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Subscriptions:
Year 2021 (Volume 61): 450 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php
Previous volumes (2010-2020): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France
ISSN 0044-586X (print), ISSN 2107-7207 (electronic)

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

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New records of Phytoseiidae (Acari: Mesostigmata) from Mauritius

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ABSTRACT

Mauritius is one of the three islands constituting Mascareignes Archipelago, with La Réunion and Rodrigues. So far, only three mite species of the family Phytoseiidae are known from Mauritius, namely \textit{Amblyseius caudatus}, \textit{Euseius ovalis} and \textit{Phytoseius coheni}. We report in this paper the results of a brief survey recently conducted on Mauritius Island, in which four additional species were found, namely \textit{Paraphytoseius orientalis}, \textit{Phytoseiulus persimilis}, \textit{Scapulaseius reptans} and \textit{Typhlodromips culmulus}.

Keywords survey; collection; taxonomy; systematics; Mascareignes

Zoobank http://zoobank.org/AFDFBF83-DDCE-4336-A3C1-9398EE412B1E

Introduction

Mites of the family Phytoseiidae are best known for their predatory habits on phytophagous mites and on small insects. Some of them are used for the control of pest organisms in open fields and protected crops all around the world (McMurtry and Croft 1997; McMurtry \textit{et al.} 2013). This family is widespread around the Globe, consisting presently of 2,521 valid species of 94 genera belonging to three sub-families (Demite \textit{et al.} 2018).

Biodiversity surveys in poorly investigated areas 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.

Most of the Indian Ocean constitutes one of the world biodiversity hotspots. The concept of biodiversity hotspot was defined by Myers (1988) in order to identify the most immediately important areas for biodiversity conservation. These hotspots hold high endemism levels and have lost at least 70\% of their original natural vegetation (Myers \textit{et al.} 2000). Knowledge of the phytoseiid diversity in these areas may contribute to future establishment of conservation programs.

Located in the Indian Ocean at 1,000 km from the eastern coast of Madagascar, together with La Réunion and Rodrigues, Mauritius is one of the three main islands constituting Mascareignes Archipelago. Only three phytoseiid species have been reported from this island (Moutia 1958, Schicha 1984, Demite \textit{et al.} 2018). The objective of this paper is to present the phytoseiid species found in brief survey recently conducted in Mauritius.

Material and methods

The survey was conducted in September 2017 on cultivated plants of two locations. Mites were directly collected from leaves and transferred to vials with 70 \% ethanol, and later mounted on microscope slides in Hoyer’s medium. They were examined under a phase and DIC (differential interference contrast) microscope (DMLB, Leica Micosystèmes SAS, Nanterre, France). Measurements were done using a graded eyepiece.

How to cite this article Kreiter S. \textit{et al.} (2018), New records of Phytoseiidae (Acari: Mesostigmata) from Mauritius. 
\textit{Acarologia} 58(4): 773-785; DOI 10.24349/acarologia/20184273
Chant and McMurtry's (1994, 2007) concepts of Phytoseiidae taxonomy and the world catalogue database of Demite et al. (2018) were used for faunistical and biogeographical aspects. The chaetotaxy terminology used followed that proposed by Lindquist and Evans (1965) as adapted by Rowell et al. (1978) for Phytoseiidae for dorsal and by Chant and Yoshida-Shaul (1991) for ventral idiosomal setae, respectively.

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

All measurements are given in micrometers and presented as the mean in bold followed by the range in parentheses. All mites collected were measured. They were deposited in the mite reference collection of Montpellier SupAgro conserved in UMR CBGP INRA/IRD/CIRAD/SupAgro/Université de Montpellier.

The following abbreviations are used in this paper for morphological characters: 

- **dsl** = length of dorsal shield;
- **dsw** = width of dorsal shield width;
- **lis** = length of largest inguinal sigilla (= primary metapodal plate);
- **lisw** = width of largest inguinal sigilla;
- **sis** = length of smallest inguinal sigilla (= secondary or accessory metapodal plate);
- **vsl** = length of ventrianal shield;
- **vsw ZV2 and vsw anus** = width of ventrianal shield at ZV2 level and at anus level;
- **sc** = length of spermathecal cervix;
- **scw** = diameter of spermathecal cervix;
- **fdl** = length of fixed cheliceral digit;
- **mdl** = length of movable cheliceral digit;
- **Nb. pairs pores st. sh** = number of pairs of pores on the sternogenital shield of the male;
- **Shaft of spermadactyl**. = length of the shaft of the spermadactyl.

