Acarologia 51(1): 133–138 (2011)
DOI: 10.1051/acarologia/20112001

PHYTOSEIID MITES (ACARI: PHYTOSEIIDAE) FROM SENEGAL

Niokhor KADE[1], Absa GUEYE-NDIAYE[1], Claude DUVERNEY[2] and Gilberto J. de MORAES[3*]

(Received 19 January 2011; accepted 10 March 2011; published online 30 March 2011)

[1] *Laboratoires d'Entomologie et d'Acarologie du Département de Biologie animale, Faculté des Sciences et Techniques, Université Cheikh Anta Diop, Dakar, Sénégal. kniokhor2@yahoo.fr, absa.ndiaye@ucad.edu.sn*
[2] *Caritas-Kaolack, B.P. 482, Kaolack, Sénégal. Duverney@orange.sn*
[3] *Depto. Entomologia e Acarologia, ESALQ-Universidade de São Paulo-13418-900 Piracicaba-SP, Brazil. gjmoraes@esalq.usp.br*
[*] *Correspondig author*

ABSTRACT — This paper refers to the first report of mites of the family Phytoseiidae from Senegal. It is based mostly on a survey conducted in the Fatick (Sine Saloum) Region, in the interior, and the Dakar Region, at the coast, in search of predators associated with the tomato red spider mite, *Tetranychus evansi* Baker & Pritchard. The latter has been recently introduced to Senegal, where it is causing considerable damage to solanaceous plants. Phytoseiids have been widely studied in other countries for the biological control of phytophagous mites. Seven species were found in this survey. Measurements of the species collected are provided. *Neoseiulus californicus* (McGregor) was only found in 2010. This could represent a new introduction into the country; it is reported for the second time in northern sub-Saharan Africa. This species and *Amblyseius swirskii* Athias-Henriot were often associated with *T. evansi* and *Tetranychus urticae* Koch, but their possible impact on those pests was not evaluated.

KEYWORDS — taxonomy; predatory mites; biological control

INTRODUCTION

In the last 15 years, the tomato red spider mite, *Tetranychus evansi* Baker & Pritchard (Acari: Tetranychidae), has spread to several countries in Africa, Asia and Europe (Migeon & Dorkeld 2007). It has also been recently reported for the first time in Senegal (Duverney *et al.* 2005). Even before the introduction of this species, mites of the families Tarsonemidae and Tetranychidae were already considered problems on solanaceous plants in Senegal (Diouf, 1994). The introduction of *T. evansi* has turned those problems more severe, mainly on tomato (*Solanum lycopersicum* L.), eggplant (*Solanum melongena* L.) and "jaxatu" (*Solanum aethiopicum* L.).

Mites of the family Phytoseiidae have been widely studied for the biological control of phytophagous mites. Virtually nothing is known about these mites in Senegal; no species was reported from this country in the world phytoseiid catalog (Moraes *et al.*, 2004). Diouf (1994) conceived a prospective role of phytoseiid mites on *Solanum aethiopicum* L. and other plants of the same family in Senegal, for the control of phytophagous mites. Phytoseiid mites have been studied in other countries in the context of their possible use as control agents of *T. evansi* (Furtado *et al.*, 2006, 2007).

The inventory of the faunistic composition in a given region is one of the first steps in an effort to establish a biological control program against a pest

species. A survey was recently initiated, to determine the natural enemies associated with *T. evansi* in two regions of Senegal (Duverney *et al.*, 2005). The objective of this paper is to report the phytoseiid mites collected in that survey.

Material and Methods

The survey was conducted at the following localities: Malika and University Cheikh Anta Diop (in the coastal Dakar Region), Batamar, KBD Center, Senghor and Sokone [in the inland, Foundiougne Department of Sine-Saloum (= Fatick) Region] between 2005 and 2010.

All specimens were collected by Niokhor Kade. Because of the preference of *T. evansi* for Solanaceae (Moraes *et al.*, 1987), most effort was dedicated in the survey to examine plants of that family, although nearby plants of other families were also examined. Sampled plants were checked under stereomicroscope and mites found were mounted in Hoyer's medium for identification.

