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Phytoseiid mites (Acari: Mesostigmata) of Mohéli Island (Comoros Archipelago)

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Original research

ABSTRACT

Mohéli is one of the four main islands constituting Comoros Archipelago, with Mayotte, Anjouan and Grande Comore Islands. It is the third Island closer from Madagascar after Mayotte and Anjouan. So far, no species of the mite family Phytoseiidae had been reported from this island. We report in this paper the results of a survey conducted at the end of 2018 in Mohéli Island, in which 18 species have been recorded.

Keywords survey; collection; taxonomy; systematics

Introduction

Mites of the family Phytoseiidae are all predatory species on phytophagous mites and small insects like thrips and whiteflies, on commercial plants and the wild vegetation. Several species are biological control agents for the control of pest organisms in both open and protected crops 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, and consists of 2,521 valid species in 94 genera belonging to three subfamilies (Demite *et al.* 2020).

Biodiversity surveys in poorly investigated areas is still urgently 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, d; Kreiter and Abo-Shnaf 2020a, b, Kreiter *et al.* 2021).

In these perspectives, the more interesting area are probably those with a high level of biodiversity. Most of the Indian Ocean constitutes one of the highest world biodiversity area, those area being called hotspots, 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 agents (BCA) and future establishment of conservation programs.

Located in the Indian Ocean at around 1,000 km from the northern coast of Madagascar, 165 km from Mayotte and about only 70 km from Anjouan and Grande Comore Islands, Mohéli (Mwali in Shicomori language) Island is one of the four main islands constituting Comoros Archipelago, with Mayotte, Anjouan and Grande Comore. No phytoseiid species are known from this island.

The objective of this paper is to present the phytoseiid species reported in a survey conducted in early December 2018 in Mohéli Island.

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Material and methods

The survey took place in Mohéli in the very beginning of December 2018. Plant inhabiting mites were collected from cultivated and wild plants in few locations mainly in the southern part of the island.

Mites were directly collected on leaves with a fine brush with or without a pocket lens or a stereoscopic microscope when available (large leaves 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). Collected mites were then transferred with a fine brush into small plastic vials containing 1.5 ml of 70% ethanol.

The mites were then all slide-mounted in Hoyer's medium (Walter and Krantz 2009), the slides were dried at 45-50 °C for at least two weeks and then all examined and identified using a phase and interferential contrast microscope (DMLB, Leica Microsystèmes SAS, Nanterre, France). 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 (1989) for the dorsal surface and by Chant & Yoshida-Shaul (1991) for the ventral surface. Pore (= solenostome) and poroid (= lyrifissure) notations are that of Athias-Henriot (1975). Macrosetal notation (***Sge*** = genual macroseta; ***Sti*** = tibial macroseta; ***St*** = tarsal macroseta) are that of Muma and Denmark (1970). Numbers of teeth on the fixed and movable cheliceral digits do not include the respective apical teeth. Setae not referred to in 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. Type of spermatheca or insemination apparatus are that of Denmark and Evans 2011. Only some species with only few measurements mentioned in the literature are provided in this paper. Classification of plants follows the APG IV classification of 2016 (ex. Byng *et al.* 2018). Specimens collected in fields in Mohéli Island within these surveys were all identified. Only very few single males or immatures collected during this study are not taken into account.

Specimens of each species are deposited in the mite collections of Montpellier SupAgro conserved in UMR CBGP INRA/IRD/CIRAD/SupAgro/University of Montpellier.

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*st5*** = genital shield width at level of steae *st5*; **gensw post. cor.** = genital shield width at level of posterior corners; **lisl** = primary or largest inguinal sigilla (= "metapodal plate") length; **lisw** = primary or largest inguinal sigilla (= "metapodal plate") width; **sisl** = secondary or smallest inguinal sigilla (= "metapodal plate") length; **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 total length; **scw** = calyx widest width; **Fdl** = fixed digit length; **Mdl** = movable digit length; **Nb teeth Fd** = number of teeth on the fixed digit; **Nb 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; **imm.**: immature.

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; **INRAPE** = Institut National de Recherche pour l'Agriculture, la Pêche 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 had been found during this study, 16 presented thereafter (two new species, one *Paragigagnathus* **n. sp.** (Tribe Neoseiulini) and one *Typhlodromalus* **n. sp.** (Tribe Euseiini) found also in other islands will be published later on, five of them with new measurements compared to the only few references already available in the literature.

Subfamily Amblyseiinae Muma

Amblyseiinae Muma 1961: 273.

Tribe Neoseiulini Chant & McMurtry

Neoseiulini Chant & McMurtry 2003a: 6.

Genus *Neoseiulus* Hughes

Neoseiulus Hughes 1948: 141.

Neoseiulus teke (Pritchard & 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 and 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 as BCA against the CGM. Nwilene and Nachman (1996) studied its reproduction characteristics on *M. tanajoa*. It was more efficient than *I. degenerans*, but seems not efficient enough in field conditions (Nwilene and Nachman 1996). Quilici *et al.* (2000) had collected this species before in La Réunion Island and it was recovered recently by Kreiter *et al.* (2020d).

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

Specimens examined: 2 specimens (2 ♀♀) in total. **Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 1 ♀ on *Abutilon hirtum* (Lamarck) Sweet (Malvaceae), 2/XII/2018; **Fomboni**, University (25 m aasl, 12°17′3″ S, 43°44′34″ E), 1 ♀ on *Zyzyphus mauritiana* Lamarck (Malvaceae), 3/XII/2018.

Remarks: measurements of morphological characters of *Neoseiulus teke* female and male specimens from Mohéli Island are very close to measurements for specimens from neighbouring countries, especially from specimens from Mayotte (Kreiter *et al.* 2020a), La Réunion Island (Keiter *et al.* 2020d) 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; Chant & McMurtry 2003b: 189, 2006: 137, 2007: 33.

Subtribe Paraphytoseiina Chant & McMurtry

Paraphytoseiina Chant & McMurtry 2003b: 211.

Genus *Paraphytoseius* Swirskii & Shechter

Paraphytoseius Swirski & Shechter 1961: 113; Moraes *et al.* 1986: 104, 2004a: 160; Chant & McMurtry 2003b: 216, 2007: 49.

Paraphytoseius orientalis (Narayanan, Kaur & Ghai)

Typhlodromus (*Amblyseius*) *orientalis* Narayanan, Kaur & Ghai 1960: 394.
Paraphytoseius orientalis, Moraes *et al.* 1986: 105, 2004a: 162; Chant & McMurtry 2003b: 220, 2007: 53.
Amblyseius ipomeai, Narayanan, Kaur & Ghai 1960: 394 (synonymy according to El-Banhawy 1984).
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 Ehara & Ghai, in Ehara 1967).

This species belongs to the *orientalis* species group (Chant and McMurtry 2003b). Our specimens with relatively shorter setae *s4*, *Z4* and *Z5*, 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) had studied the life history of *P. orientalis* on the broad mite (*Polyphagotarsonemus latus*) (Banks) as prey and reported high predation rates on the eggs of *P. latus*, suggesting good potential for the control of this pest.

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

Specimens examined: 3 specimens (2 ♀♀ and 1 ♂) in total. **Bandar-Es-Salam**, Les Abous Inn (23 m aasl, 12°17′37″ S, 43°45′27″ E), 2 ♀♀ and 1 ♂ on *Solanum pyracanthos* Lamarck (Solanaceae), 2/XII/2018.

