A new species of *Oxyoppia* (*Oxyoppiella*) (Acari: Oribatida: Oppiidae) from Iran

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**Abstract:** A new oppiid species (Acari: Oribatida: Oppiidae), *Oxyoppia* (*Oxyoppiella*) *minuscula* sp. nov. from the Marand region in northwestern East Azerbaijan Province in Iran, is described and illustrated. A new generic (subgeneric) diagnosis of *Oxyoppia* (*Oxyoppiella*) Subías and Rodríguez, 1986 is given, and a key to all known species is provided.

**Key words:** Generic and subgeneric diagnosis, Iran, key, mites, Oxyoppiinae

1. **Introduction**

Oppiidae is one of the largest families of oribatid mites (Subías, 2004). This family is also very species-rich in Iran, with 21 genera and 65 species (including subspecies) recorded (Akrami, 2015; Akrami and Bastan, 2015; Movahedzade et al., 2016), which constitutes almost 17% of the known oribatid mites in this country.

The genus *Oxyoppia* Balogh & Mahunka, 1969 currently consists of 33 species with a collectively cosmopolitan distribution (except in the Nearctic and boreal regions) (Subías, 2004). *Oxyoppia* comprises 4 subgenera: *Oxyoppia* Balogh & Mahunka, 1969 (3 species); *Aciculoppia* Subías & Rodríguez, 1986 (3 species); *Dzarogneta* Kuljiev, 1978 (14 species); and *Oxyoppiella* Subías & Rodríguez, 1986 (13 species, 1 subspecies). Only 2 described *Oxyoppia* species have been recorded from Iran: *O. (Dzarogneta) intermedia* Subías & Rodríguez, 1986 and *O. (Dzarogneta) iranensis* Akrami & Subías, 2008.

This paper describes a new species under the name *Oxyoppia* (*Oxyoppiella*) *minuscula* sp. nov. Previously, an unknown *O. (Oxyoppiella)* species was recorded for Iran (Keshavarz Jamshidian et al., 2015) with too few specimens to describe it. However, the new species described here differs from the unknown species recorded previously (see short description by Keshavarz Jamshidian et al., 2015). An updated generic and subgeneric diagnosis for *Oxyoppia* and *O. (Oxyoppiella)* is given and a key and distribution map to all known *O. (Oxyoppiella)* species are presented.

2. **Materials and methods**

Soil samples were taken in wheat fields and grasslands in the Marand region, East Azerbaijan Province, Iran, during mid-September 2014. Samples were taken at the three top horizons and transferred to the laboratory. Mites were extracted with a Berlese funnel, stored in Oudeman's solution, cleared in Nesbitt's fluid, and slide-mounted in Hoyer's medium (see Krantz and Walter, 2009 for compositions).

All measurements are given in micrometers. Body length was measured in dorsal view from the tip of the rostrum to the posterior edge of the notogaster. Body width was measured in dorsal view at the widest part. Setae and legs were measured in the view in which they could be best observed. Leg setation is given in the following sequence: trochanter – femur – genu – tibia – tarsus (including famulus). Solenidia are given in brackets. General terminology follows that of Norton and Behan-Pelletier (2009).

3. **Results and discussion**

3.1. **Generic diagnosis:** *Oxyoppia* Balogh and Mahunka, 1969

(From Balogh and Mahunka, 1969; Balogh, 1983; Subías and Rodríguez 1986.)

Type species: *Oppia spinosa* Hammer, 1958.

Bothridial seta fusiform, setiform or lanceolate, not globular; lamellar seta mostly closer to interlamellar seta.
than to rostral setae; 0–3 pairs of sigillae between bothridia; humeral region with developed process; notogastral setae \( c_s \), mostly well developed, adjacent to humeral process, 9–10 pairs of short to long notogastral setae; 4–6 pairs of genital setae, 1 pair of aggenital, 2 pairs of anal, 3 pairs of adanal setae; lyrifissure \( iad \) in various positions; \( ad_i \), mostly postanal, \( ad_p \), preanal.

3.2. Subgeneric diagnosis: *Oxyoppia* (Oxyoppiella) Subias and Rodriguez, 1986

(From Subias and Rodriguez, 1986 and known species, including new species described below.)