Mites were measured under an optical microscope (at 400 or 1000 X) for comparisons with original descriptions and re-descriptions of phytoseiid species. When more than two specimens were examined, measurement of each structure is indicated by the mean followed (in parentheses) by the respective range, in micrometers. The classification system used is that of Chant & McMurtry (2007). The setal terminology of Rowell *et al.* (1978) and Chant & Yoshida-Shaul (1991) were used for dorsal and ventral idiosomal setae, respectively. Except where otherwise specified, world distribution of each species is based on Moraes *et al.* (2004).

Phytoseiidae

Amblyseius herbicolus (Chant)

Typhlodromus herbicolus Chant, 1959: 84
Amblyseius herbicolus, Moraes *et al.*, 2004: 27; Chant & McMurtry, 2007: 78; Zannou *et al.*, 2007: 14

Measurements of 2 adult females collected are: dorsal shield 360 – 365 long and 250 – 268 wide; j1 35 – 38, j3 38 – 45, j4 6 – 8, j5 4, j6 8, J2 8 – 9, J5 8 – 10, z2 8 – 9, z4 10 – 11, z5 7 – 9, Z1 8 – 10, Z4 163 – 172, Z5 310 – 345, s4 123 – 135, S2 13 – 15, S4 and S5 8 – 10, r3 10 – 11, R1 9 – 10; distances between st1 – st3 63 – 65, st2 – st2 75 – 78 and st5 – st5 65 – 70; ventrianal shield 113 – 115 long, 65 – 69 wide at level of ZV2, 75 – 78 wide at anus level; calyx of spermatheca 33 – 35 long; Sge I 43 – 48, Sge II 38 – 40, Sge III 48 – 52, Sti III 43 – 45, Sge IV 160 – 162, Sti IV 102 – 115, St IV 76 – 78.

Chaetotaxy — genu II 2, 2/0-2/0, 1; genu III 1, 2/1-2/0, 1.

Remarks — Most measurements of the specimens collected are similar to those reported by Zannou *et al.* (2007) for specimens from sub-Saharan Africa. However, the lengths of s4, Z4, Z5 and leg macrosetae are close to the corresponding upper limits of the ranges shown by those authors for those setae.

Specimens collected — 3 females, on *Urena lobata* L., at University Cheikh Anta Diop, in July 2006.

World distribution — This species has been reported from tropical and subtropical regions of the Americas, sub-Saharan Africa, Canary Island, Asia and Oceania.

Amblyseius swirskii Athias-Henriot

Amblyseius swirskii Athias-Henriot, 1962: 5; Chant & McMurtry, 2007: 81; Zannou *et al.*, 2007: 27
Typhlodromips swirskii, Moraes *et al.* 2004: 227

Measurements of 3 adult females collected are: dorsal shield 348 (345 – 350) long and 208 (203 – 215) wide; j1 31 (30 – 33), j3 51 (48 – 55), j4 9 (8 – 10), j5 9 (6 – 15), j6 10 (8 – 13), J2 12 (10 – 13), J5 8 (6 – 10), z2 12 (8 – 14), z4 13 (10 – 15), z5 7 (6 – 8), Z1 9 (8 – 10), Z4 75 (73 – 77), Z5 108 (100 – 115), s4 79 (75 – 85), S2 17 (15 – 18), S4 10 (8 – 13), S5 9 (8 – 10), r3 21 (18 – 24), R1 12 (10 – 15); distances between st1 – st3 63 (54 – 68), st2 – st2 74 (73 – 75) and st5 – st5 76 (75 – 78); ventrianal shield 117 (103 – 130) long, 91 (88 – 92) wide at level of ZV2, 85 (83 – 87) wide at anus level; calyx of spermatheca 10 (8 – 13) long; Sge I 24 (23 – 25), Sge II 22 (20 – 23), Sge III 27 (25 – 28), Sti III 26 (25 – 28), Sge IV 55 (52 – 58), Sti IV 47 (43 – 50), St IV 53 (52 – 55).

Chaetotaxy — genu II 2, 2/0-2/0, 1; genu III 1, 2/1-2/0, 1.

Remarks — Measurements of the specimens collected are very similar to those reported by Zannou *et al.* (2007) for specimens of sub-Saharan Africa and Israel.

Specimens collected — 23 females and 6 males on *Passiflora foetida* L., in June 2009, and 56 females and 17 males, on *Solanum aethiopicum* L., in May 2009, at Malika. In both cases, the predator was commonly associated with *T. evansi* and *Tetranychus urticae* Koch.

World distribution — This species has been reported from the Mediterranean region, southwest Asia and northern and sub-Saharan Africa.

