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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, present 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 (Nduzuwani or Nzwan 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.
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 Microsystèmes 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 dorsal and by Chant & Yoshida-Shaul (1991) for the ventral. 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; lisw = 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; vsv Z1/2 & vsv anus = ventrianal shield width at Z1/2 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 (Rodriguez-Reina *et al.* 1992), *Thrips tabaci* (Lindeman) (Broodsgaard and Stengaard Hansen 1992) and *Tetranychus urticae* Koch on cucumbers (Fan and Petitt 1994b). Fan and Petitt (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 vegetable 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 (Demite *et al.* 2020).

**Specimens examined:** a single ♀ specimen collected during this study. L’Abattoir, City Center (15 m asl, 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 horrifer (Pritchard & Baker)**

*Amblyseius (Ptenoseius) horrifer* Pritchard & Baker 1962: 295.

*Amblyseius horrifer*, Meyer & Rodrigues 1966: 30.

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

*Proprioseius (Paraphytoseius) horrifer*, Karg 1983: 302.

*Paraphytoseius horrifer*, 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. horrifer* 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. horrifer* 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       | –              |
| j1         | 18 – 19                  | 18 (16 – 19)  | 18   | 15 (13 – 18)    | 20 | 19 – 23         | –              |
| j3         | 55                       | 44 (35 – 50)  | 39  | 46 (38 – 53)    | 50 | 62 – 67         | 61             |
| j4         | 30 – 33                  | 30 (23 – 36)  | 39  | 25 (23 – 28)    | 30 | 38 – 45         | 42             |
| j5         | 47 – 48                  | 42 (35 – 48)  | 39  | 39 (35 – 43)    | 45 | 47 – 54         | –              |
| j6         | 55                       | 48 (43 – 53)  | 42  | 47 (45 – 53)    | 54 | 62 – 66         | 60             |
| J2         | 62 – 63                  | 53 (45 – 59)  | 48  | 55 (50 – 58)    | 65 | 68 – 75         | 68             |
| J5         | 10 – 13                  | 11 (10 – 12)  | 9   | 11 (10 – 13)    | 10 | 12 – 14         | –              |
| r3         | 47 – 50                  | 40 (34 – 46)  | 37  | 44 (40 – 48)    | 50 | 54 – 66         | 61             |
| R1         | 48 – 40                  | 37 (27 – 48)  | 37  | 42 (40 – 45)    | 48 | 54 – 66         | 66             |
| s4         | 64 – 65                  | 60 (54 – 64)  | 55  | 60 (55 – 65)    | 66 | 75 – 82         | 71             |
| S2         | 68 – 71                  | 61 (56 – 67)  | 58  | 64 (60 – 68)    | 70 | 72 – 80         | –              |
| S4         | 51 – 55                  | 43 (40 – 48)  | 39  | 47 (43 – 60)    | 50 | 56 – 63         | –              |
| S5         | 45 – 48                  | 32 (23 – 40)  | 34  | 36 (28 – 38)    | 40 | 46 – 52         | 48             |
| z2         | 58                       | 49 (41 – 54)  | 46  | 51 (48 – 53)    | 56 | 66 – 71         | 62             |
| z4         | 56 – 58                  | 51 (43 – 56)  | 48  | 50 (48 – 50)    | 54 | 68 – 75         | 65             |
| z5         | 35 – 38                  | 39 (29 – 38)  | 35  | 25 (23 – 28)    | 25 | 33 – 44         | 42             |
| Z1         | 60 – 63                  | 53 (45 – 62)  | 44  | 54 (50 – 58)    | 55 | 71 – 77         | 65             |
| Z4         | 65 – 68                  | 60 (54 – 67)  | 55  | 57 (50 – 63)    | 66 | 66 – 74         | –              |
| Z5         | 70 – 78                  | 65 (59 – 74)  | 58  | 68 (65 – 73)    | 76 | 80 – 90         | –              |
| st1-st1    | 45                       | –           | –   | 44 (43 – 48)    | –  | –              | –              |
| st2-st2    | 54 – 56                  | 58 (56 – 63)  | 53  | 55 (53 – 58)    | –  | –              | –              |
| st3-st3    | 68 – 69                  | –           | –   | 67 (61 – 70)    | –  | 63 – 67         | –              |
| st1-st3    | 60                       | 56 (53 – 58)  | 53  | 60 (55 – 63)    | –  | 56 – 59         | –              |
| st4-st4    | 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 ZIV2   | 95 – 103                 | 97 (93 – 102) | 80  | 90 (83 – 95)    | 100 | 95 – 100        | 95             |
| Vsw anus   | 75                       | –           | –   | 71 (63 – 80)    | –  | –              | –              |
| gv3 – gv3 | 20 – 23                  | –           | –   | –              | –  | –              | –              |
| JV5        | 68                       | –           | 55  | 57 (55 – 63)    | 64 | 66 – 72         | –              |
| StIV       | 63 – 65                  | 66 (51 – 77)  | 65  | 69 (48 – 75)    | 75 | 75 – 78         | 72             |
| Sc1        | 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              | –              |
| 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-Banawy & 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 ♀♀ on an unknown host plant, 24/XI/2018; *Mirérénì* (356 m aasl, 12°47′45″ S, 45°9′28″ E), 1 ♀ + 2 ♂♂ on *Rubus alceifolius* Poiret (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 narayani* Ehara 1967: 67 (synonymy according to Chant & McMurtry 2003b).

