

## Two New Species of *Zercon* C.L.Koch (Acari, Mesostigmata, Zerconidae) from Turkey: *Zercon longisetosus* sp.n. and *Zercon osmanelinensis* sp.n.

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**Abstract:** Two new species of zerconid mites, *Zercon longisetosus* sp.n. and *Z. osmanelinensis* sp.n., from Turkey are described and illustrated. Additionally, a key to adults of *Zercon* known from Turkey is given.

**Key Words:** Acari, taxonomy, Zerconidae, *Zercon*, Turkey

### Türkiye'den İki Yeni *Zercon* C.L.Koch (Acari, Mesostigmata, Zerconidae) Türü: *Zercon longisetosus* sp.n and *Zercon osmanelinensis* sp.n.

**Özet:** Türkiye'den iki yeni zerconid akar türünün, *Zercon longisetosus* sp.n. ve *Z. osmanelinensis* sp.n., tanımları yapıldı ve şekilleri çizildi. Ayrıca, Türkiye'den bilinen ergin *Zercon* türleri için bir teşhis anahtarı verildi.

**Anahtar Sözcükler:** Acari, taksonomi, Zerconidae, *Zercon*, Türkiye

### Introduction

When compared with other families of mesostigmatic (Mesostigmata) mites, zerconid mites are relatively well known in Europe, some parts of Asia, and North America. Zerconid mites are known predators and play an important role as zoedaphon components in all soil microhabitats of the temperate zone of the northern hemisphere (Masan and Fenda, 2004). The zerconid mites of Turkey are similar to Europe mite species and could be distributed in the whole of the European continent. Of the 38 genera of the family Zerconidae known from the northern hemisphere, only 3 (*Prozercon*, *Rafas*, and *Zercon*) are known from Turkey. *Zercon* is the richest genus in Turkey based on the number of species. The known Turkish zerconid fauna includes 18 species of *Prozercon*, 1 species of *Rafas*, and 38 species of *Zercon* (Błaszak, 1979; Urhan and Ayyıldız, 1993, 1996a, 1996b; Urhan, 1997, 1998a, 1998b, 2000, 2001a, 2001b, 2002, 2007a, 2007b; Çobanoğlu et al., 2002; Urhan and Ekiz, 2002; During studies on

the zoogeographic distribution of the zerconid mites in Turkey, 2 undescribed species were found and identified as new species and described as a contribution to the acari faunal richness of Turkey.

### Materials and Methods

Soil and litter samples were collected from Osmaneli district (Bilecik, Turkey) on 13 April 2007, at 450 m a.s.l. and Kerpe village (Kandıra, Kocaeli, Turkey) on 14 April 2007, at 10 m a.s.l. The soil and litter samples were placed into plastic bags, labelled, and transferred to the laboratory. Samples were placed into combined Berlese funnels, and mites were extracted for 5-7 days according to their humidity. At the end of this process, the contents of the bottles were transferred into petri dishes and mites were separated under a stereo-microscope. They were placed in 60% lactic acid for clearing and mounted onto permanent microscope slides using a glycerine medium. The examination and drawing of mites were done using



