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Phytoseiid mites of Mayotte Island (Acari: Mesostigmata)

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Original research

ABSTRACT


Mayotte is one of the four main islands constituting Comoros Archipelago, with Anjouan, Mohéli and Grande Comore. Among them, it is the closest island to Madagascar. So far, only one species of the mite family Phytoseiidae (Acari: Mesostigmata) had been reported from this island in an early study. In addition, only five species were recently collected from Grande Comore. In this paper, we report the results of a survey conducted at the end of 2018 in Mayotte Island, in which 18 species are reported for the first time for the Mayotte Island.

Keywords fauna; predatory mites; survey; systematics; taxonomy

Introduction

Mites of the family Phytoseiidae (Acari: Mesostigmata) are well-known for their predatory behaviour on phytophagous mites and small insects on cultivated plants and wild vegetation. Some of them are used to control pest organisms especially in protected crops and to some extent in open fields all around the world (McMurtry and Croft 1997; McMurtry *et al.* 2013). This family is widespread around the world, presents on all continents (except Antarctica). It presently consists of more than 2,500 valid species belonging to 94 genera and three subfamilies (Demite *et al.* 2020). Biodiversity surveys in poorly investigated areas is still an urgent needed and might result in the discovery of additional species potentially useful for biological control as well as having more information on the biodiversity of these areas (Kreiter *et al.* 2018a, b, c, 2020a, b, c). The more interesting area are probably those with a high level of biodiversity. Most of the Indian Ocean constitutes one of the world biodiversity hotspots, a concept defined by Myers (1988) in order to identify the most immediately important areas for biodiversity conservation. The common characteristics of these hotspots is that they hold high endemism levels and have lost at least 70% of their original natural vegetation (Myers *et al.* 2000). Knowledge of the phytoseiid diversity in these high interest areas in the context of global climate changes may contribute to identify potential biological control agent (BCA) and future establishment of conservation programs. Located in the Indian Ocean at 300 km from the northern coast of Madagascar, Mayotte Island (Maore in Shikomori language) is one of the four main islands constituting Comoros Archipelago, with Anjouan (Ndzuwani or Nzwani in Shikomori, and Johanna or Anjouane in Arabic), Mohéli (Mwali in Shikomori) and Grande Comore (Ngazidja in Shikomori). Only one phytoseiid species had been reported from this island long time ago, namely *Phytoseius mayottae* Schicha (Schicha 1984). The objective of this paper is to report the phytoseiid species found in a new survey conducted in November 2018 in Mayotte Island.


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Material and methods

The survey took place in Mayotte in the second half of November 2018. Plant inhabiting mites were collected from cultivated and uncultivated plants in few locations in the centre of the island. Mites were directly collected on leaves with a fine brush with or without a pocket lens or a stereo-microscope when available (large leaf and herbaceous plants) or by beating the plants (mainly shrubs and trees with very small or spiny leaves) and collecting the mites in a black plastic rectangular saucer 45 x 30 cm (Ref. STR 45, BHR, 71370 Saint-Germain-du-Plain, France). The mites were then transferred with a fine brush into small plastic vials containing 1.5 ml of 70% ethanol. All mites were mounted on slides using Hoyer's medium and they were identified using a phase and interferential contrast microscope (DMLB, Leica Microsystems SAS, Nanterre, France). Morphological characters of specimens were measured using a graded eyepiece (Leica, see above). Chant and McMurtry's (1994, 2007) concepts of the taxonomy of the family Phytoseiidae for identification and the world catalogue database of Demite *et al.* (2014, 2020) for distribution and information on descriptions and re-descriptions were used. The setal nomenclature system adopted was that of Lindquist & Evans (1965) and Lindquist (1994) as adapted by Rowell *et al.* (1978), and Chant & Yoshida-Shaul (1992) for the dorsum and by Chant & Yoshida-Shaul (1991) for the venter. The notation for solenostomes and poroids is based on Athias-Henriot (1975). Numbers of teeth on the fixed and movable cheliceral digits do not include the respective apical teeth on apical hook. Setae not referred to in the results section should be considered as absent. All measurements are given in micrometres (μm) and presented with the mean in bold followed by the range in parenthesis.

Specimens of each species are deposited in the mite collections of Montpellier SupAgro conserved in UMR CBGP INRAE/IRD/CIRAD/SupAgro/University of Montpellier. Specimens collected in fields in Mayotte within these surveys were all identified. Only few single males or immatures collected during this study are not taken into account. The following abbreviations are used in this paper for morphological characters: **dsl** = dorsal shield length just above *j1* to just below *J5*; **dsw** = dorsal shield width at the level of *s4*; **Z4 ser.**, **Z5 ser.** = *Z4*, *Z5* serrated (if *Z4* and *Z5* without ser. = not serrated); **gensl** = genital shield length; **gensw post. cor.** = genital shield width posteriorly; **lisl** = Largest inguinal sigilla (= "metapodal plate") length; **lism** = Largest inguinal sigilla (= "metapodal plate") width; **sisl** = smallest inguinal sigilla (= "metapodal plate") length; **sisw** = smallest inguinal sigilla (= "metapodal plate") width; **vsl** = ventrianal shield length; **gv3 – gv3** = distance between solenostomes *gv3* on the ventrianal shield; **vsw ZV2 & vsw anus** = ventrianal shield width at *ZV2* level and at paranal setae level; **scl** = calyx length; **scw** = calyx widest width; **Fdl** = fixed digit length; **Mdl** = movable digit length; **No teeth Fd** = number of teeth on the fixed digit; **No teeth Md** = number of teeth on the movable digit; **Shaft** = length of the shaft of spermatodactyl; **toe** = length of the toe; **BCA** = Biological control agent; **aasl** = altitude above sea level. 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; **INRAE** = Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement; **IRD** = Institut de Recherche pour le Développement; **MSA** = Montpellier SupAgro, France; **UMR** = Unité Mixte de Recherche; **UR** = Unité de Recherche.

Results and discussion

A total of 18 species are found, sixteen presented thereafter.

Subfamily Amblyseiinae Muma

Amblyseiinae Muma 1961: 273.

Tribe Neoseiulini Chant & McMurtry

Neoseiulini Chant & McMurtry 2003a: 6.

Genus Neoseiulus Hughes

Neoseiulus Hughes 1948: 141.

***Neoseiulus barkeri* Hughes**

Neoseiulus barkeri Hughes 1948: 141; Ryu *et al.* 2001: 8; Chant & McMurtry 2003a: 35, 2007: 25; Moraes *et al.* 1986:70, 2004: 104.

Typhlodromus (Neoseiulus) barkeri, Nesbitt 1951: 35.

Typhlodromus (Typhlodromus) barkeri, Chant 1959: 63.

Amblyseius barkeri, Athias-Henriot 1961: 440; Moraes *et al.* 1989: 95.

Typhlodromus (Amblyseius) barkeri, Hughes 1961: 222.

Typhlodromus barkeri, Hirschmann 1962: 5.

Amblyseius (Amblyseius) barkeri, van der Merwe 1968: 112.

Amblyseius mckenziei Schuster & Pritchard 1963: 268 (synonymy according to Ragusa & Athias-Henriot 1983).

Amblyseius usitatus van der Merwe 1965: 71 (synonymy according to Ueckermann & Loots 1988).

Amblyseius oahuensis Prasad 1968: 1518 (synonymy according to Ragusa & Athias-Henriot 1983).

Amblyseius picketti Specht 1968: 681 (synonymy according to Ragusa & Athias-Henriot 1983).

Amblyseius mycophilus Karg, 1970: 290 (synonymy according to Ragusa & Athias-Henriot 1983).

Amblyseius masiaka Blommers & Chazeau 1974: 308 (synonymy according to Ueckermann & Loots 1988).

This species belongs to the *barkeri* species group of the genus *Neoseiulus* and to the *barkeri* species subgroup (Chant and McMurtry 2003a). *Neoseiulus barkeri* has a worldwide distribution (Moraes *et al.* 2004; Demite *et al.* 2020). Various studies have shown its ability to control *Frankliniella occidentalis* Pergande (Rodríguez-Reina *et al.* 1992), *Thrips tabaci* (Lindeman) (Broodsgaard and Stengaard Hansen 1992) and *Tetranychus urticae* Koch on cucumbers (Fan and Pettitt 1994b). Fan and Pettitt (1994a) showed that augmentative releases of *N. barkeri* provided also control of the broad mite, *Polyphagotarsonemus latus* (Banks), on peppers. *Neoseiulus barkeri* constitutes a potential BCA for several crops, especially in vegetables greenhouses. This species has been mentioned by Quilici *et al.* (2000) and Kreiter *et al.* (2020c) in La Réunion Island and more recently from Rodrigues by Kreiter and Abo-Shnaf (2020a).

