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The superfamily Phytoseioidea (Acari: Mesostigmata) from Saudi Arabia: a new species, new records and a key to the reported species

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ABSTRACT — Twenty two phytoseiid species belonging to three families Blattisocidae Garman, Otopheidomenidae Treat, and Phytoseiidae Berlese (Acari: Phytoseioidea), collected from Baha, Bisha, Jazan, Madinah, Makkah, Riyadh and Tabuk province of Saudi Arabia (SA), are reported in this paper. Among these, a new species Phytoseius tabukensis Alatawi, Basahih and Kamran, n. sp. is described and illustrated for both females and males, collected from the leaf galls of toothbrush trees, Savadora persica (Salvadoraceae), in association with eriophyid mites (Acari: Eriophyidae). Three genera Amblyseius Berlese, Iphiseius Berlese and Kuzinellus Wainstein and ten species of the family Phytoseiidae, and three species belonging to family Blattisocidae, are reported for the first time from SA. New distribution and host records of eight phytoseiid species previously reported are given. A key to females of Phytoseioidea from Saudi Arabia is presented. Also a key to the horridus species group of the genus Phytoseius Ribaga (Acari: Phytoseiidae) is provided.

KEYWORDS — Phytoseioid; Phytoseius tabukensis; Kuzinellus; Iphiseius; Cheiroseius

ZOOBANK — 6A964AE2-52C1-434A-BDDD-EE7993107E1D

INTRODUCTION

The superfamily Phytoseioidea Berlese (Acari: Mesostigmata) includes four families: Blattisocidae Garman, Otopheidomenidae Treat, Phytoseiidae Berlese, and Podocinidae Berlese. The family Phytoseiidae is the most diverse group of mites with approximately more than 2452 species belonging to 91 genera (Demite et al. 2016). Mites of the family Phytoseiidae are mostly present on plant surface and are predators of phytophagous mites and other small insect pests of various agricultural crops worldwide (Gerson et al. 2003; Chant and McMurtry 2007).

The family Blattisocidae is the second most diverse family in the superfamily Phytoseioidea, including 12 genera and more than 329 nominal species, among these more than 200 species belong to the genus Lasioseius Berlese (Moraes et al. 2016). Most species of this family have been reported from litter, while some species have been found on rodent and in bird nests as well as from aerial plant parts (Moraes et al. 2016). Some species of the genus Lasioseius have been reported feeding on phytophagous mites, small insects, springtails and nematodes while some others have also been observed to feed on fungi (Walter and Lindquist 1989; Christian and Karg 2006; Britto et al. 2012).
The families Otopheidomenidae and Podocinidae include 30 and 32 species respectively worldwide (Halliday 1994; Menon et al. 2012; Yan et al. 2012). The phytoseioid mite fauna of SA is poorly known. Previously, 23 species including in eight genera of Phytoseiidae (Dabbour and Abdel-Aziz 1982; Fouly and Al-Rehiayani 2011; Alatawi 2011a, b; Negm et al. 2012 a, b; Basahih et al. 2015; Alatawi et al. 2016), one species each of families Blattisociidae and Otopheidomenidae have been reported from SA (Alatawi 2011a; Negm and Alatawi 2013).

MATERIALS AND METHODS

Different provinces of SA (Baha, Bisha, Jazan, Madinah, Makkah, Riyadh, and Tabuk) were surveyed for the collection of phytoseioid mites. Mites were collected either shaking the different plant parts i.e. leaves, flowers and twigs etc. over a white piece of paper and were transferred into 70 % ethanol using camel hair brush or different plant parts, soil and leaf debris were taken to the laboratory and were processed through Tullgren funnels to extract mites. The mite specimens, after mounting on slides in Hoyer’s medium, were examined under a phase-contrast microscope (DM2500, Leica®, Germany) and were identified using literature and diagnostic keys. Template illustrations of different mite body parts of specimens were either pictured with an Auto-montage Software System (SYNCROSCOPY®, Cambridge, UK) attached to the microscope or were drawn with pencil by using a drawing tube (U-DA, Olympus®), Japan attached to the microscope. Final processing of drawings were made in Adobe Illustrator (Adobe Systems Incorporated, USA). The terminology used in this study follows that of Chant and McMurtry (2007). The apical tooth is not included in the number of teeth of the cheliceral digits. All measurements are given in micrometers.

Type specimens of the new species have been deposited at Acarology Research Laboratory, Department of Plant Protection, College of Food and Agriculture Sciences, King Saud University.

RESULTS AND DISCUSSION

A total of 22 phytoseiid species belonging to three families Blattisociidae (four species), Otopheidomenidae (one species) and Phytoseiidae (18 species) (Acari: Phytoseioidea) are reported in this study (Table 1). Also, distribution along with collection data and field association of the reported species are presented in table 1. Among these, three genera Amblyseius Berlese, Iphiseius Berlese and Kuzinellus Wainstein and 11 species including new species, Phytoseius tabukensis n. sp., belonging to family Phytoseiidae and three species of the family Blattisociidae are new to the mite fauna of SA.