**Dorsum** (Figure 1A). Podonotal setae j1 feathered and r4-r5 slightly pilose and the remainder short and smooth. Opisthonotal setae  $J_1$ ,  $J_2$ ,  $Z_1$ ,  $Z_2$ ,  $Z_5$  and  $S_1$  short and smooth. Setae  $J_2$  with anteroparaaxially position of the bases of setae  $J_3$  and reach the base of setae  $J_3$ . Setae  $J_3$  and  $J_4$  prolonged, thickened, apically smooth, slightly pilose and reach beyond the bases of following setae. Setae  $J_5$  slightly thickened, pilose, apically flattened and rounded and reach beyond the posterior margin of opisthonotum. Setae  $J_6$  prolonged, thickened, barbed, and terminated with hyaline ending. The mean distance between the insertions of setae  $J_6$  is 132  $\mu\text{m}$ . Setae  $Z_2$  reach the bases of setae  $Z_3$ . Setae  $Z_3$  similar to setae  $J_3$  and reach beyond the base of setae  $Z_4$ . Setae  $Z_4$  are similar to setae  $J_6$  and reach beyond the posterior margin of opisthonotum. The mean distance between setae  $Z_5$  and  $J_6$  is 26  $\mu\text{m}$ . Setae  $S_2$  are similar to setae  $J_4$  and reach the base of setae  $S_3$ . Setae  $S_3$  and  $S_4$  are similar to seta  $J_6$ , and setae  $S_3$  exceed half the length of lateral margin of opisthonotum. Setae  $R_1$ - $R_7$  slightly pilose. Setae  $J_6$  are the longest opisthonotal setae (90-93  $\mu\text{m}$ ). Serrated lateral margins of opisthonotum wide and with sharply ended segments. The lengths of opisthonotal setae and distances between setal bases within longitudinal rows are given in Table 1.

**Pores** (Figure 1A): Pores po1 situated inside the line connecting setae s1-s2. Pores po2 lie under the line connecting setae j4-s4. Pores po3 lie under the line connecting setae z1-s5. Pores  $Po_1$  situated anteroantiparaxially to the bases of setae  $Z_1$ . Pores  $Po_2$  lie slightly above or on the line connecting setae  $Z_2$ - $S_2$ . Pores  $Po_3$  lie on the line connecting setae  $Z_4$ - $J_4$  located closer to setae  $Z_4$ . Pores  $Po_4$  are located under the insertion of setae  $S_4$ .

**Pattern of dorsal integument:** The ornamentation of the dorsal shields is shown in Figure 1. Dorsal cavities are distinct, equal in size with axes parallel to the body axis.

**Venter** (Figure 2B): The chaetotaxy and shape of the peritremal shield are typical for the genus. The adgenital shields are present with 4 pores. Anterior margin of the ventro-anal shield with 2 setae.

#### Allotype

**Male** (Figure 1C, D): The mean length and width of idiosoma (excluding gnathosoma) were 348 (338-355) and 285 (278-295)  $\mu\text{m}$ , respectively ( $n = 22$ ). The setae, pores, and sculpturing pattern on the podo- and opisthonotum are the same as in the female. The mean distances between setae  $J_6$  and  $J_6$  and between  $Z_5$  and  $J_6$

Table 1. Lengths of opisthonotal setae and distances between setal bases within longitudinal rows in *Zercon longisetosus* sp.n. (measurements in  $\mu\text{m}$ ).

	♀	♂	DN		♀	♂	DN		♀	♂	DN
$S_1$	28-33	20-23	20	$Z_1$	23-25	15-20	10-15	$J_1$	13-18	13-18	13-15
↓	38-50	25-30	25-33	↓	43-50	33-35	25-35	↓	65-73	40-45	30-45
$S_2$	58-63	43-48	38-50	$Z_2$	33-40	20-25	15-25	$J_2$	25-33	25	25-30
↓	38-45	33-48	33-48	↓	30-43	23-28	15-25	↓	20-28	20	25-28
$S_3$	75-78	58	45-68	$Z_3$	63-75	40-48	43-53	$J_3$	58-65	35-45	33-48
↓	48-53	38-50	35-50	↓	38-48	28-35	35-43	↓	30-33	18-23	20-28
$S_4$	80-93	65-75	68-78	$Z_3$	83-88	63-73	70-83	$J_3$	58-63	45-50	28-50
				↓	45-53	35-45	33-50	↓	30-33	18-23	15-25
				$Z_5$	28-38	20-23	25-30	$J_5$	63-73	50-53	18-38
								↓	30-38	33-45	33-43
								$J_6$	90-93	73-75	60-90

are 101  $\mu\text{m}$  and 18  $\mu\text{m}$ , respectively. The lengths of opisthotal setae and distances between setal bases within longitudinal rows are given in Table 1.