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**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) | Mayotte (1) (this study) | La Réunion (2) | Madagascar (5) | South Africa (2) |
|------------|--------------------------|----------------|----------------|------------------|--------------------------|----------------|----------------|------------------|
| Dsl        | 225                      | 225 – 230      | 260            | 270 – 285        | st1-st1                 | 40             | –              | –                |
| Dsw        | 150                      | 150            | 170            | 197 – 200        | st2-st2                 | 49             | –              | –                |
| j1         | 15                       | 10 – 13        | 15             | 15 – 18          | st3-st3                 | 51             | –              | –                |
| j3         | 30                       | 25 – 33        | 34             | 40 – 46          | st1-st5                 | 98             | 95             | –                |
| 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             | 112 – 131        |
| J2         | 38                       | 33 – 38        | 35             | 40 – 46          | Vsw ZV2                 | 130            | 125 – 140      | –                |
| J5         | 11                       | 8 – 13         | 9              | 11               | Vsw amus                 | 60             | 50             | –                |
| r3         | 20                       | 23 – 28        | 30             | 26 – 34          | gv3 – gv3                | 15             | –              | –                |
| R1         | 20                       | 23             | 24             | 26 – 34          | JV5                      | 28             | 28 – 33        | 33 – 40          |
| s4         | 44                       | 43 – 48        | 45             | 54 – 59          | StIV                     | 43             | 50 – 53        | 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          | –                        | –              | –              | –                |
| Z4         | 44                       | 40 – 45        | 42             | 46 – 54          | –                        | –              | –              | –                |
| Z5         | 46                       | 45 – 50        | 50             | 54 – 59          | –                        | –              | –              | –                |

**Sources of measurements – Madagascar** (Identified as *Amblyseius bibens*, but synonymized by Ueckermann & Loots 1988); –: not provided.
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 *s*4, *Z*4 and *Z*5, 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. horrifer* 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)

Amblyseius 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: 2.
Amblyseius largoensis, Muma 1961: 287.
Amblyseius largoensis, Swirski & Golan 1967: 2.
Amblyseius largoensis, Ehara 1966: 22.
Amblyseius largoensis, Swirski & Golan 1967: 2.
Amblyseius largoensis, 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 amtalensis 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

| Characters | Mayotte (1) | Africa (20) | Angola (?) | Madagascar (1?) |
|------------|-------------|-------------|------------|----------------|
| Dsl        | 320         | 332 (310 – 347) | 347 – 362 | 320           |
| Dsw        | 205         | 217 (200 – 226) | 223 – 246 | 230           |
| j1         | 15          | 16 (13 – 21) | 19         | 15            |
| j3         | 18          | 19 (16 – 24) | 19         | 18            |
| j4         | 8           | 10 (8 – 13) | 11         | 10            |
| j5         | 8           | 10 (8 – 11) | 11         | 10            |
| j6         | 9           | 12 (10 – 13) | 12         | 10            |
| J2         | 10          | 13 (11 – 14) | 16         | 12            |
| J5         | 8           | 8 (8 – 10) | 9          | 8             |
| r3         | 15          | 14 (11 – 16) | 16         | 12            |
| R1         | 9           | 11 (8 – 13) | 13         | 12            |
| s4         | 15          | 21 (16 – 26) | 19         | 18            |
| S2         | 10          | 11 (8 – 13) | 13         | 12            |
| S4         | 8           | 10 (8 – 13) | 11         | 10            |
| S5         | 8           | 9 (8 – 10) | 9          | 10            |
| z2         | 13          | 12 (11 – 13) | 13         | 14            |
| z4         | 10          | 12 (10 – 13) | 13         | 10            |
| z5         | 8           | 10 (8 – 11) | 9          | 10            |
| Z1         | 11          | 13 (13 – 14) | 14         | 16            |
| Z4         | 23          | 31 (22 – 37) | 29 – 34    | 26            |
| Z5         | 68          | 67 (53 – 74) | 72         | 60            |
| st1-st1    | 50          | –           | –          | –             |
| st2-st2    | 60          | 63 (59 – 66) | –          | –             |
| st3-st3    | 65          | –           | –          | –             |
| st1-st3    | 50          | 54 (50 – 58) | –          | –             |
| st4-st4    | 75          | –           | –          | –             |

