | 4              | 4              | 5       |
| j6         | 5              | 5              | 8       |
| J5         | 8-9            | 9              | 8       |
| z2         | 10-12          | 11             | 18      |
| z4         | 9-10           | 11             | 18      |
| z5         | 4              | 10             | 5       |
| Z1         | 6              | 8              | 5       |
| Z4         | 56-60, serrated| 56             | 68      |
| Z5         | 78, serrated   | 74             | 89      |
| s4         | 45-46          | 43             | 50      |
| S2         | 5-9            | 9              | 7       |
| S4         | 9              | 9              | 10      |
| S5         | 10             | 9              | 10      |
| r3         | 11-13          | 10             | 18      |
| R1         | 7-9            | 8              | 10      |
| St1-St1    | 42-43          |                |         |
| St1-St5    | 87-92          |                |         |
| St2-St2    | 51             |                |         |
| St3-St3    | 49-50          |                |         |
| St4-St4    | 53-57          |                |         |
| St5-St5    | 28-36          |                |         |
| Vsl        | 104-110        | 103            | 127     |
| vsw ZV2    | 101-118        | 121            | 144     |
| vsw anus   | 72             |                |         |
| JV5        | 22-33          |                |         |
| SgeII      | 15             |                | 25      |
| SgeIII     | 18             | 19             | 23      |
| SgeIV      | 33-34          | 32             | 38      |
| StiIV      | 19-22          | 23             | 21      |
| StIV       | 49-53          | 48             | 51      |
| Shaft length | 15             | 18             |         |
| Fdl teeth  | 20             |                |         |
| Mdl teeth  | 22             |                |         |

Data from this study for Martinique, from Kreiter and Moraes (1997) for Guadeloupe, from Guanilo *et al.* (2008a) for Peru.
♀ on *P. phaseoloides* collected between 18-06 and 19-09-2012, and 1 ♀ on *M. atropurpureum* collected 6-03-2013; **Saint-Joseph**, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 9 ♀♀ collected 17-07-2012, 2 ♀♀ collected 25-07-2012 and 12 ♀♀ collected 3-05-2012 on citrus leaves (*C. sinensis* et *C. latifolia*).

Previous record — Argentina, Australia (New South Wales, Queensland), Brazil (Alagoas, Amazonas, Bahia, Goiás, Maranhão, Mato Grosso do Sul, Minas Gerais, Pernambuco, Piauí, Rio Grande do Sul, Roraima, São Paulo, Tocantins), Canada (British Columbia), China (Guangdong, Hainan), Columbia, Costa Rica, Cuba, DR Congo, Ecuador, Egypt, Fiji, Ghana, El Salvador, Guadeloupe, Guyana, Hawaii, Honduras, India (West Bengal), Lesotho, Madagascar, Malawi, Malaysia, Marie-Galante, Martinique, Mozambique, New Caledonia, Papua New Guinea, Paraguay, Peru, Philippines, Puerto Rico, Saudi Arabia, Sierra Leone, South Africa, Spain, Sri Lanka, Taiwan, Thailand, Turkey, USA (Arizona, California, Florida, Kansas, Louisiana, Minnesota, Missouri, New Mexico, North Carolina, Utah, Washington), Venezuela, Zaire, Zimbabwe.

Remarks — Measurements in Table 5 show great variations. Those of the 11 females from Martinique fit very well with the measurements of the holotype female except for slightly longer *s₄*, *Z₄*, *Z₅* and *SgeIV* and shorter *StIV*. Measurements of females fit also very well with those of specimens collected in Peru and Argentina (Guanilo *et al.* 2008a, b). Some measurements of the two specimens from Ecuador show differences (*j₃*, *z₂*, *s₄*, *Z₄*, *Z₅* far longer and *Z₁*, *S₂*, *S₄*, *r₃* shorter). This might be an indication of another species of *Proprioseiopsis* involved.

**Tribe Euseiini Chant and McMurtry**

*Euseiini* Chant & McMurtry, 2005b: 191.

**Subtribe Euseiina Chant and McMurtry**

Euseiina Chant & McMurtry, 2005b: 209.

**Genus Euseius Wainstein**

*Amblyseius* (*Amblyseius*) section *Euseius*, Wainstein, 1962: 15; *Euseius* De Leon, 1967: 86.

**Euseius sibelius** (De Leon)

*Amblyseius* (*Typhlodromalus*) *sibelius* De Leon, 1962: 21.

*Euseius sibelius*, Muma & Denmark, 1970: 98; Feres & Moraes, 1998: 128; Moraes *et al.*, 1986: 54; Moraes *et al.*, 2004b: 83; Chant & McMurtry, 2005b: 216; Chant & McMurtry, 2007: 123.

*Euseius subalatus* De Leon, 1965: 127 (synonymy according to Muma & Denmark, 1970).

This species was already known from Guadeloupe and Les Saintes (Moraes *et al.* 2000) but not from Martinique. This is the first record of this species from this island. This species seems to be rather rare on companion plants as it was collected in few numbers. It was also found in association with *T. evansi* (Moraes and McMurtry 1983) but probably an inefficient predator of that species. The biology of this species is totally unknown.

Specimens examined — 36 ♀♀ + 1 ♂ in total (12 ♀♀ measured but 1 ♂ in bad state not measured). **Lamentin**, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 5 ♀♀ + 1 ♂ on *N. wightii*, 5 ♀♀ on *M. atropurpureum* and 26 ♀♀ on *P. phaseoloides* collected between 23-07-2012 and 18-09-2013.
Table 5 Comparisons of character measurements of female specimens of *Proprioseiopsis ovatus* collected in seven different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (11) | Guadeloupe (5) | Brazil SP (5) | Ecuador (2) | Holotype (1) | Peru (3) | Argentina (2) |
|------------|-----------------|----------------|--------------|-------------|--------------|----------|--------------|
| Dsl        | 334 (316-365)   | 334 (316-343) | 355 (333-395) | 408         | 372          | 358      | 389          |
| Dsw        | 291 (255-321)   | 264 (250-279) | 266 (237-300) | 252         | 277 (245-310)| 343      | 345          |
| j1         | 29 (27-32)      | 25 (23-27)    | 30 (28-35)   | 24-28       | 28 (26-30)   | 32       | 30-33        |
| j3         | 64 (54-70)      | 67 (64-72)    | 65 (60-75)   | 101-108     | 64 (62-65)   | 86       | 85-86        |
| j4         | 6 (5-7)         | 5 (4-5)       | 6 (5-8)      | 7           | 8            | 5        | 4-5          |
| j5         | 5 (4-6)         | 5 (4-6)       | 5 (4-7)      | ?           | 8            | 5        | 4-5          |
| j6         | 7 (3-9)         | 10 (9-12)     | 9 (7-12)     | ?           | 12           | 7        | 5-8          |
| J5         | 9 (8-9)         | 9 (8-12)      | 9 (8-10)     | 7-10        | 8            | 8        | 7-9          |
| z2         | 34 (31-45)      | 38 (36-42)    | 46 (40-60)   | 53-55       | 42           | 35       | 40-45        |
| z4         | 20 (15-23)      | 24 (19-26)    | 26 (22-30)   | 19          | 22           | 21       | 19-23        |
| z5         | 6 (4-7)         | 5 (4-6)       | 5 (5-7)      | 5           | 8            | 6        | 5-6          |
| Z1         | 23 (17-26)      | 23 (19-25)    | 23 (20-30)   | 12          | 17           | 21       | 20-23        |
| Z2         | 116 (111-120)   | 110 (95-114)  | 108 (103-115)| 120-125     | 101          | 116      | 100-120      |
| ZS         | 98 (91-102)     | 88 (77-101)   | 93 (90-95)   | 103-106     | 90           | 98       | 96-102       |
| S4         | 101 (96-106)    | 100 (95-112)  | 96 (92-105)  | 118-120     | 88           | 101      | 100-102      |
| S2         | 19 (16-22)      | 20 (13-23)    | 21 (20-25)   | 12          | 17           | 21       | 20-22        |
| S4         | 12 (10-14)      | 14 (14-15)    | 13 (12-15)   | 7           | 16           | 12       | 10-13        |
| S5         | 10 (9-11)       | 14 (13-17)    | 11 (10-13)   | 7           | 12           | 10       | 7-8          |
| r3         | 19 (17-21)      | 20 (18-24)    | 23 (22-25)   | 14          | 22           | 22       | 20-23        |
| R1         | 10 (8-12)       | 15 (13-17)    | 11 (10-12)   | ?           | 17           | 11       | 10-12        |
| St1-St1    | 47 (43-49)      | 56 (53-60)    | 52 (51-55)   | 55          | 50-53        | 58       | 56-60        |
| St1-St3    | 69 (62-73)      | 74 (70-76)    | 75 (73-78)   | 74-77       | 72           | 70-75    | 79           |
| St2-St2    | 86 (81-90)      | 86 (81-94)    | 86 (80-94)   | 89          | 86-94        | 95       | 90-97        |
| St3-St6    | 28 (26-32)      | 4 (3-5)       | 12 (10-14)   | 108         | 103-120      | 108      | 102-113      |
| Lsl        | 108 (103-120)   | 107 (91-117)  | 106 (100-115)| 108-110     | 98           | 95-105   | 119          |
| Lsw        | 109 (108-120)   | 116 (113-121)| 113 (105-132)| 125         | 114          | 112-115  | 118          |
| Vsl        | 85 (76-94)      | 101 (104-110)| 108 (98-130) | 60-62       | 73           | 70-75    | 68           |
| Vsw ZV2    | 80 (76-87)      | 82 (77-85)    | 83 (76-88)   | 71          | 82           | 60       | 78           |
| Anus       | 22              | 18            | 14           | 22          | 18           | 14       | 14-20        |
| SgelI      | 28 (26-32)      | 27 (22-32)    | 30 (29-30)   | 26          | 28           | 26       | 26-30        |
| SgelII     | 25 (19-24)      | 53 (46-60)    | 60 (55-70)   | 50-53       | 55           | 59       | 58-60        |
| SgelV      | 40 (37-44)      | 35 (28-41)    | 43 (35-55)   | 36-41       | 43           | 38       | 35-39        |
| StlV       | 83 (76-88)      | 76 (70-83)    | 79 (70-85)   | 79          | 86           | 87       | 82-90        |
| Sel        | 14 (12-16)      | 17 (12-19)    | 17 (15-19)   | 17          | 22           | 20       | 17-23        |
| Sgw        | 9 (6-11)        | 30 (28-32)    | 31 (28-33)   | 30 (29-20)  | 29           | 29       | 29-30        |
| teeth      | 6               | 6             | 2            | 2           | 2            | 2        | 2            |
| teeth      | 32 (31-34)      | 32 (30-34)    | 32           | 36          |              |          |              |