New distribution and collection data of eight phytoseiid species previously reported are also given in table 1.

Among all phytoseiid species, two generalist predators i.e. Cydnoseius negevi (Swirski and Amitai) and Neoseiulus barkeri Hughes (Acari: Phytoseiidae) were found most abundant and well distributed in all surveyed provinces (Table 1).

Previously, 23 phytoseiid species within eight genera have been reported from SA. Among these, 12 species have been found in date palm agroecosystem (Al-Shammery 2010; Alatawi 2011a, b; Fouly and Al-Rehiayani, 2011; Negm et al. 2012 a, b; Basahih et al. 2015; Alatawi et al. 2016). Cydnoseius negevi (Swirski and Amitai) and Neoseiulus barkeri Hughes naturally occur in date palm orchards in different regions of SA and are the most abundant species found even on date palm trees (Negm et al. 2012 a).

Cydnoseius negevi is a common phytoseiid species found in Middle East countries (Abou-Awad et al. 1989; Abou-Awad et al. 1998; Fouly and Laithy 1992; Palevsky et al. 2009; Hountondji et al. 2010) and feeds on wide range of phytophagous mites and small insect pests (Momen 2010).

A biological study of C. negevi and N. barkeri, collected from date palm orchards, was conducted in SA against date palm mite pest, Oligonychus afrasiaticus (McGregor) at (25, 35 °C and 35 ± 10 % RH). This study showed that the C. negevi could be considered as a valuable predator for the control of spider mite pests especially date palm mite at comparatively low RH levels (Negm et al. 2014).
### TABLE 1: Phytoseioid mites (Acari: Phytoseioidea) collected in the current study from Saudi Arabia.

<table>
<thead>
<tr>
<th>Family/Subfamily, Genus</th>
<th>Species</th>
<th>Province/Locality</th>
<th>Host/Habitat</th>
<th>Collection time</th>
<th>Field association</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytoseiidae</td>
<td>Neoseiulus</td>
<td>Jazan</td>
<td>Unidentified plants (Poaceae), Cynodon dactylon L. (Cynodontiaceae), Palicrinus multifolius L. (Palicrinaceae), Compositae sp. (Compositae)</td>
<td>Apr., Sept. 2014</td>
<td>Thrips sp. (Thripidae)</td>
</tr>
<tr>
<td>Amblyseiinae</td>
<td>N. unica</td>
<td>Tabuk city, (Dariah) Riyadh</td>
<td>Palicrinus multifolius L. (Palicrinaceae), Compositae sp. (Compositae)</td>
<td>Mar., Oct. 2015</td>
<td>Thrips sp. and Tetranychus urticae (Tetranychidae)</td>
</tr>
<tr>
<td>Amitai and Grinberg</td>
<td>P. tamaricis</td>
<td>Tabuk</td>
<td>Tamarix sp. (Tamarixaceae)</td>
<td>Oct. 2015</td>
<td>Spinibdella cromeri (Baker and Balck) (Psyllidae) tamarix leafhopper (Hemiptera: Cicadellidae)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amblybeiidae</td>
<td>A. largoensis</td>
<td>Jazan</td>
<td>Unidentified plants (Poaceae)</td>
<td>Apr. 2014</td>
<td>Thrips sp.</td>
</tr>
<tr>
<td>Euseius Wainstein</td>
<td>E. africana</td>
<td>(Baljurashi) Baha</td>
<td>Unidentified plants (Moraceae)</td>
<td>June 2014</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>E. yosef</td>
<td>(El-Borodossy) Tabuk</td>
<td>Ziclinus sp. (Rhamnaeaceae)</td>
<td>Oct. 2015</td>
<td>-</td>
</tr>
<tr>
<td>Iphiseius Berlese</td>
<td>I. degenerans</td>
<td>(Wadi Turab, Baha, (Wadi dafa) Jazan</td>
<td>Ocimum bastusim L. (Lamiaceae), Baccharis sp. (Compositae)</td>
<td>Apr., May 2014</td>
<td>Thrips sp.</td>
</tr>
<tr>
<td>Phytoseius Ribaga</td>
<td>P. tubulorum sp. Alatawi, Basaah and Kamman</td>
<td>Jazan</td>
<td>Saludara persica L. (Saludaraeaceae)</td>
<td>Oct. 2015</td>
<td>Eriophyid species (Briophyidae)</td>
</tr>
<tr>
<td></td>
<td>T. (A ) persiansis McMurtry</td>
<td>(Wadi Turab, Attalgha, Almikhwah) Baha, (Sabya, BinMakem) Jazan</td>
<td>Tamarix sp., Juniperus procera Hochst. Saludara sp. (Saludaraeaceae), P. crispa (Forsk.) (Asteraceae), Olor sp. (Oleaceae)</td>
<td>Apr., 2013, May, June 2014</td>
<td>Thrips sp.</td>
</tr>
<tr>
<td>Blattisocidae Garman</td>
<td>L. queenslandicae (Womerskey)</td>
<td>Wadi Dawaar, Riyadh</td>
<td>Soil debris under date palm trees</td>
<td>Feb., Dec. 2010</td>
<td>-</td>
</tr>
<tr>
<td>Blattisocidae Garman</td>
<td>L. nummulariae Krantz</td>
<td>Riyadh</td>
<td>Soil debris under date palm trees</td>
<td>Jan. 2011</td>
<td>-</td>
</tr>
<tr>
<td>Platyscoiidae</td>
<td>C. nucornger (Oudemans)</td>
<td>Hessa</td>
<td>Soil debris under date palms</td>
<td>Mar. 2012</td>
<td>-</td>
</tr>
</tbody>
</table>