The following abbreviations are used for institutions:

- **CBGP** = Centre de Biologie pour la Gestion des Populations;
- **CIRAD** = Centre International de Recherche Agronomique pour le Développement;
- **INRA** = Institut National de la Recherche Agronomique;
- **IRD** = Institut de Recherche pour le Développement;
- **MSA** = Montpellier SupAgro, France;
- **UMR** = Unité Mixte de Recherche;
- **UPR** = Unité Propre de Recherche.

**Results and discussion**

All collected phytoseiid species belong to the subfamily Amblyseiinae are identified as follows.

**Subfamily Amblyseiinae Muma**

Amblyseiinae Muma, 1961: 273.

**Tribe Kampimodromini Kolodochka**

Kampimodromini Kolodochka, 1998: 59.

**Subtribe Paraphytoseiina Chant & McMurtry 2003**

Paraphytoseiina Chant & McMurtry, 2003: 211.

**Genus Paraphytoseius Swirski and Shechter**

*Paraphytoseius* Swirski & Shechter, 1961: 113.

*Amblyseius* (Paraphytoseius) Ehara, 1967: 77.

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

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

*Ptenoseius* Schuster & Pritchard, 1963: 198.

*Paraphytoseius orientalis* (Narayanan, Kaur & Ghai)

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

*Paraphytoseius orientalis* Chant & McMurtry, 2003: 220; Moraes *et al.*, 2004: 162.

*Paraphytoseius ipomeai* El-Banhawy, 1984: 126 (synonym according to Chant & McMurtry 2003).
Paraphytoseius multidentatus Swirski & Shechter, 1961: 114; McMurtry & Moraes, 1984: 27; Moraes et al., 1986: 104 (synonymy according to Chant & McMurtry 2003).

Paraphytoseius narayanami Ehara & Ghai in Ehara, 1967: 77 (synonym according to Chant & McMurtry 2003).

Paraphytoseius parabilis Chaudhri, 1967: 266 (synonym according to Matthysse & Denmark 1981).

Paraphytoseius santurcensis De Leon, 1965: 130 (synonym according to Chant & McMurtry 2003).

Paraphytoseius seychellensis Schicha & Corpuz-Raros, 1985: 71 (synonym according to Chant)

### Table 1

Comparison of measurements of an adult female Paraphytoseius orientalis collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

| Characters | Mauritius (1) | Kenya (5) | Various Countries (5) | Paratype (1) |
|------------|---------------|-----------|------------------------|--------------|
| Dsl        | 290           | 250       | 291 (280–304)          | 306          |
| Dsw        | -             | 150       | 159 (149–168)          | 165          |
| j1         | 38            | 40        | 32 (29–37)             | 36           |
| j3         | 83            | 80        | 83 (72–90)             | 81           |
| j4         | 5             | 2–3       | 3 (2–3)                | 4            |
| j5         | -             | 2–3       | 3 (2–3)                | 5            |
| j6         | -             | 2–3       | 6 (5–6)                | 6            |
| J5         | -             | 9         | 4 (3–5)                | 5            |
| z2         | 8             | 9         | 9 (8–10)               | 9            |
| z4         | 10            | 5         | 9 (8–10)               | 11           |
| z5         | -             | 3         | 5                      | 3            |
| Z1         | 8             | 6         | 7 (6–8)                | 8            |
| Z4         | 70            | 83        | 72 (67–77)             | 71           |
| Z5         | 93            | 138       | 96 (90–101)            | 94           |
| s4         | 125           | 127       | 117 (110–126)          | 118          |
| r3         | 55            | 46        | 42 (38–46)             | 45           |
| R1         | 33            | 39        | 28 (26–30)             | 25           |
| St1-St1    | -             | -         | -                      | -            |
| St1-St3    | 65            | 65        | 64 (61–66)             | 66           |
| ST2-ST2    | -             | 60        | 65 (62–67)             | 66           |
| ST2-ST3    | 35            | -         | -                      | -            |
| ST5-ST5    | -             | 96        | 82 (80–85)             | 79           |
| Lstl       | -             | -         | -                      | -            |
| Lst1w      | -             | -         | -                      | -            |
| Sstl       | -             | -         | -                      | -            |
| Sstl       | 113           | 100       | 99                     | 97           |
| Vsw ZV2    | -             | 55        | 61 (56–64)             | 52           |
| Vsw aus    | -             | -         | 59 (56–62)             | 55           |
| Jv5        | 25            | 70        | -                      | -            |
| SgeI       | 8             | -         | 8                      | 6            |
| SgeII      | 13            | 10        | 12 (11–13)             | 13           |
| SgeII      | -             | -         | 13 (11–14)             | 13           |
| SstII      | -             | -         | 13 (11–14)             | 14           |
| SgeIV      | 30            | 28        | 28 (24–32)             | 25           |
| SstIV      | 38            | 40        | 34 (33–37)             | 35           |
| SstIV      | 45            | 40        | 41 (40–42)             | 43           |
| SstIV      | 48            | -         | 38 (35–40)             | 36           |
| SeI        | 4             | 5         | 3                      | -            |
| SeII       | 6             | -         | 13 (13–14)             | -            |
| Fdl        | 25            | -         | 26                     | -            |
| Nb teeth Fd| 7             | 8–9       | 7–8                    | -            |
| Mdl        | 28            | -         | 28                     | -            |
| Nb teeth Md| 2             | 2         | 2                      | -            |