Data from this study for Martinique, from Kreiter and Moraes (1997) for Guadeloupe, from Lofego et al. (2009) for Brazil (São Paulo), from Moraes et al. (1991) for Ecuador, from Moraes and McMurtry (1983) for the holotype (USA), from Guanilo et al. (2008a) for Peru and from Guanilo et al. (2008b) for Argentina.
Table 6 Comparisons of character measurements of female specimens of *Euseius sibelius* collected in six different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (12) | Dominican Rep. (5) | Brazil SP (4) | Peru (1) | Holotypes |
|------------|----------------|-------------------|---------------|----------|-----------|
| Dsl        | 269 (251-278)  | 268 (260-278)     | 279 (255-300) | 290      | 240-275   |
| Dsw        | 153 (141-161)  | 154 (140-167)     | 172 (160-186) | 175      | 150-166   |
| j1         | 23 (19-24)     | 23 (20-28)        | 26 (25-27)    | 25       | 25        |
| j2         | 20 (17-22)     | 22 (20-24)        | 22 (20-23)    | 23       | 20-24     |
| j4         | 18 (16-18)     | 19 (18-20)        | 19 (15-20)    | 19       | 18-19     |
| j5         | 18 (17-19)     | 19 (18-20)        | 20 (18-21)    | 20       | 17-19     |
| j6         | 20 (19-21)     | 19 (18-20)        | 23 (22-25)    | 23       | 21        |
| J2         | 19 (17-20)     | 19 (18-20)        | 22 (20-25)    | 21       | 18-21     |
| J5         | 6 (5-7)        | 8 (7-8)           | 7 (5-8)       | 7        | 07-09     |
| z2         | 22 (17-24)     | 22 (18-25)        | 23 (20-26)    | 23       | 23-24     |
| z4         | 24 (22-26)     | 22 (20-24)        | 27 (23-29)    | 28       | 25-26     |
| z5         | 19 (17-20)     | 20 (18-21)        | 21 (18-23)    | 23       | 21        |
| Z1         | 19 (18-20)     | 20 (18-21)        | 22 (20-23)    | 21       | 20-21     |
| Z4         | 21 (18-22)     | 22 (21-23)        | 25 (23-28)    | 26       | 21-23     |
| Z5         | 51 (46-54)     | 51 (48-53)        | 53 (50-56)    | 54       | 49-52     |
| s4         | 28 (26-30)     | 28 (27-28)        | 32 (30-33)    | 32       | 27-29     |
| S2         | 22 (20-23)     | 23 (22-25)        | 24 (20-25)    | 25       | 21-23     |
| S4         | 22 (20-23)     | 21 (19-23)        | 23 (20-25)    | 21       | 21-23     |
| S5         | 22 (20-24)     | 21 (19-23)        | 23 (20-25)    | 24       | 21-24     |
| r3         | 22 (21-24)     | 23 (22-23)        | 25 (23-27)    | 26       | 22-25     |
| R1         | 15 (13-17)     | 15 (13-16)        | 17 (13-19)    | 16       | 13-21     |
| St1-St1    | 49 (48-52)     |                   |               |          |           |
| St1-St3    | 51 (48-54)     | 55 (54-56)        | 50           |          |           |
| St2-St2    | 59 (57-60)     |                   | 63           | 58       |           |
| St3-St3    | 66 (65-68)     |                   | 75           |          |           |
| St4-St4    | 68 (71-73)     |                   |             |          |           |
| St5-St5    | 62 (60-63)     | 64 (61-67)        | 69           |          |           |
| lisl       | 15 (13-16)     |                   |              |          | 14        |
| lsiw       | 3             |                   |              |          |           |
| sisl       | 7 (6-8)        |                   |              |          |           |
| vsl        | 79 (69-91)     | 75 (73-80)        | 89 (88-92)   | 90       | 77-78     |
| vsw Z1V2   | 42 (40-46)     | 44 (43-47)        | 47 (45-48)   | 45       | 41        |
| vsw anus   | 50 (45-52)     |                   | 53 (50-56)   | 63       | 52-57     |
| SgelIV     | 27 (23-33)     |                   | 33-39        | 28       | 28-29     |
| SIII       | 26 (25-28)     | 27 (26-28)        | 30 (29-30)   | 30       | 25-27     |
| SIV        | 19 (17-20)     | 19 (19-20)        | 19           | 21       | 19        |
| sel        | 22 (17-25)     | 22 (18-25)        | 20           | 22-23    |           |
| scw        | 4 (3-5)        |                   |              |          |           |
| Fdl        | 22 (20-23)     |                   | 22-23        | 25       | 21-23     |
| teeth      | 2             |                   |              |          |           |
| Mdl        | 20 (19-22)     |                   | 20-22        | 23       | ?         |

Data from this study for Martinique, from Ferragut et al. (2011) for Dominican Republic, from Lofego et al. (2004, 2009) for Brazil (São Paulo) recalculated by the senior author of the present paper, from Guanilo et al. (2008a) for Peru, from De Leon (1962, 1965) for holotypes of *Euseius sibelius* collected in Florida and of *Euseius subalatus*, considered as a junior synonym of the former, collected in Puerto Rico.
Previous record — Brazil (Bahia, Ceará, Distrito Federal, Espírito Santo, Goiás, Mato Grosso do Sul, Minas Gerais, Paraíba, Paraná, Pernambuco, Piauí, Rio Grande do Sul, Santa Catarina, São Paulo), Colombia, Dominican Republic, El Salvador, Guadeloupe, Honduras, Jamaica, Les Saintes, Peru, Puerto Rico, USA (Florida), Venezuela.

Remarks — Measurements in the Table 6 show only slight variations. Measurements of the twelve females fit very well with those of the holotype females of *E. sibelius* and *E. subalatus*. Measurements of females fit also very well with measurements of specimens collected in Dominican Republic (Ferragut et al. 2011), Brazil and Peru (Guanilo et al. 2008a).

**Subtribe Typhlodromalina Chant and McMurtry**

*Typhlodromalina* Chant & McMurtry, 2005b: 195.

**Genus Typhlodromalus Muma**

*Amblyseius* (*Typhlodromalus*) Muma, 1961: 288; *Typhlodromalus*, De Leon, 1966: 87.

**Typhlodromalus peregrinus** (Muma)

*Typhlodromus* peregrinus Muma, 1955: 270;
*Typhlodromus* (*Amblyseius*) peregrinus Chant, 1959: 97.
*Typhlodromalus* peregrinus, Muma & Denmark, 1970: 88; Moraes *et al.*, 1986: 132; Moraes *et al.*, 2004b: 202; Zacarias & Moraes, 2001: 582; Chant & McMurtry, 2005a: 199; Chant & McMurtry, 2007: 111. *Amblyseius* peregrinus, McMurtry, 1983: 255. Moraes *et al.*, 1991: 130;
*Typhlodromus* (*Amblyseius*) robineae Chant, 1959: 98;
*Typhlodromus* (*Amblyseius*) evansi Chant, 1959: 99;
*Typhlodromalus* (*Amblyseius*) primulae Chant, 1959: 99 (synonymies, according to Muma, 1964).

This species is very common on citrus (Muma 1955, 1967; Peña, 1992; Childers 1994; Villanueva and Childers 2004, 2005; Fadamiro *et al.* 2008, 2009) and solanaceous plants (McMurtry 1983; Fiaboe *et al.* 2007) in several countries and is very often reported as the most abundant species. *Typhlodromalus* peregrinus can be found at the underside of mature citrus leaves, inside tree canopy, under empty scale armour, clump and dead scale insects, whitefly exuvia, sooty mould and mines of *Phyllocnistis citrella* Stainton (Muma 1967; Childers 1994; Villanueva and Childers 2011). Muma (1969) reported that *T. peregrinus* was able to reproduce and develop on *Panonychus citri* (McGregor) but perform better on eggs and crawlers of *Parlatoria pergandii* Comstock, and *Eotetranychus sexmaculatus* (Riley). This phytoseiid was also reported to feed on *Phylocoprata oleivora* (Ashmead), with at least partial rust mite suppression on lime (Peña, 1992). Thus, *T. peregrinus* seems to be a generalist species with the ability to reproduce and develop on the two key pests of Guadeloupe and Martinique citrus, *P. citri* and *P. oleivora* and probably several occasional pests. Its optimal preys were evaluated as Aleyrodidae, Coccidae, and Tetranychidae by Muma (1971).

The following organisms were evaluated by Fouly *et al.* (1995) as suitable diet in the laboratory at 26°C: all stages of *T. urticae*; immature stages of *P. citri*; pollens of *Malephora crocea* (Jacquemin) Schwant., *Quercus virginiana* Miller, and *Typha latifolia* L.

The occurrence of high densities of this species on ground cover vegetation (weeds) of Alabama citrus orchards (Fadamiro *et al.* 2008, 2009) can be explained by the possibility that grasses may serve as overwintering sites and alternative food sources, which is probably the most important factors in French West Indies citrus orchards as there is no overwintering in citrus crop in this tropical area.

*Typhlodromalus peregrinus* was collected from 64 ground cover plants in Florida citrus fields (Childers and Denmark, 2011) with highest numbers found on the following plants:
Bidens alba (L.) DC., Solanum americanum Miller (one plant of the ground cover on which T. peregrinus was collected previously in Guadeloupe), Amaranthus spinosus L., Gnaphalium pensylvanicum (Willdenow) Cabrera, Lantana camara L. and Dysphania ambrosioides (L.) Mosyakin & Clemants.

In Florida, the highest numbers of T. peregrinus in ground cover corresponded with peaks in thrips numbers, suggesting possible predation on one or more species of thrips occurring. Childers and Denmark (2011) suggest that this species should therefore be evaluated as a predator of thrips larvae and/or adults. Significant increases in numbers of T. peregrinus were also correlated with increased levels of several pollen species on citrus leaves (Villanueva and Childers 2004).

Thus, considering all these elements, it is possible that T. peregrinus may constitute a key species in citrus orchards in French West Indies: in Guadeloupe where it is abundant on companion plants in citrus orchard (Kreiter et al. 2013) and in Martinique apparently in the same way in the case of this study.

Specimens examined — 75 ♀♀ + 9 ♂♂ in total (13 ♀♀ + 6 ♂♂ measured). Lamentin, CIRAD-CAEC station (long. 14°37’N, lat. 60°58’O, alt. 25 m), 44 ♀♀ + 4 ♂♂ on N. wightii, 23 ♀♀ + 5 ♂♂ on P. phaseoloides, 6 ♀♀ on M. atropurpureum and 1 ♂ on P. notatum collected between 20-08-2012 and 18-09-2013; Le Lorrain, Mr. Trepon’s farm (long. 14°49’N, lat. 61°50’O, alt. 117 m), 1 ♂♀ on various weeds in a citrus orchard, 25-11-2012.

We have also examined: one holotype and four paratype ♀♀ (all measured) and one paratype ♂ and six paratype immatures (not measured) of Typhlodromalus peregrinus (Muma) in one slide with label: Minneola, Florida, 23-01-1952, on scaly orange leaves, M.H. Muma coll., borrowed at the National Museum of Natural History in Washington DC, USA; one holotype ♀ (measured) of Typhlodromalus aripo (De Leon) borrowed at the Museum of Comparative Zoology in the University of Harvard, Cambridge, USA; and one paratype ♀ (measured) and one paratype nymph (not measured) of T. aripo, holotype and paratypes in three slides with the same label: Trinidad, Upper Aripo Valley, 6-10-1963 on Solanum stromonifolium, Bennett and De Leon (n° 2435-1c), for comparison with T. peregrinus.

Previous Records — Argentina, Brazil (Pernambuco, São Paulo), Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guadeloupe, Guatemala, Guyana, Hawaii, Honduras, Mexico, Nicaragua, Peru, Puerto Rico, Suriname, USA (District of Columbia, Florida, Georgia, Louisiana, Maryland, Massachusetts, Missouri, New Jersey, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia), Venezuela.