**Deutonymph** (Figure 1E): Idiosoma (excluding gnathosoma); mean length 343 (298-378)  $\mu\text{m}$ , mean width 283 (243-308)  $\mu\text{m}$  ( $n = 7$ ). Podonotal setae j1 feathered, r3 and r6 pilose, the remainder are smooth. Opisthotal setae  $J_1$ ,  $J_2$ ,  $Z_1$ ,  $Z_2$ ,  $Z_5$ , and  $S_1$  smooth. Setae  $J_3$ - $J_5$ ,  $Z_3$ , and  $S_2$  prolonged, slightly pilose and apically smooth. Setae  $J_2$ - $J_4$  reach beyond the bases of following setae. Setae  $J_6$ ,  $Z_4$ ,  $S_3$ , and  $S_4$  prolonged, barbed terminated with hyaline ending. The mean distances between the insertions of setae  $J_6$  is 98 (80-110)  $\mu\text{m}$ . Setae  $Z_3$  reach base of setae  $Z_4$  and setae  $Z_4$  exceed posterior margin of opisthotalum. The mean distance between setae  $Z_5$  and  $J_6$  is 18 (15-20)  $\mu\text{m}$ . Setae  $S_3$  exceed half the length of lateral margin of opisthotalum. Pores  $po_3$  lie on the line connecting setae  $Z_4$ - $J_4$  shifted toward seta  $Z_4$ . Setae  $R_1$ - $R_3$  slightly pilose, the remainder of this row (R) short and smooth. Length of opisthotal setae and distances between setal bases within longitudinal rows are given in Table 1.

**Remarks:** *Zercon longisetosus* sp.n. is most similar to *Zercon tematinensis* Masan and Fenda, 2004 and *Zercon hercynicus* Halaskova, 1969 by the sculpture of podonotal and opisthotal shield and dorsal chaetotaxy. The similarities and differences between the females of the 3 species are given in Table 2.

**Etymology:** The specific name *longisetosus* refers to the long opisthotal setae.

*Zercon osmanelinensis* sp.n.

**Type material:** Holotype ♀. Turkey, Bilecik, Osmaneli district, 450 m a.s.l., 13 April 2007. The specimens were found in litter, soil, and moss pads in a mixed forest (mostly *Pinus* sp. and *Juniperus* sp.). Paratypes: 11 ♀♀, Allotypes: 4 ♂♂; from the same sample. Type material is deposited in the Department of Zoology of Pamukkale University, Denizli (Turkey).

### Holotype

**Female** (Figures 2A, B). Length of idiosoma (excluding gnathosoma) in holotype 425  $\mu\text{m}$ , width 298  $\mu\text{m}$ , mean length and width of paratypes 426 (410-450) and 298 (293-303)  $\mu\text{m}$ , respectively ( $n = 11$ ).