World distribution: it has a worldwide distribution in all continents, in more than 50 countries (Demitte *et al.* 2020).

Specimens examined: a single ♀ specimen collected during this study. **L'Abattoir**, City Center (15 m aasl, 12°47'18" S, 45°16'21" E), 1 ♀ on *Hibiscus rosa-sinensis* L. (Malvaceae) with eriophyid mite galls, 14/XI/2018.

Remarks: measurements of characters of female from Mayotte are only slightly different from female specimens from other countries, especially La Réunion Island. Comparisons with *N. barkeri* measurements of female and male specimens of various origins in Beaulieu and Beard (2018) shows shorter dimensions of all characters of Mayotte specimens. These authors already mentioned the shorter dimensions of dorsal setae of African female and male specimens (lower part of observed ranges) compared to their measurements of type and additional materials (Beaulieu and Beard 2018).

Neoseiulus teke (Pritchard and Baker)

Amblyseius (Amblyseius) teke Pritchard & Baker 1962: 239.

Amblyseius teke, Meyer & Rodrigues 1966: 30; Moraes *et al.* 1989a: 83, 1989b: 97.

Neoseiulus teke, Moraes *et al.* 1986: 98, 2004: 147; Chant & McMurtry 2003a: 37, 2007: 31.

Amblyseius (Amblyseius) bibens Blommers 1973: 111 (synonymy according to Ueckermann & Loots 1988).

Neoseiulus teke belongs to the *barkeri* species group and the *womersleyi* species subgroup (Chant and McMurtry 2003a). This species is found in sub-Saharan Africa often associated with *Mononychellus tanajoa* (Bondar), the cassava green mite (CGM). It has been studied for its potential use as a BCA against the CGM. Nwilene and Nachman (1996) studied its reproduction characteristics on *M. tanajoa*. It was more efficient than *Iphiseius degenerans* (Berlese), but seems not efficient enough in field conditions (Nwilene and Nachman 1996). Quilici *et al.* (2000) collected this species in La Réunion Island and it was reported recently by Kreiter *et al.* (2020c).

World distribution: Burundi, DR Congo, Ghana, Kenya, Malawi, Mozambique, La Réunion Island, Rwanda, Sierra Leone, South Africa, Tanzania, Zimbabwe.

Specimens examined: 4 specimens in total, 3 ♀♀ + 1 ♂. **L'Abattoir**, City Center (15 m aasl, 12°47'18" S, 45°16'21" E), 1 ♀ + 1 ♂ on *Hibiscus rosa-sinensis* L. (Malvaceae) with eriophyid mite galls and 2 ♀♀ on *Carica papaya* L. (Caricaceae), 27/XI/2018.

Remarks: measurements of morphological characters of *N. teke* female and male specimens from Mayotte Island (Tables 1 and 2) are very close to those specimens from neighbouring countries, especially from specimens of La Réunion Island (Kreiter *et al.* 2020c) and various countries in Africa, except for the holotype (Zannou *et al.* 2006) and specimens from South Africa which are larger (van der Merwe 1965).

Tribe Kampimodromini Kolodochka

Kampimodromini Kolodochka 1998: 59.

Subtribe Paraphytoseiina Chant & McMurtry

Paraphytoseiina Chant & McMurtry 2003b: 211.

Genus Paraphytoseius Swirskii & Shechter

Paraphytoseius Swirski & Shechter 1961: 113.

Paraphytoseius horrifera (Pritchard & Baker)

Amblyseius (Ptenoseius) horrifera Pritchard & Baker 1962: 295.

Amblyseius horrifera, Meyer & Rodrigues 1966: 30.

Amblyseius (Paraphytoseius) horrifera, van der Merwe 1968: 169.

Proprioseius (Paraphytoseius) horrifera, Karg 1983: 302.

Paraphytoseius horrifera, Moraes *et al.* 1986: 105, 2004: 152; Beard 2001: 84; Chant & McMurtry 2003a: 37, 2007: 53.

In all of our specimens of *Paraphytoseius*, setae *S5* are absent. So according to Chant and McMurtry (2003b), they belong to the *orientalis* species group. According also to these previous authors, and Moraes *et al.* (2007), we consider that *P. horrifera* and *P. orientalis* (Narayanan, Kaur & Ghai) are different valid species. Our specimens with longer setae *s4*, *Z4*, *Z5*, and with no distinctly short, thick, spatulate macroseta on genu I belongs to the former species. This species is widely distributed in Sub-Saharan Africa and Madagascar. The biology of *P. horrifera* remains totally unknown. It was recently recorded for the first time from several

Table 1 Character measurements of adult females of *Neoseiulus teke* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

Characters	Mayotte (3) (this study)	Africa (10)	Kenya (2)	La Réunion (10)	Madagascar (1)	South Africa (5)	Holotype Congo
Dsl	305 – 323	308 (293 – 320)	295	307 (293 – 328)	340	332 – 341	348
Dsw	170 – 183	172 (162 – 186)	160	165 (155 – 173)	200	190 – 203	–
<i>j1</i>	18 – 19	18 (16 – 19)	18	15 (13 – 18)	20	19 – 23	–
<i>j3</i>	55	44 (35 – 50)	39	46 (38 – 53)	50	62 – 67	61
<i>j4</i>	30 – 33	30 (23 – 36)	39	25 (23 – 28)	30	38 – 45	42
<i>j5</i>	47 – 48	42 (35 – 48)	39	39 (35 – 43)	45	47 – 54	–
<i>j6</i>	55	48 (43 – 53)	42	47 (45 – 53)	54	62 – 66	60
<i>J2</i>	62 – 63	53 (45 – 59)	48	55 (50 – 58)	65	68 – 75	68
<i>J5</i>	10 – 13	11 (10 – 12)	9	11 (10 – 13)	10	12 – 14	–
<i>r3</i>	47 – 50	40 (34 – 46)	37	44 (40 – 48)	50	54 – 66	61
<i>R1</i>	48 – 40	37 (27 – 48)	37	42 (40 – 45)	48	54 – 66	66
<i>s4</i>	64 – 65	60 (54 – 64)	55	60 (55 – 65)	66	75 – 82	71
<i>S2</i>	68 – 71	61 (56 – 67)	58	64 (60 – 68)	70	72 – 80	–
<i>S4</i>	51 – 55	43 (40 – 48)	39	47 (43 – 60)	50	56 – 63	–
<i>S5</i>	45 – 48	32 (23 – 40)	34	36 (28 – 38)	40	46 – 52	48
<i>z2</i>	58	49 (41 – 54)	46	51 (48 – 53)	56	66 – 71	62
<i>z4</i>	56 – 58	51 (43 – 56)	48	50 (48 – 50)	54	68 – 75	65
<i>z5</i>	35 – 38	29 (19 – 38)	35	25 (23 – 28)	25	33 – 44	42
<i>Z1</i>	60 – 63	53 (45 – 62)	44	54 (50 – 58)	55	71 – 77	65
<i>Z4</i>	65 – 68	60 (54 – 67)	55	57 (50 – 63)	66	66 – 74	–
<i>Z5</i>	70 – 78	65 (59 – 74)	58	68 (65 – 73)	76	80 – 90	–
<i>st1-st1</i>	45	–	–	44 (43 – 48)	–	–	–
<i>st2-st2</i>	54 – 56	58 (56 – 63)	53	55 (53 – 58)	–	–	–
<i>st3-st3</i>	68 – 69	–	–	67 (61 – 70)	–	63 – 67	–
<i>st1-st3</i>	60	56 (53 – 58)	53	60 (55 – 63)	–	56 – 59	–
<i>st4-st4</i>	61 – 63	–	–	66 (53 – 70)	–	–	–
Gensl	–	–	–	–	–	–	–
Gensw st5	56 – 60	56 (51 – 63)	58	54 (50 – 58)	–	70 – 74	–
Gensw post. corn.	64 – 73	–	–	–	–	–	–
Lisl	23 – 27	–	–	25 (23 – 28)	–	–	–
Lisw	2 – 4	–	–	3 (3 – 5)	–	–	–
Sisl	10 – 13	–	–	10 (8 – 10)	–	–	–
Vsl	115 – 125	111 (104 – 118)	105	109 (100 – 115)	125	115 – 122	108
Vsw ZV2	95 – 103	97 (93 – 102)	80	90 (83 – 95)	100	95 – 100	95
Vsw anus	75	–	–	71 (63 – 80)	–	–	–
<i>gv3 – gv3</i>	20 – 23	–	–	–	–	–	–
<i>JV5</i>	68	–	55	57 (55 – 63)	64	66 – 72	–
<i>StIV</i>	63 – 65	66 (51 – 77)	65	69 (48 – 75)	75	75 – 78	72
Scl	25 – 30	24 (22 – 27)	16	25 (23 – 28)	24	27	–
Scw	5	–	–	6 (5 – 13)	7	–	–
Fdl	23 – 25	24 (23 – 25)	–	24 (18 – 25)	24	24	–
No teeth Fd	4	4	7	4	3	4	–
Mdl	26 – 28	26 (25 – 27)	–	24 (20 – 28)	26	27	–
No teeth Md	2	2	2	2	2	2	–