Remarks — Measurements in the Table 7 show low variations. Measurements of the 13 females fit very well with all those of all other specimens from all other locations. The maximum divergence is observed with measurements of the holotype especially with the longer Z5 and StIV in the holotype and the longer j6, z4, Z1, s4, S2 and S4 in specimens from Martinique. All measurements obtained for males (Table 8) are very close. Muma and Denmark (1962) pointed out that T. peregrinus is a highly variable species in relation to dorsal setal lengths, shape of the ventrianal shield and leg macrosetae. McMurtry (1983) stated that T. peregrinus is very close to T. aripo (De Leon) and that detailed comparative studies were necessary in order to determine if these species are both valid or not. In the study of Moraes and Mesa (1988), T. peregrinus was separated from T. aripo based only on some differences in setal lengths. In T. peregrinus, z4 is nearly 20% longer than z2, whereas in T. aripo z4 is nearly twice longer than z2. These authors considered that T. peregrinus showed generally shorter setae j3, z4, Z4, Z5 and longer j4, j5, j6 and J2. Looking at the table 9, j3 is equal for both species, Z5 is longer in T. peregrinus and not shorter, and all setae j-J mentioned as longer in T. peregrinus are actually shorter. If we compare our measurements to measurements of type material of both species, if more lengths correspond to T. peregrinus, some data are very confusing as they are closer to T. aripo. The synonymy between these two species is consequently suspected.
### Table 7: Comparisons of character measurements of female specimens of *Typhlodromalus peregrinus* collected in seven different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (13) | Guadeloupe (9) | Dominican Republic (5) | Brazil SP (15) | Guatemala (5) | Colombia (7) | Peru (3) | Argentina (3) | Types |
|-----------|----------------|---------------|------------------------|----------------|---------------|-------------|--------|--------------|-------|
| Dsl       | 329 (310-345)  | 344 (339-350) | 316 (300-326)          | 334 (320-350)  | 341 (319-374) | 329 (320-343)| 353 (345-365)| 377  |
| Dsw       | 199 (185-250)  | 219 (184-285) | 183 (176-188)          | 180 (167-217)  | 205 (191-229) | 203 (190-218)| 205 (203-208)| 223  |
| j1        | 28 (25-30)     | 25 (22-29)    | 23 (22-25)             | 26 (21-30)     | 25-30 (26-26) | 23 (23-24)  | 31 (30-32) | 29-31 |  |
| j3        | 34 (30-35)     | 37 (34-42)    | 22 (20-24)             | 31 (27-35)     | 38-40 (33-41) | 28 (23-33)  | 35 (34-36) | 34-36 |  |
| j4        | 15 (13-15)     | 15 (11-20)    | 13 (12-14)             | 14 (12-16)     | 13-14 (15-14) | 11 (9-14)  | 12 (12-13) | 11-13 |  |
| j5        | 15 (18-23)     | 17 (16-27)    | 15 (14-15)             | 17 (17-20)     | 16-19 (18-20) | 16 (13-21) | 15 (15-16) | 13  |
| j6        | 19 (18-20)     | 20 (17-23)    | 19 (16-20)             | 17 (15-22)     | 15-18 (16-22)| 17 (16-19) | 16 (16-17) | 14-16 |  |
| J2        | 19 (8-10)      | 8 (6-11)      | 8 (5-10)               | 10-11 (9-10)   | 8 (10-11)    | 8 (10-11)  | 10 (9-10)  | 8-9  |
| z2        | 22 (20-25)     | 21 (20-25)    | 16 (16-17)             | 22 (17-25)     | 24-26 (23-19)| 21 (19-25) | 20 (19-20) | 22-24 |  |
| z4        | 29 (25-33)     | 33 (28-41)    | 18 (17-19)             | 26 (25-30)     | 31-36 (27-23)| 29 (25-33)| 29 (28-31) | 22-24 |  |
| z5        | 15 (13-15)     | 17 (11-20)    | 14 (14-15)             | 14 (11-17)     | 15 (16-15)  | 12 (11-14) | 11 (10-12) | 11  |
| Z1        | 27 (23-30)     | 32 (29-35)    | 21 (20-22)             | 22 (17-25)     | 19-20 (17-28)| 20 (17-24) | 22 (21-23) | 16-17 |  |
| Z4        | 50 (43-55)     | 48 (47-51)    | 45 (43-46)             | 43 (37-46)     | 48-54 (44-53)| 45 (41-53)| 45 (43-48) | 42-46 |  |
| Z5        | 67 (63-70)     | 59 (57-61)    | 72 (68-76)             | 63 (57-65)     | 66-70 (59-64)| 68 (65-71)| 66 (64-68) | 73-79 |  |
| s4        | 43 (40-45)     | 45 (38-50)    | 26 (25-28)             | 39 (35-43)     | 48-50 (40-50)| 38 (32-45)| 42 (40-45) | 36-40 |  |
| S2        | 33 (30-35)     | 31 (28-34)    | 20 (20-21)             | 29 (25-34)     | 41-44 (29-49)| 31 (29-35)| 32 (30-33) | 24-28 |  |
| S4        | 28 (25-30)     | 25 (20-30)    | 16 (16-21)             | 23 (20-28)     | 26-30 (25-19)| 23 (22-25) | 25 (25-26) | 19  |
| S5        | 12 (10-18)     | 13 (10-19)    | 14 (12-15)             | 11 (10-15)     | 15-19 (12-15)| 16 (15-17)| 12 (12-13) | 12-14 |  |
| r3        | 23 (18-25)     | 18 (12-22)    | 13 (12-14)             | 17 (16-20)     | 24-26 (21-17)| 21 (19-23)| 21 (20-21) | 19-20 |  |
| M1        | 17 (15-22)     | 17 (13-20)    | 17 (16-18)             | 16 (12-20)     | 17-19 (17-14)| 18 (17-19) | 19 (17-22) | 16-18 |  |
| St1-St1   | 56 (53-58)     | 64 (60-68)    | 66 (63-71)             | 64 (56-67)     | 66 (59-68)| 66 (65-76) | 64 (60-66) | 69  |
| St1-St3   | 63 (60-68)     | 66 (60-65)    | 63 (60-65)             | 63 (56-66)     | 57 (55-68)  | 64 (60-66) | 69  |
| St3-St5   | 75 (73-78)     | 63 (60-65)    | 63 (60-65)             | 63 (56-66)     | 57 (55-68)  | 64 (60-66) | 69  |
| S4-S4     | 91 (78-105)    | 81 (77-104)   | 76 (73-78)             | 71 (66-78)     | 70 (65-82)| 71 (60-88) | 75 (72-78) | 80  |
| St5-St5   | 70 (65-78)     | 76 (73-78)    | 71 (66-78)             | 70 (65-82)     | 71 (60-88)| 75 (72-78) | 80  |
| Lsl       | 17 (14-18)     | 16 (14-18)    | 15 (14-18)             | 16 (14-18)     | 16 (15-17)| 15 (15-16)| 12 (12-13) | 12-14 |  |
| Lsw       | 5 (4-6)        | 4 (3-6)       | 7 (6-10)               | 5-08 (5-08)    | 5-08 (5-08) | 5-08 (5-08)| 5-08 (5-08)| 5-08 |  |

Data from this study for Martinique, from Kreiter et al. (2013) for Guadeloupe, from Ferragut et al. (2011) for Dominican Republic, from Moraes et al. (2013) for Brazil (São Paulo), from McCrory (1983) for Guatemala, from Moraes and Mesa (1988) for Colombia, from Guanilo et al. (2008a, 2008b), respectively for Peru and Argentina, and holotype (Minneola, Florida, USA, on orange).
Table 8  Comparisons of character measurements of male specimens of *Typhlodromalus peregrinus* collected in three different locations (Localities followed by the number of specimens between brackets)

| Characters | Martinique (6) | Guadeloupe (7) | Florida (20) | Peru (1) |
|------------|----------------|----------------|--------------|---------|
| dsl        | 258 (235-320)  | 256 (243-275)  | 235-300      | 278     |
| dsw        | 154 (138-175)  | 143 (134-149)  | 150-180      | 175     |
| j1         | 19 (18-20)     | 19 (18-20)     |              | 22      |
| j3         | 25 (23-25)     | 29 (25-30)     |              | 27      |
| j4         | 12 (10-13)     | 11 (7-13)      |              | 9       |
| j5         | 11 (8-13)      | 12 (8-16)      |              | 10      |
| j6         | 14 (13-15)     | 14 (12-16)     |              | 10      |
| J2         | 14 (13-15)     | 11 (7-16)      |              | 11      |
| J5         | 7 (5-8)        | 7 (5-8)        |              | 9       |
| z2         | 16 (15-18)     | 16 (13-17)     |              | 13      |
| z4         | 23             | 27 (25-29)     |              | 20      |
| z5         | 11 (10-13)     | 11 (10-12)     |              | 9       |
| Z1         | 18 (15-18)     | 18 (16-22)     |              | 15      |
| Z4         | 32 (30-33)     | 34 (31-37)     |              | 28      |
| Z5         | 39 (38-40)     | 39 (34-42)     |              | 36      |
| s4         | 30 (28-30)     | 35 (33-36)     |              | 32      |
| S2         | 20 (18-20)     | 17 (16-18)     |              | 19      |
| S4         | 16 (13-18)     | 14 (12-16)     |              | 14      |
| S5         | 9 (8-10)       | 9 (7-12)       |              | 10      |
| r3         | 19 (18-20)     | 17 (15-19)     |              | 17      |
| R1         | 12 (10-13)     | 13 (12-16)     |              | 14      |
| St1-St5    | 47 (45-48)     |                |              |         |
| St2-St2    | 55 (53-55)     | 54 (50-56)     |              |         |
| St3-St3    | 58 (58-60)     |                |              |         |
| St4-St5    | 46 (45-48)     |                |              |         |
| St5-St5    | 41 (38-48)     | 37 (32-40)     |              |         |
| vsl        | 95 (90-100)    | 93 (85-100)    | 115          |         |
| vsw ZV2    | 128 (105-150)  | 132 (127-146)  | 163          |         |
| vsw anus   | 59 (48-75)     | 59 (54-65)     |              |         |
| JV5        |                |                |              | 24      |
| SgelI      | 14 (13-15)     | 15 (13-18)     |              | 10      |
| SgelII     | 15 (13-15)     | 16 (15-20)     |              | 16      |
| SgelIII    | 15 (13-15)     | 22 (20-25)     |              | 16      |
| StIII      | 15             | 15             |              | 12      |
| SgelIV     | 28 (25-30)     | 31 (27-36)     |              | 28      |
| StIV       | 17 (15-18)     | 17 (15-21)     |              | 20      |
| StIV       | 49 (48-50)     | 46 (40-51)     |              | 46      |
| Shaft length | 18 (16-20)     | 19 (18-20)     |              | ?       |