**Type:** *Oppiella polynesia* Hammer, 1972.

Small species (length 160–287); rostrum not incised [except possibly *O. bituberculata bituberculata* (Balogh, 1958), rostrum bidentate in Balogh (1961a), rounded in Mahunka (1983)], lamellar costula present, translamella mostly present [possibly absent in *O. vtorovi* (Rjablinin, 1987)]; bothridial seta scapulate, fusiform to lanceolate fusiform; interbothridial tubercles present or absent; humeral process distinct, additional crista present or absent; 10 pairs of notogastral setae, \( c_s \), present, medially to humeral process, but shorter than other setae, other notogastral setae smooth or ciliate, short to medium in length, position of seta \( lm \) to \( la \) variable; \( ad_i \), postanal.

3.3. Description of new species: *Oxyoppia* (Oxyoppiella) minuscula sp. nov.

(Figures 1A and 1B)

**Specific diagnosis.** Translamella present; weak crista present anterior of notogaster; ciliated notogastral setae, setae \( lm \) anteromedially to \( la \); shallow apodeme 4; cerotegumental extensions at pedotectum II present; adanal seta \( ad_i \), posteromedially to aggenital seta, \( ad_i \) posterior to lyrifissure \( iad \), \( iad \) inverse apoanal, almost longitudinally orientated.

**Measurements.** Holotype (female): length 166, width 81; paratypes, all female (\( n = 8 \)), length: mean 173 (range 160–180); width: 83 (82–85).

**Integument.** Body surface smooth; exobothridial region weakly granulated, cerotegumental extensions at pedotectum II.

**Prodorsum.** Rostrum rounded; rostral seta (ro 8–12) located dorsolaterally, slightly thickened, smooth, lamellar seta (le 6–8) thin, weakly ciliate, interlamellar seta (in 3–6), exobothridial seta (ex 8–9) thin, smooth, \( le \) closer to \( in \) than to \( ro \), ex inserted on tubercle anterolaterally to bothridium; distinct lamellar costula present, extending from the bothridium to \( le \); curved translamella present, less distinct than lamellar costula, \( le \) inserted on tubercle at junction of costula and translamella; interbothridial tubercle present posterior to \( in \), extending to anterolateral of \( in \); bothridium with posterior tubercle; bothridial seta (bs 20–31) fusiform to scapulate, head with 13 to 16 setulae of similar lengths on the outer side, inner side with very small indistinct cilia; distinct sigillae anterior of bothridium visible, sigillae between \( in \) could not be observed.

**Notogaster.** Distinct humeral process present, additional weak crista present posterior to \( in \); 10 pairs of notogastral setae present, \( c_s \), thin, smooth, short (2–3), halfway between humeral process and crista, other setae thin, weakly ciliate, of similar length (7–12), seta \( lm \) anteromedially to \( la \); seta \( lp \) anteromedially to \( h_s \); lyrifissures \( ia \), \( im \) distinct (4–7), \( ia \) located in humeral process, \( im \) longitudinally orientated.

**Epigermal region.** Seta \( h \) (5–6) thin, with 1 cillum, \( m \) (4–6), thin, smooth, \( a \) could not be observed; all epimal setae thin, smooth, short, of similar length (3–6); discidium distally weakly triangular, apodeme 4 shallow, i.e. only slightly extending past anterior level of genital plates.

**Anogenital region.** All setae thin, smooth; 5 pairs of genital setae (2–3), \( g \), on anterior border of genital plate; 1 pair of aggenital setae (ag 4–5), 2 pairs of anal setae (3–5), 3 pairs of adanal setae (ad 3–6), \( ad \), posteromedially to \( ag \); \( ad \), posterior to lyrifissure \( iad \), \( iad \) (5–9) thin, curved, inverse apoanal, almost longitudinally orientated.

**Legs.** Leg IV (85–101) > leg I (80–88) > leg III (65–82) > leg II (60–70); leg setation: leg I: 1-5-2(1)-4(2)-18(2), leg II: 1-5-2(1)-4(1)-13(2), leg III: 2-3-1(1)-3(1)-13, leg IV: 1-2-2-3(1)-10 (see Table for setation detail); morphology of legs, setae, and solenidia similar to that of *Oxyoppia mustaciata* Kun, 2014, but differs slightly in relative shorter solenidia \( s \) on genua I–III and solenidia \( q \) on tibiae III–IV, setae \( s \) and \( pv \) on tarsus IV thick, fan-shaped.

**Etymology.** The species is named after the Latin for small, minusculus, since the new species is the smallest of all known *O. (Oxyoppiella)* species.