Sources of measurements – Africa (Burundi 1♀, Ghana 2♀♀, Kenya 3♀♀, Malawi 1♀, Mozambique 1♀, Rwanda 1♀, Sierra Leone 1♀): Zannou *et al.* (2006); **Kenya**: El-Banhawy & Knapp (2011); **La Réunion**: Kreiter *et al.* (2020c); **Madagascar** (Identified as *Amblyseius bibens*, but synonymized by Ueckermann & Loots 1988): Blommers (1973); **South Africa**: van der Merwe (1968); **Holotype Congo**: Zannou *et al.* (2006); – : not provided.

countries: Mauritius (Kreiter and Abo-Shnaf 2020b), La Réunion (Kreiter *et al.* 2020c), Rodrigues (Kreiter and Abo-Shnaf 2020a) and Vietnam (Kreiter *et al.* 2020b).

World distribution: Benin, DR Congo, Ghana, India, Kenya, La Réunion Island, Madagascar Island, Malawi, Mozambique, Senegal, South Africa, Uganda.

Specimens examined: 11 specimens in total, 7 ♀♀ + 4 ♂♂. **Coconi**, Maison de L'Office National des Forêts (156 m aasl, 12°50'1" S, 45°8'5" E), 1 ♀ + 1 ♂ on *Cananga odorata* L. (Annonaceae) and 4 ♀♀ + 1 ♂ on an unknown host plant, 24/XI/2018; **Miréréni** (356 m aasl, 12°47'45" S, 45°9'28" E), 1 ♀ + 2 ♂♂ on *Rubus alceifolius* Poirlet (Rosaceae); **Coconi**, Lycée Agricole (189 m aasl, 12°50'7" S, 45°8'11" E), 1 ♀ on *R. alceifolius*, 26/XI/2018.

Remarks: morphological and morphometric characters and all measurements fit well with those provided by Kreiter *et al.* (2020b, c). This species described from Africa (Pritchard and Baker 1962) was first mentioned in the Indian Ocean from La Réunion Island (Kreiter *et al.* 2020c), but seems to be present in several other investigated islands (Kreiter and Abo-Shnaf 2020a, b).

Paraphytoseius orientalis (Narayanan, Kaur & Ghai)

Typhlodromus (Amblyseius) orientalis Narayanan, Kaur & Ghai 1960: 394.

Paraphytoseius orientalis, Moraes *et al.* 1986: 105, 2004: 162; Chant & McMurtry 2003b: 220, 2007: 53.

Amblyseius ipomeai El-Banhawy 1984: 126 (synonymy according to Chant & McMurtry 2003b).

Paraphytoseius multidentatus Swirski & Shechter 1961: 114 (synonymy according to Matthysse & Denmark 1981 in Denmark *et al.* 1999).

Paraphytoseius narayanani Ehara 1967: 67 (synonymy according to Chant & McMurtry 2003b).

Table 2 Character measurements of an adult male of *Neoseiulus teke* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

Characters	Mayotte (1) (this study)	La Réunion (2)	Madagascar (5)	South Africa (2)	Characters	Mayotte (1) (this study)	La Réunion (2)	Madagascar (5)	South Africa (2)
Dsl	225	225 – 230	260	270 – 285	st1-st1	40	40	–	–
Dsw	150	150	170	197 – 200	st2-st2	49	50	–	–
j1	15	10 – 13	15	15 – 18	st3-st3	51	53	–	–
j3	30	25 – 33	34	40 – 46	st1-st5	98	95	–	116 – 128
j4	19	18 – 20	18	26 – 34	st4-st4	43	40 – 43	–	–
j5	28	25 – 30	28	34 – 40	st5-st5	35	35	–	–
j6	34	28 – 35	30	40 – 46	Vsl	105	95 – 103	115	112 – 131
J2	38	33 – 38	35	40 – 46	Vsw ZV2	130	125 – 140	–	139 – 145
J5	11	8 – 13	9	11	Vsw anus	60	50	–	–
r3	20	23 – 28	30	26 – 34	gv3 – gv3	15	–	–	–
R1	20	23	24	26 – 34	JV5	28	28 – 33	33	34 – 40
s4	44	43 – 48	45	54 – 59	StIV	43	50 – 53	54	54 – 63
S2	43	40 – 45	45	46 – 54	Fdl	20	20	19	–
S4	28	28 – 30	27	31 – 34	No teeth Fd	Not visible	3-4?	2	–
S5	20	20 – 23	25	25 – 31	Mdl	20	18 – 20	19	–
z2	38	33 – 37	32	42 – 49	No teeth Md	Not visible	2?	1	–
z4	38	33 – 35	38	42 – 49	Shaft	13	13	12	–
z5	16	18	15	20 – 28	Branch	20	–	–	–
Z1	36	33 – 40	37	40 – 46	Sources of measurements – Madagascar (Identified as <i>Amblyseius bibens</i> , but synonymized by Ueckermann & Loots 1988); Blommers (1973); South Africa: Ueckermann & Loots (1988); – : not provided.				
Z4	44	40 – 45	42	46 – 54					
Z5	46	45 – 50	50	54 – 59					

This species belongs to the *orientalis* species group (Chant and McMurtry 2003b), but according to these authors and Moraes *et al.* (2007), specimens with shorter setae *s4*, *Z4* and *Z5*, and having a distinctly short, thick, spatulate macroseta on genu I belong to the species *P. orientalis*. This species is widely distributed in tropical and subtropical areas in South America, Africa and Asia. It belongs to a genus included in the large polyphagous generalist group named type III phytoseiid mites (McMurtry and Croft 1997; McMurtry *et al.* 2013). Navasero and Navasero (2016) studied the life history of *P. orientalis* on the broad mite (*P. latus*) as prey and reported high predation rates when eggs of *P. latus* were offered as food, suggesting good potential for the control of this pest. This species was also collected in Mauritius (Kreiter *et al.* 2018a; Ferragut and Baumann 2019; Kreiter and Abo-Shnaf 2020b), La Réunion (Kreiter *et al.* 2020c) and Vietnam (Kreiter *et al.* 2020b).

World distribution: Argentina, Brazil, Burundi, India, Japan, Kenya, La Réunion Island, Madagascar Island, Martinique Island, Mauritius Island, Mozambique, Rwanda.

Specimens examined: 3 ♀♀ specimens in total. **Coconi**, Lycée Agricole (189 m aasl, 12°50'7" S, 45°8'11" E), 3 ♀♀ on *Capsicum annuum* L. (Solanaceae), 26/XI/2018.

Remarks: this species was reported by Kreiter *et al.* (2018a, 2020b, c) and by Ferragut and Baumann (2019) from various places. Morphological and morphometric characters and all measurements fit well with those given by Ferragut and Baumann (2019) and Kreiter *et al.* (2020b, c). It is described from Asia (Narayanan *et al.* 1960) and present in Vietnam (Kreiter *et al.* 2020b). *Paraphytoseius orientalis* seems to be more common than *P. horrifera* in Mauritius Island (Kreiter and Abo-Shnaf 2020b), whereas the latter is more abundant in Mayotte Island.