Sources of measurements – Africa (Benn: 3♀; Cameroon: 2♀; Ghana: 1♀; Kenya: 3♀; Mozambique: 1♀; Democratic Republic of Congo: holotype): Moraes et al. (2007); Angola: Ueckermann & Loots (1988); Madagascar (Identified as Amblyseius toloaeae, but synonymized by Ueckermann & Loots 1988): Blommers (1974); –: not provided.
most abundant species collected by Moraes et al. (2000) in French Caribbean Islands and as a potential BCA of Ruoella 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 Amblyseius 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, Dziaini lake (23 m aasl, 12°46′14″ S, 45°17′18″ E), 1 ♂ and 2 im. on Phoenix dactylifera L. (Arecaceae) and 1 ♂ on Artocarpus altulis (Parkinson) Fosberg (Moeaceae) 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 & Muna 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 ♀♀ on Terminalia catappa L. (Combretaceae), 24/XI/2018; Miréréni (356 m aasl, 12°47′45″ S, 45°9′28″ E), 1 ♀ on Calophyllum inophyllum Poiret (Calophyllaceae) and 1 ♀ on Pieridium aequilimum (L.) Kuhn (Dennstaedtiaceae), 24/XI/2018; Combani, gîte du Mont Combani (437 m aasl, 12°48′1″ S, 45°7′12″ E), 2 ♀♀ on Artocarpus heterophyllus Lamark (Moeaceae), 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 altulis (Parkinson) Fosberg (Moeaceae), 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. altulis, 1 ♀ on Mangifera indica L. (Anacardiaceae), 1 ♀ on Syngonium podophyllum Schott (Araeaceae) 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, Dziaini lake (23 m aasl, 12°46′14″ S, 45°17′18″ E), 1 ♀ on A. altulis, 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 (j3, r3) 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 & Matthysse in Matthysse & 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* 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

| Characters | Mayotte (12) (this study) | Madagascar 1 (1) | Madagascar 2 (?) |
|------------|--------------------------|------------------|-----------------|
| Dsl        | 364 (338–405)            | 370              | 361–370         |
| Dsw        | 224 (195–258)            | 290              | 235             |
| j1         | 37 (31–44)               | 40               | 42              |
| j3         | 46 (43–48)               | 52               | 51              |
| j4         | 4 (3–5)                  | 3                | 5               |
| j5         | 4 (3–5)                  | 3                | 5               |
| j6         | 5 (3–6)                  | 3                | 6               |
| J2         | 5 (3–6)                  | 5                | 7               |
| J5         | 6 (4–8)                  | 4                | 6               |
| r3         | 12 (10–15)               | 22               | 20              |
| R1         | 8 (7–10)                 | 10               | 12              |
| s4         | 168 (135–183)            | 165              | 153             |
| s2         | 8 (5–8)                  | 7                | 6               |
| s4         | 8 (6–9)                  | 9                | 7               |
| s5         | 7 (6–8)                  | 7                | 6               |
| z2         | 7 (5–9)                  | 10               | 6               |
| z4         | 6 (5–7)                  | 6                | 6               |
| z5         | 4 (3–5)                  | 3                | 5               |
| Z4         | 170 (140–190)            | 170              | –               |
| Z5         | 475 (438–520)            | 430              | 426             |