Sources of measurements - Kenya: El-Banhawy & Knapp (2011); Various countries (Burundi 1, Kenya 2, Rwanda 2) in Africa: Moraes et al. (2007); paratype collected in Hong Kong: Moraes et al. (2007). -: not provided.
Specimens examined — Chamouny (20°28'55.99"S, 57°27'58.00"E, alt. 128 m), 1 ♀ on an unknown host plant, 21-IX-2017.

Previous Records — Widely distributed in all the tropical area of Africa, South America and South-East Asia.

Remarks — Measurements of most setae of the single female collected (Table 1) agree with measurements provided in the literature, except for the longer r3, R1, ventrianal shield, and macrosetae of telotarsus IV. It also has shorter JV5 and Scw than reported for Kenyan specimens. This species belongs to a genus included in the great polyphagous generalist group named type III among phytoseiid mites (McMurtry and Croft 1997; McMurtry et al. 2013). Navasero and Navasero (2016) have studied the life history of P. orientalis on the broad mite as prey [Polyphagotarsonemus latus (Banks)]. The authors reported high predation rates of this predator on eggs of that prey, suggesting its potential for the control of this pest.

Tribe Phytoseiulini Chant & McMurtry

Phytoseiulini Chant & McMurtry, 2006: 7.

Genus Phytoseiulus Evans

Phytoseiulus Evans, 1952: 397.

Phytoseiulus persimilis Athias-Henriot

Phytoseiulus persimilis Athias-Henriot, 1957: 347; Moraes et al., 1986: 109; Moraes et al., 2004: 169; Chant & McMurtry, 2006: 20; 2007: 55. Phytoseiulus riegeli Dosse, 1958: 48 (synonymy according to Chant, 1959: 109).

Typhlodromus persimilis, Hirschmann, 1962: 75.

Phytoseiulus (Phytoseiulus) persimilis, Wainstein, 1962: 17.

Phytoseiulus tardi (Lombardini, 1959): 166 (synonymy according to Kennett & Caltagirone, 1968: 571).

Specimens examined — Cascavelle (20°17'12.98"S, 57°24'25.99"E, alt. 135 m), 14 ?? + 4 ?? + 5 immatures on Solanum lycopersicum L., 28-IX-2017.

Previous Records — Widely distributed in Africa, Australia, Europe, especially Mediterranean countries, South America, and Asia, probably after largely distributed commercial uses in the world, dispersion in the environment in at least some locations and establishment of this species.

Remarks — (tables 2 & 3) — Measurements of the 14 adult females collected in this work (Table 2) agree very well with measurements of the literature, especially with those of Ueckermann et al. (2007) obtained with a great number of specimens (29) from various African countries.

Macrosetae on basitarsus of leg IV are not serrated but macrosetae of genu and tibia are serrated and there is no pre-anal macrosetae on the ventrianal shield. These are key characters of P. persimilis in comparison to the closely related species Phytoseiulus macropilis (Banks) (Okassa et al. 2010).

Only few measurements of adult males are available in the literature and consequently measurements of the four males found in Mauritius are of great interest.