Tribe Typhlodromipsini Chant & McMurtry

Typhlodromipsini Chant & McMurtry 2005c: 318.

Genus *Typhlodromips* De Leon

Typhlodromips 2007: 55.

Typhlodromips shi (Pritchard & Baker)

Amblyseius (*Amblyseius*) *shi* Pritchard & Baker 1962: 252.

Typhlodromips shi, Moraes *et al.* 1986: 147, 2004: 224; Chant & McMurtry 2005c: 327, 2007: 63.

Typhlodromips ivoloinae (Blommers 1974): 146 (synonymy according to Ueckermann & Loots 1988).

This species belongs to the *culmulus* species group of the genus *Typhlodromips* with nine other species. It was described under the name *ivoloinae* by Blommers (1974) from Madagascar on *Citrus lemon* (L.) Burman (Rutaceae). Mayotte Island is approximately 340 km away from Madagascar coasts and it is not surprising to find this species on a close island. The species was not reported from Mascareignes Archipelago. Its biology is totally unknown.

World distribution: Angola, Benin, Cameroon, DR Congo, Ghana, Kenya, Madagascar, Malawi, Mozambique, Nigeria, Sierra Leone.

Specimens examined: a single ♀ collected during this study. **Coconi**, Lycée Agricole (189 m aasl, 12°50'7" S, 45°8'11" E), 1 ♀ on *Carica papaya* L. (Caricaceae), 26/XI/2018.

Remarks: morphological and morphometric characters and all measurements fit well with those provided in the literature as indicated in (Table 3). This species recorded in several countries of Africa and is also present in Madagascar. Mayotte is consequently the second island of Indian Ocean known for hosting this species.

Tribe Amblyseiini Muma

Amblyseiinae Muma 1961: 273.

Amblyseiini Muma, Wainstein 1962: 26.

Subtribe Amblyseiina Muma

Amblyseiina Muma, Chant & McMurtry 2004: 179.

Genus Amblyseius Berlese

Amblyseius Berlese 1914: 143.

***Amblyseius largoensis* (Muma)**

Amblyseiopsis largoensis Muma 1955: 266.

Typhlodromus (Amblyseius) largoensis, Chant 1959: 96.

Amblyseius (Amblyseialus) largoensis, Muma 1961: 287.

Typhlodromus largoensis, Hirschmann 1962: 2.

Amblyseius (Amblyseius) largoensis, Ehara 1966: 22.

Amblyseius largoensis, Swirski & Golan 1967: 225; Moraes *et al.* 1986: 17, 2004: 33; Chant & McMurtry 2004: 208, 2007: 78.

Amblyseius magnolia Muma 1961: 289 (synonymy according to Denmark & Evans 2011).

Amblyseius sakalava Blommers 1976: 96 (synonymy according to Ueckermann & Loots 1988).

Amblyseius amtalaensis Gupta 1977: 53 (synonymy according to Gupta 1986).

Amblyseius largoensis belongs to the *largoensis* species group and the *largoensis* species subgroup. It is widespread in all tropical and subtropical regions of the world and was the

Table 3 Character measurements of adult females of *Typhlodromips shi* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

Characters	Mayotte (1) (this study)	Africa (20)	Angola (?)	Madagascar (1?)	Characters	Mayotte (1) (this study)	Africa (20)	Angola (?)	Madagascar (1?)
Dsl	320	332 (310 – 347)	347 – 362	320	Gensl	Not visible	–	–	–
Dsw	205	217 (200 – 226)	223 – 246	230	Gensw <i>st5</i>	65	65 (59 – 70)	–	–
<i>j1</i>	15	16 (13 – 21)	19	15	Gensw post. corn.	Not visible	–	–	–
<i>j3</i>	18	19 (16 – 24)	19	18	Lisl	15	–	–	–
<i>j4</i>	8	10 (8 – 13)	11	10	Lisw	4	–	–	–
<i>j5</i>	8	10 (8 – 11)	11	10	Sisl	8	–	–	–
<i>j6</i>	9	12 (10 – 13)	12	10	Vsl	103	108 (94 – 115)	109 – 123	105
<i>J2</i>	10	13 (11 – 14)	16	12	Vsw <i>ZV2</i>	65	84 (74 – 94)	85 – 92	80
<i>J5</i>	8	8 (8 – 10)	9	8	Vsw <i>anus</i>	68	79 (72 – 86)	–	–
<i>r3</i>	15	14 (11 – 16)	16	12	<i>gv3 – gv3</i>	25	–	–	–
<i>R1</i>	9	11 (8 – 13)	13	12	<i>JV5</i>	29	–	32 – 39	35
<i>s4</i>	15	21 (16 – 26)	19	18	<i>Sgel</i>	20	26 (22 – 30)	28 – 31	–
<i>S2</i>	10	11 (8 – 13)	13	12	<i>Sgell</i>	18	23 (19 – 29)	25 – 26	–
<i>S4</i>	8	10 (8 – 13)	11	10	<i>SgeIII</i>	23	29 (24 – 32)	33 – 39	28
<i>S5</i>	8	9 (8 – 10)	9	10	<i>StiIII</i>	23	23 (19 – 24)	25 – 30	–
<i>z2</i>	13	12 (11 – 13)	13	14	<i>SgeIV</i>	43	42 (35 – 48)	47 – 54	40
<i>z4</i>	10	12 (10 – 13)	13	10	<i>StiIV</i>	35	33 (26 – 40)	38 – 41	32
<i>z5</i>	8	10 (8 – 11)	9	10	<i>StIV</i>	49	52 (42 – 67)	54 – 60	50
<i>Z1</i>	11	13 (13 – 14)	14 – 16	10	Scl	8	6 (5 – 8)	–	–
<i>Z4</i>	23	31 (22 – 37)	29 – 34	26	Scw	2	13 (13 – 14)	–	–
<i>Z5</i>	68	67 (53 – 74)	72	60	Fdl	25	23 (23 – 24)	–	25
<i>st1-st1</i>	50	–	–	–	No teeth Fd	8	8	8	8
<i>st2-st2</i>	60	63 (59 – 66)	–	–	Mdl	26	27 (27 – 28)	–	27
<i>st3-st3</i>	65	–	–	–	No teeth Md	3	3	3	3
<i>st1-st3</i>	50	54 (50 – 58)	–	–	Sources of measurements – Africa (Benin: 3♀♀; Cameroon: 2♀♀; Ghana: 10♀♀; Kenya: 3♀♀; Mozambique: 1♀; Democratic Republic of Congo: holotype): Moraes <i>et al.</i> (2007); Angola : Ueckermann & Loots (1988); Madagascar (Identified as <i>Amblyseius ivoloinae</i> , but synonymized by Ueckermann & Loots 1988): Blommers (1974); – : not provided.				
<i>st4-st4</i>	75	–	–	–					

most abundant species collected by Moraes *et al.* (2000) in French Caribbean Islands and as a potential BCA of *Raoiella indica* Hirst in La Réunion Island (Moraes *et al.* 2012). Using morphometric analyses of 36 characters, molecular analyses and crossing tests, Navia *et al.* (2014) studied specimens collected in Brazil, La Réunion Island and Trinidad and Tobago to determine whether *A. largoensis* populations from different geographic origins belong to the same taxonomic entity. Though differences in the lengths of some setae were observed, molecular analyses and crossing experiments indicated that populations from Indian Ocean and America were conspecific. This species was previously recorded from Mauritius Island by Ferragut and Baumann (2019) and Kreiter and Abo-Shnaf (2020b), and Rodrigues Island by Kreiter and Abo-Shnaf (2020a).

World distribution: this species is widely distributed in the tropical and subtropical regions of Africa, America, Asia and the Pacific Islands.