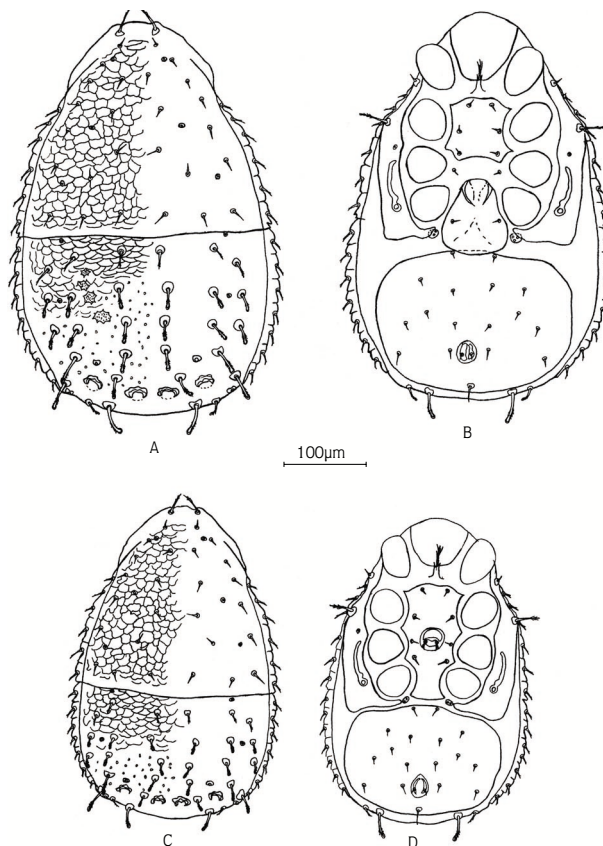


Figure 2A-D. *Zercon osmanelinensis* sp.n. Female: A- dorsum of idiosoma; B- venter of idiosoma. Male: C- dorsum of idiosoma; D- venter of idiosoma.

**Dorsum** (Figure 2A). Podonotal setae j1 feathered, all marginal setae finely pilose and the remainder short and smooth. Opisthotal setae  $J_1$ ,  $Z_1$  and  $S_1$  apically pilose. Setae  $J_2$ - $J_6$ ,  $Z_2$ - $Z_5$  and  $S_2$ - $S_4$  long, thickened, barbed with hyaline ending. Setae on the opisthotalum do not reach the bases of following setae. Setae  $J_5$  do not reach posterior margin of opisthotalum. The mean distance between the insertions of setae  $J_6$  is 99 (95-105)  $\mu\text{m}$ . Setae  $Z_4$  reach base of setae  $S_4$ . Setae  $S_2$  and  $S_3$  do not reach lateral margin of opisthotalum. The mean distance between setae  $Z_5$ - $J_6$  is 23 (20-25)  $\mu\text{m}$ . All marginal setae on the opisthotalum finely pilose. The lengths of opisthotal setae and distances between setal bases within longitudinal rows are given in Table 3.

**Pores** (Figure 2A): Pores  $po_1$  lie inside the line connecting setae j2-s1. Pores  $po_2$  lie under the line connecting setae j4-s4. Pores  $po_3$  lie under the line

Table 2. The similarities and differences between *Zercon tematinensis*, *Z. hercynicus*, and *Z. longisetosus* sp.n.

Species			
Features	<i>Zercon tematinensis</i>	<i>Z. hercynicus</i>	<i>Z. longisetosus</i> sp.n.
Seta $s_1$	Absent	Absent	Present, short and smooth
Marginal setae	All marginal setae with very fine apical pilosity	Setae r3 and r6 barbed, and $R_1$ - $R_3$ are pilose, the remainder smooth	Setae r1-r3 short and smooth, r4-r6 and $R_1$ - $R_7$ slightly pilose
The bases of setae $J_5$	On the line connecting setae $Z_4$ - $Z_4$	On the line connecting setae $Z_4$ - $Z_4$	Under the line connecting setae $Z_4$ - $Z_4$ and between inner and outer dorsal cavities
Setae $J_5$	Thickened, prolonged, apically smooth and reach posterior margin of opisthonotum	Long and feathered at the extremity and do not reach posterior margin of opisthonotum	Slightly thickened, pilose, apically flattened and rounded and reach beyond the posterior margin of opisthonotum
The longest opisthonotal setae	Setae $J_4$ and $J_5$ (100-109 $\mu$ m)	Setae $Z_4$ (84 $\mu$ m)	Setae $J_6$ (90-93 $\mu$ m)
Pores $PO_2$	Slightly above the line connecting setae $Z_2$ - $S_2$	Close outside the insertion of setae $Z_3$	On the line connecting setae $Z_2$ - $S_2$
Pores $PO_3$	On the line connecting setae $Z_4$ - $J_5$	Under the line connecting setae $Z_4$ - $J_5$	On the line connecting setae $Z_4$ - $Z_4$
The sculpture of posterior region of opisthonotum	Smooth pattern	Smooth pattern	Distinctly punctate pattern

Table 3. Lengths of opisthonotal setae and distances between setal bases within longitudinal rows in *Zercon osmanelinensis* sp.n. (measurements in  $\mu$ m).

