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RAŞİT URHAN

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Zercon kallimcii sp. n., a new species of zerconid mite (Acari, Zerconidae) from Turkey

Raşit URHAN*

Department of Biology, Faculty of Arts and Sciences, Pamukkale University, Kınıklı, Denizli - TURKEY

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Abstract: A new species of zerconid mite, *Zercon kallimcii* sp. n., is described and illustrated from Turkey on the basis of adult females.

Key words: Acari, taxonomy, Zerconidae, *Zercon*, Turkey, new species

Zercon kallimcii sp. n., Türkiye'den yeni bir zerconid akar (Acari, Zerconidae) türü

Özet: Bu çalışmada, Türkiye'den yeni bir zerconid akar türünün, *Zercon kallimcii* sp. n., ergin dişiler üzerinden tanımları yapıldı ve şekilleri çizildi.

Anahtar sözcükler: Acari, taksonomi, Zerconidae, *Zercon*, Türkiye, yeni tür

Introduction

Zerconid mites are important members of the soil fauna. Species of this family are free-living and mostly associated with humus and soil, decomposed litter, leaf mould, plant parts, and mosses. When compared with other families of mesostigmatic mites, zerconid mites are relatively well known in Europe, some parts of Asia, and North America (Mašán and Fenda, 2004).

Thirty-nine genera of the family Zerconidae are known in the northern hemisphere. Only 3 of these genera are currently recorded from Turkey, namely *Prozercon*, *Rafas*, and *Zercon*. The genus *Zercon*, based

on the number of species in Turkey and worldwide, is the richest in the family Zerconidae. The genus is estimated to include around 300 species worldwide. So far, 46 species of genus *Zercon* have been recorded from Turkey (Błaszak, 1979; Urhan 2008a, 2008b, 2008c; Urhan, 2009).

In this paper, a new species of *Zercon*, *Zercon kallimcii* sp. n., is described on material collected during a survey on the systematic of zerconid mites in Honaz Dağı National Park (Turkey) as a contribution to our understanding of the acarine faunal richness of Turkey.

* E-mail: rurhan@pau.edu.tr

Materials and methods

Soil and litter samples were collected on 03.12.2008 from the Honaz Dağı National Park, Honaz, Denizli (37°40.746 N, 29°16.743 E, 2291 m). They were placed in plastic bags, labeled, and transferred to the laboratory. Samples were placed into Berlese funnels, and mites were extracted for 5-7 days according to their moisture content. At the end of this process, the contents of the funnels' collecting 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 glycerin medium. The examination and drawing of mites were done using an Olympus BX50 microscope. Morphological terminology used in the description follows that of Sellnick (1958), Halašková (1969), Błaszak (1974), and Mašán and Fendá (2004).

Results and discussion

Family: ZERCONIDAE

Genus: *Zercon* C.L. Koch, 1836

Type-species: *Zercon triangularis* C.L.Koch, 1836

Zercon kallimcii sp. n.

(Figure 1A-F)

Type material: Holotype ♀. Turkey, Denizli, Honaz, Honaz Dağı National Park, 37°40.746 N, 29°16.743 E, 2291 m, 03 December 2008, collected by R. Urhan. Sample of litter and soil underlying *Juniperus communis*, *Astragalus* sp., and *Acatolimon* sp. Paratypes: 31 ♀♀, 8 ♂♂, 5 deutonymphs and 3 protonymphs, same data as holotype. Type deposition: Holotype (♀) and 3 paratypes (2 ♀♀, 1 ♂) at the Department of Biology, Pamukkale University, Denizli, Turkey; other paratypes (29 ♀♀, 7 ♂♂, 5 deutonymphs and 3 protonymphs) are deposited in the authors' collection.