Four males and 14 females in a collected population with a sex ratio of nearly 4 females to one male is not exceptional for that species (Laing 1968).

Phytoseiulus persimilis is a Mediterranean / subtropical predatory mite that is a type I species, i.e. a specialist predator of the urticae species group of the genus Tetranychus (McMurtry and Croft 1997; McMurtry et al. 2013). Considerable research has been conducted on this predator–prey interaction (see review by Kostiainen and Hoy 1996), and numerous
Table 2  Comparison of measurements of adult females of *Phytoseiulus persimilis* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

| Characters | Mauritius (14) | Various countries (29) | Various countries (?) | Types (3) |
|------------|----------------|------------------------|-----------------------|----------|
| Dsl        | 349 (325–375)  | 339 (316–369)          | 322 (314–330)         | 300–330  |
| Dsw        | 217 (178–245)  | 227 (196–256)          | 224 (215–232)         | -        |
| j1         | 25 (20–28)     | 26 (22–32)             | 28 (25–32)            | 25–35    |
| j3         | 42 (37–50)     | 42 (31–51)             | 42 (38–46)            | 45–55    |
| j4         | 46 (43–50)     | 52 (39–72)             | 50 (48–52)            | 45–55    |
| j5         | 65 (55–75)     | 77 (62–92)             | 69 (65–74)            | 65–70    |
| j6         | 145 (128–155)  | 150 (114–161)          | 152 (145–160)         | 145–160  |
| J5         | 5 (4–6)        | 5 (4–8)                | 6 (5–6)               | 5        |
| z2         | 14 (13–18)     | 12 (7–16)              | 12 (10–13)            | 10–15    |
| z4         | 57 (53–63)     | 58 (39–68)             | 61 (57–65)            | 45–55    |
| z5         | 11 (8–13)      | 10 (7–15)              | 9 (8–12)              | 10–15    |
| Z1         | 105 (95–115)   | 107 (94–124)           | 110 (105–115)         | 80–90    |
| Z4         | 129 (122–139)  | 135 (119–152)          | 134 (131–138)         | 115–125  |
| Z5         | 121 (110–128)  | 125 (113–137)          | 126 (120–132)         | 115–125  |
| s4         | 165 (150–180)  | 163 (114–183)          | 165 (159–172)         | 145–160  |
| S5         | 33 (25–40)     | 29 (20–37)             | 32 (25–38)            | 25–35    |
| r3         | 24 (23–25)     | 24 (17–29)             | 23 (21–26)            | -        |
| R1         | 26 (25–31)     | 29 (22–33)             | 28 (25–32)            | -        |
| St1-St1    | 53 (45–58)     | 54 (47–61)             | -                     | -        |
| St1-St3    | 71 (60–78)     | 74 (67–82)             | -                     | 73       |
| St2-St2    | 79 (75–88)     | 80 (69–91)             | -                     | -        |
| St2-St3    | 33 (30–35)     | 33 (28–37)             | -                     | 32       |
| St3-St3    | 90 (80–98)     | 94 (83–104)            | -                     | 93       |
| St4-St4    | 101 (90–115)   | 99 (82–120)            | -                     | -        |
| St5-St5    | 82 (75–88)     | 86 (76–82)             | -                     | 86       |
| Lis1       | 41 (35–50)     | -                      | -                     | -        |
| Lsiw       | 4 (3–5)        | -                      | -                     | -        |
| Sisl       | 18 (13–20)     | -                      | -                     | -        |
| Vsl        | 76 (50–88)     | 81 (69–90)             | 93 (89–98)            | -        |
| vsv anus   | 76 (63–88)     | 77 (63–93)             | -                     | -        |
| JV5        | 46 (43–50)     | 45 (32–62)             | 40 (35–44)            | -        |
| SgeIV      | 84 (75–95)     | 83 (69–94)             | 84 (80–91)            | 90       |
| StIV       | 43 (30–50)     | 44 (38–48)             | 45 (40–48)            | 50       |
| StIV       | 134 (125–140)  | 123 (108–132)          | 126 (110–135)         | 125      |
| Sel        | 31 (25–38)     | -                      | -                     | -        |
| Scw        | 9 (7–13)       | -                      | -                     | -        |
| Fdl        | 26 (25–33)     | -                      | -                     | -        |
| Nb teeth Fd| 6              | -                      | -                     | -        |
| Mdl        | 26 (25–30)     | -                      | -                     | -        |
| Nb teeth Fd| 3              | -                      | -                     | -        |
| Sources of measurements - Various countries (Spain 7, Italy 4, Syngenta Bioline rearings 11, Tunisia 7) in Europe and Northern Africa: Okassa et al. (2010); various countries (Sicily, Italy; Valparaiso, Chile; California, USA and Sydney, Australia) in the world: Takahashi and Chant (1993); type material collected in Algeria: Athias-Henriot (1957). - not provided.
biological control programs have used *P. persimilis* against *T. urticae* on a wide range of ornamental and vegetable crops. *Phytoseiulus persimilis* was the first greenhouse biological control agents available commercially and it is one of the most successful biological control agents. It can also be used in temperate climates on open-field crops such as strawberries. Optimum conditions are 20-27 °C and relative humidity of 60-90%. Cooler or warmer temperatures may have a negative effect on reproduction, development and efficiency of this predatory mite. This species is present in Mauritius probably because of its commercial introduction and uses in vegetable and ornamental greenhouses, dispersion of some specimens released and establishment in the environment. This species is actually reared and sold in La Réunion and commercialised in Mascareignes since a long time (Quilici, personal communication).