Remarks: morphological and morphometric characters and all measurements fit well measurements in Ferragut and Baumann (2019) and Kreiter *et al.* (2020d). This species was described from Asia (Narayanan *et al.* 1960) and presented also in Mauritius (Ferragut and Baumann 2019; Kreiter *et al.* 2018a; Kreiter and Abo-Shnaf 2020b), Mayotte (Kreiter *et al.* 2020a), Vietnam (Kreiter *et al.* 2020b), and in La Réunion Island (Kreiter *et al.* 2020d).

Tribe Amblyseiini Muma

Amblyseiinae Muma 1961: 273 and Amblyseiini Muma, Wainstein 1962: 26.

Subtribe Amblyseiina Muma

Amblyseiina Muma, Chant & McMurtry 2004: 179.

Genus *Amblyseius* Berlese

Amblyseius Berlese 1914: 143.

Amblyseius duplicesetus Moraes & McMurtry

Amblyseius duplicesetus Moraes & McMurtry 1988: 13; Moraes *et al.* 2004a: 143, 2004b: 22; Zannou *et al.* 2007: 10; El-Banhawy & Knapp 2011: 25.
Amblyseius duplicisetus [sic], Chant & McMurtry 2004: 208, 2007: 78.

Like the previous species and for the same reasons, *A. duplicesetus* belongs to the *largoensis* species group and to the *largoensis* species subgroup (Chant and McMurtry 2004a, 2007). First of all found only in Kenya (Moraes and McMurtry 1988; Zannou *et al.* 2007; El-Banhawy

and Knapp 2011) and more recently in Sri Lanka (Moraes *et al.* 2004a), its biology is totally unknown. This is the second mention of that species in Indian Ocean Islands after Anjouan (Kreiter *et al.* 2021).

World distribution: Kenya, Sri Lanka.

Specimens examined: 55 specimens (30 ♀♀, 11 ♂♂ and 14 imm) collected during this study. **Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 1 ♀ and 1 ♂ on *Annona muricata* L. (Annonaceae), 2/XII/2018; **Fomboni**, Les-Hauts (60 m aasl, 12°17′29″ S, 43°44′35″ E), 2 ♂♂ and 3 imm. on an unknown host plant, 2/XII/2018; **Fomboni**, University (25 m aasl, 12°17′3″ S, 43°44′34″ E), 1 ♀ on *Ricinus communis* L. (Euphorbiaceae), 3/XII/2018; **Hoani**, inside village (38 m aasl, 12°17′3″ S, 43°44′34″ E), 5 ♀♀, 1 ♂ and 2 imm. on the same unknown host plant than above, 1 ♀, 1 ♂ and 2 imm. on *A. muricata*, 10 ♀♀, 2 ♂♂ and 1 imm. on *Artocarpus altilis* J.R. Forster and G. Forster (Moraceae) and 4 ♀♀, 1 ♂ and 3 imm. on *Theobroma cacao* L. (Malvaceae), 3/XII/2018; **Bangoma**, Les Hauts (137 m aasl, 12°17′18″ S, 43°43′41″ E), 1 ♂ on *Cinnamomum odoratum* Schäffer (Lauraceae), 3 ♀♀ and 2 imm. on *Annona senegalensis* Persoon (Annonaceae), 1 ♀ on *A. muricata*, 1 ♀ on *Mangifera indica* L. (Anacardiaceae), 2 ♀♀ and 1 ♂ on *A. altilis* and 1 ♀, 1 ♂ and 1 imm. on *Persea americana* Miller (Lauraceae), 4/XII/2018.

Remarks: this is the more abundant species found in several sites. All measurement values fit well those already published on this species with only very slight variations (Moraes and McMurtry 1988; Moraes *et al.* 2004a; Zannou *et al.* 2007; El-Banhawy and Knapp 2011; Kreiter *et al.* 2021). Measurement values of female specimens of Mohéli are very similar with values for specimens from Kenya and Sri Lanka, however with some shorter setae just like specimens of Anjouan (Kreiter *et al.* 2021). The male of that species will be redescribed in following papers.

Amblyseius herbicolus (Chant)

Typhlodromus (*Amblyseius*) *herbicolus* Chant 1959: 84.
Amblyseius (*Amblyseius*) *herbicolus*, Muma 1961: 287.
Typhlodromus herbicolus, Hirschmann 1962: 23.
Amblyseius herbicolus, Moraes *et al.* 1986: 14, 1989: 79, 2004b: 27; Chant & McMurtry 2004: 208, 2007: 78.
Amblyseius impactus Chaudhri 1968: 553 (synonymy according to Daneshvar & Denmark 1982).
Typhlodromus (*Amblyseius*) *amitae* Bhattacharyya 1968: 677 (synonymy according to Denmark & Muma 1989).
Amblyseius deleoni Muma & Denmark 1970: 68 (synonymy according to Daneshvar & Denmark 1982).
Amblyseius giganticus Gupta 1981: 33 (synonymy according to Gupta 1986).
Amblyseius (*Amblyseialus*) *thermophilus* Karg 1991: 12 (synonymy according to El-Banhawy & Knapp 2011).

This species belongs to the *largoensis* species group as setae *J2* and *Z1* are present, setae *s4* are minute and the ventrianal shield of the female is vase-shaped. It belongs to the *largoensis* species subgroup as setae *Z4* are long, spermatheca has the calyx elongate and the female ventrianal shield is entire (Chant and McMurtry 2004).

Amblyseius herbicolus is widespread in all tropical and subtropical regions of the world. It is the second most abundant phytoseiid mite on *Coffea arabica* L. in Brazil, associated with *Brevipalpus phoenicis* (Geijskes), vector of the coffee ring spot virus and it was found to be an efficient predator (Reis *et al.* 2007). *Amblyseius herbicolus* is also found associated with the broad mite, *P. latus*, in crops such as chili pepper (*Capsicum annuum* L.) in Brazil and has also a good potential for controlling the pest. Rodriguez-Cruz *et al.* (2013) had studied biological, reproductive and life table parameters of *A. herbicolus* on three different diets: broad mites, castor bean pollen (*Ricinus communis* L.) and sun hemp pollen (*Crotalaria juncea* L.). The

predator was able to develop and reproduce on all three these diets. However, its intrinsic growth rate was higher on broad mites and castor bean pollen. Feeding on alternative food such as pollen can facilitate the predator's mass rearing and maintain its population on crops when prey is absent or scarce. Many polyphagous generalist phytoseiid mites are important natural enemies because they can feed on plant provided pollen and various prey species, and thus persist in crops even in the absence of target pests (McMurtry *et al.* 2013). Hence, populations of these predators can be established in a crop by providing alternative food, thus increasing biological control. Alternative food affects *P. latus* control on chilli pepper plants by predatory mites (Duarte *et al.* 2015). *Amblyseius herbicolus* had high oviposition and population growth rates when fed with cattail pollen (*Typha latifolia* L.), chilli pepper pollen and bee-collected pollen, and a low rate on the alternative prey (*Tetranychus urticae* Koch). Supplementing pepper plants with pollen resulted in better control of broad mite populations (Duarte *et al.* 2015). Release of *A. herbicolus* on young plants with weekly addition of honeybee pollen or cattail pollen until plants produce flowers seems a viable strategy to sustain populations of this predator (Duarte *et al.* 2015).

World distribution: Argentina, Australia, Azores, Benin, Brazil, Burundi, Canary Islands, China, Colombia, Grande Comore Island, Costa Rica, Dominican Republic, Dr Congo, El Salvador, Ghana, Guadeloupe Island, Guatemala, Hawaii, Honduras, India, Iran, Kenya, Les Saintes, La Réunion and Madagascar Islands, Malawi, Malaysia, Martinique Island, New Caledonia Island, Papua New Guinea, Peru, Philippines, Portugal, Puerto Rico, Rwanda, Senegal, Singapore, South Africa, Spain, Taiwan, Thailand, Turkey, USA, Venezuela, West Indies.