	♀	♂		♀	♂		♀	♂
$S_1$	20-23	10-13	$Z_1$	18-20	10-13	$J_1$	18-20	13
↓	35-38	23	↓	45-50	33	↓	43-50	33
$S_2$	20-23	10-13	$Z_2$	18-23	10-13	$J_2$	18-25	15
↓	35-38	20	↓	28-35	23	↓	35-40	28
$S_3$	18-23	15	$Z_3$	20-25	13-15	$J_3$	20-25	15
↓	50-58	33-40	↓	30-40	18-20	↓	33-38	18-20
$S_4$	325-33	25-30	$Z_4$	28-33	(20-23	$J_4$	20-25	15
			↓	43-55	25-30	↓	28-33	18-20
			$Z_5$	115-18	10-13	$J_5$	23-28	15
						↓	30-40	18-23
						$J_6$	28-35	25-35

connecting setae z1-s5. Pores Po1 located anteroantiaxially to the insertion of setae Z<sub>1</sub>. Pores Po2 lie on the line connecting setae Z<sub>2</sub>-S<sub>2</sub>. Pores Po<sub>3</sub> lie above the line connecting setae Z<sub>4</sub>-J<sub>5</sub>. Pores Po4 located under the insertion of setae Z<sub>5</sub>.

**Pattern of dorsal integument:** The ornamentation of the dorsal shields is shown in Figure 2A. Dorsal cavities are distinct, and equal in size, with undulated anterior margin.

**Venter** (Figure 2B): The chaetotaxy and shape of the peritremal shield are typical for the genus. The adgenital shields are present with 3 pores. Anterior margin of the ventro-anal shield with 2 setae.

**Allotype**

**Male** (Figure 2C, D): The mean length and width of idiosoma (excluding gnathosoma) were 332 (318-340) and 230 (228-233) μm, respectively (n = 4). The setae, pores, and sculpturing pattern on the podo- and opisthonotum are same as in the female. The mean distances between setae J<sub>6</sub> and J<sub>6</sub> and between Z<sub>5</sub> and J<sub>6</sub> are 88 (80-95) μm and 16 (15-18) μm, respectively. The lengths of opisthonotal setae and distances between setal bases within longitudinal rows are given in Table 3.

**Remarks:** *Zercon osmanelinensis* sp.n. is closely related to *Zercon hispanicus* Sellnick, 1958 (Blaszak 1979) and *Zercon colligans* (Berlese, 1920) (Lundquist and Johnston 1986) by the sculpture of podonotal and opisthonotal shield and dorsal chaetotaxy. The similarities and differences between the females of the 3 species are given in Table 4.

**Etymology:** The specific name *osmanelinensis* reflects the name of the Osmani district (Bilecik, Turkey), where the new species was collected.

**Key to the adults of the genus *Zercon* known from Turkey**

1. Anterior margin of ventro-anal shield with 2 setae..... 2
  - Anterior margin of ventro-anal shield with 4 setae ..... 14
2. The long setae of opisthonotum with hyaline ending ..... 3
  - The long setae of opisthonotum without hyaline ending ..... 12

Table 4. The similarities and differences between *Zercon hispanicus*, *Z. colligans*, and *Z. osmanelinensis* sp.n.