**Table 3** Comparison of measurements of adult males of *Phytoseiulus persimilis* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

| Characters | Mauritius (3) | Various countries (?) | Types (1) |
|------------|---------------|-----------------------|----------|
| Dsl        | 293 (263–325) | -                     | 265      |
| Dsw        | 215 (200–250) | -                     | -        |
| j1         | 21 (20–25)    | -                     | -        |
| j3         | 42 (40–45)    | -                     | -        |
| j4         | 51 (50–55)    | -                     | -        |
| j5         | 60 (53–68)    | -                     | -        |
| j6         | 111 (105–113) | -                     | 95–105   |
| J5         | 5             | -                     | -        |
| z2         | 19 (18–20)    | -                     | -        |
| z4         | 58 (54–63)    | -                     | -        |
| z5         | 12 (10–13)    | -                     | -        |
| Z1         | 79 (75–85)    | -                     | -        |
| Z4         | 99 (83–116)   | -                     | 95–105   |
| Z5         | 81 (75–88)    | -                     | 95–105   |
| s4         | 122 (113–130) | -                     | 95–105   |
| S5         | 32 (30–35)    | -                     | -        |
| r3         | 20            | -                     | -        |
| R1         | 28 (25–30)    | -                     | -        |
| St1-St1    | 53 (50–54)    | -                     | 50–55    |
| St1-St5    | 128           | -                     | -        |
| St2-St2    | 67 (65–70)    | -                     | 70       |
| St2-St3    | 35 (33–37)    | -                     | -        |
| St3-St3    | 69 (68–70)    | -                     | 70       |
| St4-St4    | 62 (60–63)    | -                     | 60–65    |
| St5-St5    | 51 (48–54)    | -                     | 50–55    |
| Nb. pairs pores st. sh | 3 | - | - |
| Vsl        | 129 (110–150) | 122 (118–128)         | 120      |
| vsw ZY2    | 137 (110–163) | 125 (113–139)         | -        |
| vsw anus   | 75            | -                     | -        |
| JV5        | 42 (40–43)    | -                     | -        |
| SgeIV      | 62 (58–65)    | -                     | 70       |
| SliIV      | 35 (33–35)    | -                     | -        |
| SIV        | 97 (92–100)   | -                     | 90       |
| Fdl        | 20            | -                     | -        |
| Nb teeth Fd | -           | -                     | -        |
| Mdl        | 21 (20–23)    | -                     | -        |
| Nb teeth Md | -           | -                     | -        |
| Schait of spermatod. | 23 (20–25) | 34 (32–36) | - |