* New species
<table>
<thead>
<tr>
<th>Family/Subfamily, genus</th>
<th>Species</th>
<th>Province/Locality</th>
<th>Host/Habitat</th>
<th>Collection time</th>
<th>Field association</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N. barkeri Hughes</td>
<td>(Near sea port) Jeddah, Duba, Tabuk, (Sabia, Aboareesh, Bnimalak, Sabia, (near Air port), Talgyah) Baha, (Darjah, Waseel) Riyadh</td>
<td>Tamari sp., soil debris of date palm, Olea sp. (Oleaceae), J. procera</td>
<td>Jan., Mar., Oct. 2015</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>P. ovatus (Carman)</td>
<td>Tabuk city, Baha, (Alharem) Bisha</td>
<td>Malus sp. (Rosaceae)</td>
<td>June 2014</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>E. scutalis (Arhias-Henriot)</td>
<td>(Wadi Jir Madinah, (Duba) Tabuk, (Faffa) Jazan, (Wadi e Turbah), Wadi e Shora) Baha, Riyadh</td>
<td>C. dactylon, soil debris and unidentified plant species under Acacia trees, unidentified plants (Fabaceae)</td>
<td>Apr. 2014, Oct. 2015</td>
<td>-</td>
</tr>
<tr>
<td>Lasiobius Berloese</td>
<td>N. aralica Negm and Alatawi</td>
<td>Riyadh, Makkah</td>
<td>Holotrichius baciferum Forsk. (Botanicaeae)</td>
<td>Apr. 2014, 2016</td>
<td>Aegyptius sp. (Tenuipalpidae)</td>
</tr>
</tbody>
</table>
Moreover, co-occurrence of *C. negevi* along with date palm mite on different grasses (Poaceae) and its abundance and distribution in different provinces of SA as compared to other phytoseiid predators support the previous studies that it can be used as an effective predator against date palm mite under high temperature and low humidity levels. However, it needs further biological studies on this predator at different field conditions to find its potential use against date palm mite.

Another phytoseiid species, *Euseius scutalis* (Athias-Henriot) generally feed on plant pollens, was found abundantly in five provinces, Baha, Jazan, Madinah, Tabuk and Riyadh of SA (Table 1). Previously, *E. scutalis* was observed feeding on different phytophagous mites, scale insects and whiteflies in Hail, SA. (AlShammery 2010).

A blattisociid species *Lasioseius parberlesei* Bhattacharyya was reported from Jazan, Madinah, Makkah and Riyadh. It has been considered potentially effective as biological control agent of pest mites of the family Tarsonemidae (Moraes *et al.* 2015).

*Nabiseius arabis* Negm and Alatawi (Otophidiomendidae) was recorded in high numbers on *H. bacciferum* Forssk. (Boraginaceae) in association with *Aegyptobia* sp. (Tenuipalpidae) from Riyadh and Makkah provinces (Table 1). Before, it was recorded on *C. dactylon* from Riyadh (Negm and Alatawi 2013).

### Superfamily Phytoseioidea Berlese, 1916
### Family Phytoseiidae Berlese, 1916
### Subfamily Phytoseiinae Berlese, 1913
### Genus *Phytoseius* Ribaga, 1904
### Species group *horridus* Denmark, 1966

*Phytoseius tabukensis* Alatawi, Basahih and Kamran n. sp.

Zoobank: 7DDC5CB3-F38A-4F6B-A98C-D30B8D8EAFD0

Description — **Female** (*n* = 3) (Figs. 1-2) — Measurements of holotype female followed by two female paratypes in parenthesis.

Dorsum (Fig. 1) — Dorsal shield 278 (273 – 283) long, 156 (154 – 157) wide, with 15 pairs of setae. Setae r3 on the shield, setae J2 and R1 absent. Length of dorsal setae j1 21 (21 – 22), j3 18 (18 – 19), j4 6, j5 6 (6 – 7), j6 6, J5 10 (9 – 11), z2 18 (17 – 19), z3 32 (31 – 33), z4 13 (11 – 14), z5 9 (5 – 12), Z4 64 (63 – 65), Z5 53 (50 – 58), s4 55 (53 – 57), s6 73 (70 – 75), and lateral setae r3 28 (26 – 29). All dorsal setae serrate except j4, j5, j6, z4 and z5 smooth. Setae s6 and Z4 finely serrated only on 1/3 distal part, setae Z5, Z4, s4, s6, z3 set on tubercles. Peritremes extending up to setae j1.