**Type material.** The holotype (IEAM-W-M14-OOM-1) and 4 adult paratypes from wheat field soil, 38°27′28.13″N, 45°55′21.99″E, 1541 m a.s.l.; 3 adult paratypes from wheat field soil, 38°26′37.45″N, 45°53′15.60″E, 1399 m a.s.l.; 1 adult paratype from grassland soil, 38°24′35.27″N, 45°55′21.99″E, 1541 m a.s.l.

The holotype and 7 paratypes are deposited at the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, Azarbaijan Shahid Madani University, Tabriz (Iran), and 1 paratype (IEAM-W-M14-OOM-2) is deposited in the Acarology Collection of the National Museum, Bloemfontein, South Africa.

**Remarks.** *Oxyoppia* (Oxyoppiella) minuscula sp. nov. is most similar to *O. antillensis* Mahunka, 1998 in having crista on the notogaster in addition to the humeral process, extended interbothridial tubercules, ciliated notogastral setae, and 5 pairs of genital setae. *Oxyoppia minuscula* sp. nov. differs from *O. antillensis* in the junction of the costula and translamella (*O. minuscula*: translamella at the end of the costula; *O. antillensis*: costula extends one-third beyond translamella), the position of notogastral seta \( lm \)
relative to la (O. minuscula: anteromedially; O. antillensis: posteromedially), position of adanal seta ad₁ relative to aggenital seta (O. minuscula: posteromedially, O. antillensis: posterolaterally). See key below for differentiation of O. minuscula sp. nov. from other species.

3.4. Key to species of *Oxyoppia* (*Oxyoppiella*)

(Body sizes in micrometers; for species distribution, see Section 3.5 and Figure 2.)

1. Notogastral seta lm anteromedially to la ............... 2
   Notogastral seta lm posteromedially to la or slightly
   posteromedially to la .................................................. 3

2. Translamella distinct, crista present in addition to
   the humeral process, seta ad₂ posterior to lyrifissure iad,
   160–180 × 82–85 ................................. O. minuscula sp. nov.
   Translamella indistinct or absent, crista absent, seta ad₂
   anterior to lyrifissure iad, 229 × 106 ............................... O. vtorovi (Rjabinin, 1987)

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Figure 1. *Oxyoppia* (*Oxyoppiella*) *minuscula* sp. nov. (legs removed). A: dorsal view, B: ventral view.
Oxyoppia (Oxyoppiella) minuscula sp. nov.

Table. Leg setation and solenidia of Oxyoppia (Oxyoppiella) minuscula sp. nov.

<table>
<thead>
<tr>
<th>Leg</th>
<th>Trochanter</th>
<th>Femur</th>
<th>Genu</th>
<th>Tibia</th>
<th>Tarsus</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>v'</td>
<td>d, l', v', bv'</td>
<td>(l), σ</td>
<td>(l), (v), φ, φ_2</td>
<td>(ft), (tc), (it), (p), (u), (a), s, (pν), (pl), r, ω_1, ω_2</td>
</tr>
<tr>
<td>II</td>
<td>v'</td>
<td>d, l', v', bv'</td>
<td>(l), σ</td>
<td>(l), (v), φ</td>
<td>(ft), (tc), (p), (u), (a), s, (pν), ω_1, ω_2</td>
</tr>
<tr>
<td>III</td>
<td>l', v'</td>
<td>d, l', ev'</td>
<td>l', σ</td>
<td>l', (v), φ</td>
<td>(ft), (tc), (p), (u), (a), s, (pν)</td>
</tr>
<tr>
<td>IV</td>
<td>v'</td>
<td>d, ev'</td>
<td>d', l'</td>
<td>l', (v), φ</td>
<td>ft', (tc), (u), (a), s, (pν)</td>
</tr>
</tbody>
</table>

Roman letters refer to normal setae, Greek letters refer to solenidia (except ε to famulus), parentheses indicate pairs of setae. Setae on the anterior side of a leg segment are indicated with a single accent (') and setae on the posterior side with a double accent ("').