Euseius nyalensis (El-Badry, 1968)

Amblyseius nyalensis El-Badry, 1968: 322
Euseius nyalensis, Moraes *et al.*, 2001 : 40 ; Moraes *et al.*, 2004: 76; Chant & McMurtry, 2007: 121

Measurements of 3 adult females collected are: dorsal shield 339 (332 – 340) long and 226 (215 – 235) wide; j1 35 (33 – 35), j3 43 (38 – 48), j4 43 (38 – 50), j5 45 (43 – 48), j6 62 (62 – 65), J2 63 (62 – 65), J5 7 (5 – 8), z2 37 (35 – 41), z4 55 (53 – 60), z5 18 (14 – 23), Z1 60 (55 – 64), Z4 61 (58 – 65), Z5 82 (80 – 83), s4 74 (62 – 85), S2 59 (48 – 65), S4 49 (45 – 55), S5 49 (47 – 50), r3 27 (25 – 29), R1 18 (17 – 20); distances between st1 – st3 65 (64 – 67), st2 – st2 70 (67 – 75) and st5 – st5 83 (81 – 87); ventrianal shield 106 (102 – 110) long, 64 (63 – 65) wide at level of ZV2, 74 (72 – 76) wide at anus level; calyx of spermatheca 23 (20 – 25) long; Sge I 31 (30 – 32), Sge II 32 (30 – 33), Sge III 41 (40 – 42), Sti III 27 (25 – 28), Sge IV 59 (57 – 60), Sti IV 36 (35 – 37), St IV 71 (70 – 73).

Chaetotaxy — genu II 2, 2/0-2/0, 1; genu III 1, 2/1-2/0, 1.

Remarks — Measurements of the specimens collected fit well those given in the original description of the species. Moraes *et al.* (2001) reported a wide variation in setal lengths of specimens identified as *E. nyalensis* from sub-Saharan Africa. The calyx of the spermatheca of the specimens collected is very similar to the illustration of Moraes *et al.* (2001).

Specimens collected — 2 females, on *Urena lobata*, at University Cheikh Anta Diop, in August 2006; 2 females on *Anacardium occidentalis* L., 5 females and 1 male on *Ficus sycomorus* L., at KBD, in February 2009.

World distribution — This species has been reported from Asia, northern and sub-Saharan Africa.

Neoseiulus barkeri Hughes

Neoseiulus barkeri Hughes, 1948: 141; Moraes *et al.*, 2004: 104; Chant & McMurtry, 2007: 22; Zannou *et al.*, 2006: 249.

Measurements of the single adult female collected are: dorsal shield 355 long and 195 wide; j1 15, j3 18, j4 and j5 15, j6 18, J2 19, J5 10, z2 19, z4 20, z5 16, Z1 21, Z4 33, Z5 45, s4 23, S2 23, S4 20, S5 18, r3 15, R1 13; distances between st1 – st3 63, st2 – st2 65 and st5 – st5 55; ventrianal shield 113 long, 90 wide at level of ZV2; calyx of spermatheca 25 long; St IV 55.

Chaetotaxy —genu II 2, 2/0-2/0, 1; genu III 1, 2/1-2/0, 1.

Remarks — Measurements of the only specimen collected fit well those given by Zannou *et al.* (2006) for specimens from sub-Saharan Africa.

Specimens collected — 1 female, on *Solanum aethiopicum* L., at Malika, in March 2007.

Neoseiulus californicus (McGregor)

Typhlodromus californicus McGregor, 1954: 89
Amblyseius californicus, Schuster & Pritchard, 1963: 271
Neoseiulus californicus, Moraes *et al.*, 2004: 109; Chant & McMurtry, 2007: 25; Guanilo *et al.*, 2008: 27

Measurements of 5 adult females collected are: dorsal shield 359 (340 – 375) long and 174 (168 – 187) wide; j1 22 (20 – 23), j3 30 (25 – 33), j4 25 (23 – 28), j5 24 (20 – 27), j6 28 (25 – 33), J2 31 (28 – 33), J5 13 (13 – 15), z2 25 (23 – 28), z4 28 (25 – 33), z5 24 (23 – 28), Z1 36 (33 – 40), Z4 50 (48 – 53), Z5 65 (55 – 73), s4 32 (30 – 38), S2 40 (38 – 45), S4 37 (35 – 38), S5 31 (30 – 33), r3 25 (24 – 25), R1 23 (22 – 23); distances between st1 – st3 63 (53 – 68), st2 – st2 63 (53 – 68)

and st5 – st5 67 (63 – 73); ventrianal shield 119 (113 – 127) long, 86 (95 – 105) wide at level of ZV2; calyx of spermatheca 10 (9 – 10) long; St IV 52 (48 – 60). Fixed and movable cheliceral digits with 3 and 2 teeth, respectively.