Venter (Fig. 2A) — Sternal shield not clear. Distances between ST1-ST1 45 (44 – 45), ST2-ST2 61 (58 – 63), ST3-ST3 76 (72 – 79), ST4-ST4 81 (77 – 100). Genital shield smooth; distance between ST5-ST5 68 (66 – 70); membranous fold between genital and ventrianal shields absent. Ventrianal shield elongate, slightly rounded anteriorly, 74 (73 – 76) long, 46 (44 – 47) wide at the level of para-anal setae, with one pair of pre-anal setae. Four pairs of setae present on the soft cuticle around the ventrianal shield. Lyrifissures not clear. All ventral setae simple except JV5 thick and serrated. Metapodal platelets not clear in all specimens.

Spermatheca (Fig. 2B) — Calyx of spermatheca bell-shaped, 5 long; 4 wide, atrium adjacent to the calyx. Major duct long tube like and minor duct small.

Chelicerae (Fig. 2C) — Fixed digit 19 – 21 long, with two subapical teeth and a pilus dentilis, movable digit 17 (16 – 18) long, with one tooth.

Legs (Fig. 2D) — Macrosetae absent on leg IV, all setae simple.

**Male** (*n* = 3) (Figs. 3-4)

Dorsum (Fig. 3) — Dorsal shield 229 (226 – 232) long, and 137 (132 – 141) wide, with 15 pairs of setae. Length of dorsal setae: j1 15 – 16, j3 17 – 18, j4=j5 5 – 6, j6 6, J5 7 – 8, z2 14 – 16, z3 28 – 32, z4 9 – 12, z5 7 – 9, Z4 44 – 46, Z5 39 – 42, s4 44 – 53, s6 47 – 55, and lateral setae r3 21 – 25. All dorsal setae serrate except j4, j5, j6, z4 and z5 which are simple, setae Z5, Z4, s4, s6, z3 and r3 set on tubercles. Peritremes extending to the level between setae j3 and j1.

Venter (Fig. 4A) — Sternotergal shield smooth, 114 long and 63 wide with 5 pairs setae, distances between ST1-ST1 35 – 38, ST2-ST2 44 – 49, ST3-ST3 54 – 58, ST4-ST4 52 – 54; ST5-ST5 43 – 47. Ventrianal
Figure 1: *Phytoseius tabakensis* n. sp., Female, Dorsal shield
FIGURE 2: *Phytoseius tabukensis* n. sp., Female: A – Venter; B – Spermatheca; C – Chelicera; D – Leg IV
FIGURE 3: *Phytoseius tabukensis* n. sp., Male, Dorsal shield
FIGURE 4: *Phytoseius tabakensis n. sp.*, Male: A – Venter; B – Chelicera
shield wider than long, 83 – 84 long, 104 – 109 wide at the level of ZV2, four pairs of preanal setae, two para-anal and one postanal setae.

Chelicerae (Fig. 4B) — Fixed digit 16 – 17 long, with 3 – 4 subapical teeth and a pilus dentilis; movable digit 15 – 16 long, with one tooth. Spermato- dactyl V-shaped distally.

Legs — As in female.

Material Examined — Holotype female and five paratypes (two females and three males), Salvadora persica L. (Salvadoraceae), 30 km Sherma road, Duba, Tabuk, 18 Oct. 2015, coll. M. Kamran and J.H. Mirza.

Etymology — The name of new species is derived from province "Tabuk" where the type specimens were collected.

Remarks — Phytoseius tabukensis n. sp. belongs to the horridus species group of the genus Phytoseius due to absence of setae J2 and R1. Within the horridus species group Chant and McMurtry 1994, 14 species including new species (mentioned in the diagnostic key #1) in which macrosetae on tibia IV is absent. The new species closely resembles P. brigalow by having one pair preanal setae on the ventrianal shield vs. two pairs, dorsal shield setae z3, s4, s6, and Z4 serrated vs. smooth in P. brigalow. The new species is different from other 12 species by the presence of only one pair of preanal setae on the ventrianal shield and four pairs of setae present on the soft cuticle surrounding the ventrianal shield.