Specimens examined: 18 specimens (10 ♀♀, 5 ♂♂ and 3 imm.) collected during this study. **Hoani**, inside village (38 m aasl, 12°17′3″ S, 43°44′34″ E), 1 ♂ on *Theobroma cacao* L. (Malvaceae), 3/XII/2018; **Bangoma**, top of the village (42 m aasl, 12°17′15″ S, 43°43′40″ E), 2 ♀♀ and 1 imm. on *Morinda citrifolia* L. (Rubiaceae), 1 ♂ on *Dendrocnide moroides* (Weddel) Chew (Urticacae), 4/XII/2020; **Bangoma**, Les Hauts (137 m aasl, 12°17′18″ S, 43°43′41″ E), 1 ♂ and 1 imm. on *Asplenium petiolulatum* Mettenius (Aspleniaceae), 1 ♀ and 1 imm. on *Cinnamomum odoratum* Schäffer (Lauraceae), 1 ♀ and 1 ♂ on *Annona muricata* L. (Annonaceae), 3 ♀♀ on *Mangifera indica* L. (Annacardiaceae), 1 ♂ on *Litchi chinensis* Sonnerat (Sapindaceae), 2 ♀♀ on *Artocarpus altilis* J.R. Forster and G. Forster (Moraceae) and 1 ♀ on an unknown host plant, 4/XII/2018.

Remarks: morphological and morphometric characters and all measurements fit well measurements provided in Kreiter *et al.* (2018b, 2020c, d). *Amblyseius herbicolus* was previously recorded in a lot of countries world-wide and especially in French West Indies (Moraes *et al.* 2000, Kreiter *et al.* 2006). It was first reported by Kreiter *et al.* (2018b) in the Comoros Archipelago in Grande Comore Island with two females collected. *Amblyseius herbicolus* was reported in the past from La Réunion Island from few specimens (Quilici *et al.* 1997, 2000) and more recently from a lot of specimens (Kreiter *et al.* 2020d). It is also reported recently from Vietnam (Kreiter *et al.* 2020c), Rodrigues and Maurice Islands (Kreiter and Abo-Shnaf 2020a, b) but only from females.

The five male specimens of that species collected in this study will be redescribed in a following paper.

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, 2004b: 33; Chant & McMurtry 2004: 208, 2007: 78.

Amblyseius magnolia Muma 1961: 289 (synonymy by Denmark & Evans 2011).
Amblyseius sakalava Blommers 1976: 96 (synonymy by Ueckermann & Loots 1988).
Amblyseius amtalaensis Gupta 1977: 53 (synonymy by Gupta 1986).

Amblyseius largoensis belongs to the *largoensis* species group and to the *largoensis* species subgroup. It is widespread in all tropical and subtropical regions of the world and was the 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 Rodrigues Island by Kreiter and Abo-Shnaf (2020a), from Mauritius Island by Ferragut and Baumann (2019) and Kreiter and Abo-Shnaf (2020b) and from Mayotte by Kreiter *et al.* (2020a).

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

Specimens examined: 24 specimens (16 ♀♀, 5 ♂♂ and 3 imm.) collected during this study.**Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 11 ♀♀, 4 ♂♂ and 1 imm. on *Terminalia mantaly* H. Perrier (Combretaceae), 1 imm. on *Pentas lanceolata* (Forskål) Deflers (Rubiaceae) and 1 ♀ on *Artocarpus altilis* J.R. Forster and G. Forster (Moraceae), 2/XII/2018; **Bandar-Es-Salam**, Les Abous Inn (23 m aasl, 12°17′37″ S, 43°45′27″ E), 2 ♀♀, 1 ♂ and 1 imm. on *Citrus limon* (L.) Burman (Rutaceae), 2/XII/2018; **Hoani**, inside village (38 m aasl, 12°17′3″ S, 43°44′34″ E), 2 ♀♀ on *Amaranthus viridis* L. (Amaranthaceae), 3/XII/2018.

Remarks: morphological and morphometric characters and all measurements of the Mohéli specimen 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, by Ferragut and Baumann (2019) and Kreiter and Abo-Shnaf (2020b) for specimens from Mauritius Island and by Kreiter and Abo-Shnaf (2020a) for specimens from Rodrigues Island.

Tribe Euseiini Chant & McMurtry

Euseiini Chant & McMurtry 2005a: 191.

Subtribe Euseiina Chant & McMurtry

Euseiina Chant & McMurtry 2005a: 209.

Genus *Euseius* Wainstein

Amblyseius (*Amblyseius*) section *Euseius* Wainstein 1962: 15; *Euseius* De Leon 1966: 86.

Euseius baetae (Meyer & Rodrigues)

Amblyseius baetae (Meyer & Rodrigues, 1966): 28.
Euseius baetae (Meyer & Rodrigues), Moraes *et al.* 1986: 37, 2001: 11, 2004b: 62; Chant & McMurtry 2005b: 215; 2007: 120; El Banhawy & Knapp, 2011: 36.
Amblyseius (*Amblyseius*) *kangwanensis* Ueckermann & Loots 1988: 85 (synonymy according to Ueckermann & Loots, 1988).

The 200 species of the genus *Euseius* are considered as Type IV species, polliniphagous generalists (McMurtry and Croft 1997; McMurtry *et al.* 2013). Like the previous *Euseius* species, the biology of *E. baetae* is however totally unknown.

Specimens examined: seven specimens (5 ♀♀, 1 ♂ and 1 imm.) collected during this study. **Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 3 ♀♀ on *Senna siamea* (Lamarck) Irwin & Barneby (Fabaceae), 2/XII/2018 and 1 ♂ and 1 imm. on *Pterocarpus indicus* Willdenow (Fabaceae, 4/XII/2018; **Bangoma,** Bridge (11 m aasl, 12°17′2″ S, 43°45′5″ E), 3 ♀♀ on *Averroha carambola* L. (Oxalidaceae), 4/XII/2018.

Previous record: Congo, Grande Comore, Kenya, Malawi, Mozambique, South Africa.

Remarks: measurements of the five females (Table 1) and one male (Table 2) fit well with the measurements from the literature with slightly shorter dimensions in general, except concerning specimens from Grande Comore (Kreiter *et al.* 2018b), the neighboring island in the West less than 40 km from coasts of Mohéli. These specimens have almost identical measurements.

Euseius hima (Pritchard & Baker)

Amblyseius (*Amblyseius*) *hima* Pritchard & Baker 1962: 257; Blommers 1976: 89.
Euseius hima, Moraes *et al.* 1986: 46, 2004b: 71; Quilici *et al.* 2000: 99; Chant & McMurtry 2005a: 215, 2007: 121.

The 200 species of the genus *Euseius* are considered as Type IV species, polliniphagous generalists (McMurtry and Croft 1997; McMurtry *et al.* 2013). The biology of this species, however, remains totally unknown.

World distribution: Cameroon, Equatorial Guinea, La Réunion Island, Madagascar Island.

Specimens examined: six specimens (6 ♀♀) collected during this study. **Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 6 ♀♀ on *Pentas lanceolata* (Forskål) Deflers (Rubiaceae), 2/XII/2018.

Remarks: this species was recorded from several countries of Sub-Saharan Africa, but also from India (Demite *et al.* 2020), La Réunion (Quilici *et al.* 2000; Kreiter *et al.* 2020d), Madagascar (Blommers 1976), Mauritius (Kreiter and Abo-Shnaf 2020b) and Anjouan (Kreiter *et al.* 2021). Morphological and morphometric characters and all measurements of our specimens fit well measurements published in Kreiter *et al.* (2020d) and with measurements of specimens from Mauritius Island (Kreiter and Abo-Shnaf 2020b).