Specimens examined: 17 specimens in total, 8 ♀♀, 4 ♂♂ and 5 im. **L'Abattoir**, Dziani lake (23 m aasl, 12°46'14" S, 45°17'18" E), 1 ♂ and 2 im. on *Phoenix dactyliphera* L. (Arecaceae) and 1 ♂ on *Artocarpus altilis* (Parkinson) Fosberg (Moraceae) 27/XI/2018; **L'Abattoir**, City Center (15 m aasl, 12°47'18" S, 45°16'21" E), 2 ♀♀ and 1 im. on *Mangifera indica* L. (Anacardiaceae), 3 ♀♀ and 2 ♂♂ on *Hibiscus rosa-sinensis* (Malvaceae) with eriophid mite galls, and 3 ♀♀ and 2 im. on *Cordia sebestena* (Boraginaceae), 27/XI/2018.

Remarks: morphological and morphometric characters and all measurements of Mayotte Island specimens fit well with those given in Zannou *et al.* (2007) for specimens from Africa, Navia *et al.* (2014) for specimens from Brazil, La Réunion and Trinidad & Tobago and Ferragut and Baumann (2019) for specimens from Mauritius. This is the third more common species of our samplings.

***Amblyseius parasundi* Blommers**

Amblyseius (Proprioseiopsis) parasundi Blommers 1974: 144.

Amblyseius parasundi, Moraes *et al.* 1986: 27, 2004: 46.

Amblyseius (Amblyseius) parasundi, Denmark & Muma 1989: 19.

This species have no setae Z1 and consequently belongs to the *sundi* species group and having the spermatheca elongate, tub-like, belongs to the *sundi* species subgroup. Despite its high population on fruit trees in Madagascar and preying on tetranychid mites (Blommers and Gutierrez 1975), its biology is totally unknown.

World distribution: Madagascar Island.

Specimens examined: 29 specimens in total, 24 ♀♀, 4 ♂♂ and 1 im. **Coconi**, Maison de L'Office National des Forêts (156 m aasl, 12°50'1" S, 45°8'5" E), 1 ♀ on *Persea americana* Miller (Lauraceae) and 2 ♀♀ + 1 ♂ on *Terminalia catappa* L. (Combretaceae), 24/XI/2018; **Miréréni** (356 m aasl, 12°47'45" S, 45°9'28" E), 1 ♀ on *Calophyllum inophyllum* Poiré (Calophyllaceae) and 1 ♀ on *Pteridium aquilinum* (L.) Kuhn (Dennstaedtiaceae), 24/XI/2018; **Combani**, gîte du Mont Combani (437 m aasl, 12°48'23" S, 45°9'17" E), 2 ♀♀ on *Artocarpus heterophyllus* Lamarck (Moraceae), 1 ♀ on *Malvaviscus arboreus* Cavanilles (Malvaceae), 1 ♀ and 1 ♂ on *Cananga odorata* (Lamarck) Hook & Thomson (Annonaceae), 3 ♀♀ on *Psidium guajava* L. (Myrtaceae), 1 ♂ on *Cocos nucifera* L. (Arecaceae), 2 ♀♀ on *Artocarpus altilis* (Parkinson) Fosberg (Moraceae), 1 ♀ on *P. americana* and 2 ♀♀ on *Psidium cattleianum* Afzelius ex. Sabine (Myrtaceae), 25/XI/2018; **Coconi**, Lycée Agricole (189 m aasl, 12°50'7" S, 45°8'11" E), 1 ♀ on *A. altilis*, 1 ♀ on *Mangifera indica* L. (Anacardiaceae), 1 ♀ on *Syngonium podophyllum* Schott (Araceae) and 1 ♀ on *Piper nigrum* L. (Piperaceae), 26/XI/2018; **Combani**, grower farm (104 m aasl, 12°47'14" S, 45°7'57" E), 2 ♀♀ on *C. odorata* and 1 ♀ and 1 im. on *Theobroma cacao* L. (Malvaceae), 26/XI/2018; **L'Abattoir**, Dziani lake (23 m aasl, 12°46'14" S, 45°17'18" E), 1 ♂ on *A. altilis*, 27/XI/2018.

Remarks: morphological and morphometric characters and all measurements (Table 4) fit quite well with few measurements from the other studies (Table 4) except some setae which are 10–20% longer (Z5, JV5, SgeIV, StiIV and StIV) or 10–40% shorter (*j*3, *r*3) in Mayotte

specimens. This is the second more common species of our samplings. *Amblyseius sundi* is reported by Blommers (1974) as being a thelytokous species in mass-rearing and field collected specimens and similar information is also mentioned by Denmark and Muma (1989). Four males were however collected during our study.

Amblyseius tamatavensis Blommers

Amblyseius tamatavensis Blommers 1974: 144; Moraes *et al.* 1986: 31, 2004: 52; Denmark & Muma 1989: 13; Chant & McMurtry 2004: 203, 2007: 81; Ehara & Amano 2004: 17.

Amblyseius maai Tseng 1976: 123 (synonymy according to Denmark & Muma 1989).

Amblyseius aegyptiacus Denmark & Matthyse in Matthyse & Denmark 1981: 343 (synonymy according to Denmark & Muma 1989).

Amblyseius (Amblyseius) tamatavensis, Ehara 2002: 33; Ehara & Amano 2002: 322.

Amblyseius tamatavensis belongs to the *obtusus* species group and the *aerialis* species subgroup which contains 46 species (Chant and McMurtry 2004). It seems to fit the functional type III-b (generalist predators living on glabrous leaves) group defined by McMurtry *et al.* (2013). Cavalcante *et al.* (2017) reported this species as a promising natural enemy of *Bemisia tabaci* (Gennadius). Experimental releases of this predator on caged plants in a screenhouse caused the reduction of the density of *B. tabaci* on pepper plants by up to 60–80 % (Massaro and Moraes 2019). It can be easily produced in large numbers (Massaro *et al.* 2018) when fed

Table 4 Character measurements of adult females of *Amblyseius parasundi* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

Characters	Mayotte (12) (this study)	Madagascar 1 (1)	Madagascar 2 (?)	Characters	Mayotte (12) (this study)	Madagascar 1 (1)	Madagascar 2 (?)
Dsl	364 (338 – 405)	370	361 – 370	Gensl	128 (113 – 140)	–	–
Dsw	224 (195 – 258)	290	235	Gensw st5	75 (68 – 80)	–	–
j1	37 (31 – 44)	40	42	Gensw post. corn.	92 (86 – 100)	–	–
j3	46 (43 – 48)	52	51	Lisl	23 (20 – 28)	–	–
j4	4 (3 – 5)	3	5	Lisw	5 (3 – 6)	–	–
j5	4 (3 – 5)	3	5	Sisl	13 (10 – 15)	–	–
j6	5 (3 – 6)	3	6	Sisw	2 (1 – 2)	–	–
J2	5 (3 – 6)	5	7	Vsl	114 (108 – 120)	125	–
J5	6 (4 – 8)	4	6	Vsw ZV2	75 (68 – 80)	–	–
r3	12 (10 – 15)	22	20	Vsw anus	79 (73 – 83)	80	–
R1	8 (7 – 10)	10	12	gv3 – gv3	26 (21 – 29)	–	–
s4	168 (135 – 183)	165	153	JV5	107 (90 – 128)	90	–
S2	8 (5 – 8)	7	6	SgeI	76 (69 – 83)	70	–
S4	8 (6 – 9)	9	7	SgeII	44 (38 – 50)	50	–
S5	7 (6 – 8)	7	6	SgeIII	74 (65 – 85)	70	–
z2	7 (5 – 9)	10	6	StiIII	58 (50 – 63)	55	–
z4	6 (5 – 7)	6	6	SgeIV	224 (188 – 243)	190	190
z5	4 (3 – 5)	3	5	StiIV	162 (125 – 180)	140	140
Z4	170 (140 – 190)	170	–	StiV	108 (93 – 120)	85	90
Z5	475 (438 – 520)	430	426	Scl	34 (25 – 40)	35	36
st1-st1	68 (65 – 73)	–	–	Scw	4	3	–
st2-st2	75 (70 – 80)	–	–	Fdl, No teeth Fd	36 (33 – 38), 12	38, 13	–, 11
st3-st3	80 (70 – 85)	–	–	Mdl, No teeth Md	38 (35 – 40), 4	38, 3	–, 3
st1-st3	66 (63 – 68)	–	–	Sources of measurements – Madagascar 1: Blommers (1974); Madagascar 2: Denmark & Muma (1989); – : not provided.			
st4-st4	81 (69 – 94)	–	–				

with astigmatine mites, which could allow the mass production for augmentative biological control. This species is reported in tropical areas from over 20 countries around the world (Africa, Asia, America and Oceania). It was recorded from La Réunion Island (Quilici *et al.* 2000; Kreiter *et al.* 2020c), from Rodrigues Island (Kreiter and Abo-Shnaf 2020a) and from Mauritius Island (Ferragut and Baumann 2019; Kreiter and Abo-Shnaf 2020b).