Key to the species of horridus species group of the genus Phytoseius Ribaga (Acari: Phytoseiidae) with macro setae absent on leg IV tibia

1. Macrosetae on leg IV basi- and disti-tarsus with hyaline knobbled tips … P. oreillyi Walter and Beard
   — Macrosetae on leg IV tarsus absent, if present short, without hyaline knobbled tips …… 2

2. One pair of preanal setae present on ventrianal shield …………………… P. tabukensis n. sp.
   — Two or three pairs of preanal setae present on ventrianal shield …………………… 3

3. Two pairs of preanal setae present on ventrianal shield, ZV1 off the shield, on the soft cuticle…………… P. brigalow Walter and Beard
   — Three pairs of preanal setae present on ventrianal shield …………………… 4

4. Setae ZV3 absent, two pairs of setae present on soft cuticle around the ventrianal shield … P. darwin Walter and Beard
   — Setae ZV3 present, three pairs of setae present on soft cuticle around the ventrianal shield ……… 5

5. Setae Z4 equal in length as Z5 ……… P. mancus Afzal et al.
   — Setae Z4 distinctly longer than Z5 ……… 6

6. Setae s6 ≥ Z5 …………………………… 7
   — Setae s6 distinctly shorter than Z5 … P. gleba Afzal et al.

7. Setae Z4 serrated ………………………… 8
   — Setae Z4 smooth ……………………… 12

8. Setae j3 reaching the basis of j4 ……… P. glyptos Afzal et al.
   — Setae j3 well behind to the basis of j4 ……… 9

9. Setae s6 = Z5 ……… P. mantoni Walter and Beard
   — Setae s6 distinctly longer than Z5 ……… 10

10. Setae s3 smooth, s4 longer than s6……………… P. litchfieldensis Walter and Beard
    — Setae z3 serrated, s4 shorter than s6 ……… 11

11. Setae s4, crossing the basis of setae s6, s4 55, s6 72-74, setae s4 almost at the level of r3……………… P. intermedius Evans and Macfarlane
    — Setae s4, just reaching the basis of setae s6, s4

284
43, s6 52, setae s4 well posterior to the level of r3................. P. douglasensis Schicha

12. Setae s4, s6 smooth......................... P. acacia Walter and Beard
   — Setae s4, s6 serrated ................. 13

13. Setae Z2, JV5 smooth, setae s4 subequal to s6......................... P. longchuanensis Wu
   — Setae Z2, JV5 serrated, setae s4 shorter than s6......................... P. ruidus Wu and Li

NEW RECORDS

FAMILY PHYTOSEIIDAE BERLESE, 1916

Subfamily Amblyseinae Muma, 1961
Tribe Neoseiulini Chant and McMurtry, 2003
Genus Neoseiulus Hughes, 1948

Neoseiulus imbricatus Corpuz-Raros and Rimando

Amblyseius (A.) imbricatus Corpuz and Rimando 1966: 127.


Field association — This species was found in association with Thrips sp. and Tetranychus urticae (Tetranychidae).

World distribution — Philippines, Thailand, India, Azerbaijan, China, Philippines and Iran (Moraes et al. 2004; Faraji et al. 2007).

Neoseiulus zaheri (El-Borolossy)


Field association — The specimens of this species were collected in association with Thrips sp. and Tetranychus urticae (Tetranychidae).

World distribution — Egypt (Abo-Shnaf et al. 2014).

Genus Paragigagnathus Amitai and Grinberg, 1971

Paragigagnathus tamaricis Amitai and Grinberg 1971: 327.


Field association — The specimens of this species were collected along with another predatory mite Spinibdella cronini (Baker and Balock) (Prostigmata: Bdellidae) and tamarix leafhopper (Hemiptera: Cicadellidae).

World distribution — Egypt, Iran, Israel, Jordan, (Moraes et al. 2004; Hajizadeh et al. 2010).

Tribe Amblyseiini Muma, 1961
Genus Amblyseius Berlese, 1914

Amblyseius largoensis (Muma)

Amblyseiospis largoensis Muma, 1955:266.


Field association — The specimen of A. largoensis were collected together with Thrips sp.
World distribution — Africa: Angola, Ivory Coast, Kenya, Mozambique, Tanzania; North America: California, Florida; Central and South America: Brazil, Colombia, Costa Rica, Guatemala, Honduras, Venezuela; Caribbean: Cuba, Jamaica; Middle East: Israel; Southern Europe: Turkey, Georgia; Asia: China, Hong Kong, India, Indonesia, Iran, Japan, Singapore, Taiwan, Thailand; Pacific: Cook Islands, Fiji, Hawaii, New Caledonia, New Zealand, Papua New Guinea, US Samoa, Vanuatu Australia: Queensland (Moraes et al. 2004).

Tribe Euseiini Chant and McMurtry, 2005
Genus Euseius Wainstein, 1962

*Euseius africanus* (Evans)


World distribution — Kenya (Moraes et al. 2001).

*Euseius yousefi* (El-Borolossy)


*Euseius yousefi* (El-Borolossy) Moraes et al. 2004: 86.


World distribution — Egypt (Nasr and Abou-Awad 1985).

Genus Iphiseius Berlese, 1916

*Iphiseius degenerans* Berlese

*Iphiseius degenerans* Berlese 1921: 95.


Field association — This species was collected along with *Oligonychus* sp. (Tetranychidae), *Spinibdella* sp. and *Thrips* sp.

World distribution — Egypt (El-Badry 1967a; Moraes et al. 2004).