Euseius rhusi (van der Merwe)

Amblyseius (*Amblyseius*) *rhusi* van der Merwe 1965: 63.
Euseius rhusi Moraes *et al.* 1986: 52.
Typhlodromalus rhusi Moraes *et al.* 2004b: 203.
Euseius rhusi Chant & McMurtry 2005a: 215, 2007: 123.

Species of *Euseius* are classified as type IV = polliniphagous generalists (McMurtry and Croft 1997; McMurtry *et al.* 2013). The biology of this species, however, is totally unknown.

World distribution: Burundi, Colombia, Kenya, Mozambique, La Réunion Island, Rwanda, South Africa.

Specimens examined: A single female was collected during this study. **Fomboni**, University (25 m aasl, 12°17′3″ S, 43°44′34″ E), 1 ♀ on *Zyzyphus mauritiana* Lamarck (Malvaceae), 3/XII/2018.

Remarks: this species was described from Amanzimtoti Kwazulu-Natal Province in South Africa on *Rhus rehmanniana* Engler (Anacardiaceae) (van der Merwe 1965) and recorded in several countries of Africa (Ueckermann and Loots 1998; Moraes *et al.* 2006; El-Banhawy and Knapp 2011) and La Réunion (Quilici *et al.* 2000).

Measurements of the single female (Table 3) fit well with the measurements from the literature (Ueckermann and Loots 1988; Moraes *et al.* 2006; El-Banhawy and Knapp 2011), with however some slightly shorter dimensions, especially for *Z5,* and some longer dimensions, especially of *j3*.

Table 1 Character measurements of adult females of *Euseius baetae* collected in this study compared to those obtained in previous studies (localities followed by the number of specimens measured between brackets).

Characters	**Mohéli** (5) (this study)	**Congo** (1)	**Grande Comore** (4)	**Kenya** (1)	**Mozambique** (4)	**South Africa** (7)
Dsl	**329 (**325 – 335)	336	341 (310 – 375)	300	322 – 336	337 (343 – 359)
Dsw	**227** (218 – 238)	230	229 (220 – 238)	210	201 –243	252 (224 – 239)
j1	**28** (25 – 30)	29	28	21	29 – 38	32 (28 – 32)
j3	**10**	16	8 (6 – 10)	25	11 –12	9 (8 – 11)
j4	**8** (8 – 9)	11	6 (5 – 8)	12	9 –10	9 (8 – 11)
j5	**8** (8 – 9)	11	7 (6 – 8)	12	9	9 (8 – 11)
j6	**8** (8 – 9)	16	8 (6 – 8)	12	10 –11	9 (8 – 11)
J2	**10**	13	9 (8 – 10)	13	12 – 13	11 (11 – 13)
J5	**8**	8	7 (5 – 8)	7	7 – 9	6
r3	**16** (13 – 18)	19	14 (13 – 15)	14	–	13 (13 – 16)
R1	**10** (9 – 10)	11	9 (8 – 10)	14	–	9
s4	**15**	21	14 (13 – 14)	30	16 – 20	16 (16 – 19)
S2	**12** (1**2 – 13)**	14	9 (8 – 10)	16	12 – 14	11 (11 – 13)
S4	**11** (10 – 12)	14	10 (9 – 10)	16	12 – 16	11 (11 – 13)
S5	**10** (10 – 11)	14	9 (8 – 10)	14	11 – 13	11 (11 – 13)
z2	**10** (8 – 12)	14	9 (8 – 10)	14	11 – 12	9 (8 – 11)
z4	**9** (8 – 11)	13	9 (8 – 10)	20	11 – 12	9 (8 – 11)
z5	**8**	11	7 (5 – 8)	12	9 – 10	9 (8 – 11)
Z1	**10** (9 – 11)	11	9 (9 – 10)	12	10 – 12	9 (8 – 11)
Z4	**11** (10 – 13)	16	10	15	11 – 14	11 (11 – 13)
Z5	**58** (55 – 60)	53	59 (55 – 65)	50	59 – 65	55 (55 – 60)
st1-st1	**60** (58 – 61)	–	57 (55 – 58)	–	–	–
st2-st2	**71** (70 – 73)	58	58 (55 – 60)	58	77 – 86	88 (82 – 91)
st3-st3	**78** (75 – 80)	70	67 (65 – 68)	70	–	–
st1-st3	**56** (53 – 59)	–	74 (70 – 78)	–	71 – 78	95 (91 – 101)
st4-st4	**86** (80 – 89)	–	79 (78 – 80)	–	–	–
Gensl	**123** (118 – 131)	–	–	–	–	–
Gensw *st5*	**74** (73 – 75)	–	–	–	–	–
Gensw post. corn.	**85** (80 - 90)	–	–	–	–	–
st5-st5	**70** (68 – 70)	74	72 (68 – 75)	80	–	88 (82 – 91)
Lisl	**26** (25 – 28)	–	26 (25 – 28)	–	–	–
Lsiw	**3** (2 – 3)	–	2	–	–	–
Sisl	**15** (10 – 20)	–	10 (8 – 13)	–	–	–
Vsl	**93** (90 – 95)	–	91 (78 – 100)	100	95 – 108	88 (82 – 91)
vsw *ZV2*	**51** (48 – 53)	48	49 (45 – 50)	–	69	69 (69 – 76)
Vsw anus	**72** (68 – 73)	67	71 (70 – 73)	70	–	–
gv3 – gv3	**30** (25 – 33)	–	–	–	–	–
JV5	**42** (40 – 45)	–	39 (38 – 40)	37	–	38 (38 – 47)
SgeI	**20** (20 – 22)	–	22 (20 – 25)	–	–	28
SgeII	**29** (28 – 30)	29	27 (25 – 28)	25	–	32 (32 – 35)
SgeIII	**34** (33 – 35)	38	35	30	–	38 (41 – 44)
StiIII	**29** (25 – 33)	29	27 (25 – 28)	–	–	32 (32 – 35)
SgeIV	**58** (55 – 60)	56	57 (55 – 58)	58	64 – 72	72 (63 – 72)
StiIV	**39** (38 – 40)	38	38	51	40 – 47	41 (44 – 47)
StIV	**71** (68 – 73)	70	67 (65 – 68)	95	71 – 80	76 (76 – 79)
scl	**17** (15 – 18)	19	15	24	16 – 18	–
scw	**5**	–	5	5	–	–
Fdl	**24** (23 – 25)	–	25	–	–	–
No teeth Fdl	**4**	–	–	4	–	6
Mdl	**24** (23 – 25)	–	24 (23 – 25)	–	–	–
No teeth Mdl	**2**	–	–	2	–	2

Sources of measurements – Grande Comore: Kreiter *et al.* (2018b); **Kenya:** El-Banhawy & Knapp (2011); **Mozambique holotype + paratypes:** Meyer & Rodrigues (1966); **South Africa:** Ueckermann & Loots (1988); – : not provided.

Sub-tribe Typhlodromalina Chant & McMurtry

Typhlodromalina Chant & McMurtry 2005a: 195.

Genus *Typhlodromalus* Muma

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

Typhlodromalus spinosus (Meyer & Rodrigues)

Amblyseius spinosus Meyer & Rodrigues 1966: 30; Moraes *et al.* 1986: 31.
Kampimodromus spinosus, Quilici *et al.* 2000: 100.
Typhlodromalus spinosus, Moraes *et al.* 2004b: 204; Chant & McMurtry 2005a: 199, 2007: 111.