Data from this study for Martinique, from Kreiter et al. (2013) for Guadeloupe, from Muma and Denmark (1962) for Florida without any setae length, from Guanilo et al. (2008a) for Peru.
Table 9 Comparisons of character measurements of one holotype and four paratype females of *Typhlodromalus peregrinus* and of one holotype and one paratype females of *Typhlodromalus aripo*

| Characters | *T. peregrinus* Martinique (13) | *T. peregrinus* (5) | *T. aripo* (2) |
|------------|-------------------------------|---------------------|----------------|
| dsl        | 329 (310-345)                 | 362 (350-375)       | 355-363        |
| dsw        | 199 (185-250)                 | 222 (215-236)       | 213            |
| j1         | 28 (25-30)                    | 29 (28-33)          | 28             |
| j3         | 34 (30-35)                    | 35 (33-37)          | 35             |
| j4         | 15 (13-15)                    | 13 (10-15)          | 15             |
| j5         | 15                            | 12 (10-13)          | 15             |
| j6         | 19 (18-23)                    | 14 (13-15)          | 20-23          |
| J2         | 19 (18-20)                    | 15                  | 20             |
| J5         | 9 (8-10)                      | 8                   | 8              |
| z2         | 22 (20-25)                    | 23 (23-25)          | 15-18          |
| z4         | 29 (25-35)                    | 24 (23-28)          | 28-30          |
| z5         | 15 (13-15)                    | 12 (10-13)          | 15             |
| Z1         | 27 (23-30)                    | 17 (16-18)          | 28-30          |
| Z4         | 50 (43-55)                    | 43 (40-47)          | 45-50          |
| Z5         | 67 (63-70)                    | 76 (75-80)          | 60             |
| s4         | 43 (40-45)                    | 39 (37-40)          | 40-43          |
| S2         | 33 (30-35)                    | 26 (25-28)          | 28-30          |
| S4         | 28 (25-30)                    | 18 (15-20)          | 25-28          |
| S5         | 12 (10-18)                    | 14 (13-15)          | 10-13          |
| r3         | 23 (18-25)                    | 19 (18-20)          | 18-19          |
| R1         | 17 (15-22)                    | 17 (15-18)          | 15             |
| St1-St1    | 56 (53-58)                    | 62 (60-65)          | 50-60          |
| St1-St3    | 63 (60-68)                    | 67 (65-70)          | 70             |
| St2-St2    | 75 (73-78)                    | 70 (68-70)          | 65-68          |
| St3-St3    | 64 (60-68)                    | 80 (75-83)          | 78             |
| St4-St4    | 91 (78-105)                   | 90 (75-105)         | 105-125        |
| St5-St5    | 70 (65-78)                    | 75 (70-80)          | 75             |
| lisl       | 17 (14-18)                    | 21 (20-23)          | 18             |
| lsiw       | 5 (4-6)                       | 5                   | 5              |
| sisl       | 9 (6-10)                      | 8                   | 10             |
| vsl        | 103 (95-110)                  | 119 (108-128)       | 103-113        |
| vsw ZV2    | 75 (60-75)                    | 64 (58-65)          | 63-65          |
| vsw anus   | 56 (55-70)                    | 72 (68-75)          | 68-70          |
| JV5        | 47 (40-50)                    | 53 (50-53)          | 45-50          |
| SgeI       | 17 (15-18)                    | 22 (18-25)          | 13             |
| SgeII      | 18 (15-20)                    | 22 (20-23)          | 18             |
| SgeIII     | 24 (23-28)                    | 29 (28-30)          | 30-33          |
| StIII      | 20 (15-25)                    | 20                  | 20             |
| Sge IV     | 44 (37-48)                    | 46 (42-50)          | 43-45          |
| St IV      | 21 (18-25)                    | 27 (25-28)          | 25-28          |
| St IV      | 70 (65-75)                    | 78 (65-85)          | 60             |
| scl        | 13 (10-15)                    | 13 (10-15)          | 13             |
| scw        | 3                             | 3                   | 3              |
| Fdl        | 29 (25-33)                    | 31 (30-33)          | 28             |
| teeth      | 8-9                           | 9-11                | 9              |
| Mdl        | 33 (30-34)                    | 35 (33-37)          | 33             |
| teeth      | 3-4                           | 3-4                 | 3              |

Data from this study for Martinique and other data from measurements made by authors on type specimens as indicated in the paragraph “Specimens examined” of *Typhlodromalus peregrinus*. 

Kreiter S. et al. (2018), *Acarologia* 58(2): 366-407; DOI 10.24349/acarologia/20184248
Tribe Neoseiulini Chant and McMurtry

Neoseiulini Chant & McMurtry, 2003a: 6.

Genus Neoseiulus Hughes

Neoseiulus Hughes, 1948: 141.

Neoseiulus benjamini (Schicha 1981)

Amblyseius benjamini, Schicha, 1981; Amblyseius (Amblyseius) benjamini, Ueckermann & Loots 1988.

Neoseiulus benjamini, Moraes et al., 1986: 72; Moraes et al., 2004b: 108; Chant & McMurtry, 2003: 27; Chant & McMurtry, 2007: 25.

Neoseiulus benjamini (Schicha) was previously known from Australia and South Africa (Schicha 1981; Ueckermann and Loots 1988; Beard 2001) and found recently in the Neotropical area, in Brazil where it seems to be quite common in several states (Lofego et al. 2009; Rezende and Lofego 2011, 2012; Demite et al. 2011, 2012; Rezende et al. 2012). This is the first record of this species in the French Caribbean islands. Lofego et al. (2009) found a great variation in the number of teeth on both cheliceral digits, even between right and left chelicerae of the same individual. Neoseiulus benjamini belongs to paspalivorus species group (14 species) of the large genus Neoseiulus and it is more similar to N. mumai (Denmark), N. paspalivorus (De Leon) and N. baraki (Athias-Henriot). Neoseiulus paspalivorus was previously found in Guadeloupe in two locations (Moraes et al. 2000; Mailloux et al. 2010, specimens of N. paspalivorus misidentified as N. baraki; Kreiter et al. 2013, correct identification as N. paspalivorus) but not in Martinique. However N. paspalivorus differs from N. benjamini by having the pre-anal pores longitudinally aligned with the base of JV2 and setae Z4 and StIV shorter (12 and 18 µm respectively against 18 and 25-28 respectively for our two specimens). Whether these differences can really allow distinctions between different species and not variations of the same or disable to distinguish a significant number of cryptic species demands a further investigation. Molecular and other tools (Tixier et al. 2009; Famah Sourassou et al. 2012) would be of great help for not only a lot of phytoseiid mites identification but also for that species group in particular. This species was found on pineapples associated with Dolichotetranychus floridanus (Banks) and Bryobia tuberosa Meyer (Schicha 1987) but most of the biology of N. benjamini remains totally unknown.

Specimens examined — Lamentin, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 1 ♀ on N. wightii, 15-VII-2013; Saint-Joseph, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 1 ♀ on citrus leaves (C. sinensis et C. latifolia), 17-VII-2012.

Previous record — Australia (New South Wales, Queensland), Brazil (Distric Federal, Goiás, Minas Gerais, São Paulo, Tocantins), South Africa.

Remarks — The measurements reported in the table 10 of the two specimens collected during this study agree well with measurements of specimens of Lofego et al. (2009) from Brazil and even also with the holotype of Schicha (1981), with only very slight differences.

Neoseiulus longispinosus (Evans)

Typhlodromus longispinosus Evans, 1952: 413; Evans, 1953: 465; Womersley, 1954: 177; Ehara, 1958: 55; Typhlodromus (Amblyseius) longispinosus, Chant, 1959: 74; Amblyseius longispinosus, Corpuz and Rimando, 1966: 129; Schicha, 1975: 103; Neoseiulus longispinosus, Moraes et al., 1986: 85; Moraes et al., 2000: 245; Moraes et al.,
Table 10 Comparisons of character measurements of female specimens of *Neoseiulus benjamini* collected in three different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (2) | Brazil SP (9) | Holotype |
|------------|----------------|---------------|-----------|
| Dsl        | 338-340        | 358 (337-375) | 342       |
| Dsw        | 150            | 155 (145-167) | 152       |
| j1         | 15             | 18 (17-19)    | 10        |
| j3         | 12             | 18 (16-20)    | 11        |
| j4         | 10             | 12 (11-13)    | 10        |
| j5         | 10-13          | 12 (10-13)    | 8         |
| j6         | 13             | 13 (12-15)    | 10        |
| J2         | 13             | 14 (12-16)    | 11        |
| J5         | 10             | 11 (10-12)    | 10        |
| z2         | 11-13          | 14 (13-16)    | 10        |
| z4         | 13             | 15 (14-17)    | 10        |
| z5         | 9-10           | 11 (10-13)    | 8         |
| Z1         | 13             | 15 (13-17)    | 10        |
| Z4         | 18             | 22 (21-24)    | 17        |
| Z5         | 58             | 64 (57-70)    | 53        |
| s4         | 15             | 16 (15-18)    | 12        |
| S2         | 13-15          | 18 (17-22)    | 11        |
| S4         | 15-18          | 24 (22-29)    | 14        |
| S5         | 18-20          | 27 (25-30)    | 19        |
| r3         | 13             | 17 (15-19)    | 10        |
| R1         | 10             | 15 (13-18)    | 10        |
| St1-St1    | 40-47          |               |           |
| St1-St3    | 78-80          | 84 79-86)     | 84        |
| St2-St2    | 50-55          | 56 (52-58)    | 51        |
| St3-St3    | 58-60          |               |           |
| St5-St5    | 58-60          | 60 (55-64)    |           |
| Lisl       | 38             |               | 38        |
| Lsiw       | 4              |               |           |
| Sisl       | 8              |               | 7         |
| Vsl        | 113            | 120 (114-128) | 110       |
| vsw ZV2    | 88             | 91 (84-98)    | 79        |
| Vsw anus   | 78             | 81 (75-85)    |           |
| JV5        | 25             | 34 (31-37)    | 25        |
| St1V       | 25-28          | 27 (25-28)    | 29        |
| Sc1        | ?              | 5 (4-10)      |           |
| Scw        | ?              | 10            | 10        |
| Fdl        | 20             | 28 (26-29)    | 22        |
| teeth      | ?              | 6-10          | 7         |
| Mdl        | 23             | 27 (26-29)    | 25        |
| teeth      | 2              | 1-2           | 2         |

Data from this study for Martinique, from Lofego *et al.* (2009) for Brazil (São Paulo), from Schicha (1981) for Australia (New South Wales).
This species was already mentioned from Guadeloupe and other Islands of the French Antilles (Moraes et al. 2000; Mailloux et al. 2010; Kreiter et al. 2013) but only in very few localities on various host plants. It is distributed in many countries of the world, mainly in tropical areas.

The biology of this species has been studied for pest control purposes including side effects of acaricides (Bin Ibrahim and Tan 2000). The activity, feeding, development, predation, cannibalism, intra-guild predation and behaviour have been extensively studied by several authors (Schausberger and Croft 1999a, b; Croft et al. 1999a, b; Schausberger and Croft 2000a, b; Blackwood et al. 2001). It was found very rarely except in a study on companion plants in citrus orchards in Guadeloupe (Mailloux et al. 2010; Kreiter et al. 2013) and La Réunion (Le Bellec, unpublished data). This species seems to be more common on grasses of the lower vegetation, especially Fabaceae with populations of tetranychid mites.

Previous Records — Australia, China (Fujian, Guangdong, Guangxi, Hainan, Yunnan), Cuba, Dominican Republic, Guadeloupe, Egypt, Hawaii, Hong-Kong, India, Indonesia, Japan, Les Saintes, Malaysia, Marie-Galante, Martinique, New Zealand, Nicaragua, Pakistan, Papua New Guinea, Philippines, Russia (Primorsky Territory), South Korea, Sri Lanka, Taiwan, Thailand, USA (Florida), Vietnam.

Specimens examined — All 8 ♀♀ measured: Lamentin, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 4 ♀♀ on P. phaseoloides collected 23-05-2012, 1 ♀ on N. wightii collected 7-02-2013, 2 ♀♀ on M. atropurpureum collected 6-03-2013; Saint-Joseph, Rivière Lézarde, CIRAD (long. 14°39′N, lat. 60°59′O, alt. 45 m), 1 ♀ on citrus leaves (C. sinensis et C. latifolia), 17-07-2012.

Remarks — Although showing some great variations, especially with the holotype from Indonesia re-described by Schicha (1975), all the measurements and description of the specimens collected in this study fit very well those concerning other populations given in the table 11, especially with those from specimens of the French Caribbean Islands (Moraes et al. 2000) and from specimens of the Dominican Republic (Abo-Shnaf et al. 2016).

**Neoseiulus paraibensis** (Moraes & McMurtry)

*Amblyseius paraibensis* Moraes & McMurtry, 1983: 135; Moraes & Mesa, 1988: 76; Moraes et al., 1991: 126; *Neoseiulus paraibensis*, Moraes et al., 1986: 92; Moraes et al., 2004b: 137; Chant & McMurtry, 2003: 23; Chant & McMurtry, 2007: 29.