Species Features	<i>Zercon hispanicus</i>	<i>Z. colligans</i>	<i>Z. osmanelinensis</i> sp.n.
All long setae of opisthonotum	Feathered	Barbed with hyaline ending	Barbed with hyaline ending
Setae J1, Z1 and S1	Short and smooth	Short and smooth	Long and apically pilose
Setae J2 and Z2	Short and smooth	Short and smooth	Long and barbed with hyaline ending
Setae S2 and S3	Short and smooth	Long and barbed with hyaline ending	Long and barbed with hyaline ending
All marginal setae	Short and smooth	r1-r3 short and smooth, r4-r6 and R1-R7 slightly pilose	All setae slightly pilose
Setae Z5	Short and smooth	Slightly pilose	Barbed with hyaline ending
Setae J3	Reach the base of setae J4	Do not reach the base of setae J4	Do not reach the base of setae J4.
Anterior margin of dorsal cavities	Smooth	Smooth	Undulated

3. Setae J<sub>4</sub>-J<sub>5</sub> smooth..... 4  
 – Setae J<sub>4</sub>-J<sub>5</sub> delicately barbed or with hyaline ending ..... 6
4. Seta S<sub>2</sub> with hyaline ending .....*solenites* Haarlov, 1942  
 – Seta S<sub>2</sub> smooth..... 5
5. Seta S<sub>3</sub> smooth ..... *leporus* Blaszak, 1979  
 – Seta S<sub>3</sub> with hyaline ending..... *separatus* Urhan, 2001
6. Setae J<sub>4</sub>-J<sub>5</sub> delicately barbed ..... 7  
 – Setae J<sub>4</sub>-J<sub>5</sub> with hyaline ending ..... 9
7. Seta S<sub>2</sub> with hyaline ending ..... *nemoralis* Urhan, 2001  
 – Seta S<sub>2</sub> delicately barbed and without hyaline ending ..... 8
8. Seta Z<sub>3</sub> with hyaline ending ..... *fragilis* Urhan, 2001  
 – Seta Z<sub>3</sub> delicately barbed and without hyaline ending ..... *longisetosus* sp.n.
9. Seta S<sub>3</sub> not reaching margin of opisthonotum..... 10  
 – Seta S<sub>3</sub> reaching margin of opisthonotum .... 11
10. Setae J<sub>2</sub> and Z<sub>2</sub> short and smooth ..... *colligans* Berlese, 1920  
 – Setae J<sub>2</sub> and Z<sub>2</sub> long and barbed with hyaline ending..... *osmanelinensis* sp.n.
11. Seta J<sub>3</sub> with hyaline ending ..... *plumatopilus* Athias-Henriot, 1961  
 – Seta J<sub>3</sub> smooth ..... *insperatus* Blaszak, 1979
12. Pores Po<sub>3</sub> on the line connecting setae Z<sub>4</sub>-J<sub>5</sub>, seta Z<sub>4</sub> not reaching posterior margin of opisthonotum ..... *ignobilis* Blaszak, 1979  
 – Pores Po<sub>3</sub> anterior to the line connecting setae Z<sub>4</sub>-J<sub>4</sub>, seta Z<sub>4</sub> reaching posterior margin of opisthonotum ..... 13
13. Seta j<sub>2</sub> short and smooth ..... *adoxyphes* Blaszak, 1979  
 – Seta j<sub>2</sub> long and barbed ..... *caucasicus* Blaszak, 1979
14. Between the setal rows J-J and J-Z 8 extra setae ..... *trabzonensis* Urhan, 1997  
 – Between the setal rows J-J and J-Z no extra setae .....15
15. Setae J<sub>4</sub>-J<sub>5</sub> smooth .....16  
 – Setae J<sub>4</sub>-J<sub>5</sub> delicately barbed or with hyaline ending ..... 26
16. Seta S<sub>3</sub> absent ..... *beleviensis* Urhan, 2001  
 – Seta S<sub>3</sub> present .....17
17. Seta S<sub>3</sub> delicately barbed ..... *serratus* Urhan, 2001  
 – Seta S<sub>3</sub> smooth or with hyaline ending .....18
18. Setae S<sub>4</sub> long barbed with hyaline ending .....19  
 – Setae S<sub>4</sub> smooth ..... 22
19. Seta Z<sub>3</sub> short and smooth ..... *ozkani* Urhan & Ayyildiz, 1994  
 – Seta Z<sub>3</sub> long and with hyaline ending ..... 20
20. Seta S<sub>2</sub> short and smooth ..... 21  
 – Seta S<sub>2</sub> long and with hyaline ending ..... *andrei* Sellnick 1958
21. Seta S<sub>3</sub> short and smooth ..... *carpathicus* Sellnick, 1958  
 – Seta S<sub>3</sub> long and with hyaline ending .... *pinicola* Halaskova, 1970
22. Long setae of opisthonotum thick and terminally broad ..... *berlesei* Sellnick, 1958  
 – Long setae of opisthonotum thin and smooth. 23
23. Seta S<sub>3</sub> exceeding the margin of opisthonotum ..... 24  
 – Seta S<sub>3</sub> not reaching the margin of opisthonotum ..... *perforatulus* Berlese, 1904
24. Pores Po<sub>3</sub> between setal rows J-Z and the outer dorsal cavities 2 times bigger than inner cavities ..... 25  
 – Pores Po<sub>3</sub> between setal rows Z-S and the dorsal cavities equal in siz.. *montanus* Willmann, 1943
25. Seta J<sub>3</sub> not reaching the bases of seta J<sub>4</sub> ..... *cayblus* Athias-Henriot, 1961  
 – Seta J<sub>3</sub> reaching the bases of seta J<sub>4</sub> ..... *bulgaricus* Balogh, 1961
26. Pores Po<sub>3</sub> between setal rows Z-S ..... *notabilis* Blaszak, 1979  
 – Pores Po<sub>3</sub> between setal rows J-Z ..... 27
27. Setae J<sub>4</sub>-J<sub>5</sub> delicately barbed ..... 28  
 – Setae J<sub>4</sub>-J<sub>5</sub> with hyaline ending ..... 29