Sources of measurements: Various countries (Sicily, Italy; Valparaiso, Chile; California, USA and Sydney, Australia) in the world: Takahashi and Chant (1993); type material collected in Algeria: Athias-Henriot (1957). -: not provided.
Table 4. Comparison of measurements of adult females of *Scapulaseius reptans* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

| Characters | Mauritius (2) | Madagascar (5) |
|------------|---------------|----------------|
| Dsl        | 303–305       | 290            |
| Dsw        | 185–188       | 190            |
| j1         | 23            | 21             |
| j3         | 20–23         | 15             |
| j4         | 8             | 8              |
| j5         | 8             | 7              |
| j6         | 10            | 10             |
| J2         | 8–9           | 10             |
| J5         | 8             | 7              |
| z2         | 18–20         | 16             |
| z4         | 23            | 16             |
| z5         | 8             | 18             |
| Z1         | 10            | 10             |
| Z4         | 56–53         | 48             |
| Z5         | 72–75         | 70             |
| s4         | 28            | 25             |
| S2         | 22–25         | 18             |
| S4         | 18–23         | 15             |
| S5         | 18–20         | 14             |
| r3         | 18            | 15             |
| R1         | 13            | 15             |
| St1-St1    | 50            | -              |
| St1-St3    | 53–56         | -              |
| St2-St2    | 60            | -              |
| St2-St3    | 20–22         | -              |
| St3-St3    | 65            | -              |
| St4-St4    | 65–78         | -              |
| St5-St5    | 60            | -              |
| Lisl       | 18–23         | -              |
| Lsiw       | 4–5           | -              |
| Sisl       | 10–13         | -              |
| Vsl        | 98–100        | 98             |
| vsw ZV2    | 85–87         | 78             |
| vsw anus   | 68–70         | -              |
| JV5        | 28            | 24             |
| SgeI       | 23            | -              |
| SgeII      | 13–15         | -              |
| SgeIII     | 18            | -              |
| STI III    | 18            | -              |
| SgeIV      | 28            | 27             |
| StII       | 23–25         | 20             |
| StIV       | 50–53         | 50             |
| Scl        | 30–35         | 45             |
| Scw        | 2             | 2              |
| Fdl        | 25            | 26             |
| Nb teeth Fd| 9             | 8              |
| Mdl        | 25            | 26             |
| Nb teeth Md| 3             | 3              |

Sources of measurements - Madagascar: Blommers (1974). -: not provided.
**Tribe Typhlodromipsini Chant & McMurtry**

Typhlodromipsini Chant & McMurtry, 2005: 318.

**Genus Scapulaseius Karg & Oomen-Kalsbeek**

Scapulaseius Karg & Oomen-Kalsbeek, 1987: 132.

Amblyseius (Scapulaseius) Karg & Oomen-Kalsbeek, 1987: 132.

newsami species group of Typhlodromus (Amblyseius), Chant, 1959: 95.

markwelli species group of Amblyseius, Schicha, 1987: 25.

japonicus species group of Amblyseius, Schicha, 1987: 26.

ogaro species group of Amblyseius, Wu & Ou, 1999: 103.

Scapulaseius, Chant & McMurtry, 2005: 331.

**Scapulaseius reptans** (Blommers)

Amblyseius (Amblyseius) reptans Blommers, 1974: 145.

Typhlodromips reptans. Moraes et al., 1986: 146; Moraes et al., 2004: 222.

Scapulaseius reptans, Chant & McMurtry, 2005: 335; Chant & McMurtry, 2007: 68.

Specimens examined — Chamouny (20°28′55.99″S, 57°27′58.00″E, alt. 128 m), 2 ?? and 1 ? on an unknown host plant, 21-IX-2017.

Previous Records — La Réunion, Madagascar.

Remarks — Measurements of collected females are consistently longer than reported for the type specimens (Table 4). Measurements of the only male specimen collected (Table 5) are more variable in comparison with the type specimens. In Mauritius specimen, setae s₄, Z₄, Z₅ and macrosetae SgeIV are longer but setae z₂, z₄, S₂, S₄, and S₅ are shorter than type specimens. The rest of the measurements however agree well with the original description of Blommers (1974) and with our own measurements of females and males collected in La Réunion Island (Quilici et al. 2000 and Kreiter et al. in prep.).

Species of this genus Scapulaseius are supposed to be of type III (McMurtry and Croft 1997; McMurtry et al. 2013), i.e. a polyphagous generalist predator. However, the biology of S. reptans remains totally unknown.

**Genus Typhlodromips De Leon**

Typhlodromips De Leon, 1965: 23; Moraes et al., 2004: 205 (in part); Chant & McMurtry, 2005: 323. Amblyseius (Typhlodromips), Wainstein, 1983: 313.