This species belongs to the *athiasae* species group as setae *J1* and *S5* are absent. This species group contains six species (Chant and McMurtry 2005a, Moraes *et al.* 2006).

Typhlodromalus spinosus was collected from Eastern, Western, but mainly Southern Africa and La Réunion (Demite *et al.* 2020). The rapid multiplication of this species on the western flower thrips (WFT), *Frankliniella occidentalis* Pergande, was confirmed and clear evidence that *T. spinosus* predates on WFT under laboratory and field conditions, but not on *T. urticae* (Mwangi *et al.* 2015). It seems abundant in low vegetation as it was found in high populations in a study of companion plants in a citrus orchard (Le Bellec *et al.* unpub. data).

This species have never been record from Guadeloupe or Martinique in similar studies, but it is interesting to notice that in those islands, another *Typhlodromalus* was collected, *T. peregrinus* (Muma) (Mailloux *et al.* 2010; Kreiter *et al.* 2013, 2018c). *Typhlodromalus spinosus* was recorded from La Réunion by Quilici *et al.* (2000) and was then find in quite

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

Characters	**Mohéli** (1) (this study)	**Mozambique** (?)
Dsl	**233**	–
Dsw	**155**	–
j1	**23**	–
j3	**12**	9
j4	**8**	9
j5	**7**	9
j6	**8**	9
J2	**9**	10
J5	**4**	6 – 7
r3	**15**	–
R1	**9**	–
s4	**14**	19
S2	**10**	10
S4	**9**	10
S5	**8**	9
z2	**10**	10
z4	**9**	11
z5	**8**	9
Z1	**9**	9
Z4	**10**	9
Z5	**43**	43

Characters	**Mohéli** (1) (this study)	**Mozambique** (?)
st1-st1	**55**	–
st2-st2	**60**	–
st3-st3	**55**	–
st1-st5	**100**	–
st4-st4	**48**	–
st5-st5	**34**	–
Vsl	**93**	–
Vsw *ZV2*	**135**	–
Vsw *anus*	**73**	–
gv3 – gv3	**24**	–
JV5	**26**	–
SgeI	**18**	–
SgeII	**23**	25
SgeIII	**26**	25
StiIII	**23**	28
SgeIV	**43**	42
StiIV	**30**	31
StIV	**55**	55
Fdl	**21**	–
No teeth Fd	**Not visible**	–
Mdl	**23**	–
No teeth Md	**Not visible**	–
Shaft	**15**	–
Branch	**7**	–

Sources of measurements – Mozambique paratypes: Meyer & Rodrigues (1966); – : not provided.

high numbers by Kreiter *et al.* (2020d) and in lower numbers from Mauritius Island (Kreiter and Abo-Shnaf 2020b).

World distribution: Benin, Burundi Dr Congo, Kenya, Malawi, Mozambique, La Réunion Island.

Specimens examined: four specimens (2 ♀♀ and 2 ♂♂) collected during this study. **Hoani**, inside village (38 m aasl, 12°17′3″ S, 43°44′34″ E), 2 ♀♀ and 2 ♂♂ on *Amaranthus viridis* L. (Amaranthaceae), 3/XII/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens fit well measurements in Kreiter *et al.* (2020d). This species was described from Mozambique (Meyer and Rodrigues 1966), then mentioned in the Indian Ocean from la Réunion (Quilici *et al.* 2000; Kreiter *et al.* 2020d), Mauritius (Kreiter and Abo-Shnaf 2020b) and more recently from Anjouan (Kreiter *et al.* 2021).

Genus *Ueckermannseius* Chant & McMurtry

Ueckermannia Chant & McMurtry 2005a: 201. Preoccupied by *Ueckermannia* Kaźmierski, 1996 (Tydeidae).
Ueckermannseius Chant & McMurtry 2005b: 337, 2007: 115.

Ueckermannseius eastafricae Moraes, Zannou & Oliveira

Ueckermannseius eastafricae Moraes *et al.* 2006: 30.

This species was described from Uganda and Kenya (Moraes *et al.* 2006) and recovered only once in Kenya (El-Banhawy *et al.* 2009). Its biology is totally unknown.

World distribution: Kenya, Uganda.

Table 3 Character measurements of an adult female of *Euseius rhusi* collected in this study with those obtained from previous studies (localities followed by the number of specimens measured between brackets).

Characters	Mohéli (1) (this study)	Africa (5)	Kenya (?)	South Africa (5)
Dsl	**318**	367 (336 – 384)	320	350 – 355
Dsw	**213**	264 (238 – 285)	240	226 – 236
j1	**30**	25 (21 – 27)	22	25
j3	**11**	10 (10 – 13)	5	15
j4	**8**	8 (5– 10)	5	9
j5	**8**	7 (5 – 10)	5	9
j6	**8**	9 (8 – 11)	5	12
J2	**8**	10 (8 – 11)	5	12
J5	**8**	8 (6 – 10)	7	9
r3	**11**	15 (14 – 15)	12	17
R1	**9**	13 (13 – 14)	12	17
s4	**broken**	18	14	20
S2	**broken**	18	12	17 – 19
S4	**broken**	16	12	17 – 19
S5	**broken**	15 (14 – 15)	9	15
z2	**10**	11 (8 – 14)	12	15
z4	**10**	11 (8 – 14)	12	14
z5	**8**	9 (6 – 10)	9	12
Z1	**10**	11 (8 – 14)	9	15
Z4	**broken**	26	9	17 – 19
Z5	**23**	36 (34 – 38)	25	26 – 29
St1-St1	**58**	–	–	–
St1-St3	**53**	62 (58 – 66)	60	–
St2-St2	**63**	66 (62 – 72)	65	–
St3-St3	**70**	–	–	–
St4-St4	**85**	–	–	–

Characters	Mohéli (1) (this study)	Africa (5)	Kenya (?)	South Africa (5)
Gensl	**115**	–	–	80 – 84
Gensw *st5*	**70**	–	–	–
Gensw post. corn.	**78**	–	87	67 – 70
St5-St5	**64**	78 (70 – 86)	–	–
Lisl	**25**	–	–	–
Lsiw	**3**	–	–	–
Vsl	**103**	104 (96 – 112)	96	93
vsw *ZV2*	**60**	58 (53 – 62)	–	–
Vsw anus	**58**	65 (58 – 72)	70	65
gv3 – gv3	**33**	–	–	–
JV5	**40**	–	28	37 – 39
SgeI	**25**	–	–	–
SgeII	**23**	22 (19 – 24)	–	–
SgeIII	**38**	37 (35 – 40)	–	–
StiII	**28**	29 (26 – 32)	–	–
SgeIV	**65**	66 (61 – 70)	80	66 – 68
StiIV	**51**	56 (51 – 62)	65	54 – 56
StIV	**63**	63 (53 – 72)	82	66 – 70
scl	**35**	42 (38 – 45)	45	33 – 38
scw	–	–	–	–
Fdl	**25**	27 (25 – 28)	–	–
No teeth Fdl	**Not visible**	3	3	3 – 4*
Mdl	**28**	30	–	–
No teeth Mdl	**Not visible**	1	1	1*

Sources of measurements – Africa (Burundi 1♀, Kenya 4♀♀; Rwanda 3♀♀): Moraes *et al.* (2006); **Kenya:** El-Banhawy & Knapp (2011); **South Africa:** van der Merwe (1965) & *Ueckermann & Loots (1988) for number of teeth; – : not provided.