Genus Typhlodrominae Wainstein, 1962
Tribe Typhlodromini Wainstein, 1962
Subgenus Anthoseius De Leon, 1959

*Typhlodromus* (Anthoseius) egypiticus El-Badry

*Typhlodromus egypiticus* El-Badry 1967a: 180


Field association — This species was found together with *Thrips* sp.

World distribution — Algeria, Benin, Brazil-Pique, Burundi, Canary Islands, Cape Verde, Egypt, Georgia, Greece, Israel, Italy, Kenya, Lebanon, Madeira Island, Madagascar, Malawi, Morocco, Nigeria, Portugal, Rwanda, South Africa, Tanzania, Turkey, Yemen, Zaire and Zimbabwe (Moraes et al. 2004).

*Typhlodromus* (Anthoseius) persianus McMurtry


Material examined — Five females and two males, *Tamarix* sp., Wadi Turbah, Baha, 19°49’79.7 N, 041°26’47.8 E, 24 Apr. 2013; four females, *J. procera* Hochst, Attalgiaba, Baha, 19°51’33.6 N, 041°36’15.7 E, 16 June 2014; two females *J. procera* Wadi Feeq, Baha, 19°58’97.0 N, 041°31’66.5 E, 15 June, 2014; one female, *Salvadora* sp., Mikhwah, Baha, 19°55’74.7 N, 041°26’47.9 E, 14 June 2014; five females, *Pulicaria crispa* (Forssk.), *Olea* sp. (Oleaceae), Sabya, Jazan, 17°06’35.1 N, 042°40’88.7 E, 28 May 2014; one female,

Field association — Specimens of *T. (A.) persianus* were found in association with *Thrips* sp.

World distribution — Oman, Iran, Cape Verde, South Africa and Yemen (Moraes et al. 2004; Ueckermann et al. 2008).

**Typhlodromus (Anthoseius) tamaricis** (Kolodochka, 1982)

*Anthoseius* (*Amblydromellus*) *tamaricis* Kolodochka 1982: 11.

*Amblydromella* *tamaricis* (Kolodochka 1982) Moraes et al. 1986: 176.

*Typhlodromus (Anthoseius) tamaricis* (Kolodochka 1982), Moraes et al. 2004; Chant and McMurtry 2007.


Field association — The specimens of this species were found in association with *Tetranychus* sp.

World distribution — Sudan and Egypt (El-Badry 1967b; El-Badry 1970).

**Family Blattisocidae Garman, 1948**

**Subfamily Blattisociinae Garman, 1948**

**Genus Lasioseius Berlese, 1916**

**Lasioseius queenslandicus** (Womersley)


World distribution — Australia and Egypt (Nawar and Nasr 1991; Moraes et al. 2016).

**Lasioseius nambirimae** Krantz


Material examined — One female, soil debris under date palm trees, King Saud University, Riyadh, 24°43’336N, 46°37’611E, 01 Jan. 2011, coll. W. Negm.


**Subfamily Platysieinae, 1957**

**Genus Cheiroseius Berlese, 1916**

**Cheiroseius neocorniger** (Oudemans)

*Hypoaspis neocorniger* Oudemans


Type locality and depository — Unknown.
NEW DISTRIBUTION AND HOST DATA OF SOME PREVIOUSLY REPORTED PYTOSEIOID SPECIES FROM SA

FAMILY PHYTOSEIIDAE

Genus Cydnoseius Muma, 1967

Cydnoseius negevi (Swirski and Amitai, 1961)


Field association — This species was found with Tetranychus sp. and Thrips sp.

Previous records — Apple leaves, Malus domestica L. (Alatawi 2011b).

Genus Neoseiulus Hughes, 1948

Neoseiulus burkeri Hughes, 1948


Field association — This species was found with Oligonychus afrasiaticus (McGregor), Tetanychus sp., and Thrips sp.

Previous records — Wadi Dawaser, Waseel, Kharj, Dierab (Riyadh), Khutta (Hail) and Hssa (Negm et al. 2012b).

Genus Proprioseiopsis Muma, 1961

Proprioseiopsis asetus (Chant, 1959)


Previous records — Riyadh and Qassim (Negm et al. 2012b).

Proprioseiopsis ovatus (Garman, 1958)


Previous records — Riyadh and Qassim (Negm et al. 2012b).
Genus *Paragigagnathus* Amitai and Grinberg, 1971

*Paragigagnathus insuetus* (Livshitz and Kuznetsov, 1972)


Genus *Euseius* Wainstein, 1962

*Euseius scutalis* (Athias-Henriot, 1958)


Previous records — Riyadh and Qassim, ex *Solanum melongena* L. (Solanaceae), *Vitis vinifera* L. (Vitaceae), *Ricinus communis* (Euphorbiaceae), *Fragaria* sp. (Rosaceae) (Al-Shammery 2010; Alatawi 2011b).

Family Otopheidomenidae Treat, 1955

Genus *Nabiseius* Chant and Lindquist, 1965

*Nabiseius arabicus* Negm and Alatawi

*Nabiseius arabicus* Negm and Alatawi 2013: 184.