**Typhlodromips culmulus** (Van der Merwe)

Amblyseius (Amblyseius) culmulus Van der Merwe, 1968: 132; Ueckermann & Loots, 1988: 157.

Typhlodromips culmulus, Moraes et al., 1986: 139; 2004: 210; Chant & McMurtry, 200: 327; 2007: 61.

Specimens examined — Chamouny (20°28′55.99″S, 57°27′58.00″E, alt. 128 m), 1 ? on an unknown host plant, 21-IX-2017.

Previous Records — Kenya, Lesotho, South Africa.

Remarks — Measurements of the single adult female collected (Table 6) agree with those of the literature, except for the shorter Z₄, JV₅, macrosetae SgeII and StiIV.

Species of this genus are supposed to belong to the type III (McMurtry and Croft 1997; McMurtry et al. 2013), i.e. a polyphagous generalist predator. However, the biology of T. culmulus remains totally unknown.
**Table 5** Comparison of measurements of one adult male of *Scapulaseius reptans* collected in this study with those in previous study (localities followed by the number of specimens measured between brackets).

| Characters | Mauritius (1) | Madagascar (3) |
|------------|---------------|----------------|
| Dsl        | 255           | 230            |
| Dsw        | 175           | 170            |
| j1         | 18            | 16             |
| j3         | 25            | 20             |
| j4         | 10            | 7              |
| j5         | 10            | 8              |
| j6         | 10            | 8              |
| J2         | 10            | 8              |
| J5         | 6             | 3              |
| z1         | 13            | 16             |
| z4         | 13            | 16             |
| z5         | 10            | 6              |
| Z1         | 13            | 9              |
| Z4         | 33            | 20             |
| Z5         | 50            | 35             |
| s4         | 25            | 20             |
| S2         | 10            | 20             |
| S4         | 10            | 15             |
| S5         | 9             | 13             |
| r3         | 15            | 14             |
| R1         | 13            | 13             |
| St1-St1    | 47            | -              |
| St1-St5    | 105           | -              |
| St2-St2    | 53            | -              |
| St2-St3    | 25            | -              |
| St3-St3    | 55            | -              |
| St4-St4    | 40            | -              |
| St5-St5    | 35            | -              |
| vsl        | 113           | 105            |
| vsw ZV2    | 135           | -              |
| vsw anus   | 60            | -              |
| JV5        | 20            | 17             |
| Sgel      | 25            | -              |
| SgelII    | 20            | -              |
| SgelIII   | 25            | -              |
| StilIII   | 20            | -              |
| SgelIV    | 35            | 19             |
| StilV     | 20            | 15             |
| StilV     | 48            | 45             |
| Fdl        | 20            | -              |
| Nb teeth Fd | 8            | 8              |
| Mdl        | 23            | -              |
| Nb teeth Md | 1            | 1              |
| Shaft      | 17            | 15             |

Sources of measurements - Madagascar: Blommers (1974). -: not provided.

**Discussion**

Until now, the only phytoseiid species reported from Mauritius (Demite et al. 2018) were: *Amblyseius caudatus* Berlese, associated with *Polyphagotarsonemus latus* (Banks) on chilli pepper (*Capsicum annuum* L.), with various eriophyid mites on sugarcane (*Saccharum officinarum* L.) and buffalograss (*Panicum maximum* Jacquemin), in undetermined localities (Moutia 1958); *Euseius ovalis* (Evans), associated with *Raoeilla indica* Hirst on coconut (*Cocos nucifera* L.), with *Tetranychus cucurbitae* Rahman and Sapra and *Tetranychus marianae* McGregor on eggplant (*Solanum melongena* L.) and *Solanum nigrum* L., and with *Eotetranychus* sp. on apple (*Malus domestica* L.), in undetermined localities (Moutia 1958); and *Phytoseius coheni*
Table 6 Comparison of measurements of an adult female of *Typhlodromips culmulus* collected in this study with those in previous studies (localities followed by the number of specimens measured between brackets).