3. Notogastral setae ciliate .................................................. 4
4. Five pairs of genital setae ........................................... 5
5. Notogastral seta h_1 anterolaterally to lp, seta p_3 anterolaterally to h_1, 108–200 × 80–92 ...................................................... O. cubana Balogh & Mahunka, 1980
7. Humeral process short, interbothridial tubercle posterior to interlamellar seta present, interlamellar seta short, 200 × 110 .......................................................... O. bituberculata bituberculata (Balogh, 1958) (see also Balogh, 1961a; Mahunka, 1983)
8. Translamella interrupted medially, lamellar seta on cusp, 287 × 152 ...... O. saskai (Balogh, 1961b) (see also Mahunka, 1983)

Translamella complete, distinct or thin line, lamellar seta inserted in the junction between costula and translamella .......................................................... 9
9. Humeral process extending backwards as a thin line, aggenital setae shorter than adanal setae, body surface punctuate, 205–240 × 115–125 ............................................. O. polynesia (Hammer, 1972) (see also Subias and Sarkar, 1983)

Humeral process short, aggenital setae of similar length than adanal setae, body surface smooth .................................................. 10
10. Costula smooth, converging, interbothridial tubercles reduced, length 250 .......................................................... O. baliensis (Hammer, 1982)

Costula indented, almost parallel, strong interbothridial tubercle present, which almost reaches interlamellar seta, 220–229 × 114–119 ...................... O. struthio Mahunka, 1983
11. Costula does not extend beyond translamella .... 12
12. Costula extends beyond translamella ................. 13

14. Interbothridial tubercle absent or represented by short crest, lamellar seta inserted anterior of junction of costula and translamella, stalk of bothridial seta long .................. 14

3.5. Known distribution of Oxyoppia (Oxyoppiella) species (Figure 2)

Species of this subgenus mostly occur in the southern hemisphere or close to the equator, while it is absent in northern parts of the world.

O. antillensis: Antilles (St Lucia) (Mahunka, 1998)
O. baliensis: Bali (Hammer, 1982)
O. bituberculata bituberculata: Angola (Balogh 1958, 1961a); Ghana (Wallwork 1961a, 1961b); Democratic Republic of the Congo (Noti et al., 1996); sub-Antarctic islands: Saint Paul and New Amsterdam (Travé, 1973; Travé and De Bovée, 1989)
**Figure 2.** Distribution of *Oxyoppia* (*Oxyoppiella*) species in the world (see text for details).
O. bituberculata cognata: Ghana (Wallwork, 1961a)
O. crassata: Madagascar (Mahunka and Mahunka-Papp, 2012)
O. cubana: Cuba (Balogh and Mahunka, 1980; Ermilov et al., 2016); Chile (Covarrubias, 2009); Brazil (Franklin et al., 2006)
O. minuscula sp. nov.: Iran
O. mustaciata: Argentina (Kun, 2014)
O. polynesia: Polynesia (Tahiti) (Hammer, 1972); Paraguay (Balogh and Mahunka, 1981); Brazil (Franklin et al., 2006; Ermilov and Tolstikov, 2015); Ecuador (Ermilov et al., 2013); Panama (Subías et al., 2004); Cambodia (Ermilov and Niedbala, 2013); India (Subías and Sarkar, 1983); Philippines (Corpuz-Raros and Lit, 2005)
O. saskai: Tanzania (Balogh, 1961b); Democratic Republic of the Congo (Noti et al. 1996)
O. scalifera: Argentina (Hammer, 1958, 1961; Balogh and Csiszár, 1963; Martínez and Velis, 2000; Kun et al., 2010; Kun 2014); Bolivia (Hammer, 1958); Chile (Hammer, 1962a, 1962b); Peru (Hammer, 1962a); Panama (Schatz, 2006); Galapagos Islands (Schatz 1998, 2006); India (Bhaduri and Raychaudhuri, 1981); New Zealand (Hammer, 1968; Spain and Luxton, 1971; Minor et al., 2016); Australia (Coffol and Halliday, 1998)
O. struthio: Tanzania (Mahunka, 1983)
O. suramericana: Various places in Argentina (Hammer, 1958, 1961; Balogh and Csiszár, 1963; Martínez and Velis, 2000; Martínez et al., 2009; Kun et al., 2010; Kun 2014); Bolivia (Hammer, 1958); Chile (Hammer, 1962a, 1962b); Peru (Hammer, 1962a); Panama (Schatz, 2006); Galapagos Islands (Schatz 1998, 2006); India (Bhaduri and Raychaudhuri, 1981); New Zealand (Hammer, 1968; Spain and Luxton, 1971; Minor et al., 2016); Australia (Coffol and Halliday, 1998)
O. vtorovi: China/Kyrgyzstan (Rjabinin, 1987)

**References**


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