Field association — This species was collected together with *Aegyptobia* sp. (Tenuipalpidae).

Previous records — Riyadh, ex *C. dactylon* (Negm and Alatawi 2013).

Family Blattisociidae

*Lasioseius parberlesei* Bhattacharyya

*Lasioseius parberlesei* Bhattacharyya 1968: 532.


Field association — This species was found in association with *Tetranychus* sp.

Previous Records — Hayer, ex *Capsicum* sp. (Solanaceae) (Alatawi 2011a).

Key to the females of Phytoseioidea of Saudi Arabia

1. Dorsal shield with less than 20 pairs of setae, setae J1 absent, and with less than 4 pairs of marginal setae on soft integument ................................. 7 — Dorsal shield with more than 20 pairs of setae, setae J1 present, and usually with more than 4 pairs of marginal setae on soft integument........ Family Blattisociidae Garman ........................................ 2

2. Legs II-IV with median lobe of pulvillus broadly rounded; para-anal setae inserted anterior to hind margin of anus, and usually at least slightly shorter than postanal seta...... Subfamily Blattisociniae, Genus *Lasioseius* Berlese ................................................................. 4
--- Legs II-IV with median lobe of pulvillus slender, acute or narrowly rounded; para-anal setae inserted level with or posterior to hind margin of anus, and usually longer than postanal seta. **Subfamily Platyselinae, Genus Cheiroseius**

3. Tarsus I longer than tibia I. **C. neocorniger** (Oudemans)
   - Tarsus I shorter than tibia I or equal in length. **C. serratus** (Halbert)

4. Anus remarkably large, length of anus = 1/4 to 1/3 of the length of the ventrianal Shield. **Lasioseius** (Boringuolaclaps) *dentatus* Fox
   - Anus normal, not remarkably large.

5. A number of dorsal setae trispinate. **Lasioseius** (Crinidens) *queenslandicus* (Womersley)
   - Dorsal setae acicular or pectinate.

6. Ventrianal shield with six pairs of setae. **Lasioseius** (Lasioseius) *parberlesei* Bhattacharyya
   - Ventrianal shield with five pairs of setae. **Lasioseius** (Cuspiacus) *garambae* Krantz

7. Dorsal shield laterally incised, peritremes reduced, extending up to coxae II. **Family Otopheidomenidae Treat, Genus Nabiseius Chant and Lindquist**. **N. arabicus** Negm and Alatawi
   - Dorsal shield entire, peritremes not reduced, extending anteriorly beyond coxae II. **Family Phytoseiidae Berlese**

8. Setae z3 and s6 absent.
   - Either or both setae z3 and s6 present.

--- Sternal shield without median posterior projection; preanal setae JV2 and ZV2 not migrated forward on ventrianal shield.

10. Female ventrianal shield divided into separate ventral and anal shields, dorsal shield strongly sclerotized. **Genus Iphiseius Berlese, I. degenerans Berlese**
   - Female ventrianal shield entire, dorsal shield not strongly sclerotized. **Genus Euseius Wainstein**

11. Peritreme extending up to the level between z2 and z4, spermathecal calyx long and slender. **E. scutalis** (Athias-Henriot)
   - Peritreme extending forward up to setae j3.

   - Dorsal shield setae in j series comparatively long, j1=42, j5=49, j6=73, j2=75.

13. Spermathecal calyx incompletely sclerotized, broad and apparently fused with atrium. **E. batus** (Ueckermann and Loots)
   - Spermathecal calyx completely sclerotized, proximal two third tubular and distal third cup-shaped not fused with the atrium. **E. africanus** (Evans)

14. Setae s4 more than three times long than setae Z1, setae s4, Z5 and Z4 markedly longer than other dorsal setae. **Tribe Amblyseiini**.
   - Setae s4 less than three times as long as setae Z1, setae s4, Z5 and Z4 not greatly longer than other dorsal setae.

15. Sternal shield as long as or longer than wide, setae J2 present. **Genus Amblyseius Berlese, A. largoensis** (Muma)
   - Sternal shield wider than long, setae J2 absent. **Genus Proprioseiopsis Muma**