Specimens examined: 12 specimens (11 ♀♀ and 1 ♂) collected during this study. **Bandar-Es-Salam**, Les Abous Inn (23 m aasl, 12°17′37″ S, 43°45′27″ E), 11 ♀♀ and 1 ♂ on *Carica papaya* L. (Caricaceae), 2/XII/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens (Table 4) fit well measurements in Moraes *et al.* (2006) for specimens from Africa and above all that of Kreiter *et al.* (submitted) for specimens from Anjouan. But specimens from Mohéli have shorter setae *j4*, *j5*, *j6*, *R1*, *s4*, *S2*, *z2*, *z4*, *z5*, *SgeII*, *SgeIII* and smaller ventrianal shield and cheliceral digits but have longer macrosetae *StIV* compared to specimens from Africa. Above all, our specimens have pointed macrosetae or slightly rounded macrosetae on leg IV and the original description (Moraes *et al.* 2006) mentioned three evidently knobbed macrosetae. As it is the only main difference, we consider this difference as a variation of the character and not enough for considering that our specimens belong to a new species. The male of *U. eastafricae* was unknown until our collection. The single male collected will be described in a following paper.

Subfamily Phytoseiinae Berlese

Phytoseiini Berlese 1913: 3; Phytoseiinae Vitzthum 1941: 767.

Genus *Phytoseius* Ribaga

Phytoseius Ribaga 1904: 177.

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

Characters	**Mohéli** (11) (this study)	**Anjouan** (2)	**Africa** (7)
Dsl	**330** (318 – 353)	333 – 338	390 (336 – 405)
Dsw	**220** (200 – 240)	170 – 195	274 (258 – 291)
j1	**37** (35 – 40)	34 – 35	34 (30 – 38)
j3	**24** (23 – 25)	22 – 24	23 (19 – 27)
j4	**10** (8 – 10)	8 – 10	15 (11 – 18)
j5	**10** (8 – 10)	8 – 10	14 (10 – 19)
j6	**11** (10 – 13)	9 – 11	12 (10 – 16)
J2	**13** (10 – 14)	12 – 13	13 (10 – 16)
J5	**8** (7 – 9)	6 – 7	5 (3 – 6)
r3	**18** (15 – 20)	15 – 18	18 (16 – 21)
R1	**13** (10 – 16)	13	18 (14 – 21)
s4	**23** (20 – 25)	21 – 23	26 (19 – 35)
S2	**14** (13 – 15)	13 – 15	18 (16 – 22)
S4	**13** (12 – 15)	13 – 15	17 (14 – 21)
S5	**14** (12 – 16)	13 – 15	16 (14 – 21)
z2	**14** (13 – 15)	13 – 15	20 (16 – 24)
z4	**15** (13 – 16)	13 – 15	21 (13 – 29)
z5	**10** (9 – 11)	10	14 (13 – 16)
Z1	**12** (11 – 13)	11 – 13	16 (13 – 21)
Z4	**14** (13 – 16)	13 – 14	16 (11 – 19)
Z5	**42** (35 – 47)	43	39 (32 – 53)
st1-st1	**58** (55 – 60)	55	–
st2-st2	**66** (62 – 70)	63 – 65	72 (69 – 80)
st3-st3	**79** (75 – 84)	75	–
st1-st3	**60** (54 – 64)	63 – 65	71 (62 – 77)
st4-st4	**86** (78 – 90)	75 – 81	–

Characters	**Mohéli** (11) (this study)	**Anjouan** (2)	**Africa** (7)
Gensl	**133** (125 – 143)	128 – 138	–
Gensw *st5*	**82** (78 – 93)	80	–
Gensw post. corn.	**98** (90 – 105)	80 – 85	–
st5-st5	**76** (70 – 80)	75 – 81	80 (67 – 90)
Lisl	**25** (19 – 28)	28	–
Lisw	**2** (1 – 3)	2 – 4	–
Sisl	**13** (11 – 15)	Not visible	–
Vsl	**101** (88 – 118)	90 – 95	122 (96 – 130)
Vsw *ZV2*	**61** (55 – 70)	60	78 (67 – 85)
Vsw *anus*	**75** (70 – 80)	65 – 75	71 (62 – 75)
gv3 – gv3	**34** (30 – 38)	–	–
JV5	**34** (30 – 40)	28 – 30	–
SgeI	**21** (18 – 25)	20 – 23	–
SgeII	**24** (23 – 25)	22 – 23	28 (24 – 34)
SgeIII	**34** (30 – 43)	31 – 33	39 (37 – 45)
StiII	**28** (28 – 30)	28 – 30	31 (29 – 37)
SgeIV	**52** (48 – 55)	43 – 53	57 (51 – 62)
StiIV	**44** (38 – 47)	40 – 45	44 (34 – 56)
StIV	**77** (74 – 80)	70	58 (51 – 69)
Scl	**34** (31 – 36)	30 – 37	35
Scw	**8** (6 – 8)	11 – 14	–
Fdl	**24** (23 – 25)	25 – 26	34 (33 – 35)
Nb teeth Fd	Not visible	Not visible	10
Mdl	**26** (25 – 28)	23 – 28	38
Nb teeth Md	Not visible	Not visible	4

Sources of measurements – Africa (Uganda 2♀♀, Kenya 5♀♀)**:** Moraes *et al.* (2006); **Anjouan:** Kreiter *et al.* 2021) – : not provided.

Phytoseius hongkongensis

Phytoseius (*Phytoseius*) *hongkongensis* Swirski & Shechter 1961: 99; Amitai & Swirski 1966: 22.
Phytoseius (*Pennaseius*) *hongkongensis* Ehara 1966: 25; Ehara 1972: 169; Moraes *et al.* 1986: 211.
Phytoseius hongkongensis Moraes *et al.* 2004a: 240; Chant & McMurtry 2007: 129.

This species belongs to the *plumifer* species group (Chant and McMurtry 1994) as setae *R1* and *J2* are present. This species was described from specimens collected on *Heterosmilax gaudichaudiana* (Kunth) Maximovich (Smilacaceae), and *Urena lobata* L. (Malvaceae) in Victoria Mount Forest, Hong Kong Island, Hong Kong. Although species of the genus *Phytoseius* are considered to belong to the type III (polyphagous generalist predators) of McMurtry and Croft (1997) and McMurtry *et al.* (2013), its specific biology is totally unknown.

World distribution: Benin, Burundi, Cameroon, Cape Verde, DR Congo, Kenya, Madagascar Island, Malawi, Mozambique, Nigeria, Reunion Island, Rwanda, Senegal, South Africa, Zambia, Zimbabwe.

Specimens examined: 22 specimens (16 ♀♀, 2 ♂♂ and 4 imm.) collected during this study. **Fomboni**, Les-Hauts (60 m aasl, 12°17′29″ S, 43°44′35″ E), 7 ♀♀ and 2 imm. on *Psidium cattleianum* Afzelius ex Sabine (Myrtaceae), 7 ♀♀ and 2 imm. on *Annona senegalensis* Persoon (Annonaceae) and 4 ♀♀, 2 ♂♂ and 1 imm. on *Adansonia digitata* L. (Malvaceae), 2/XII/2018.

Remarks: Measurements of the three adult females agree well with measurements of the literature, especially with those of Ueckermann *et al.* (2007) obtained with a great number of specimens (29) from various countries in Africa with those of Kreiter *et al.* (2020b) for specimens from Vietnam.

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.* 2004b: 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 and McMurtry 1994) and its biology remains totally unknown.