Diagnosis: Anterior margin of ventri-anal shield with 2 pairs of setae. Dorsal cavities are distinct, saddle-like, and with undulated anterior margin. On the podonotum setae j2 barbed. Pores Po₃ situated between setal rows J and Z, on the line connecting setae Z₄-J₅. Setae J₁ and Z₁ are short and smooth. Setae

J₂-J₆, Z₂-Z₅ and S₁-S₄ thickened, prolonged, apically pilose, and terminated with hyaline ending. R₁-R₇ delicately barbed. Opisthonotal shield with distinct reticulate pattern in the anterior region and punctuate pattern in the posterior region.

Description: Female

Dorsum (Figure 1A). Length of idiosoma in holotype 528 µm, width 328 µm. Measurement of 31 paratypes; length 465-528 µm, width 323-350 µm. Ornamentation of the dorsal shields is shown in Figure 1A. Dorsal cavities are distinct, saddle-like, and with smooth or some undulated anterior margin.

Setae (Figure 1A). On podonotum, 20 pairs of differently formed setae present: j-setal row with 6 pairs of setae, z-setal row with 2 pairs, s-setal row with 6 pairs, and r-setal row with 6 pairs. Podonotal setae j1 and j2 and marginal setae r1-r6 distinctly barbed, remaining podonotal setae short and smooth. On opisthonotum, 22 pairs of setae present: J-setal row with 6 pairs of setae, Z-setal row with 5 pairs, S-setal row with 4 pairs, R-setal row with 7 pairs. Opisthonotal setae J₁ and Z₁ short and smooth. Setae J₂-J₆, Z₂-Z₅ and S₁-S₄ thickened, prolonged, apically pilose, and terminated with hyaline ending. Setae J₂ not reaching the base of setae J₃. Setae J₃ reaching the base of setae J₄. Setae J₅ reaching posterior margin of opisthonotum. Setae J₆ the longest opisthonotal setae (48-50 µm). The insertions of setae J₆-J₆ 112 (103-118) µm apart. Setae Z₂ not reaching the base of setae Z₃. Setae Z₃ reaching the base of setae Z₄. Setae Z₄ not reaching posterior margin of opisthonotum. The distance between setae Z₅ and J₆ 30 (28-33) µm. Setae S₂ not reaching lateral margin of opisthonotum. Setae S₃ with tips reaching lateral margin of opisthonotum. Setae R₁-R₇ delicately barbed. Lengths of opisthonotal setae and distances between setae within rows are as in Table 1.

Pores. Pores po1 lie on a line connecting setae s1-j4 closer to s1. Pores po2 lie slightly under line connecting setae s4-j4. Pores po3 lie inside the line connecting setae s5-s6. Pores Po₁ located anteroantiaxially to bases of setae Z₁. Pores Po₂ lie on the line connecting setae Z₂-S₃. Po₃ situated between setal rows J and Z, lie on the line connecting setae Z₄-J₅. Pores Po₄ situated under the base of setae S₄.