Chaetotaxy — genu II 2, 2/0-2/0, 1; genu III 1, 2/1-2/0, 1.

Remarks — Measurements of the specimens collected are similar to what was reported in redescriptions of the species based on specimens from California (Schuster & Pritchard, 1963) and Peru (Guanilo *et al.*, 2008), except for the anterolateral dorsal shield setae and Z5, about 10 % shorter in the specimens collected.

Specimens collected — More than 50 specimens on *Solanum aethiopicum* L. and *S. melongena* L., infested by *T. evansi* and *T. urticae*, at Malika, between March and July 2010.

World distribution — This species has been reported from subtropical to temperate areas in the Americas, Europe, Asia and northern Africa. A few years ago (Pringle & Heunis, 2006) it was introduced to South Africa for the control of mite pests in apple orchards; thus, our finding is the second record of this species in sub-Saharan Africa (Zannou *et al.*, 2006).

***Paraphytoseius horrifer* (Pritchard & Baker)**

Amblyseius (*Ptenoseius*) *horrifer* Pritchard & Baker, 1962: 295
Paraphytoseius horrifer, Moraes *et al.*, 2004: 161; Chant & McMurtry, 2007: 49; Moraes *et al.*, 2007: 10

Measurements of 2 adult females collected are: dorsal shield 300 – 304 long and 163 – 170 wide; j1 35 – 38, j3 83 – 85, j4 and j5 3 – 5, j6 5 – 6, J5 3 – 5, z2 8 – 10, z4 8 – 10, z5 3 – 5, Z1 7 – 9, Z4 73 – 75, Z5 95 – 100, s4 118 – 125, r3 43 – 45, R1 30 – 32; distances between st1 – st3 68 – 70, st2 – st2 68 – 69 and st5 – st5 85 – 88; ventrianal shield 113 – 115 long, 68 – 70 wide at level of ZV2, 65 wide at anus level; Sge II 13 – 15, Sge IV 28 – 30, Sti IV 32 – 38, St (basitarsus) IV 43 – 45, St (telotarsus) 33 – 35.

Chaetotaxy — genu II 2, 2/0-2/0, 1; genu III 1, 2/1-2/0, 1.

Remarks — Measurements of the specimens collected are similar to those given by Moraes *et al.* (2007) for specimens from sub-Saharan Africa, including the holotype. The presence of a macroseta on genu II and not on genu III, observed in the specimens collected and in the specimens examined by Moraes *et al.* (2007) is not common for other phytoseiid mites. Usually, the presence of a macroseta on a given leg implies its presence on subsequent legs.

Specimens collected — 28 females and 9 males on *Centaurea perrotettii* DC., *Chrosophora senegalensis* Vis. and *Urena lobata* L, at KBD, in November 2009.

World distribution — This species has been reported almost only from sub-Saharan Africa; the exception refers to a single report from India (Gupta, 1981).

***Phytoseius amba* Pritchard & Baker**

Phytoseius amba Pritchard & Baker, 1962: 224; Moraes *et al.*, 2004: 232; Chant & McMurtry, 2007: 127; Ueckermann *et al.*, 2007: 4.

Measurements of 3 adult females collected are: dorsal shield 296 (288 – 303) long and 149 (148 – 155) wide; j1 24 (23 – 25), j3 52 (50 – 53), j4 5 (4 – 5), j5 and j6 6 (5 – 8), J2 5 (5 – 8), J5 11 (10 – 12), z2 5 (5 – 6), z3 27 (24 – 30), z4 and z5 6 (5 – 8), Z4 63 (58 – 68), Z5 71 (68 – 75), s4 81 (79 – 83), s6 84 (80 – 88), r3 46 (43 – 48), R1 14 (13 – 15); distances between st1 – st3 61 (60 – 63), st2 – st2 69 (67 – 70) and st5 – st5 64 (63 – 65); ventrianal shield 97 (90 – 105) long, 52 (50 – 53) wide at level of ZV2; 49 (48 – 50) wide at anus level; calyx of spermatheca 11 (10 – 13) long; SgeIV 24 (23 – 25), Sti IV 25 (23 – 28), St (basitarsus) IV 26 (23 – 28), St (telotarsus) 30 (28 – 33).