This species is known from Brazil, Colombia, Costa Rica, Nicaragua, Panama and USA (Florida), so a wide area around the Caribbean Sea. This is however the first record of this species for the Caribbean Islands and so for French Caribbean Islands. It seems to be very rare. Moraes and McMurtry (1983) have collected and described this species from *Musa* sp. in Brazil. But then, Moraes et al. (1991) have recorded first this species from Colombia on *Oriza sativa*. Rodriguez et al. (2009) and Quiros-McIntire and Rodriguez (2010) have found it in Cuba and Panama respectively also on rice on which it was the more frequent and abundant predator, associated in great numbers with *Steneotarsonemus spinki* Smiley. However, most of its biology remains totally unknown.

Specimens examined — Lamentin, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 2 ♀♀ on *P. phaseoloides*, 20-08 and 19-11-2012.
Table 11 Comparisons of character measurements of male specimens of *Neoseiulus longispinosus* collected in five different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (8) | F.C.I. (7) | Dominican Rep. (2) | Sri Lanka (3) | Holotype |
|------------|----------------|------------|-------------------|--------------|----------|
| Dsl        | 321 (295-340)  | 332 (308-398) | 325-337           | 321 (313–338) | 332      |
| Dsw        | 168 (150-183)  | 179 (154-200) | 183-195           | 187 (175–208) | 173      |
| j1         | 16 (13-18)     | 18 (16-22)   | 16-20             | 18 (17–19)   | 14       |
| j3         | 58 (48-63)     | 59 (52-64)   | 63-65             | 62 (61–64)   | 51       |
| j4         | 56 (50-65)     | 59 (52-65)   | 55-60             | 58 (56–60)   | 49       |
| j5         | 66 (60-73)     | 69 (64-75)   | 73-75             | 70 (69–71)   | 59       |
| j6         | 68 (60-83)     | 72 (68-75)   | 70-75             | 70 (68–72)   | 64       |
| J2         | 76 (68-88)     | 76 (73-78)   | 78-80             | 77 (75–79)   | 66       |
| J5         | 9 (8-10)       | 9 (8-11)     | 6-7               | 8            | 10       |
| z2         | 64 (58-70)     | 65 (62-68)   | 66-70             | 69 (68–70)   | 58       |
| z4         | 70 (63-87)     | 69 (67-73)   | 73-75             | 73 (73–75)   | 58       |
| z5         | 31 (28-35)     | 35 (32-40)   | 30                | 32 (32-38)   | ?        |
| Z1         | 74 (68-80)     | 75 (72-80)   | 75-77             | 77 (76–78)   | 67       |
| Z4         | 69 (63-78)     | 71 (67-75)   | 71-72             | 72 (71–73)   | 68       |
| Z5         | 77 (65-80)     | 80 (78-81)   | 75-85             | 80 (80–81)   | 72       |
| s4         | 78 (73-88)     | 77 (73-80)   | 85-88             | 82 (80–83)   | 75       |
| S2         | 69 (63-76)     | 72 (68-76)   | 73-74             | 73 (70–79)   | 67       |
| S4         | 52 (45-58)     | 57 (48-76)   | 58-60             | 59 (57–62)   | 49       |
| S5         | 14 (13-15)     | 16 (14-16)   | 12-15             | 21 (19–23)   | 15       |
| r3         | 54 (45-63)     | 57 (49-62)   | 52-53             | 55 (55–56)   | 54       |
| R1         | 57 (50-63)     | 61 (57-65)   | 65-68             | 60 (59–62)   | 58       |
| St1-St1    | 46 (45-50)     | 46 (45-50)   | 54-55             | 55 (53–56)   |          |
| St1-St3    | 54 (53-55)     | 55 (49-57)   | 54-55             | 55 (53–56)   |          |
| St2-St2    | 58 (55-60)     | 60 (59-62)   | 60-61             | 53 (50–55)   |          |
| St3-St3    | 70 (68-73)     | 72 (63-88)   | 77-80             | 80 (78-81)   | 72       |
| St4-St4    | 72 (63-88)     | 75 (70-80)   | 85-88             | 82 (80–83)   | 75       |
| St5-St5    | 53 (50-63)     | 56 (52-60)   | 55-58             | 53 (51–54)   |          |
| Lisl       | 28 (23-33)     | 3           | 3                 | 3            |          |
| Lsiw       | 13 (10-15)     | 13 (10-15)   | 13 (10-15)        | 13 (10-15)   |          |
| Val        | 111 (103-120)  | 115 (94-121) | 115-120           | 106 (103–111) | 97       |
| vsw ZV2    | 84 (75-90)     | 86 (80-92)   | 82-84             | 91 (89–93)   | 87       |
| vsw anus   | 70 (65-75)     | 75 (67-83)   | 75-80             | 75 (73–77)   |          |
| JV5        | 60 (55-63)     | 75 (70-80)   | 80-85             | 80 (80–81)   | 80-87    |
| StLV       | 81 (75-88)     | 80 (75-87)   | 80-85             | 80 (78-83)   |          |
| scl        | 20 (17-25)     | 28 (25-30)   | 15-20             | 21 (20–21)   | 30       |
| scw        | 5              | 5           | 5                 | 4            |          |
| Fdl        | 24 (23-25)     | 25 (22-27)   | 22 (21–22)        | 22 (21–22)   |          |
| teeth      | 4              | 4           | 4                 | 4             |          |
| Mdl        | 24 (23-25)     | 24 (22-25)   | 25 (23–25)        | 25 (23-25)   | 2        |

Data from this study for Martinique, from Moraes et al. (2000) for F.C.I (French Caribbean Islands, from various localities of five Islands), from Abo-Shnaf et al. (2016) for Dominican Republic, from Moraes et al. (2004a) for Sri Lanka, and from Evans (1952) for the holotype from Indonesia, re-described by Schicha (1975).
Table 12: Comparisons of character measurements of female specimens of *Neoseiulus paraibensis* collected in five different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (2) | Brazil NE (6) | Brazil SP (3) | USA Florida (1) | Colombia (?) |
|------------|---------------|---------------|---------------|-----------------|-------------|
| Dsl        | 366-382       | 382 (355-394) | 384 (377-395) | 397             |             |
| Dsw        | 183-197       | 197 (187-204) | 193 (185-200) | 188             |             |
| j1         | 28-29         | 29 (29-30)    | 28 (26-29)    | 31              |             |
| j3         | 36-39         | 39 (37-42)    | 36 (34-37)    | 33              | 34          |
| j4         | 20            | 20 (18-22)    | 20 (19-21)    | 17              |             |
| j5         | 18-20         | 20 (19-22)    | 19 (18-20)    | 20              |             |
| j6         | 25-27         | 27 (24-29)    | 27 (26-29)    | 25              |             |
| J2         | 30-34         | 34 (31-36)    | 32            | 33              | 28          |
| J5         | 15            | 15 (14-16)    | 15 (14-19)    | 17              |             |
| z2         | 30-33         | 33 (30-35)    | 30 (30-31)    | 33              |             |
| z4         | 34-35         | 35 (34-36)    | 35 (33-37)    | 35              |             |
| z5         | 20-21         | 21 (19-24)    | 23 (22-24)    | 22              |             |
| Z1         | 30-35         | 35 (32-36)    | 34 (34-35)    | 32              |             |
| Z4         | 42-48         | 48 (47-50)    | 48 (47-49)    | 44              |             |
| Z5         | 63-70         | 70 (62-73)    | 73 (68-75)    | 64              |             |
| s4         | 42-46         | 46 (42-48)    | 43 (40-45)    | 35              |             |
| S2         | 42-45         | 45 (43-47)    | 43 (42-45)    | 44              |             |
| S4         | 47-49         | 49 (44-54)    | 47 (46-48)    | 50              |             |
| S5         | 48-51         | 51 (48-54)    | 46 (46-47)    | 50              |             |
| r3         | 37-40         | 40 (38-41)    | 39 (38-40)    | 44              |             |
| R1         | 37-41         | 41 (38-47)    | 38 (40-41)    | 47              |             |
| St1-St1    | 47            |               |               |                 |             |
| St1-St5    | 70            | 75 (74-76)    |               |                 |             |
| St2-St2    | 60            | 63 (62-64)    |               |                 |             |
| St3-St3    | 73            |               |               |                 |             |
| St4-St4    | 75            |               |               |                 |             |
| St5-St5    | 63            | 67 (64-70)    |               |                 |             |
| Lsl        | 20            |               |               |                 |             |
| Lsiw       | 5             |               |               |                 |             |
| Sis1       | 10            |               |               |                 |             |
| Vsl        | 118-124       | 124 (120-126) | 120 (117-122) |                 |             |
| vsv ZV2    | 100-116       | 116 (108-120) | 110 (106-117) |                 |             |
| vsv anus   | 88            | 96 (89-102)   |               |                 |             |
| JV5        | 50            | 59 (56-63)    | 60            |                 |             |
| SgelIV     | 30-33         | 30 (30-31)    | 32 (31-32)    | 33              |             |
| SIIv       | 30-35         | 30 (30-36)    | 31 (30-32)    | 39              | 24          |
| Slv        | 69-75         | 69 (62-72)    | 74 (73-75)    | 79              |             |
| Scl        | 5             | 7 (5-9)       |               | 4               |             |
| fdl        | 33-34         | 34            | 33 (32-33)    | 10              | 7-8         |
| teeth      | 8-10          | 10            | 10-11         |                 |             |
| mdl        | 34-35         | 34            | 30 (29-31)    |                 |             |
| teeth      | 3             | 3             | 3             |                 |             |

Data from this study for Martinique, from Moraes and McMurtry (1983) for Brazil (North Eastern), from Lofego et al. (2009) for Brazil (São Paulo), from Denmark and Evans (2011) for USA (Florida), and from Moraes and Mesa (1988) for Colombia.
Neoseiulus tunus is one of the most frequently reported species in the Neotropical Region. This species was described briefly only from the holotype collected in Trinidad by De Leon in 1967. Soon after, another species, *N. neotunus* Denmark and Muma, was described on the basis of a single female and a male by Denmark and Muma in 1973 from Piracicaba, São Paulo State, Brazil. *Neoseiulus tunus* was then reported from other Caribbean islands and South America (Cavalcante et al. 2017). Measurements of the holotype of *N. tumus* were provided by Moraes et al. (2000) followed by complementary descriptions on specimens from French Caribbean Islands (Moraes et al. 2000) or from South America (for example Lofego et al. 2004; Guanilo et al. 2008a, b). The great similarity between *N. tunus* and *N. neotunus* has been outlined very early (Moraes and Mesa 1988; Lofego 1998). Denmark and Muma (1973) arguments for distinction between *N. neotunus* and *N. tunus* were based on setal ornamentation (all setae barbed except *j5* and not all setae of the *j-J* serie smooth like in *N. tunus*), shape of the spermatheca (cervix fundibuliform and not cup-shaped like in *N. tunus*) and of leg IV macrosetae setiform (and not knobbed distally like in *N. tunus*). Our examination of both holotypes and of the huge number of specimens collected in this study (12 measured) let us to conclude like Cavalcante et al. (2017) that the differences mentioned in the original description of *N. neotunus* correspond to intraspecific variations and to agree with Cavalcante et al. (2017) that *N. neotunus* is a junior synonym of *N. tunus*. Actually, some of our specimens have all setae barbed except *j5* and *J5* and with knobbed macrosetae and some specimens have setae *j-J* smooth with setaceous macrosetae.