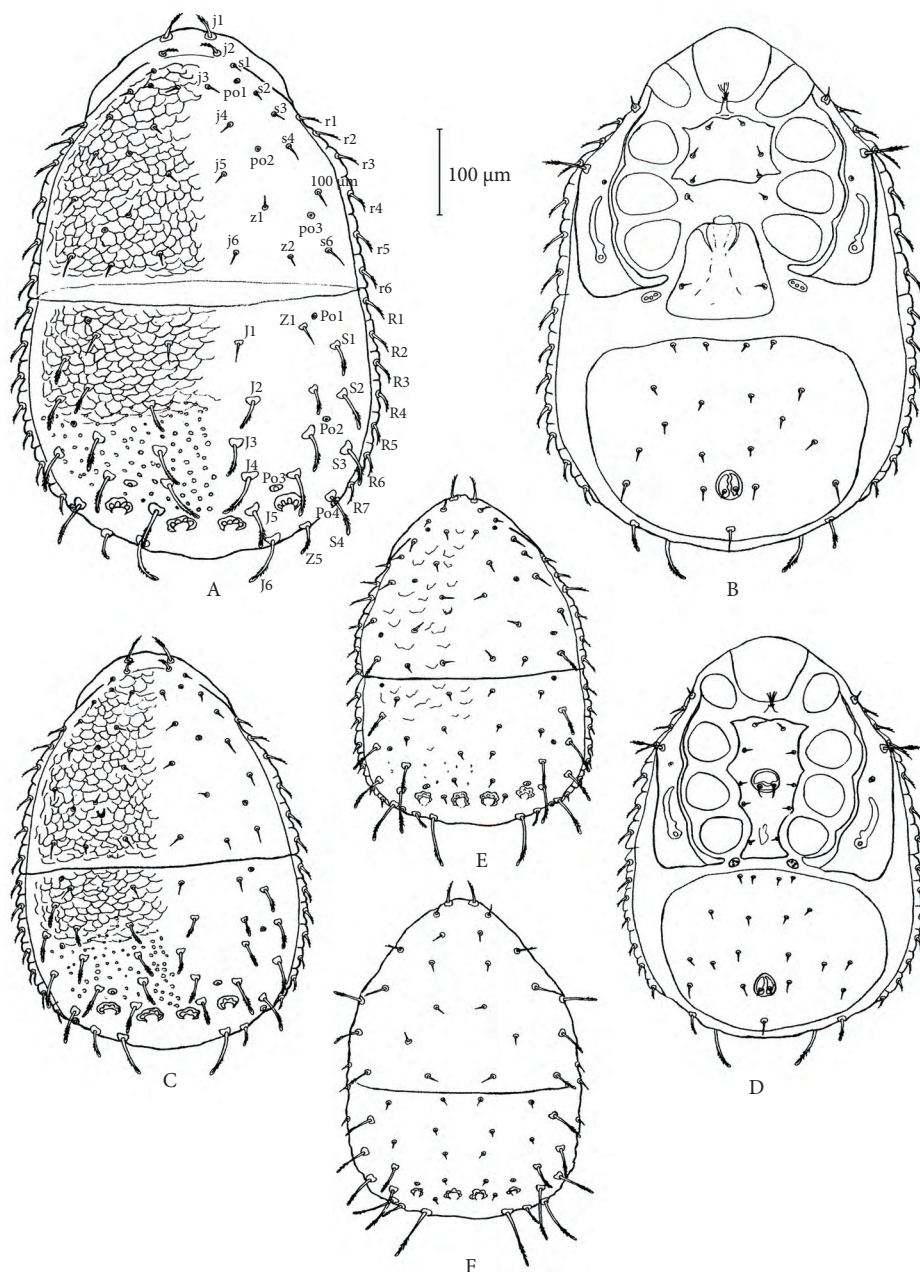


Figure 1. *Zercon kallimcii* sp. n. Female: A. Dorsal idiosoma, B. Ventral idiosoma. Male: C. Dorsal idiosoma, D. Ventral idiosoma. Deutonymph: E. Dorsal idiosoma. Protonymph: F. Dorsal idiosoma.

Venter (Figure 1B). Chaetotaxy and shape of the peritrematal shield are typical for the genus. Adgenital shields present with 3 pores. Anterior margin of the ventri-anal shield with 4 setae.

Allotype - Male (Figure 1C,D). Idiosoma length 378-400 μm , width 245-270 μm . Setae, pores, and

sculpturing pattern on the podonotum and opisthonotum as in female. Distance between setae J_6 and J_6 92 (88-98) μm . The distance between setae Z_5 and J_6 24 (20-28) μm . Lengths of opisthonotal setae and distances between setae within rows are as in Table 1.

Table 1. Lengths of opisthonotal setae and distances between them in females and males of *Zercon kallimcii* sp. n. (measurements in μm).