World distribution: this species was described from Madagascar, but is actually widely distributed in the tropical and subtropical regions of Africa, America, Asia and the Pacific Islands.

Specimens examined: 4 specimens in total, 3 ♀♀ and 1 ♂. **Combani**, grower farm (104 m aasl, 12°47'14" S, 45°7'57" E), 3 ♀♀ on *Capsicum annuum* L. (Solanaceae), 26/XI/2018 and 1 ♂ on *Citrus sinensis* (L.) Osbeck (Rutaceae), 26/XI/2018.

Remarks: this species was described from Madagascar (Blommers 1974), then was mentioned in the Indian Ocean from La Réunion Island (Quilici *et al.* 2000). Morphological and morphometric characters and all measurements of our specimens fit well with those provided in Blommers (1974) for specimens from Madagascar, Ferragut and Baumann (2019) for specimens from Mauritius Island and Kreiter *et al.* (2020c) for specimens from La Réunion Island.

Subtribe *Proprioseiopsina* Chant & McMurtry

Proprioseiopsina Chant & McMurtry, 2004: 219.

Genus *Proprioseiopsis* Muma

Proprioseiopsis Muma 1961: 277.

Proprioseiopsis ovatus (Garman)

Amblyseiopsis ovatus Garman 1958: 78.

Typhlodromus (*Amblyseius*) *ovatus*, Chant 1959: 90.

Amblyseiulus ovatus, Muma 1961: 278.

Typhlodromus ovatus, Hirschmann 1962: 2.

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

Proprioseiopsis (*Proprioseiopsis*) *ovatus*, Karg 1989: 208.

Proprioseiopsis cannaensis (Muma 1962: 4) (synonymy according to Denmark & Evans 2011).

Proprioseiopsis peltatus (van der Merwe: 1968: 119) (synonymy according to Tseng 1983).

Proprioseiopsis hudsonianus (Chant & Hansell 1971: 723) (synonymy according to Denmark & Evans 2011).

Proprioseiopsis parapeltatus (Wu & Chou, 1981: 274) (synonymy according to Tseng 1983).

Proprioseiopsis antonelli Congdon 2002: 15 (synonymy according to Denmark & Evans 2011).

Proprioseiopsis ovatus belongs to the *belizensis* species group as genu I have no macrosetae. As the spermatheca of that species is saccular, it belongs to the *belizensis* species subgroup (Chant and McMurtry 2005a). This species is known from Guadeloupe, Marie-Galante and Martinique (Kreiter and Moraes 1997; Moraes *et al.* 2000; Mailloux *et al.* 2010; Kreiter *et al.* 2018c). It 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, unpub. data). In other habitats, it seems to be rare. Similar to *P. mexicanus* (Garman), *P. ovatus* seems to be abundant on weeds in the lower vegetation. Denmark and Evans (2011) indicated that this species is associated with *Oligonychus pratensis* (Banks) and *Brevipalpus* spp. It was also found in association with *Tetranychus evansi* Baker and Pritchard (Furtado *et al.* 2014), but mentioned as poor predator of that species. Despite this information, the biology of *P. ovatus* remains unknown.

World distribution: Argentina, Brazil, Colombia, Costa Rica, Cuba, Ecuador, Egypt, Ghana, Hawaii, Honduras, Japan, Malaysia, Martinique Island, Mozambique, Peru, Philippines, Puerto Rico, La Réunion Island, Saudi Arabia, Sierra Leone, South Africa, Spain, Sri Lanka, Taiwan, Thailand, Turkey, USA, Venezuela.

Specimens examined: a single ♀ collected during this study. **Combani**, gîte du Mont Combani (437 m aasl, 12°48'23" S, 45°9'17" E), 1 ♀ on *Hydrangea aspera* Buch.-Ham. ex D. Don (Hydrangeaceae), 25/XI/2018.

Remarks: morphological and morphometric characters and all measurements of our single specimen in perfect shape fit well measurements of Kreiter *et al.* (2020c) and other measurements of the literature mentioned by these authors for specimens from La Réunion and other parts of the world.

Tribe Euseiini Chant & McMurtry

Euseiini Chant & McMurtry 2005b: 191.

Subtribe Euseiina Chant & McMurtry

Euseiina Chant & McMurtry 2005b: 209.

Genus *Moraeseius* Chant & McMurtry

Moraeseius Chant & McMurtry 2005b: 209.

Moraeseius papayana (van der Merwe)

Amblyseius (*Amblyseius*) *papayana* van der Merwe 1965: 57.

Amblyseius (*Propriozeiospsis*) *papayana*, van der Merwe 1968: 161.

Euseius papayana, Moraes *et al.* 1986: 46, 2001: 46, 2004: 78.

Moraeseius papayana, Chant & McMurtry 2005b: 216, 2007: 123.

Moraeseius papayana was first placed in the genus *Amblyseius*, then assigned to the genus *Euseius* before being erected as a new genus, *Moraeseius* by Chant and McMurtry (2005b). It was described from Nelspruit, Transvaal, South Africa on *Carica papaya* L. This is the first record of this species outside the African continent. The biology of this species is totally unknown.

World distribution: Kenya, Mozambique, South Africa.

Specimens examined: 2 ♀♀ specimens in total. **Combani**, gîte du Mont Combani (437 m aasl, 12°48'23" S, 45°9'17" E), 2 ♀♀ on *Carica papaya* L. (Caricaceae), 25/XI/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens (Table 5) fit well with those of van der Merwe (1965) in the original description for specimens from South Africa and of Moraes *et al.* (2001) for specimens from Kenya.

Genus *Euseius* Wainstein

Amblyseius (*Amblyseius*) section *Euseius* Wainstein 1962: 15.

Euseius De Leon 1966: 86.

Euseius ovaloides (Blommers)

Amblyseius (*Amblyseius*) *ovaloides* Blommers 1974: 147.

Euseius ovaloides, Moraes *et al.* 1986: 51, 2004: 78; Chant & McMurtry 2005a: 215, 2007: 121.

Euseius ovaloides was described by Blommers (1974) from specimens collected on *Citrus hystrix* de Candolle (Rutaceae) and *Persea americana* Miller (Lauraceae) in Madagascar. Like all *Euseius* species, this species belongs to the type IV (polliniphagous generalist predators) of

McMurtry and Croft (1997) and McMurtry *et al.* (2013). The species had been occasionally recorded from Madagascar (Blommers 1974), Papua-New Guinea (Schicha and Gutierrez 1985), Seychelles (Schicha 1987), La Réunion Island, (Quilici *et al.* 1997, 2000, Kreiter *et al.* 2020c), Guadeloupe, Martinique and Marie-Galante (Moraes *et al.* 2000; Kreiter *et al.* 2006) on various plants, though its biology remains unknown. It is suspected to be a poor predator of tetranychid mites (Gutierrez and Etienne 1986), but can be considered as a potential predator of thrips and whiteflies. This is one of the most common species on La Réunion Island (Kreiter *et al.* 2020c).

World distribution: Guadeloupe, Madagascar Island, Marie-Galante, Martinique, Papua New Guinea, La Réunion Island, Seychelles Archipelago.

Specimens examined: 4 ♀♀ specimens in total. **L'Abattoir**, City Center (15 m aasl, 12°47'18" S, 45°16'21" E), 4 ♀♀ *Carica papaya* L. (Caricaceae), 27/XI/2018.

Remarks: this species was recently reported from Vietnam (Kreiter *et al.* 2020b). Morphological and morphometric characters and all measurements of our specimens fit well with measurements in Kreiter *et al.* (2020b). This species was the second more collected species in our study concerning Mauritius (Kreiter & abo-Shnaf 2020b) Phytoseiidae after *A. herbicolus* and it was also very common in La Réunion (Kreiter *et al.* 2020c), but less common in Mayotte Island.