As populations identified as *N. tunus* and as *N. neotunus* exist in several places and are available, and as it is possible to recover specimen for a posteriori identification after molecular extraction, the best solution in order to establish definitively this synonymy is to undertake a molecular study with several populations from South and Central America and Caribbean area.

Specimens examined — 126 ♀♀ + 1 ♂ in total (12 ♀♀ measured and 1 ♂ in very bad state not measured). Lamentin, CIRAD-CAEC station (long. 14°37′N, lat. 60°58′O, alt. 25 m), 19 ♀♀ + 1 ♂ on *N. wightii*, 28 ♀♀ on *M. atropurpureum*, 76 ♀♀ on *P. phaseoloides* and 3 ♀♀ on *P. notatum* collected between 23-07-2012 and 18-09-2013.

We have also examined: one holotype ♀ (measured) of *Neoseiulus tunus* (De Leon) in one slide with label: Tunapuna, Trinidad, 16-10-1963, on *Psidium guajava* L., De Leon coll., borrowed at Florida Department of Agriculture and Consumer Services, Department of Plant Industry, Gainesville, USA; one holotype and one paratype ♀ (both measured) of *N. neotunus* (Denmark & Muma) in one slide with the label: Picacicaba, São Paulo, Brazil, 1-03-1967 *Pothomorphe sidifolia* (Link & Otto) Miq. (and not *P. sidaesolia* as labelled), which is a junior synonym of *Piper umbellatum* L. (Piperaceae), Flechtmann coll., for comparisons.

Previous Records — Brazil (Bahia, Ceará, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Paraná, Rio Grande do Sul, Santa Catarina, São Paulo), Guadeloupe.
Table 13. Comparisons of character measurements of female specimens of *Neoseiulus tunus* collected in five different locations (Localities followed by the number of specimens measured between brackets).

| Characters | Martinique (12) | Guadeloupe (3) | Brazil (40) | Peru (3) | Argentina (3) |
|------------|-----------------|----------------|-------------|---------|---------------|
| Dsl        | 281 (277-284)   | 289 (277-297)  | 288 (270-315) | 283 (280-285) | 290 (275-300) |
| Dsw        | 156 (153-160)   | 154 (150-156)  | 177 (168-192) | 174 (170-178) | 181 (175-185) |
| j1         | 22 (21-23)      | 23 (19-26)     | 24 (20-27)   | 22 (21-23)    | 23 (21-25)    |
| j3         | 28 (23-30)      | 24 (19-27)     | 28 (25-31)   | 27 (25-29)    | 29 (28-30)    |
| j4         | 15 (13-16)      | 14 (13-16)     | 14 (11-17)   | 14 (13-15)    | 14 (12-16)    |
| j5         | 15 (14-17)      | 16 (14-18)     | 14 (11-16)   | 16 (15-18)    | 14 (14-15)    |
| j6         | 20 (18-21)      | 19 (18-21)     | 19 (14-24)   | 20 (20-21)    | 20 (19-22)    |
| J2         | 21 (19-22)      | 21 (18-24)     | 21 (16-27)   | 22          | 26 (22-28)    |
| J5         | 8 (7-8)         | 9 (8-10)       | 8 (7-9)      | 7          | 8 (7-10)      |
| z2         | 21 (20-23)      | 23 (21-24)     | 23 (19-27)   | 20 (20-21)   | 25 (24-27)    |
| z4         | 30 (28-33)      | 27 (23-31)     | 31 (27-37)   | 27 (25-30)   | 35          |
| z5         | 16 (15-17)      | 18 (16-19)     | 15 (11-18)   | 15 (15-16)   | 16 (15-16)   |
| Z1         | 24 (20-25)      | 25 (24-26)     | 25 (21-31)   | 26 (25-27)   | 29 (26-32)   |
| Z4         | 44 (42-46)      | 40 (39-40)     | 45 (41-54)   | 41 (40-41)   | 47          |
| Z5         | 68 (64-72)      | 66 (64-68)     | 70 (63-80)   | 67 (65-68)   | 70 (67-72)   |
| s4         | 37 (35-40)      | 35 (34-37)     | 38 (33-44)   | 37 (36-37)   | 42 (42-43)   |
| S2         | 32 (31-34)      | 33 (32-34)     | 34 (29-40)   | 32 (31-33)   | 41 (38-43)   |
| S4         | 19 (17-21)      | 20 (19-21)     | 20 (17-25)   | 20 (18-21)   | 25 (23-30)   |
| S5         | 12 (10-14)      | 13 (11-16)     | 14 (10-20)   | 13          | 16 (13-18)   |
| r3         | 23 (20-25)      | 21 (21-22)     | 25 (22-30)   | 23 (20-25)   | 26 (23-30)   |
| R1         | 16 (15-18)      | 17 (16-18)     | 17 (14-20)   | 16 (15-17)   | 18 (17-20)   |
| St1-Stl    | 55 (54-57)      | 57 (55-58)     | 57 (55-58)   | 54 (53-55)   |
| St1-St3    | 54 (51-56)      | 56 (55-56)     | 58 (55-62)   | 57 (55-58)   | 54 (53-55)   |
| St2-St2    | 61 (60-64)      | 62 (60-64)     | 65 (61-70)   | 63 (61-65)   | 62 (60-63)   |
| St3-St3    | 74 (70-76)      | 75             |
| St4-St4    | 82 (67-89)      | 81             |
| St5-St5    | 58 (57-61)      | 58 (56-60)     | 62 (58-69)   | 61 (58-63)   | 61 (60-63)   |
| Lisl       | 22 (19-24)      | 22             |
| Lsiw       | 3 (3-4)         | 3              |
| Sisl       | 12 (11-14)      | 12             |
| Vsl        | 100 (92-109)    | 100 (99-100)   | 104 (95-117) | 99 (98-100) | 97 (90-105) |
| vsw ZV2    | 71 (66-78)      | 67 (63-72)     | 73 (66-80)   | 70 (65-75)   | 75          |
| vsw anus   | 56 (53-60)      | 52 (52-53)     | 58 (51-65)   | 56 (55-58)   | 62 (60-63)   |
| JV5        | 43 (41-49)      | 43             |
| SgeIV      | 22 (20-23)      | 20 (19-21)     | 20 (16-24)   | 22 (20-21)   | 20 (20-21)   |
| StiIV      | 18 (16-19)      | 19 (16-23)     | 18 (15-20)   | 18 (17-19)   | ?          |
| StfIV      | 32 (29-34)      | 25 (23-29)     | 31 (25-36)   | 32 (31-32)   | 32 (30-33)   |
| Sel        | 8 (8-9)         | 9 (8-10)       | 7 (6-9)      | 10 (8-11)    | 7 (6-9)      |
| Secw       | 6 (5-7)         | 6              |
| Fdl teeth  | 27 (25-29)      | 27 (26-27)     | 29 (26-31)   | 34 (33-35)   | 30          |
| Mdl teeth  | 33 (32-33)      | 27 (26-27)     | 28 (25-30)   | 30          | 32 (31-33)   |

Data from this study for Martinique, from Moraes *et al.* (2000) for Guadeloupe, from Cavalcante *et al.* (2017) for Brazil, from Guanilo *et al.* (2008a) for Peru and from Guanilo *et al.* (2008b) for Argentina.
Table 14. Comparisons of character measurements of specimens of Martinique with the holotype female of *Neoseiulus tunus* and with the holotype female of *Neoseiulus neotunus*.

| Characters | *Neoseiulus tunus* | Martinique (12) | *Neoseiulus tunus* | *Neoseiulus neotunus* |
|-----------|--------------------|----------------|-------------------|-----------------------|
| Dsl       | 281 (277-284)      | 288            | 293               |
| Dsw       | 156 (153-160)      | 166            | 170               |
| j1        | 22 (21-23)         | 23             | 24                |
| j3        | 28 (23-30)         | 28             | 30                |
| j4        | 15 (13-16)         | 13             | 12                |
| j5        | 15 (14-17)         | 16             | 13                |
| j6        | 20 (18-21)         | 20             | 19                |
| j2        | 21 (19-22)         | 20             | 21                |
| z2        | 21 (20-23)         | 20             | 24                |
| z4        | 30 (28-33)         | 30             | 38                |
| z5        | 16 (15-17)         | 16             | 18                |
| Z1        | 24 (20-25)         | 24             | 27                |
| Z4        | 44 (42-46)         | 43             | 49                |
| Z5        | 68 (64-72)         | 64             | 69                |
| s4        | 37 (35-40)         | 36             | 38                |
| S2        | 32 (31-34)         | 31             | 36                |
| s4        | 19 (17-21)         | 19             | 22                |
| S5        | 12 (10-14)         | 12             | 14                |
| r3        | 23 (20-25)         | 24             | 22                |
| R1        | 16 (15-18)         | 14             | 19                |
| St1-St1   | 55 (54-57)         |                |                   |
| St1-St3   | 54 (51-56)         | 54             | 59                |
| St2-St2   | 61 (60-64)         | 62             | 66                |
| St3-St3   | 74 (70-76)         | 64             | 69                |
| St4-St4   | 82 (67-89)         | 75             | 77                |
| St5-St5   | 58 (57-61)         | 60             | 56                |
| Lisl      | 22 (19-24)         |                |                   |
| Lsiw      | 3 (3-4)            |                |                   |
| Sisl      | 12 (11-14)         |                |                   |
| Vsl       | 100 (92-109)       | 98             | 106               |
| vsw ZV2   | 71 (66-78)         | 70             | 72                |
| vsw anus  | 56 (53-60)         | 54             | 56                |
| JVs       | 43 (41-49)         |                |                   |
| SgeIV     | 22 (20-23)         | 22             | 19                |
| StiIV     | 18 (16-19)         | 19             | 17                |
| StiV      | 32 (29-34)         | 32             | 29                |
| Sel       | 8 (8-9)            | 8              | 7 (6-9)           |
| Scw       | 6 (5-7)            |                |                   |
| Fdl       | 27 (25-29)         | ?              | 26                |
| teeth     | 8                  | 8              | 6                 |
| Mdl       | 33 (32-33)         | 31             | 30                |
| teeth     | 3                  | 3              | 3                 |

Data from this study for Martinique and other data from measurements made by authors on holotype specimens as indicated in the paragraph “Specimens examined” of *Neoseiulus tunus*.
Remarks — The females collected agree well with all measurements provided in the literature (Table 13) and with our measurements of holotypes of *N. tunus* and *N. neotunus* (Table 14).

**Subfamily Phytoseiinae Berlese**

Phytoseiini Berlese, 1913: 3; Phytoseiinae, Vitzthum, 1941: 768.

**Genus Phytoseius Ribaga**

*Phytoseius* Ribaga, 1904: 177.

**Phytoseius bennetti** De Leon

*Phytoseius* (*Pennaseius*) *bennetti* De Leon, 1965: 14; *Phytoseius* (*Phytoseius*) *bennetti*, Denmark, 1966: 36. *Phytoseius bennettii*, Moraes et al., 2004b: 233; Chant & McMurtry, 2007: 129.

This species is found in several locations around the Caribbean Sea. It seems to be quite rare in French West Indies as only one female was previously found and only in Martinique (Moraes et al. 2000). Its biology is totally unknown.

**Description**

**Adult Female** (Fig. 5 and Table 15) (n = 3)

Dorsum (Fig. 5A) — Dorsal shield 255 (250–260) long and 124 (123–125) wide, smooth, with 3 solenostomes (gd1, gd5 and gd9), 6 pairs of poroids, 17 pairs of dorsal setae and 2 pairs of sub-lateral setae: j1 19 (18–20), j3 31 (28–35), j4 8, j5 8, j6 9 (8–10), J2 9 (8–10), J5 6 (5–8), z2 11 (10–12), z3 41 (40–43), z4 16 (13–18), z5 8, Z4 56 (52–58), Z5 49 (48–50), s4 48 (47–48), s6 61 (58–65), r3 35, R1 15 (13–17). All setae barbed except the j-J series and setae z2, z4, z5 and R1.