	♀♀	♂♂		♀♀	♂♂		♀♀	♂♂
S ₁	30-38	25-30	Z ₁	20-25	18-23	J ₁	20-25	13-18
↓	38-50	30-35	↓	53-65	35-43	↓	58-63	38-43
S ₂	38-43	30-35	Z ₂	30-33	20-25	J ₂	28-33	20-33
↓	45-55	33-40	↓	43-53	30-33	↓	40-50	33-38
S ₃	38-43	30-35	Z ₃	38-43	28-35	J ₃	38-43	28-35
↓	35-58	28-40	↓	30-43	33-35	↓	33-38	23-33
S ₄	38-43	35-43	Z ₄	38-43	38-43	J ₄	38-43	30-35
			↓	35-53	33-43	↓	20-30	20-25
			Z ₅	25-30	18-23	J ₅	38-43	33-38
						↓	23-35	25-35
						J ₆	48-53	38-50

Deutonymph (Figure 1E). Length of idiosoma in 5 paratypes 325-418 μm , width 213-288 μm . Podonotal setae j1 and r3 distinctly barbed, s6 thickened, prolonged, apically pilose, and terminated with hyaline ending, j2, r1, r2, and r4-r6 with apically pilose, remaining podonotal setae short and smooth. Opisthonotal setae J₁-J₅, Z₁, Z₂, and R₂-R₇ short and smooth, setae J₆, Z₃-Z₅, and S₁-S₄ thickened, prolonged, apically pilose, and terminated with hyaline ending. Setae R₁ apically pilose. Distance between setae J₆ and J₆ 90 (78-100) μm . Setae S₂ reaching the lateral margin of opisthonotum. Setae Z₄ reaching half of its length posterior margin of opisthonotum. The distance between setae Z₅ and J₆ 20 (15-23) μm . Pores Po₂ lie under the line connecting setae Z₂-S₂. Pores Po₃ lie on the line connecting setae Z₄-J₄ closer to setae Z₄. Lengths of opisthonotal setae and distances between setae within rows are as in Table 2.

Protonymph (Figure 1F). Length of idiosoma in 3 paratypes 278-315 μm , width 168-205 μm . Podonotal setae j1 distinctly barbed, setae j2, s2, and s4 apically pilose, r3, s5, and s6 thickened, prolonged, apically pilose, and terminated with hyaline ending, remaining podonotal setae short and smooth. Opisthonotal setae J₁-J₅, Z₁, and Z₂ short and smooth, setae J₆, Z₃-Z₅, and S₁-S₄ thickened, prolonged, apically pilose, and terminated with hyaline ending. Distance between

setae J₆ and J₆ 73 (70-75) μm . The distance between setae Z₅ and J₆ 20 (18-28) μm . Pores Po₃ lie on the line connecting setae Z₄-J₄. Lengths of opisthonotal setae and distances between setae within rows are as in Table 2.

Remarks. *Zercon kallimcii* sp. n. is closely related to *Z. agnostus* Błaszak, 1979 and *Z. gregalis* Mašán and Fenda, 2004. They may be distinguished according to the features given in Table 3. **Z. agnostus:** The species is known from 2 localities in Turkey. It was found in litter and soil in mixed forest, at altitudes between 1400 and 1550 m a.s.l. (Błaszak, 1979; Urhan et al., 2007). **Z. gregalis:** It was only known from Slovakia. It inhabits primarily warmer and relatively dry stands in woods, foot-hills, and low highlands at altitudes between 160 and 650 m a.s.l. This species was recorded in leaf litter and soil detritus of steppes, forest steppes, and mixed forest (especially oak and pine). It probably represents a sub-Mediterranean or Mediterranean faunistic element (Mašán and Fenda, 2004). **Z. kallimcii** sp.n.: The species was recorded in litter and soil underlying *Juniperus communis*, *Astragalus* sp., and *Acatolimon* sp. at 2291 m a.s.l.

Etymology. This species is named in honor of Mustafa KALLİMCİ (Director of Department of Nature Conservation and National Parks in Denizli, Turkey), who helped me to collect the samples.