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

Specimens examined: 31 specimens (10 ♀♀, 15 ♂♂ and 6 imm.) collected during this study. **Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 1 ♂ on *Senna siamea* (Lamarck) Irwin & Barneby (Fabaceae), 2/XII/2018; **Fomboni**, Les-Hauts (60 m aasl, 12°17′29″ S, 43°44′35″ E), 1 imm. on *Lawsonia inermis* L. (Lythraceae), 1 ♀ and 1 ♂ on *Psidium cattleianum* Afzelius ex Sabine (Myrtaceae) and 1 ♀ on *Adansonia digitata* L. (Malvaceae), 2/XII/2018; **Bandar-Es-Salam**, Les Abous Inn (23 m aasl, 12°17′37″ S, 43°45′27″ E), 2 ♀♀, 5 ♂♂ and 2 imm. on *Cajanus cajan* L. (Fabaceae), 2/XII/2018; **Fomboni**, University (25 m aasl, 12°17′3″ S, 43°44′34″ E), 2 ♀♀, 5 ♂♂ and 2 imm. on *Zyzyphus mauritiana* Lamarck (Malvaceae), 3/XII/2018; **Hoani**, inside village (38 m aasl, 12°17′3″ S, 43°44′34″ E), 1 ♂ on *Amaranthus viridis* L. (Amaranthaceae), 1 ♀ + 1 imm. on *Citrus* sp., 3/XII/2018; **Bangoma**, top of the village (42 m aasl, 12°17′15″ S, 43°43′40″ E), 1 ♀ on *Dendrocnide moroides* (Weddel) Chew (Urticacae), 1 ♀ and 1 ♂ on *Anacardium occidentale* L. (Anacardiaceae) 4/XII/2020; **Bangoma**, Les Hauts (137 m aasl, 12°17′18″ S, 43°43′41″ E), 1 ♂ on *Asplenium petiolulatum* Mettenius (Aspleniaceae) and 1 ♀ on *Abutilon hirtum* (Lamarck) Sweet (Malvaceae), 4/XII/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens fit well measurements in numerous descriptions and redescriptions available in the literature, especially those of Blommers (1976) for specimens from Madagascar. Mentioned only from South-East Asia and Madagascar, it is the second mention in the Indian Ocean of this species outside Madagascar after Mayotte Island (Kreiter *et al.* 2020a).

Tribe Typhlodromini Wainstein

Typhlodromini Wainstein 1962: 26.

Genus *Typhlodromus* Scheuten

Typhlodromus Scheuten 1857: 111.

Subgenus *Anthoseius* De Leon

Typhlodromus (*Anthoseius*) De Leon 1959: 258; van der Merwe 1968: 20; Karg 1982: 194; Chant & McMurtry 1994: 250, 2007: 149.

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 and dorsal shield setae are short (Chant and McMurtry 1994). The biology of that species is totally unknown. It was mentioned only from Kenya (Ueckermann *et al.* 2008) only from one female.

World distribution: Kenya, Mayotte Island.

Specimens examined: 5 specimens (2 ♀♀ and 3♂♂) collected during this study. **Fomboni**, Les-Hauts (60 m aasl, 12°17′29″ S, 43°44′35″ E), 1 ♀ on *Annona senegalensis* Persoon (Annonaceae), 2/XII/2018; **Bangoma**, top of the village (42 m aasl, 12°17′15″ S, 43°43′40″ E), 1 ♀ and 3 ♂♂ on *Syzygium aromaticum* (L.) Merrill & Perry, 4/XII/2018.

Remarks: the species was mentioned only once from Kenya and described from only one female specimen (Ueckermann *et al.* 2008). Morphological and morphometric characters and all measurements of our specimens (Table 5) fit well measurements of the original description of Zannou, Moraes & Oliveira in Ueckermann *et al.* (2008) and with measurements of specimens from Mayotte Island (Kreiter *et al.* 2020a)

Typhlodromus (*Anthoseius*) *hartlandrowei* Evans

Typhlodromus (*Typhlodromus*) *hartlandrowei* Evans, 1958: 580-581; Chant 1959: 60.
Clavidromus hartlandrowei, Muma, 1961: 296.
Typhlodromus (*Neoseiulus*) *hartlandrowei*, Pritchard & Baker, 1962: 222.
Typhlodromus (*Anthoseius*) *hartlandrowei*, Moraes *et al.* 2004b: 328; Chant & McMurtry, 2007: 155; Ueckermann *et al.* 2008: 50.

This species belongs to the *bergi* species group (Chant and McMurtry 1994). The biology of that species is totally unknown. This is the first mention of that species outside the African continent.

World distribution: Democratic Republic of Congo, Nigeria, Uganda.

Specimens examined: two specimens (2 ♀) collected during this study. **Fomboni**, University (25 m aasl, 12°17′3″ S, 43°44′34″ E), 1 ♀ on *Persea americana* Miller (Lauraceae), 4/XII/2018; **Bangoma**, top of the village (42 m aasl, 12°17′15″ S, 43°43′40″ E), 1 ♀ on *Anacardium occidentale* L. (Anacardiaceae) 4/XII/2020.

Remarks: morphological and morphometric characters and all measurements of our specimens (Table 6) fit well with measurements of the original description given by Evans (1958), those given by Ueckermann *et al.* (2008) concerning specimens from Africa and those of specimens from Anjouan Island (Kreiter *et al.* 2021).

Typhlodromus (*Anthoseius*) *lobatus* Zannou, Moraes & Oliveira

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

This species belongs to the large *rhenanus* species group (Chant and McMurtry 1994). The biology of this species is totally unknown.

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

Table 5 Character measurements of adult females of *Typhlodromus* (*Anthoseius*) *grewiae* collected in this study compared to those obtained in previous studies (localities followed by the number of specimens measured between brackets).

Characters	**Mohéli** (2) (this study)	**Anjouan Island** (1)	**Kenya** (1, the holotype)	**Mayotte Island** (2)
Dsl	**300**	315	298	288 – 308
Dsw	**179**	205	179	168 – 180
j1	**15**	13	Not visible	15
j3	**20**	20	16	15 – 20
j4	**18**	15	16	13 – 15
j5	**18**	15	16	15
j6	**23**	20	19	20
J2	**28 – 30**	25	22	21 – 23
J5	**10**	10	10	9 – 10
r3	**16 – 18**	18	16	15
R1	**17 – 18**	18	16	15 – 18
s4	**20 – 23**	20	19	18 – 20
s6	**25 – 26**	25	22	21 – 23
S2	**30**	30	24	26 – 28
S4	**29 – 30**	30	27	28
S5	**25**	25	22	23
z2	**16**	18	14	13 – 15
z3	**18 – 20**	18	14	15
z4	**21 – 23**	20	18	15 – 18
z5	**20**	19	18	18
Z4	**33 – 35**	35	29	30 – 33
Z5	**35 – 37**	36	35	33 – 35

Characters	**Mohéli** (2) (this study)	**Anjouan Island** (1)	**Kenya** (1, the holotype)	**Mayotte Island** (2)
st1-st1	**43 – 47**	48	–	38
st2-st2	**55 – 60**	60	61	53
st3-st3	**58**	59	–	48
st1-st3	**55 – 58**	63	58	55
st4-st4	**65**	63	–	43
Gensl	**95**	100	–	93
Gensw *st5*	**60**	63	53	50
Gensw post. corn.	**73**	68	–	75
st5-st5	**55**	55	–	–
Lisl	**25**	20	–	18 – 23
Lisw	**3**	5	–	4
sisl	**10**	10	–	10
Vsl	**103**	110	99	95 – 100
Vsw *ZV2*	**90**	63	90	83 – 90
Vsw anus	**73**	70	–	68 – 75
gv3 – gv3	**24**	25	–	26
JV5	**25**	26	–	25 – 27
StIV	**16 – 20**	20	18	17 – 18
Scl	**14 – 15**	15	14	13 – 15
Scw	**8 – 12**	5	–	5
Fdl	**23**	25	23	25
No teeth Fd	**3**	Not visible	3 – 4	4
Mdl	**25**	26	25	25 – 28
No teeth Md	**2**	Not visible	2	2

Sources of measurements – Kenya: Ueckermann *et al.* (2008), original description base on a single female; **Mayotte Island** (Kreiter *et al.* 2020a); –: not provided.