Peritreme (Fig. 5A) — Extending to the level of j1.

Venter (Fig. 5B) — All ventral shields smooth to very slightly reticulated. Sternal shield not very large, with 3 pairs of setae and 2 pairs of pores; 1 pair (st4) out of the sternal shield, on a small metasternal shield with one pore; posterior margin straight. Distances between st1-st1 50, st1-st3 55 (53–58), st2-st2 60, st3-st3 67 (65–70), st4-st4 78 (75–84), st5-st5 55 (50–62). Two pairs of inguinal sigilla (called also “metapodal shields”) 55 (50–62) long and very thin for the largest, not measurable for the smallest one. Ventrianal shield amphora-shaped with 3 pairs of pre-anal setae (JV1, JV2 and ZV2) and one pair of small lateral pre-anal pores in the middle. Membrane surrounding ventrianal shield with 3 pairs of setae (ZV1, ZV3 and JV5) and 5 pairs of poroids (called also “platelets”), the last one near the anus not visible on the same focus and thus not drawn on Figure 20; ventrianal shield 81 (75–85) long, 45 (42–47) wide at level of anterior corners and 51 (50–52) wide at level of anus. JV5 50 long and smooth.

Chelicera (Fig. 5C) — Fixed digit 20 with 3 – 4 teeth and movable digit 22 (20–23) with 1 tooth. *Pilus dentilis* not visible.

Spermatheca (Fig. 5D) — Spermatheca (called also “insemination apparatus”) saccular, 15 long and 9 (8–10) large. Minor and major ducts visible on few specimens.

Legs (Fig. 5E) — Macrosetae on legs IV, SgeIV 14 (12 – 15), StIV 14 (12–15), StIV 21 (20–23). All macrosetae knobbed. Chaetotactic formula of genu II: 2-2/0, 2/1-0; genu III: 1-2/1, 2/0-1.

**Adult male** — Unknown and not collected in our study.
Figure 5  *Phytoseius bennetti* female: A – Dorsal shield and peritreme; B – Ventral shields; C – Chelicera; D – Calyx of the spermatheca; E – Macrosetae on leg IV.
Table 15  Comparisons of character measurements of female specimens of *Phytoseius bennetti* collected in three different locations (Localities followed by the number of specimens measured between brackets)

| Characters | Martinique (3) | Dominican Rep. (3) | Trinidad (1) |
|------------|----------------|--------------------|--------------|
| Dsl        | 255 (250-260)  | 252 (240-260)     | 247          |
| Dsw        | 124 (123-125)  | 114 (114-115)     | 121          |
| j1         | 19 (18-20)     | 17 (16-18)         | 16           |
| j3         | 31 (28-35)     | 27 (26-28)         | 28           |
| j4         | 8              | 7 (6-8)            | 8            |
| j5         | 8              | 7 (6-8)            | 8            |
| j6         | 9 (8-10)       | 7 (6-8)            | 8            |
| J2         | 9 (8-10)       | 7 (6-8)            | 8            |
| J5         | 6 (5-8)        | 7 (6-7)            |              |
| z2         | 11 (10-12)     | 8 (8-9)            | 8            |
| z3         | 41 (40-43)     | 35 (34-37)         | 38           |
| z4         | 16 (13-18)     | 10 (10-11)         | 11           |
| z5         | 8              | 7 (7-8)            | 7            |
| Z4         | 49 (48-50)     | 45 (45-46)         | 42           |
| Z5         | 56 (52-58)     | 50 (48-52)         | 49           |
| s4         | 48 (47-48)     | 39 (38-42)         | 42           |
| s6         | 61 (58-65)     | 55 (53-58)         | 53           |
| r3         | 35             | 31 (29-32)         | 33           |
| R1         | 15 (13-17)     | 13 (12-14)         | 9            |
| St1-St1    | 50             |                    |              |
| St1-St3    | 55 (53-58)     |                    |              |
| St2-St2    | 60             |                    |              |
| St3-St3    | 67 (65-70)     |                    |              |
| St4-St4    | 78 (75-84)     |                    |              |
| St5-St5    | 55 (50-62)     |                    |              |
| Lisl       | 20             |                    |              |
| Lsiw       | ?              |                    |              |
| Sisl       | ?              |                    |              |
| Vsl        | 81 (75-85)     |                    |              |
| vsw ZV2    | 45 (42-47)     |                    |              |
| vsw anus   | 51 (50-52)     |                    |              |
| JV5        | 50             | 41 (40-42)         | 44           |
| SgeIV      | 14 (12-15)     | 15                 |              |
| SIIIV      | 14 (12-15)     | 12                 |              |
| SIV        | 21 (20-23)     | 21 (21-22)         | 21           |
| Scl        | 15             | 7                  |              |
| Sew        | 9 (8-10)       |                    |              |
| fdl        | 20             |                    |              |
| teeth      | 3-4            |                    |              |
| mdl        | 22 (20-23)     |                    |              |

Data from this study for Martinique, from Ferragut et al. (2011) for Dominican Republic, from De Leon (1965) completed by Denmark (1966) for Trinidad.
Specimens examined — Lamentin, CIRAD-CAEC station (long. 14°37’N, lat. 60°58’O, alt. 25 m), 1 ♀ on M. atropurpureum collected 4-12-2012 and 1 ♀ on P. phaseoloides and 1 ♀ on M. atropurpureum collected 8-01-2013.

Previous Records — Dominican Republic, El Salvador, Honduras, Martinique, Puerto Rico and Trinidad.

Remarks — This species was already known from Martinique but only from a single female. Measurements of the three adult females (Table 15) agree well with measurements of three females of Guadeloupe (Table 15), better than with measurements of the 3 specimens collected in the close Dominican Republic by Ferragut et al. (2011). These specimens are smaller and have 10 to 20 % shorter setae (Table 15).

Phytoseius sp.

Specimens examined — Lamentin, CIRAD-CAEC station (long. 14°37’N, lat. 60°58’O, alt. 25 m), 1 ♀ broken, with missing legs and setae, on P. phaseoloides, 19-09-2012.

Subfamily Typhlodrominae Wainstein

Typhlodromini Wainstein, 1962: 26; Typhlodrominae, Chant & McMurtry, 1994: 235.

Tribe Metaseiulini Chant and McMurtry

Metaseiulini Chant & McMurtry, 1994: 258.

Genus Typhlodromina Muma

Typhlodromina Muma, 1961: 297.

Typhlodromina subtropica Muma & Denmark

Typhlodromina subtropica Muma & Denmark, 1969: 412; Muma & Denmark 1970: 132; Denmark & Muma, 1978: 16. Typhlodromus subtropicus, Chant & Yoshida-Shaul, 1983a: 1046. Typhlodromina subtropica, Moraes et al., 1986: 240; Moraes et al., 2004b: 305; Chant & McMurtry, 2007: 169.

This species seems to be very rare in French West Indies as only some individuals were previously found (Moraes et al. 2000; Kreiter et al. 2006) and its biology is totally unknown.

Specimens examined — Le François, Mr. Peronnet’s farm, La Digue François (long. 14°34’N, lat. 61°53’O, alt. 59 m), 1 ♀ in bad state on leaves of lime trees C. latifolia.

Previous Records — Antigua, Brazil (Bahia, Espirito Santo, Maranhao, Pernambuco, Rio Grande do Sul, Roraima, São Paulo), Colombia, Costa Rica, Cuba, Dominican Republic, Fernando de Noronha Archipelago, Galapagos, Guadeloupe, Jamaica, Les Saintes, Marie-Galante, Martinique, Mexico, Nicaragua, Peru, Saint-Martin, USA (Florida, Georgia, Maryland, Tennessee, Texas), Venezuela.

Remarks — This species was already known from Martinique but only from one female (Moraes et al. 2000). The measurements of the single adult female collected in this study agree well with the measurements of the holotype given by Muma and Denmark (1969), by Chant & Yoshida-Shaul (1983a), and very well with those of the single female collected by Moraes et al. (2000). Measurements of the single female collected and identified in this study are not provided as it was in a bad state, with setae missing. However, distinctive characters of the
genus according to Chant and McMurtry (2007) and of the species as provided by Chant and Yoshida-Shaul (1983) were accessible.

Conclusion

A total of 67 species belonging to 22 genera were known at the beginning of the year 2011 from the French Antilles after four surveys. After a fifth survey focused on plants tested in order to be used as cover-crops in citrus orchard and in some citrus orchards on trees and weeds in Martinique, the number of species for French Antilles is now reached to 70 with three new records: *N. benjamini*, *N. paraibensis* and *T. terminatus* new. comb.

These species belong to the three subfamilies: Amblyseinae with 54 species, Phytoseiinae with 4 species and Typhlodrominae with 12 species.

Some of species collected during this survey have interesting potential for biological control, especially *P. mexicanus*, *T. peregrinus*, and *N. longispinosus*. This must be underlined as new regulations on importation of macro-organisms are proposed in a lot of countries and specifically for over-sea territories for countries like France that have very far tropical territories. Therefore it is impossible to import and of course to sell and use exotic species if they are not indigenous in the territory. An importation permit must be requested, but it is expensive and chances to obtain are generally very low (Kreiter *et al.* 2016). The knowledge of the biodiversity, especially of efficient biological control agents from overseas territories, not only for conversation purposes but for agricultural and economical ones, is so of a considerable importance.

Acknowledgements

Thanks are due to Dr Frédéric Beaulieu and Mr. Wayne Knee (The Canadian Collection of Insects, Ottawa, Canada) for the loan of additional material of *A. terminatus*; to Mrs. Laura Liebensperger (Museum of Comparative Zoology, Invertebrate Zoology Collection in Harvard University, Cambridge, USA) for the loan of the holotype of *T. aripo*; to Mr. Ronald A. Ochoa, Mrs. Debra Creel and Dr Patricia Gentili-Poole (The Smithsonian Institution, National Museum of Natural History in Washington DC, USA) for the loan of holotypes of *A. terminatus* and *T. peregrinus*; to Dr Calvin Welbourn (Florida Department of Agriculture in Gainesville, Florida, USA) for the loan of holotypes of *Neoseiulus tunus* and *N. neotunus* and paratypes of *T. aripo*. We are finally very grateful to the two anonymous reviewers for valuable comments on an earlier version of the manuscript and the great improvements allowed.

References

Abo-Shnaf R.I.A., Sánchez L., Moraes G.J. 2016. Plant inhabiting Gamasina mites (Acari: Mesostigmata) from the Dominican Republic, with descriptions of four new species of *Lasioseius* (Blattisociidae) and complementary descriptions of other species. Syst. Appl. Acarol. 21(5): 607-646. doi: 10.11158/saa.21.5.5

Athias-Henriot C. 1975. Nouvelles notes sur les Amblyseiini. II. Le relevé organotaxique de la face dorsale adulte (Gamasides, Phytoseiidae). Acarologia 27: 20-29.

Berlese A. 1913. Systema Acarorum generis in familiis suis disposita. Acaroteca Italica 1-2: 3-19.

Bin Ibrahim Y., Tan S.Y. 2000. Influence of sublethal exposure to abamectin on the biological performance of *Neoseiulus longispinosus* (Acari: Phytoseiidae). J. Econ. Entomol. 93(4): 1085-1089. doi:10.1603/0022-0493-93.4.1085

Blackwood J.S., Schausberger P., Croft B.A. 2001. Prey stage preferences in generalist and specialist phytoseiid mites (Acari: Phytoseiidae) when offered *Tetranychus urticae* (Acari: Tetranychidae) eggs and larvae. Environ. Entomol. 30: 1103-1111. doi:10.1603/0046-225X-30.6.1103

Boller H.F. 1984. Eine einfache Ausschwemm-Methode zur schellen Erfassung von Raumilben, Trips und anderen Kleinarthropoden im Weinbau. Z. Obst- und Weinbau 120: 249-255.