28. Setae  $S_2$  and  $S_3$  delicately barbed ..... *kackaricus* Urhan & Ekiz, 2002  
 – Setae  $S_2$  and  $S_3$  with hyaline ending ..... *septemporus* Urhan, 2001
29. Seta  $J_3$  short and smooth ..... 30  
 – Seta  $J_3$  long and with hyaline ending ..... 31
30. Seta  $S_2$  short and smooth ..... *burdurensis* Urhan, 2001  
 – Seta  $S_2$  with hyaline ending ..... *kezbaniremae* Urhan, 2007
31. Seta  $S_1$  smooth ..... *quadricavum* Urhan, 2001  
 – Seta  $S_1$  delicately barbed or with hyaline ending ..... 32
32. Seta  $S_1$  delicately barbed ..... *turcicus* Urhan & Ayyıldız, 1994  
 – Seta  $S_1$  with hyaline ending ..... 33
33. Setae  $R_1$ – $R_7$  smooth ..... *delicatus* Urhan & Ekiz, 2002  
 – Setae  $R_1$ – $R_7$  delicately barbed or with hyaline ending ..... 34
34. Setae  $R_1$ – $R_7$  delicately barbed..... 35  
 – Setae  $R_1$ – $R_7$  with hyaline ending ..... 36
35. Seta  $J_2$  delicately barbed ..... *apladelus* Blaszak, 1979  
 – Seta  $J_2$  short and smooth ..... *encarpatus* Athias-Henriot, 1961
36. Setae  $J_1$  and  $Z_1$  with hyaline ending ..... *ayyildizi* Urhan, 1997  
 – Setae  $J_1$  and  $Z_1$  smooth ..... 37
37. Setae  $J_5$  and  $Z_4$  not reaching posterior margin of opisthonorium ..... *agnostus* Blaszak, 1979  
 – Setae  $J_5$  and  $Z_4$  reaching posterior margin of opisthonorium ..... *salmani* Urhan, 2001

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