Specimens examined: ten specimens (9 ♀♀ and 1 imm.) collected during this study. **Fomboni**, inside the town (15 m aasl, 12°17′29″ S, 43°44′35″ E), 2 ♀♀ + 1 imm. on *Abutilon hirtum* (Lamarck) Sweet (Malvaceae) and 4 ♀♀ on *Hibiscus tiliaceus* L. (Malvaceae), 2/XII/2018; **Bandar-Es-Salam**, Les Abous Inn (23 m aasl, 12°17′37″ S, 43°45′27″ E), 1 ♀ on *Cajanus cajan* L. (Fabaceae), 2/XII/2018; **Bangoma**, Les Hauts (137 m aasl, 12°17′18″ S, 43°43′41″ E), 2 ♀♀ on *Cananga odorata* (Lamarck) Hooker & Thomson (Malvaceae), 4/XII/2018.

Remarks: morphological and morphometric characters and all measurements of our specimens fit well with measurements of the original description by Zannou, Moraes and Oliveira in Ueckermann *et al.* (2008) concerning specimens from Ghana, Western Africa. And with measurements of specimens from Rodrigues (Kreiter and Abo-Shnaf 2020a), Mauritius (Kreiter and Abo-Shnaf 2020b), Mayotte (Kreiter *et al.* 2020a) and Anjouan (Kreiter *et al.* 2021). This species seems rather common in the Indian Ocean Islands, except in La Réunion Island.

Typhlodromus (*Anthoseius*) *moraesi* Kreiter & Ueckermannn

Typhlodromus (*Anthoseius*) *moraesi* Kreiter & Ueckermann in Kreiter *et al.* 2002: 338.

The biology of this species found in La Réunion Island by Kreiter *et al.* (2002) on various host plants (Kreiter *et al.* 2002) and then in French Caribbean Islands (Mailloux *et al.* 2010; Kreiter *et al.* 2013) remains unknown.

World distribution: La Réunion Island.

Specimens examined: three specimens (3 ♀♀) collected during this study. **Bandar-Es-**

Table 6 Character measurements of adult females of *Typhlodromus* (*Anthoseius*) *hartlandrowei* collected in this study compared to those in previous studies (localities followed by the number of specimens measured between brackets).

Characters	**Mohéli** (2) (this study)	**Africa** (3)	**Anjouan Island** (2)	**Holotype**
Dsl	**308**	290 (285 – 295)	325	295
Dsw	**200 – 205**	206 (200 – 215)	180	190
j1	**27 – 30**	26 (25 – 27)	20	–
j3	**40 – 43**	43 (40 – 45)	38	48
j4	**28**	40 (37 – 41)	25	44
j5	**25 – 26**	40 (36 – 44)	30	43
j6	**40**	55 (50 – 59)	33	57
J2	**45 – 47**	53 (50 – 55)	40	56
J5	**8 – 9**	10	8	9
r3	**38 – 40**	40 (38 – 43)	40	44
R1	**45**	59 (58 – 60)	45	60
s4	**55 – 60**	61 (60 – 62)	58	63
s6	**53 – 55**	65 (65 – 66)	55	67
S2	**63 – 65**	69 (68 – 71)	60	71
S4	**63 – 65**	70 (70 – 71)	65	71
S5	**20 – 22**	22 (19 – 24)	22	17
z2	**25 – 28**	24 (23 – 25)	25	23
z3	**44 – 47**	51 (50 – 51)	45	53
z4	**45**	56 (54 – 57)	48	58
z5	**28 – 30**	38 (35 – 40)	29	38
Z4	**60**	63 (62 – 64)	60	62
Z5	**65 – 67**	64 (63 – 66)	66	63
st1-st1	**50**	–	50	–
st2-st2	**48 – 50**	55 (54 – 56)	53	50
st3-st3	**60**	–	65	–
st1-st3	**58**	55 (52 – 57)	55	59
st4-st4	**60 – 68**	–	70	–

Characters	**Mohéli** (2) (this study)	**Africa** (3)	**Anjouan Island** (2)	**Holotype**
Gensl	**103 – 105**	–	110	–
Gensw *st5*	**58 – 60**	55 (53 – 57)	Not visible	55
Gensw post. corn.	**68 – 75**	–	Not visible	–
st5 – st5	**54 – 55**	–	Not visible	–
Lisl	**23 – 28**	–	30	–
Lisw	**3**	–	4	–
sisl	**10**	–	11	–
Vsl	**95 – 113**	102 (98 – 104)	100	97
Vsw *ZV2*	**78 – 80**	89 (84 – 96)	90	85
Vsw anus	**68 – 79**	–	68	–
gv3 – gv3	**38 – 39**	–	–	–
JV5	**65 – 67**	–	63	–
SgeIII	**18 – 20**	22 (21 – 22)	19	20
StiIII	**18 – 19**	18 (17 – 19)	18	19
SgeIV	**28 – 30**	32 (31 – 32)	29	32
StiIV	**24 – 25**	22 (21 – 24)	22	23
StIV	**40 – 47**	40 (37 – 42)	45	43
Scl	**7**	14 (11 – 17)	10	–
Scw	–	–	8	–
Fdl	**23 – 25**	24	23	–
No teeth Fd	Not visible	2	Not visible	–
Mdl	**28**	27	26	–
No teeth Md	Not visible	1	Not visible	–

Sources of measurements – Africa (DR Congo 1♀, Nigeria 1♀, Uganda 1♀) & **Holotype**: Ueckermann *et al.* (2008); **Anjouan Island**: Kreiter *et al.* (2021); –: not provided.

Salam, Les Abous Inn (23 m aasl, 12°17′37″ S, 43°45′27″ E), 1 ♀ on *Punica granatum* L. (Lythraceae), 4/XII/2018/

Remarks: several species are found both in La Réunion Island (in the Indian Ocean) and in the West Indies, probably because of reciprocal introductions certainly a long time ago with slave-trade and commercial exchanges between the two areas or because of introduction of plants from Antilles into La Réunion coming from the same African countries than slaves. The measurements and description of the specimens collected fit very well those given by Kreiter *et al.* (2002) for the original description and measurements of specimens from La Réunion (Kreiter *et al.* 2020d) and Rodrigues Islands (Kreiter and Abo-Shnaf 2020a).

Conclusion

The results of a survey carried out in 2018 in Mohéli Island is presented in this paper. A total of 18 new records, 16 of which being documented in this paper: 12 Amblyseiinae, 1 Phytoseiinae and 5 Typhlodrominae, have been obtained, namely: *Neoseiulus teke, Paraphytoseius orientalis, Amblyseius duplicesetus, A. herbicolus, A. largoensis, Euseius hima, E. baetae, E. rhusi, Typhlodromalus spinosus, Ueckermannseius eastafricae, Phytoseius hongkongensis, Chanteius contiguus, Typhlodromus* (*Anthoseius*) *grewiae, T.* (*A.*) *hartlandrowei*, *T.* (*A.*) *lobatus*, *T.* (*A.*) *moraesi*. Two new species (*Paragigagnathus* sp. and *Typhlodromalus* sp.) found in several islands will be described in a next paper

Among the 18 recorded species, at least five species (*P. orientalis*, *A. largoensis, A. herbicolus*, *T. spinosus* and *T.* [*A.*] *transvaalensis*) are already 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 Mohéli Island is of great agricultural, commercial and strategic interests for the country.

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