Table 2. Lengths of opisthonotal setae and distances between them in deutonymphs (DN) and protonymphs (PN) of *Zercon kallimcii* sp. n. (measurements in μm).

	DN	PN		DN	PN		DN	PN
S_1	28-38	28-33	Z_1	10-15	8	J_1	8	8
\downarrow	30-45	30-35	\downarrow	38-50	33-40	\downarrow	33-45	30-35
S_2	35-43	35-40	Z_2	10	5	J_2	8-10	8
\downarrow	33-40	25-33	\downarrow	28-33	18-23	\downarrow	28-33	23-28
S_3	38-48	38-43	Z_3	33-38	25-28	J_3	8-10	5
\downarrow	28-40	25-30	\downarrow	28-40	18-23	\downarrow	23-33	25-30
S_4	43-60	48-55	Z_4	43-55	48-53	J_4	10-13	5
			\downarrow	28-45	20-25	\downarrow	15-33	13-18
			Z_5	15-20	15-20	J_5	10-13	5
						\downarrow	25-38	18-23
						J_6	53-68	55-65

Table 3. Comparison of features of *Zercon kallimcii* sp. n. with those of *Z. agnostus* and *Z. gregalis*.

Species	<i>Zercon agnostus</i>	<i>Zercon gregalis</i>	<i>Zercon kallimcii</i> sp. n.
Species			
Features			
Seta j2	Smooth	Smooth	Distinctly barbed
Marginal setae of podonotum	r1-r3 delicately barbed, r4-r6 broadened at the termination with delicately hyaline ending	Very fine apically pilosity	Distinctly barbed
Setae J_2	Long, barbed with hyaline ending and reaching the base of setae J_3	Short and smooth and not reaching the base of seta J_3	Thickened, prolonged, apically pilose, and terminated with hyaline ending and not reaching the base of seta J_3
Setae J_3 and Z_4	Not reaching to posterior margin of opisthonotum	Reaching beyond posterior margin of opisthonotum	Setae J_3 reach with tips posterior margin of opisthonotum, Z_4 not reaching posterior margin of opisthonotum
Setae Z_2	Long, barbed with hyaline ending and reaching the base of setae Z_3	Short and smooth and not reaching the base of seta Z_3	Thickened, prolonged, apically pilose, and terminated with hyaline ending and not reaching the base of seta Z_3
Setae Z_5	Long, barbed with hyaline ending	Short and smooth	Thickened, prolonged, apically pilose, and terminated with hyaline ending
The longest opisthonotal setae	J_6 and S_4 (66 μm)	S_4 (58-67 μm), Z_4 (62-71 μm) and J_6 (64-73 μm)	J_6 (48-53 μm)
Marginal setae of opisthonotum	Broadened at the termination with delicately hyaline ending	Very fine apically pilosity	Distinctly barbed
Pores Po_2	Lie anterior the line connecting setae S_2 - Z_3 nearer setae S_2	Slightly posterior the line connecting setae Z_2 - S_2	Lie on the line connecting setae Z_2 - S_3
Pores Po_3	Lie posterior the line connecting setae Z_4 - J_3 nearer setae Z_4	Slightly anterior the line connecting setae Z_4 - J_5 nearer setae J_5	Lie on the line connecting setae Z_4 - J_5