| Characters | Mauritius (1) | Kenya (2) | South Africa (1) | Types (2) |
|------------|---------------|-----------|------------------|-----------|
| Dsl        | 313           | 300       | 355              | 334       |
| Dsw        | 200           | 200       | 235              | 208       |
| j1         | 18            | 18        | 21               | 19        |
| j3         | 20            | 18        | 24               | 22        |
| j4         | 10            | 9         | 11               | 9         |
| j5         | 10            | 9         | 11               | 9         |
| j6         | 10            | 10        | 11               | 13        |
| J2         | 13            | 14        | 11               | 16        |
| J5         | 10            | 7         | 11               | 9         |
| z2         | 13            | 12        | 15               | 13        |
| z3         | 10            | 7         | 11               | 9         |
| Z1         | 13            | 10        | 11               | 13–15     |
| Z4         | 33            | 35        | 44               | 38–39     |
| Z5         | 75            | 70        | 82               | 69–74     |
| s4         | 28            | 25        | 38               | 30–32     |
| S2         | 13            | 12        | 11               | 13        |
| S4         | 10            | 8         | 11               | 9         |
| S5         | 8             | 8         | 11               | 9         |
| r3         | 15            | 15        | 19               | 16        |
| R1         | 13            | 12        | 15               | 13        |
| St1-St1    | 50            | -         | -                | -         |
| St1-St3    | 55            | 52        | 65               | 47        |
| St2-St2    | 60            | 58        | 65               | 52–54     |
| St2-St3    | 23            | -         | -                | -         |
| St3-St3    | 65            | -         | -                | -         |
| St4-St4    | 60            | -         | -                | -         |
| St5-St5    | 68            | 66        | 85               | 60–62     |
| Lisl       | -             | -         | -                | -         |
| Lsiw       | -             | -         | -                | -         |
| Sisl       | -             | -         | -                | -         |
| Vsl        | 113           | 105       | 115              | 110       |
| vsw ZIV2   | 85            | 82        | 90               | 82–85     |
| vsw anus   | 63            | -         | -                | -         |
| JV5        | 33            | 36        | 39               | -         |
| SgeI       | 30            | -         | -                | 30–32     |
| SgelII     | 18            | 28        | 33               | 25–28     |
| SgelIII    | 30            | 28        | 33               | 28        |
| StilIII    | 28            | -         | -                | 22–26     |
| SgelIV     | 48            | 46        | 54               | 47–49     |
| StilV      | 30            | 40        | 45               | 41        |
| StlV       | 58            | 55        | 66               | 63        |
| Scl        | -             | 2,5       | 3                | 2         |
| Sew        | -             | 14        | 12               | -         |
| Fdl        | 25            | -         | -                | 22–25     |
| Nb teeth Fd| 5–6           | 7         | 8                | 11–12     |
| Mdl        | 25            | -         | -                | 25–26     |
| Nb teeth Fd| 3             | 3         | 3                | 3         |

Sources of measurements – Kenya: El-Banhawy & Knapp (2011); South Africa: Van der Merwe (1968); type material (the holotype and one paratype) collected in South Africa: Moraes et al. (2007a). -: not provided.

Swirski & Shechter, on *Cotoneaster* sp., in Curepipe (20°19’1.5”S, 57°31’35.5”E, alt. 561 m) (Schicha 1984). After a brief survey done in two locations, the number of species known from Mauritius Island increased to seven, of which six belong to Amblyseinae (*A. caudatus*, *E. ovalis*, *P. orientalis*, *P. persimilis*, *S. reptans*, *T. culmulus*) and one to Phytoseiinae (*P. coheni*). No Typhlodrominae was found until now. Two of them are well-known biological control
agents, namely *P. persimilis* and *P. orientalis*, and may have great interest for agriculture of the island. The first species for the history of success in the control of *T. urticae*, and the second has apparently high potential for the control of *P. latus*. The biology of the two other species remains unknown and consequently their potential for biological control. Finding local species potentially useful for biological control purpose is particularly important nowadays because new regulations of many countries of the world makes more difficult the importation of macro-organisms for biological control purposes. Importation permits must be requested, but it is expensive and chances to obtain are generally very low in many countries (Kreiter et al. 2016). Hence, knowledge of the biodiversity, especially of efficient biological control agents becomes progressively more important, not only for conservation, but also for agricultural and economic reasons.

**Acknowledgements**

To Mauritian institutions for the great help in this survey: Le Vélo Vert Association in Curepipe, the Mauritius Chamber of Agriculture in Port-Louis and The Food and Agricultural Research and Extension Institute (FAREI) in Réduit. To Cyril Festin (Phytoprotech, La Réunion) for the logistical support. To the two anonymous reviewers for the improvement of the first version of this manuscript.

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