**Sources of measurements – Madagascar 1: Blommers (1974); Madagascar 2: Denmark & Muma (1989); –: not provided.**
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. *Amblyseius (Amblyseius) ovatus*, Chant 1959: 90. *Amblyseius 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; Mailoux et al. 2010; Kreiter et al. 2018c). It was found in very large number only during a previous study on companion plant in Guadeloupe (Mailoux 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 (Proprioseiospsis) 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 st5  | 63                        | 78        | –                |
| j1         | 35 – 38                  | 42 (41 – 43)  | 38 – 42          | Gensw post. cor. | 95           | –         | 97 – 102         |
| j3         | 55 – 64                  | 84 (78 – 89)  | 78 – 83          | Lisl       | 25 – 30                   | –         | –                |
| j4         | 4                       | 8           | 5 – 10           | Lisw       | 3                       | –         | –                |
| j5         | 4                       | 7 (5 – 8)   | 5 – 10           | Sisl       | Not visible               | –         | –                |
| j6         | 7 – 8                    | 11          | 5 – 10           | Vsl        | 80                       | 86        | 103 – 107       |
| J2         | 9                       | 11          | 12 – 14          | Vsw ZV2    | 50                       | 59        | –                |
| J5         | 6                       | 5           | 5 – 10           | Vsw anus   | 65 – 75                   | 70        | 78 – 83         |
| r3         | 14                      | 23 (22 – 25) | –                | gv3 - gv3 | 30                       | –         | –                |
| R1         | 13 – 14                  | 15 (14 – 16) | –                | JV5        | 75 – 80                   | –         | 100 – 103       |
| s4         | 113 – 135                | 151        | 145 – 152        | Sgel       | 25                       | 30        | –                |
| S2         | 35 – 40                  | 34 (32 – 35) | 28 – 35          | SgelII     | 25 – 28                   | 30        | –                |
| S4         | 33 – 38                  | 28 (27 – 30) | 28 – 35          | SgelIII    | 34                       | 38        | –                |
| S5         | 38 – 43                  | 38 (35 – 41) | 28 – 35          | StIII      | 35                       | 32        | –                |
| z2         | 24 – 30                  | 35 (32 – 38)| 37 – 46;         | SgelIV     | 48 – 50                   | 62 (59 – 65)| 59 – 61       |
| z4         | 100                     | 123 (122 – 124)| 112 – 120      | StIV       | 40 – 45                   | 49        | 54 – 57         |
| z5         | 4                       | 8           | 7 – 9            | StIV       | 100 – 103                 | 119 (116 – 122)| 121 – 126    |
| Z4         | 114 – 120                | 134 (127 – 140)| 130 – 136     | Scl        | 30 – 38                   | 26 (25 – 27)| 45             |
| Z5         | 110 – 113                | 115 (111 – 119)| 130 – 136     | Sew        | 5                        | –         | –                |
| st1-st1    | 56 – 60                  | –           | –                | Fdl, No teeth Fd | 23 - 25, 6 | –        | –, 6           |
| st2-st2    | 68                      | 66 (65 – 68)| –                | Mdl, No teeth Md | 23 - 25, 1 | –        | –, 1           |

**Sources of measurements –** Kenya (identified as *Enoseius papayana* and named *Moraeseius papayana* by Chant & McMurtry 2005b); Moraes et al. (2001); South Africa: van der Merwe (1965); – : not provided.
**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 & Yoshiida-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 & Yoshiida-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 aquilinum* (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 redescriptions 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 Poiret (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).

| Characters | Mayotte (2) (this study) | Kenya (1, the holotype) |
|------------|-------------------------|------------------------|
| Dsl        | 288 – 308               | 298                    |
| Dsw        | 168 – 180               | 179                    |
| j1         | 15                      | Not visible            |
| j3         | 15 – 20                 | 16                     |
| j4         | 13 – 15                 | 16                     |
| j5         | 15                      | 16                     |
| j6         | 20                      | 19                     |
| J2         | 21 – 23                 | 22                     |
| J5         | 9 – 10                  | 10                     |
| r3         | 15                      | 16                     |
| R1         | 15 – 18                 | 16                     |
| s4         | 18 – 20                 | 19                     |
| s6         | 21 – 23                 | 22                     |
| S2         | 26 – 28                 | 24                     |
| S4         | 28                      | 27                     |
| S5         | 23                      | 22                     |
| z2         | 13 – 15                 | 14                     |
| z3         | 15                      | 14                     |
| 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 horrisfer, 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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