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

- 1 (33) Anterior margin of ventro-anal shield with 2 setae.
- 2 (25) The long setae of opisthonotum with hyaline tips.
- 3 (10) Setae J₄-J₅ smooth.
- 4 (5) Setae S₂ with hyaline tips *solenites* Haarlov, 1942
- 5 (4) Setae S₂ smooth.
- 6 (7) Setae Z₃ with hyaline tips *inonunensis* Urhan, 2007
- 7 (6) Setae Z₃ smooth.
- 8 (9) Setae S₃ smooth *leporus* Błazsak, 1979
- 9 (8) Setae S₃ with hyaline tips *separatus* Urhan, 2001
- 10 (3) Setae J₄-J₅ delicately barbed or with hyaline tips.
- 11 (16) Setae J₄-J₅ delicately barbed.
- 12 (13) Setae Z₃ delicately barbed and setae J₂ reach the base of setae J₃ *longisetosus* Urhan, 2008
- 13 (12) Setae Z₃ with hyaline tips and setae J₂ not reaching the base of setae J₃.
- 14 (15) Setae S₂ delicately barbed and without hyaline tips *fragilis* Urhan, 2001
- 15 (14) Setae S₂ with hyaline tips *nemoralis* Urhan, 2001
- 16 (11) Setae J₄-J₅ with hyaline tips.
- 17 (20) Setae S₃ do not reach margin of opisthonotum.
- 18 (19) Setae J₁, J₂, Z₁, and Z₂ smooth *colligans* Berlese, 1920
- 19 (18) Setae J₁ and Z₁ delicately barbed, setae J₂ and Z₂ with hyaline tips *osmanelinensis* Urhan, 2008
- 20 (17) Setae S₃ reach margin of opisthonotum.
- 21 (22) Setae J₃ with hyaline tips *plumatopilus* Athias-Henriot, 1961
- 22 (21) Setae J₃ smooth.
- 23 (24) Pores Po₃ between setal rows Z and J *insperatus* Błazsak, 1979
- 24 (23) Pores Po₃ between setal rows Z and S *huseyini* Urhan, 2008
- 25 (2) The long setae of opisthonotum without hyaline tips
- 26 (30) Pores Po₃ on the line connecting setae Z₄-J₅.
- 27 (28) Setae Z₄ not reaching posterior margin of opisthonotum, setae r₃-r₆ and R₁-R₄ short and smooth, length of idiosoma: ♀ 416 µm *ignobilis* Błazsak, 1979
- 28 (29) Setae Z₄ reaching posterior margin of opisthonotum, setae r₃-r₆ and R₁-R₄ delicately barbed, length of idiosoma: ♀ 452-497 µm *hungaricus* Sellnick, 1958
- 30 (26) Pores Po₃ anterior to the line connecting setae Z₄-J₄.
- 31 (32) Setae j₂ short and smooth *adoxyphes* Błazsak, 1979
- 32 (31) Setae j₂ long and barbed *causicus* Błazsak, 1979
- 33 (1) Anterior margin of ventro-anal shield with 4 setae.
- 34 (35) Between the setal rows J and J, and J and Z 8 extra setae *trabzonensis* Urhan, 1997
- 35 (34) Between the setal rows J and J, and J and Z no extra setae.
- 36 (59) Setae J₄-J₅ smooth.
- 37 (38) Setae S₃ absent *beleviensis* Urhan, 2002
- 38 (37) Setae S₃ present.
- 39 (40) Setae S₃ delicately barbed *serratus* Urhan, 2001
- 40 (39) Setae S₃ smooth or with hyaline tips.
- 41 (50) Setae S₄ long, barbed with hyaline tips.
- 42 (43) Setae Z₃ short and smooth *ozkani* Urhan and Ayyıldız, 1993
- 43 (42) Setae Z₃ long and with hyaline tips.
- 44 (45) Setae S₂ long and with hyaline tips *andrei* Sellnick, 1958
- 45 (44) Setae S₂ short and smooth.
- 46 (47) Setae S₃ long and with hyaline tips ... *pinicola* Halašková, 1969