Chaetotaxy — genu II 2, 2/0-2/0, 1; genu III 1, 2/0-2/0, 1.

Remarks — Measurements of the specimens collected are similar to those reported by Ueckermann *et al.* (2007) for specimens from sub-Saharan Africa, including the holotype; the length of the macroseta of basitarsus IV of the specimens collected is close to the lower extreme of the range given by those authors. The length of the calyx of the spermatheca is similar to that of the holotype and to the average given by Ueckermann et al (2007) for other specimens.

Specimens collected — More than 220 specimens, on *Centaurea perrottetii* DC., *Chrosophora senegalensis* Vis., *Urena lobata* L. and *Waltheria indica* L., at KBD, between 2005 and 2010; 25 females, on *U. lobata* and *W. indica*, at Malika, between 2006 and 2009.

World distribution — This species has been reported almost only from sub- Saharan Africa; the exception refers to a single report from the Island of La Réunion, in the Indian Ocean (Quilici *et al.*, 2000).

Discussion

Despite the effort dedicated to the search for predatory mites in this survey, the diversity was relatively small. *Paraphytoseius horrifer* and *Phytoseius amba* were by far the most abundant and frequent species collected. While the former was found only in the Fatick Region (in the drier interior), the latter was found in both Fatick and Dakar Region (in the more humid coastal side).

Amblyseius herbicolus and *A. swirskii* were only found in Dakar Region. The latter is by far more abundant than the former. Although found in both Regions, *E. nyalensis* is most abundant and frequent in Fatick.

It is noteworthy that *N. californicus* was only collected in 2010, often in high numbers in association with *Tetranychus* species, and only in Dakar Region. Given its absence in the samples collected in the previous years, it seems that this species may represent a recent introduction to Dakar. This species was never found in sub-Saharan Africa in the extensive survey reported by Zannou *et al.* (2006). The common association of this species and of *A. swirskii* with *T. evansi* does not imply that they were having any impact on that pest. No study has been published so far on the effect of *A. swirskii* on *T. evansi*. However, studies conducted by different authors on *N. californicus* as predator of *T. evansi* have not shown promising results, as summarized by Furtado *et al.* (2007).

Acknowledgements

To I.D. Zannou (IITA, Cotonou, Benin), for his invaluable help in the identification of part of the specimens collected.

References

Athias-Henriot C. 1962 — *Amblyseius swirskii*, un nouveau phytoséiide voisin d' *A. andersoni* (Acariens anactinotriches) — Ann. Ec. Nat. Agric. Alger, Algeria, 3: 1-7.

Chant D.A. 1959 — Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of thirty-eight new species — Can. Entomol., Suppl. 12, pp. 166.

Chant D.A., McMurtry J.A. 2007 — Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata) — West Bloomfield: Indira Publishing House, pp. 219.

Chant D.A., Yoshida-Shaul E. 1991 — Adult ventral setal patterns in the family Phytoseiidae (Acari: Gamasina) — Int. J. Acarol., 17: 187-199. doi:10.1080/01647959108683906

Diouf M. 1994 — Etude des mécanismes de résistance aux Acariens du Jaxatu (*Solanum aethiopicum* L.) et d'autres espèces du genre *Solanum* non-tubérifères — Dakar, Sénégal: Mémoire de titularisation. CDH., Institut Sénégalais de Recherches Agricoles, pp. 66.

Duverney C., Kade N., Guèye-Ndiaye A. 2005 — Essais préliminaires pour limiter les dégâts de Tetranychidae sur les cultures maraîchères dans le Sine Saloum (Sénégal). In: Comptes rendus du deuxième colloque international sur les acariens des cultures de l´AFPP. Agro-Montpellier (France), October 24-25, Annales AFPP, p. 80.

El-Badry E.A. 1968 — Three new species of phytoseiid mites from western Sudan — Rev. Zool. Bot. Afric., 77: 321-328.