   - Calyx of spermatheca elongate and bell shaped.
17. Setae Z5 longer than distance between their bases. .................. P. asetus (Chant)
   — Setae Z5 longer than distance between their bases. .................. P. beatus (Chaudhri)
18. Setae Z5 longer than distance between their bases, sternal shield medially smooth .... P. messor (Wainstein)
   — Setae Z5 shorter than distance between their bases, sternal shield medially reticulated . . . P. ovatus (Garman)
19. GeII without and GeIII rarely with macrosetae; fixed digit of chelicera usually with fewer than 6 teeth, rarely multidentate; never with these 2 character states together . Tribe Neoseiulini Chant and McMurtry ... 20
   — GeII without and GeIII rarely without macrosetae; fixed digit of chelicera usually with more than 6 teeth, most species with both of these 2 character states ................. Tribe Typhlodromipsini Chant and McMurtry, Typhlodromips De Leon, T. swirskii (Athias-Henriot)
20. Female ventrianal shield with elongate and prominent waist, length/width ratio at narrowest point 3.3:1.0 primary metapodal platelets unusually elongate ........ Genus Paragigagnathus Amitai and Grinberg .... 21
   — Female ventrianal shield without prominent waist slightly longer than wider, primary metapodal platelet normal ................. Genus Neoseiulus Hughes .... 24
21. All dorsal shield setae on prominent tubercles. .................. 22
   — Only posterior setae on dorsal shield or some lateral setae on prominent tubercles .......... 23
22. All dorsal shield setae long (range from 15 to 55 \( \mu m \)); ventrianal shield with three pairs of preanal setae, with/without pores; movable digit of chelicera smooth .................. P. desertorum (Amitai and Swirskii)
   — All dorsal shield setae short (range from 11 to 29 \( \mu m \)); ventrianal shield with two pairs of preanal setae and a pair of minute pores; movable digit of chelicera with one blunt tooth ........ P. tamaricis Amitai and Grinberg
23. Setae J5 serrated, dorsal shield setae short (9-25) ........ P. insuetus (Livshitz and Kuznetsov)
   — Setae J5 simple, dorsal shield setae long (15-50) ........ P. madinaensis Alatawi, Kamran and Basahih
24. Macrosetae absent on leg IV ........ N. mumae (Shehata and Zaher)
   — Macrosetae present on leg IV ................. 25
25. Spermatheca with atrium not forked at junction with major duct .................. 26
   — Spermatheca with atrium forked at junction with major duct .................. 32
26. Dorsal shield with marked shoulder at the level of setae r3 .................. 27
   — Dorsal shield without marked shoulder at the level of setae r3 .................. 28
27. Sternal and genital shield moderately reticulated; St IV short (less than 20 \( \mu m \)) . . . N. paspalivorus (De leon)
   — Sternal and genital shield smooth; St IV long (more than 50 \( \mu m \)) ................. N. rambami (Swirski and Amitai)
28. Spermatheca without a stalk between calyx and atrium as atrium undifferentiated or no duller, joint directly to the calyx .................. 29
   — Spermaheca with atrium and calyx joined by a stalk .................. 31
29. Sternal shield reticulated ................. N. zaheri (El-Borolossy)
   — Sternal shield smooth .................. 30
30. Fixed digit of chelicerae with 9 to 10 teeth; movable digit with 3 teeth ................. N. imbricatus Corpuz-Raros and Rimando
   — Fixed digit of chelicerae with 4-5 teeth; moveable
digit with 1 tooth ........ N. cucumeris (Oudemans)

31. Spermathecal calyx dish to bowl shaped, Z5 80-90 ......................... N. bicaudus (Wainstein)
— Spermathecal calyx bell shaped, Z5 40-50 ......................... N. conterminus (Kolodochka)

32. Calyx of spermatheca trumpet shaped; genu IV with macroseta ....................... N. makuwa (Ehara)
— Calyx of spermatheca cone-shaped; genu IV without macroseta ...................... 33

33. Spermatheca with a stalk between calyx and atrium ........................ N. saudiensis Negm, Alatawi and Aldryim
— Spermatheca without a stalk between calyx and atrium .......................... 34

34. Setae Z4 subequal in length to Z5 ...................... N. cydnodactylon (Shehata and Zaher)
— Setae Z4 shorter than Z5 ........ N. barkeri Hughes

35. Setae Z1, S2, S4 and S5 absent .......... Subfamily Phytoseiinae Berlese, Genus Phytoseius Ribagia ................................. 36
— At least one of setae Z1, S2, S4 and S5 present .... Subfamily Typhlodrominae Chant and McMurtry
— Setae Z4 absent ....................... 37

36. Dorsal setae J2 and R1 present .......... P. plumifer (Canestrini and Fanzago)
— Dorsal setae J2 and R1 absent .......... P. tabukensis n. sp.

37. Setae z3 absent, Z1 present ................. Genus Cydnoseius, C. negevi (Swirski and Amitai)
— Setae z3 present, Z1 absent .................. 38

38. Setae z6 present ............... Genus Kuzinellus Wainstein
— Setae z6 absent ............... Genus Typhlodromus Scheuten ................................. 39

39. Setae S5 present ............... Subgenus Anthoseius De Leon
— Setae S5 absent ............... Subgenus Typhlodromus, T. (T) pyri Scheuten

40. Female ventrianal shield narrow ...................... T. (A) egypiticus (El-Badry)
— Female ventrianal shield almost pentagonal .......................... 41

41. Setae Z4 serrated, setae Z5 distally knobbed, ventrianal shield with a pair of preanal pores ...................... T. (A) persianicus McMurtry
— Setae Z4 simple, setae Z5 distally sharpened, ventrianal shield without a pair of preanal pores ...................... T. (A) tamaricis Kolodochka

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REFERENCES


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