Table 5 Character measurements of adult females of *Moraeseius papayana* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

Characters	Mayotte (2) (this study)	Kenya (2)	South Africa (3)	Characters	Mayotte (2) (this study)	Kenya (2)	South Africa (3)
Dsl	313 – 338	321 (311 – 332)	348 – 353	Gensl	120	–	–
Dsw	175 – 188	223 (216 – 230)	219 – 224	Gensw <i>st5</i>	63	78	–
<i>j1</i>	35 – 38	42 (41 – 43)	38 – 42	Gensw post. corn.	95	–	97 – 102
<i>j3</i>	55 – 64	84 (78 – 89)	78 – 83	Lisl	25 – 30	–	–
<i>j4</i>	4	8	5 – 10	Lisw	3	–	–
<i>j5</i>	4	7 (5 – 8)	5 – 10	Sisl	Not visible	–	–
<i>j6</i>	7 – 8	11	5 – 10	Vsl	80	86	103 – 107
<i>J2</i>	9	11	12 – 14	Vsw ZV2	50	59	–
<i>J5</i>	6	5	5 – 10	Vsw <i>anus</i>	65 – 75	70	78 – 83
<i>r3</i>	14	23 (22 – 25)	–	<i>gv3 - gv3</i>	30	–	–
<i>R1</i>	13 – 14	15 (14 – 16)	–	<i>JV5</i>	75 – 80	–	100 – 103
<i>s4</i>	113 – 135	151	145 – 152	<i>SgeI</i>	25	30	–
<i>S2</i>	35 – 40	34 (32 – 35)	28 – 35	<i>SgeII</i>	25 – 28	30	–
<i>S4</i>	33 – 38	28 (27 – 30)	28 – 35	<i>SgeIII</i>	34	38	–
<i>S5</i>	38 – 43	38 (35 – 41)	28 – 35	<i>StiIII</i>	35	32	–
<i>z2</i>	24 – 30	35 (32 – 38)	37 – 46;	<i>SgeIV</i>	48 – 50	62 (59 – 65)	59 – 61
<i>z4</i>	100	123 (122 – 124)	112 – 120	<i>StiIV</i>	40 – 45	49	54 – 57
<i>z5</i>	4	8	7 – 9	<i>StIV</i>	100 – 103	119 (116 – 122)	121 – 126
<i>Z4</i>	114 – 120	134 (127 – 140)	130 – 136	Scl	30 – 38	26 (25 – 27)	45
<i>Z5</i>	110 – 113	115 (111 – 119)	130 – 136	Scw	5	–	–
<i>st1-st1</i>	56 – 60	–	–	Fdl, No teeth Fd	23 - 25, 6	–	–, 6
<i>st2-st2</i>	68	66 (65 – 68)	–	Mdl, No teeth Md	23 - 25, 1	–	–, 1
<i>st3-st3</i>	75 – 80	–	–	Sources of measurements – Kenya (identified as <i>Euseius papayana</i> and named <i>Moraeseius papayana</i> by Chant & McMurtry 2005b): Moraes <i>et al.</i> (2001);			
<i>st1-st3</i>	58 – 60	62	–	South Africa: van der Merwe (1965); – : not provided.			
<i>st4-st4</i>	80 – 85	–	–				

Subfamily Phytoseiinae Berlese

Phytoseiini Berlese 1913: 3.

Phytoseiinae Vitzthum 1941: 767.

Genus *Phytoseius* Ribaga

Phytoseius Ribaga 1904: 177.

Phytoseius haroldi Ueckermann & Kreiter

Phytoseius haroldi Ueckermann & Kreiter in Kreiter *et al.* 2002: 339; Chant & McMurtry 2007: 129.

This species belongs to the *horridus* species group as setae *J2* and *R1* are absent (Chant and McMurtry 1994). This species was described by Ueckermann and Kreiter in Kreiter *et al.* (2002) from La Réunion Island. It was abundant in low vegetation in a study of companion plants in citrus orchard in La Réunion Island (Kreiter *et al.* 2020c). It seems that this species prefers low plants, but this observation has to be confirmed in further studies. The biology of this species remains also totally unknown. This species was recently reported in Mauritius (Ferragut and Baumann 2019; Kreiter and Abo-Shnaf 2020b) and in Rodrigues Island (Kreiter and Abo-Shnaf 2020a).

World distribution: La Réunion Island, Mauritius Island, Rodrigues Island.

Specimens examined: a single ♀ collected during this study. **L'Abattoir**, Dziani lake (23 m aasl, 12°46'14" S, 45°17'18" E), 1 ♀ on *Anacardium occidentale* L. (Anacardiaceae), 27/XI/2018

Remarks: morphological and morphometric characters and all measurements of our specimens fit well with those of the original description in Kreiter *et al.* (2002) concerning specimens from La Réunion Island, Ferragut and Baumann (2019) for specimens from Mauritius, Kreiter *et al.* (2020c) for additional specimens from La Réunion Island and Kreiter and Abo-Shnaf (2020a) for specimens from Rodrigues Island.

Subfamily Typhlodrominae Wainstein

Typhlodromini Wainstein 1962: 26.

Typhlodrominae Chant & McMurtry 1994: 235.

Tribe Chanteiini Chant & McMurtry

Chanteiini Chant & McMurtry 1994: 237, 2007: 132.

Genus *Chanteius* Wainstein

Chanteius Wainstein 1962: 19.

Chanteius contiguus (Chant)

Typhlodromus (*Typhlodromus*) *contiguus* Chant, 1959: 29.

Typhlodromus (*Diadromus*) *contiguus*, Athias-Henriot 1960: 62.

Typhloseiopsis contiguus, Muma 1961: 294.

Chanteius (*Chanteius*) *contiguus*, Wainstein 1962: 9.

Typhlodromus contiguus, Hirshmann 1962: 2.

Typhlodromus (*Typhloseiopsis*) *contiguus*, Pritchard & Baker 1962: 222.

Diadromus contiguus, Chant & Yoshida-Shaul 1986: 2030, Moraes *et al.* 1986: 184.

Chanteius contiguus, Moraes *et al.* 2004: 261; Chant & McMurtry 1994: 239.

Chanteius lieni (Tseng 1976): 97 (synonymy according to Chant & Yoshida-Shaul 1986).

This species belongs to the *contiguus* species group (Chant & McMurtry 1994) and its biology remains totally unknown.

World distribution: China, Hong-Kong, Japan, Madagascar, Philippines, Singapore.

Specimens examined: 59 specimens in total, 51 ♀♀, 7 ♂♂ and 1 im. **Coconi**, Maison de L'Office National des Forêts (156 m aasl, 12°50'1" S, 45°8'5" E), 2 ♀♀ on *Cinnamomum verum* J. Presl (Lauraceae), 2 ♀♀ on *Barleria lupulina* Lindley (Acanthaceae), 2 ♀♀ on *Stachytarpheta jamaicensis* (L.) Vahl (Verbenaceae), 1 ♀ and 1 ♂ on *Terminalia catappa* L. (Combretaceae), 1 ♀ on *Carica papaya* L. (Caricaceae), 24/XI/2018; **Miréréni** (356 m aasl, 12°47'45" S, 45°9'28" E), 3 ♀♀ on *Pteridium aqualinum* (L.) Kuhn (Dennstaedtiaceae) and on *Lantana camara* L. (Verbenaceae), 24/XI/2018; **Combani**, gîte du Mont Combani (437 m aasl, 12°48'23" S, 45°9'17" E), 1 ♂ on *Cananga odorata* (Lamark) Hooker and Thomson (Annonaceae), 4 ♀♀, 1 ♂ and 1 im. on *Citrus limon* (L.) Burman (Rutaceae), 1 ♀ on *C. papaya*, 4 ♀♀ and 1 ♂ on *Hydrangea aspera* Buchanan-Hamilton ex D. Don (Hydrangeaceae), 2 ♀♀ on *Annona muricata* L. (Annonaceae), 14 ♀♀ and 1 ♂ on *Cocos nucifera* L. (Arecaceae), 7 ♀♀ on *Bidens pilosa* L. (Asteraceae), 1 ♀ and 1 ♂ on *Artocarpus altilis* (Parkinson) Fosberg (Moraceae) and 1 ♀ on *Persea americana* Miller (Lauraceae), 25/XI/2018; **Coconi**, Lycée Agricole (189 m aasl, 12°50'7" S, 45°8'11" E), 1 ♀ and 1 ♂ on *C. papaya* and 5 ♀♀ on *Trema orientalis* (L.) Blume (Cannabaceae), 26/XI/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens fit well with measurements in numerous description and redescrptions available in the literature, especially those of Blommers (1976) for specimens from Madagascar. This is the most abundant species in our samplings. Mentioned only from South-East Asia and Madagascar, this is the first report of this species outside this main island.