Furtado I.P., Moraes G.J. de, Kreiter S., Knapp M. 2006 — Search for effective natural enemies of *Tetranychus evansi* in south and southeast Brazil — Exp. Appl. Acarol., 40: 157-174. doi:10.1007/s10493-006-9045-y

Furtado I.P., Toledo S. E., Moraes G.J. de, Kreiter S., Knapp M. 2007 — Search for effective natural enemies of *Tetranychus evansi* (Acari: Tetranychidae) in northwest Argentina — Exp. Appl. Acarol., 43: 121-127. doi:10.1007/s10493-007-9104-z

Guanilo A.D., Moraes G.J. de, Knapp M. 2008 — Phytoseiid mites (Acari: Phytoseiidae) from Peru, with descriptions of four new species — Zootaxa, 1880: 1-47.

Gupta S.K. 1981 — Phytoseiidae (Acari) of Kumaon and Garhwal Himalaya. Contribution to acarology in India — Proceedings of the I All India Symposium of Acarology. April 23-25, 1979. Bangalore, India, p. 21.

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

McGregor E.A. 1954 — Two new mites in the genus *Typhlodromus* (Acarina: Phytoseiidae) — South. Calif. Acad. Sci. Bull., 53: 89-92.

Migeon A. , Dorkeld F. 2007 — Spider Mites Web: a comprehensive database for the Tetranychidae; [5 Apr. 2008]. Available from: http://www.montpellier.inra.fr/CBGP/spmweb/

Moraes G.J. de, McMurtry J.A., Baker E.W. 1987 — Re-description and distribution of the spider mites *Tetranychus evansi* and *T. marianae* — Acarologia, 28: 333-343.

Moraes G.J. de, Ueckermann E.A. Oliveira A.R., Yaninek J.S. 2001 — Phytoseiidae mites of the genus *Euseius* (Acari: Phytoseiidae) from sub-Saharan Africa — Zootaxa, 3: 1-70.

Moraes G.J. de, McMurtry J.A., Denmark H.A., Campos C.B. 2004 — A revised catalog of the mite family Phytoseiidae — Zootaxa, 434: pp. 494.

Moraes G.J. de, Zannou I.D., Ueckermann E.A., Oliveira A.R., Yaninek J.S., Hanna R. 2007 — Phytoseiid mites of the tribes Afroseiulini, Kampimodromini and Phytoseiulini, and complementary notes on mites of the tribes Euseiini and Neoseiulini (Acari: Phytoseiidae) from sub-Saharan Africa — Zootaxa, 1628: 1-22.

Pringle K.L., Heunis J.M. 2006 — Biological control of phytophagous mites in apple orchards in the Elgin area of South Africa using the predatory mite, *Neoseiulus californicus* (McGregor) (Mesostigmata: Phytoseiidae): a benefit-cost analysis — Afr. Entomol., 14: 113-121.

Pritchard A.E., Baker W.E. 1962 — Mites of the family Phytoseiidae from Central Africa, with remarks on genera of the world — Hilgardia, 33: 205-309.

Quilici S., Ueckermann E.A., Kreiter S., Vayssieres J.E. 2000 — Phytoseiidae (Acari) of La Reunion Island — Acarologia, 41: 97-108.

Rowell H.J., Chant D.A., Hansell R.I.C. 1978 — The determination of setal homologies and setal patterns on the dorsal shield in the family Phytoseiidae (Acarina: Mesostigmata) — Can. Entomol., 110: 859-876. doi:10.4039/Ent110859-8

Schuster R.O., Pritchard A.E. 1963 — Phytoseiid mites of California — Hilgardia, 34: 191-285.

Ueckermann E.A., Zannou I.D., Moraes G.J. de, Oliveira A.R., Hanna R., Yaninek J.S. 2007 — Phytoseiid mites of the subfamily Phytoseiinae (Acari: Phytoseiidae) from sub-Saharan Africa — Zootaxa, 1658: 1-20.

Zannou I.D., Moraes G.J. de, Ueckermann E.A., Oliveira A.R., Yaninek J.S., Hanna R. 2006 — Phytoseiid mites of the genus *Neoseiulus* Hugues (Acari: Phytoseiidae) from sub-Saharan Africa — Int. J. Acarol., 32: 241-276. doi:10.1080/01647950608684467

Zannou I.D., Moraes G.J. de, Ueckermann E.A., Oliveira A.R., Yaninek J.S., Hanna R. 2007 — Phytoseiid mites of the subtribe Amblyseiina (Acari: Phytoseiidae: Amblyseiini) from sub-Saharan Africa — Zootaxa, 1550: 1-47.

COPYRIGHT