Castro T.M.M.G. de, Moraes G.J. de, McMurtry J.A. 2010. New Phytoseiidae (Acari: Mesostigmata) from Costa Rica, with description of two new species and additional information on other species. Intern. J. Acarol. 36(1): 35-48. doi:10.1080/0167959003506718
Ehara S. 1958. Three predatory mites of the genus *Typhlodromus* from Japan (Phytoseiidae). *Acarologia* 7: 31-37. doi:10.1556/0046-225X.1958.2.2.95

Evans G.O. 1952. On a new predatory mite of economic importance. *Bull. Entomol. Res.* 43: 397-401. doi:10.1017/S000746460001564X

Evans G.O. 1953. On some mites of the genus *Typhlodromus* Scheuten, 1857, from S. E. Asia. *Ann. Mag. Nat. Hist.* 6: 449-467. doi:10.1080/00222484.1953.10636444

Fadamiyo H.Y., Xiao Y., Hargroder T., Nesbitt M., Childers C.C. 2009. Diversity and seasonal abundance of predacious mites in Alabama Satsuma citrus. *Ann. Entomol. Soc. Am.* 102 (4): 617-628. doi:10.1603/0046-225X(2008)37[555:SOOKAP]2.0.CO;2

Fadamiyo H.Y., Xiao Y., Hargroder T., Nesbitt M., Umeh V., Childers C.C. 2008. Seasonal occurrence of key arthropod pests and associated natural enemies in Alabama satsuma citrus. *Environ. Entomol.* 27: 555-567. doi:10.1603/0046-225X(2008)37[555:SOOKAP]2.0.CO;2

Famah Sourassou N., Hanna R., Zannou I., Moraes G.J. de, Breeuwer J.A.J., Sabelis M.W. 2012. Morphological, molecular and cross-breeding analysis of geographic populations of coconut-mite associated predatory mites identified as *Neoseiulus baraki*: evidence for cryptic species? *Exp. Appl. Acarol.* 57: 15-36. doi:10.1007/s10493-010-9534-0

Feres R.J.F., Moraes G.J. de 1998. Phytoseid mites (Acari: Phytoseiidae) from woody areas in the State of São Paulo, Brazil. *Syst. Appl. Acarol.* 3: 125-132. doi:10.11158/aae.3.1.20

Ferragut F., Moraes G.J. de, Návia D. 2011. Phytoseiid mites (Acari: Phytoseiidae) of the Dominican Republic, with a re-definition of the genus *Typhloseiopsis* De Leon. *Zootaxa* 2997: 37-53.

Fiaboe K.K.M., Gondim M.G.C. Jr., Moraes G.J. de, Ogol C.K.P.O., Knapp M. 2007. Surveys for natural enemies of the tomato red spider mite *Tetranychus evansi* (Acari: *Tetranychidae*) in the northeastern and southeastern Brazil. *Zootaxa* 1395: 33-58.

Fouly A.H., Abou-Setta M.M., Childers C.C. 1995. Effects of diets on the biology and life tables of *Typhlodromalus peregrinus*. *Environ. Entomol.* 24: 870-877. doi:10.1093/ee/24.4.870

Fournet J. 2002. Flore illustrée des Phanérogymes de Guadeloupe et Martinique. *CIRAD* + Gondwana éditions, Trinité, Martinique: 2538 pp.

Furtado I.P., Moraes G.J. de, Kreiter S., Flechtmann C.H.W., Tixier M.-S., Knapp M. 2014. Plant inhabiting phytoseiid predators of Midwestern Brazil, with emphasis on those associated with the tomato red spider mite, *Tetranychus evansi* (Acari: Phytoseiidae, *Tetranychidae*). *Acarologia* 54(4): 425-431 doi:10.1051/acarologia/20142138

Garman P. 1958. New species belonging to the genera *Amblyseius* and *Amblyseiopsis* with keys to *Amblyseius*, *Amblyseiopsis*, and *Phytoseiulus*. *Ann. Entomol. Soc. Am.* 51: 69-79. doi:10.1093/ress/51.1.69

Guanilo A.D., Moraes G.J. de, Knapp M. 2008a. Phytoseid mites (Acari: Phytoseiidae) of the subfamily Amblyseiinae Muma from Peru, with description of four new species. *Zootaxa* 1880: 1-47

Guanilo A.D., Moraes G.J. de, Knapp M. 2008b. Phytoseid mites (Acari: Phytoseiidae) from Argentina, with description of a new species. *Zootaxa* 1884: 1-35.

Hughes A.M. 1948. The mites associated with stored food products. *Ministry of Agriculture and Fisheries, H.M. Stationary Office, London*, 168 pp.

Karg W. 1983. Systematische untersuchung der Gattungen und Untergattungen der Raubmilbenfamille Phytoseiidae Berlese, 1916, mit der beschreibung von 8 neuen Arten. *Mittl. Zool. Mus. Berl.* 59(2): 293-328. doi:10.1007/bf00263003

Kreiter S., Moraes G.J. de 1997. Phytoseiid mites (Acari: Phytoseiidae) from Guadeloupe and Martinique. *Fla. Entomol.* 80: 376-382. doi:10.2307/3495770

Kreiter S., Tixier M.-S., Etienne J. 2006. New records of phytoseid mites (Acari: Mesostigmata) from the French Antilles, with description of the new species *Neoseiulus cecileae* the French Antilles, with description of *Neoseiulus cecileae* the French Antilles. *Acarologia* 405: doi:10.1603/0046-225X(2008)37[555:SOOKAP]2.0.CO;2

Lindquist E., Evans G.W. 1965. Taxonomic concepts in the Ascidiae, with a modified setal nomenclature for the idiosoma of the Gamasina Acarina: Mesostigmata. *Mem. Entomol. Soc. Can.*, 47: 1-64. doi:10.4039/entnemh9747n

Loféco A.C. 1998. Caracterização morfológica e distribuição geográfica das espécies de Amblyseiinae (Acari: Phytoseiidae) no Brasil. *MSc Thesis, University of São Paulo*, 167 pp + viii.

Loféco A.C., Demite P.R., Moraes G.J. de, Kishimoto R.G. 2009. Phytoseiid mites on grasses in Brazil (Acari: Phytoseiidae). *Zootaxa* 2240: 41-59.

Loféco A.C., Moraes G.J. de, Castro L.A.S. 2004. Phytoseid mites (Acari: Phytoseiidae) on Myrtaceae in the State of São Paulo, Brazil. *Zootaxa* 516: 1-18. doi:10.11646/zootaxa.516.1.3

Mailloux J., Le Bellec F., Kreiter S., Tixier M.-S., Dubois P. 2010. Influence of ground cover management on diversity and density of phytoseiid mites (Acari: Phytoseiidae) in Guadeloupean citrus orchards. *Exp. Appl. Acarol.* 52: 275-290. doi:10.1007/s10493-010-9367-7

McMurtry J.A. 1983. Phytoseid mites from Guatemala, with descriptions of two new species and re-definitions of the genera *Euseius*, *Tylipseiopsis*, and the *Typhlodromus occidentalis* species group (Acari: Mesostigmata). *Intern. J. Entomol.* 25(4): 249-272.

McMurtry J.A., Croft B.A. 1997. Life-styles of phytoseiid mites and their roles in biological control. *Ann. Rev. Entomol.* 42: 291-321. doi:10.1146/annurev.ento.42.1.291

McMurtry J.A., Moraes G.J. de, Sourassou N.F. 2015. Revision of the life styles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. *Syst. Appl. Acarol.* 18: 297-320. doi:10.11158/aae.18.4.1

Kreiter S. et al. (2018), *Acarologia* 58(2): 366-407; DOI 10.24349/acarologia/20184248
Schausberger P., Croft B.A. 1999a. Predation on and discrimination between conspecific and heterospecific eggs among specialist and generalist phytoseiid mites (Acari: Phytoseiidae). Environ. Entomol. 28: 523-528. doi:10.1093/ee/28.3.523

Schausberger P., Croft B.A. 1999b. Activity, feeding, and development among larvae of specialist and generalist phytoseiid mite species (Acari: Phytoseiidae). Biological Control 28: 322-329. doi:10.1016/S0969-5043(99)00058-8

Schausberger P., Croft B.A. 2000a. Nutritional benefits of intraguild predation and cannibalism among generalist and specialist phytoseiid mites. Ecol. Entomol. 25: 1-8. doi:10.1046/j.1365-2311.2000.00284.x

Schausberger P., Croft B.A. 2000b. Cannibalism and intraguild predation among phytoseiid mites: are aggressiveness and prey preference related to diet specialization? Exp. Appl. Acarol. 24: 709-725. doi:10.1023/A:1010747208519

Schicha E. 1975. Predacious mites (Acarina: Phytoseiidae) on sprayed apple trees at Bathurst (N.S.W.). J. Austral. Entomol. Soc. 14: 217-219. doi:10.1111/j.1440-6055.1975.tb00209.x

Schicha E. 1981. A new species of *Amblyseius* from Australia compared with ten closely related species from Asia, America and Africa. Intern. J. Acarol. 7: 203-216. doi:10.1080/01647958108683262

Shicha E. 1987. Phytoseiidae of Australia and Neighboring Areas. Indira Publishing House, Oak Park, Michigan, USA. 187 p.

Tixier M.-S. 2012. Approaches to assess intraspecific variations of morphological continuous characters: the case study of the family Phytoseiidae (Acari: Mesostigmata). Cladistics 28(2012) 489-502. doi:10.1111/j.1096-0031.2012.00394.x

Tixier M.-S., Okassa M., Kreiter S. 2009. On the way to the molecular diagnostic of species of Phytoseiidae. Eurac Newsletter 1+2.

Ueckermann E.A., Loots G.C. 1988. The African species of the subgenera *Anthoseius* De Leon and *Amblyseius* Berlese (Acari: Phytoseiidae). Entomol. Mem. Depart. Agric. Water Supply, RSA 73: 1-168.

Villanueva R.T., Childers C.C. 2004. Phytoseiidae increase with pollen deposition on citrus leaves. Fla. Entomol. 4: 609-611. doi:10.1653/0015-4040(2004)008[0609:PIWPDO]2.0.CO;2

Villanueva R.T., Childers C.C. 2005. Diurnal and spatial patterns of Phytoseiidae in the citrus canopy. Exp. Appl. Acarol. 35(4): 269-280. doi:10.1007/s10493-004-0728-4

Vitzthum H. von 1941. Acarina. In: Bronns, H.G. (Ed.), Klassen und Ordnungen des Tierreichs 5, Akademischer Verlag, Leipzig, Germany: 764-767.

Wainstein B.A. 1962. Révision du genre *Typhlodromus* Scheuten, 1857 et systématique de la famille des Phytoseiidae (Berlese 1916) (Acarina: Parasitiformes). Acarologia 4: 5-30.

Womersley H. 1954. Species of the subfamily Phytoseiinae (Acarina: Laelaptidae) from Australia-Austral. J. Zool. 2: 169-191. doi:10.1071/TO9540169

Zacarias M.S., Moraes G.J. de 2001. Phytoseiid mites (Acari) associated with rubber trees and other euphorbiaceous plants in southeastern Brazil. Neotrop. Entomol. 30: 579-586. doi:10.1590/S1519-566X2001000400011