- 47 (46) Setae S_3 short and smooth.
- 48 (49) Dorsal cavities saddle-like and with smooth anterior margin, Setae S_3 reach margin of opisthonotum, length of idiosoma: ♀ 450-510 μm *carpathicus* Sellnick, 1958
- 49 (48) Dorsal cavities star-like with undulated and weakly sclerotised on their anterior margin, Setae S_3 not reaching margin of opisthonotum, length of idiosoma: ♀ 423-433 μm *anatolicus* Urhan, 2008
- 50 (41) Setae S_4 smooth.
- 51 (52) Long setae of opisthonotum thick and terminally broad *berlesei* Sellnick, 1958
- 52 (51) Long setae of opisthonotum thin and smooth.
- 53 (54) Setae S_3 not reaching the margin of opisthonotum *perforatulus* Berlese, 1904
- 54 (53) Setae S_3 exceeding the margin of opisthonotum.
- 55 (56) Pores Po_3 between setal rows Z and S and the dorsal cavities equal in size *montanus* Willmann, 1943
- 56 (55) Pores Po_3 between setal rows J and Z and the outer dorsal cavities twice the size of inner cavities.
- 57 (58) Setae J_3 do not reach the bases of seta J_4 *cabylus* Athias-Henriot, 1961
- 58 (57) Setae J_3 reach the bases of seta J_4 *bulgaricus* Balogh, 1961
- 59 (36) Setae J_4 - J_5 delicately barbed or with hyaline tips.
- 60 (61) Pores Po_3 between setal rows Z and S *notabilis* Błaszak, 1979
- 61 (60) Pores Po_3 between setal rows J and Z.
- 62 (69) Setae J_4 - J_5 delicately barbed.
- 63 (64) Setae S_3 absent *uludagicus* Urhan, 2008
- 64 (63) Setae S_3 present.
- 65 (66) Setae S_2 smooth .. *foveolatus* Halašková, 1969
- 66 (65) Setae S_2 delicately barbed or with hyaline tips.
- 67 (68) Setae S_2 and S_3 delicately barbed *kackaricus* Urhan and Ekiz, 2002
- 68 (67) Setae S_2 and S_3 with hyaline tips *septemporus* Urhan, 2001
- 69 (62) Setae J_4 - J_5 with hyaline tips.
- 70 (73) Setae J_3 short and smooth.
- 71 (72) Setae S_2 short and smooth *burdurensis* Urhan, 2001
- 72 (71) Setae S_2 with hyaline tips *kezbaniremae* Urhan, 2007
- 73 (70) Setae J_3 long and with hyaline tips.
- 74 (77) Setae S_1 smooth.
- 75 (76) Setae S_3 present *quadricavum* Urhan, 2001
- 76 (75) Setae S_3 absent *cokelezicus* Urhan, 2009
- 77 (74) Setae S_1 delicately barbed or with hyaline tips.
- 78 (79) Setae S_1 delicately barbed *turcicus* Urhan and Ayyıldız, 1993
- 79 (78) Setae S_1 with hyaline tips.
- 80 (83) Setae R_1 - R_7 smooth.
- 81 (82) Setae Z_5 smooth *delicatus* Urhan and Ekiz, 2002
- 82 (81) Setae Z_5 with hyaline tips..... *mehmeturhani* Urhan, 2009
- 83 (80) Setae R_1 - R_7 delicately barbed or with hyaline tips.
- 84 (89) Setae R_1 - R_7 delicately barbed.
- 85 (86) Setae J_2 short and smooth *encarpatus* Athias-Henriot, 1961
- 86 (85) Setae J_2 delicately barbed or with hyaline tips.
- 87 (88) Setae J_2 delicately barbed *apladellus* Błaszak, 1979
- 88 (87) Setae J_2 with hyaline tips *kallimcii* sp.n.
- 89 (84) Setae R_1 - R_7 with hyaline tips.
- 90 (91) Setae J_1 and Z_1 with hyaline tips *ayyildizi* Urhan, 1997
- 91 (90) Setae J_1 and Z_1 smooth.
- 92 (93) Setae J_5 and Z_4 do not reach posterior margin of opisthonotum *agnostus* Błaszak, 1979
- 93 (92) Setae J_5 and Z_4 reach posterior margin of opisthonotum *salmani* Urhan, 2002

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