Tribe Typhlodromini Wainstein

Typhlodromini Wainstein 1962: 26.

Genus Typhlodromus Scheuten

Typhlodromus Scheuten 1857: 111.

Subgenus Anthoseius De Leon

Typhlodromus (Anthoseius) De Leon 1959: 258.

Typhlodromus (Anthoseius) grewiae Zannou, Moraes & Oliveira

Typhlodromus (Anthoseius) grewiae Zannou, Moraes & Oliveira in Ueckermann *et al.* 2008: 48.

This species belongs to the *singularis* species group as setae *JV3* are absent on the female and as specimens have shorter dorsal shield setae (Chant and McMurtry 1994). The biology of that species is totally unknown. It was reported only from Kenya (Ueckermann *et al.* 2008) based on a single female specimen.

World distribution: Kenya.

Specimens examined: 3 specimens in total, 2 ♀♀ and 1 ♂. **Coconi**, Maison de L'Office National des Forêts (156 m aasl, 12°50'1" S, 45°8'5" E), 2 ♀♀ on *Terminalia catappa* L. (Combretaceae), 24/XI/2018; **Combani**, gîte du Mont Combani (437 m aasl, 12°48'23" S, 45°9'17" E), 1 ♂ on *Cananga odorata* (Lamark) Hooker & Thomson (Annonaceae) or Ylang-Ylang, 25/XI/2018.

Remarks: the species was mentioned only once from Kenya and described based on a single female specimen. Morphological and morphometric characters and all measurements of our specimens (Table 6) fit well those of the original description by Ueckermann *et al.* (2008).

Typhlodromus (Anthoseius) lobatus Zannou, Moraes & Oliveira

Typhlodromus (Anthoseius) lobatus Zannou, Moraes & Oliveira in Ueckermann *et al.* 2008: 59.

This species belongs to the *rhenanus* species group (Chant and McMurtry 1994). The biology of that species is totally unknown. It was recently recorded from Rodrigues Island (Kreiter and Abo-Shnaf 2020a) and from Mauritius (Kreiter and Abo-Shnaf 2020b).

World distribution: Benin, Ghana, Mauritius Island, Rodrigues Island.

Specimens examined: 10 ♀♀ specimens in total. **Coconi**, Maison de L’Office National des Forêts (156 m aasl, 12°50’1” S, 45°8’5” E), 1 ♀ on *Persea americana* Miller (Lauraceae), 2 ♀♀ on *Terminalia catappa* L. Combretaceae) and 1 ♀ on an unknown host plant, 24/XI/2018; **Combani**, gîte du Mont Combani (437 m aasl, 12°48’23” S, 45°9’17” E), 1 ♀ on *Bidens pilosa* L. (Asteraceae), 25/XI/2018; **Coconi**, Lycée Agricole (189 m aasl, 12°50’7” S, 45°8’11” E), 1 ♀ on *Capsicum annuum* L. (Solanaceae), 2 ♀♀ on *Rubus alceifolius* Poirlet (Rosaceae), 1 ♀ on *Ageratum conizoides* L. (Asteraceae), and 1 ♀ on *Solanum mauritianum* Scopoli (Solanaceae), 26/XI/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens fit well with measurements of the original description by Ueckermann *et al.* (2008) concerning specimens from Ghana, in Western Africa and measurements of specimens from Rodrigues and Mauritius, respectively (Kreiter and Abo-Shnaf 2020a, b).

Table 6 Character measurements of adult females of *Typhlodromus (Anthoseius) greviae* collected in this study (localities followed by the number of specimens measured between brackets).

Characters	Mayotte (2) (this study)	Kenya (1, the holotype)	Characters	Mayotte (2) (this study)	Kenya (1, the holotype)
Dsl	288 – 308	298	Gensl	93	–
Dsw	168 – 180	179	Gensw st5	50	53
j1	15	Not visible	Gensw post. corn.	75	–
j3	15 – 20	16	Lisl	18 – 23	–
j4	13 – 15	16	Lisw	4	–
j5	15	16	sisl	10	–
j6	20	19	Vsl	95 – 100	99
J2	21 – 23	22	Vsw ZV2	83 – 90	90
J5	9 – 10	10	Vsw anus	68 – 75	–
r3	15	16	gv3 – gv3	26	–
R1	15 – 18	16	JV5	25 – 27	–
s4	18 – 20	19	StIV	17 – 18	18
s6	21 – 23	22	Scl	13 – 15	14
S2	26 – 28	24	Scw	5	–
S4	28	27	Fdl	25	23
S5	23	22	No teeth Fd	4	3 – 4
z2	13 – 15	14	Mdl	25 – 28	25
z3	15	14	No teeth Md	2	2
z4	15 – 18	18			
z5	18	18			
Z4	30 – 33	29			
Z5	33 – 35	35			
st1-st1	38	–			
st2-st2	53	61			
st3-st3	48	–			
st1-st3	55	58			
st4-st4	43	–			

Sources of measurements – Kenya: Ueckermann *et al.* (2008), original description base on a single female; – : not provided.

***Typhlodromus (Anthoseius) microbullatus* van der Merwe**

Typhlodromus (Anthoseius) microbullatus van der Merwe 1968: 33; Moraes *et al.* 2004: 338; Chant & McMurtry 2007: 155; Ueckermann *et al.* 2008: 67.

Amblydromella microbullata, Moraes *et al.* 1986: 167.

Amblydromella (Aphanoseia) microbullata, Denmark & Welbourn 2002: 308.

This species belongs to the *rhenanus* species group (Chant and McMurtry 1994). The biology of that species is totally unknown. It was recorded from Madagascar, Mozambique and South Africa (Ueckermann *et al.* 2008).

World distribution: Madagascar, Mozambique, South Africa.

Specimens examined: 5 specimens in total, 3 ♀♀, 1 ♂ and 1 im. **Combani**, grower farm (104 m aasl, 12°47'14" S, 45°7'57" E), 1 ♀ on *Theobroma cacao* L. (Malvaceae), 26/XI/2018; **L'Abattoir**, Dziani lake (23 m aasl, 12°46'14" S, 45°17'18" E), 1 ♀, 1 ♂ and 1 im. on *Artocarpus altilis* (Parkinson) Fosberg (Moraceae) and 1 ♀ on *Tamarindus indica* L. (Fabaceae), 27/XI/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens fit well those of specimens from South Africa in van der Merwe (1968) and Ueckermann *et al.* (2008).

Conclusion

The results of an additional survey made in 2018 in Mayotte Island is presented in this paper. A total of 18 new records: 13 Amblyseiinae, 1 Phytoseiinae and 4 Typhlodrominae, have been obtained, namely *Neoseiulus barkeri*, *N. teke*, *Paraphytoseius horrifera*, *P. orientalis*, *Typhlodromips shi*, *Amblyseius largoensis*, *A. parasundi*, *A. tamatavensis*, *Proprioseiopsis ovatus*, *Euseius ovaloides*, *Moraeseius papayana*, *Phytoseius haroldi*, *Chanteius contiguus*, *Typhlodromus (Anthoseius) lobatus*, *T. (A.) grewiae*, *T. (A.) microbullatus*. Two new species will be described in a following paper.

The fauna of Mayotte after our study is composed of 19 species: 13 Amblyseiinae, 2 Phytoseiinae and 4 Typhlodrominae. Unfortunately, we have not recovered the unique species known before our study, *Phytoseius mayottae* Schicha. Among the 18 newly recorded species, at least four species (*N. barkeri*, *A. largoensis*, *A. tamatavensis*, and *E. ovaloides*) are known as biological control agents (BCAs). In addition to the intrinsic value of phytoseiid mite biodiversity in tropical environments, demonstration of the natural occurrence of efficient BCAs in a developing country such as Mauritius is of great agricultural, commercial and strategic interests for the country.

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