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SYSTEMATIC STUDIES ON ZERCONID MITES (ACARI: GAMASIDA, ZERCONIDAE) OF TURKEY

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In this study, two new species of zerconid mites, *Zercon kackaricus* and *Z. delicatus*, from Turkey are described and illustrated. Additionally, a key to the adults of the genus *Zercon* known from Turkey is given.

Key words: *Zercon*, Gamasida, Acari, systematics, Turkey

INTRODUCTION

The family Zerconidae is well known from the Holarctic region (KRANTZ 1978, BALAN 1992). Zerconids are soil mites of idiosomal length varying between 200–700 μm. These mites are weakly sclerotized and their life cycle include four active stages; larva, protonymph, deutonymph and adult. Zerconids are free-living mites occurring in humus, litter and among mosses. Zerconids are oligophagous predators and their diet include nematodes (MARTIKAINEN & HUHTA 1990).

In Turkey, the first study of zerconids was published by BŁASZAK (1979) and further studies were made by URHAN and AYYILDIZ (1994*a, b*, 1996*a–e*) and URHAN (1997, 1998*a, b*, 2001*a–e*). During the studies on the family Zerconidae in Turkey we found two undescribed species of the genus *Zercon*. This paper presents their descriptions. Morphological terminology follows that of SELLNICK (1958) and BŁASZAK (1974).

MATERIALS AND METHODS

Soil and litter samples were collected from Artvin, Yusufeli village. The samples were placed into plastic bags, labelled and transferred to the laboratory. Afterwards, the soil and litter 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 bottles were transferred into petri dishes and mites were separated under a stereo-microscope. They were placed in lactic acid in order to facilitate examination. The examination and drawing of mites were made under an Olympus BX50 microscope.

DESCRIPTION OF THE NEW SPECIES

Zercon kackaricus sp. n.
(Figs 1A–D)

Type material. Holotype ♀. "Turkey, Artvin, Yusufeli, Yaylalar village, Kackar mountains, 2100 m, 23 June 1994, collected by R. Urhan." Sample from litter and soil underlying *Rosa canina*. Paratypes: 6 ♀♀, 3 ♂♂; from the same sample. Type deposition: holotype and 3 paratypes (2 ♀♀, 1 ♂) at the Zoological Museum of Atatürk University, Erzurum, Turkey; other paratypes (4 ♀♀, 2 ♂♂) are deposited in the authors' collection.

Female (Figs 1A, B). Length of idiosoma (excluding gnathosoma) of holotype 500 µm, width 364 µm. Measurement of 6 paratypes; mean length 498 (490–508) µm, mean width 364 (360–368) µm.

Dorsal setae (Fig. 1A). On the podonotum seta j1 feathered, setae r3–r6 delicately barbed. The remaining setae of podonotum smooth. On the opisthonotum setae J_1–J_5 long and delicately barbed. Seta J_3 not reaching the base of seta J_4. Seta J_4 reaching to the base of seta J_5. Seta J_6 long and barbed with hyaline ending. Seta J_6 126 µm (on average) apart from each other. Setae Z_1–Z_3 long and delicately barbed. Seta Z_3 not reaching the base of seta Z_4. Seta Z_4 similar to seta J_6, exceeding a third of its length beyond margin of opisthonotum. Seta Z_5 similar to seta Z_1. The distance between setae Z_5–J_6 is 31 µm. Setae S_1–S_3 similar to seta Z_3. Seta S_4 long and barbed with hyaline ending. Setae R_1–R_4 delicately barbed, the remainder of this row smooth. Lengths and their mutual distances of opisthonotal setae are given in Table 1.

Table 1. Lengths and their mutual distances (M. dist.) of opisthonotal setae

Length	M. dist.	Length	M. dist.	Length	M.dist.
S_1–26 (24–27)	34 (31–37)	Z_1–25 (24–27)	54 (52–58)	J_1–28 (27–31)	48 (44–52)
S_2–30 (27–31)	44 (37–48)	Z_2–28 (27–31)	37 (35–41)	J_2–32 (31–34)	48 (46–50)
S_3–33 (31–34)	68 (65–70)	Z_3–33 (31–34)	41 (37–44)	J_3–33 (31–34)	37 (34–38)
S_4–62 (58–65)		Z_4–64 (62–65)	68 (65–70)	J_4–33 (31–34)	33 (31–34)
		Z_5–26 (24–27)		J_5–33 (31–34)	44 (41–45)
				J_6–67 (65–68)	

Pores. Pore po_1 situated anterior to the line connecting setae s_2–j_3. Pore po_2 under the line connecting setae s_4–j_4. Pore po_3 inside the line connecting setae s_5–s_6. Pore Po_1 located anteroparaxially to the insertion of seta Z_1. Pore Po_2 posterior to the line connecting setae S_2–Z_2. Pore Po_3 lies on the line connecting setae S_4–Z_4. Pore Po_4 lies on the line connecting setae S_4–Z_5, shifted toward seta S_4.

Sculpturing pattern. The ornamentation of the dorsal shields is shown in Figure 1 A. Dorsal cavities distinct, well sclerotized, equal in size, with axes parallel the body axis.

Venter (Fig. 1B). The chaetotaxy and shape of the peritrematal shield typical for the genus. Adgenital shields present. With four setae on the anterior margin of the ventro-anal shield.

Male (Figs 1C, D). Idiosoma (excluding gnathosoma) in 3 specimens; mean length 402 (398–405) µm, mean width 272 (270–274) µm. Setae, pores and sculpturing pattern on the podo- and opisthonotum as in female. The distance between setae J_6-J_6 and Z_5-J_6 average 102 µm and 27 µm, respectively. Lengths and their mutual distances of opisthonotal setae are given in Table 2.

Distribution. Artvin, Turkey.
Etymology. The new species is named after its locality which is Kackar Mountains (Turkey).

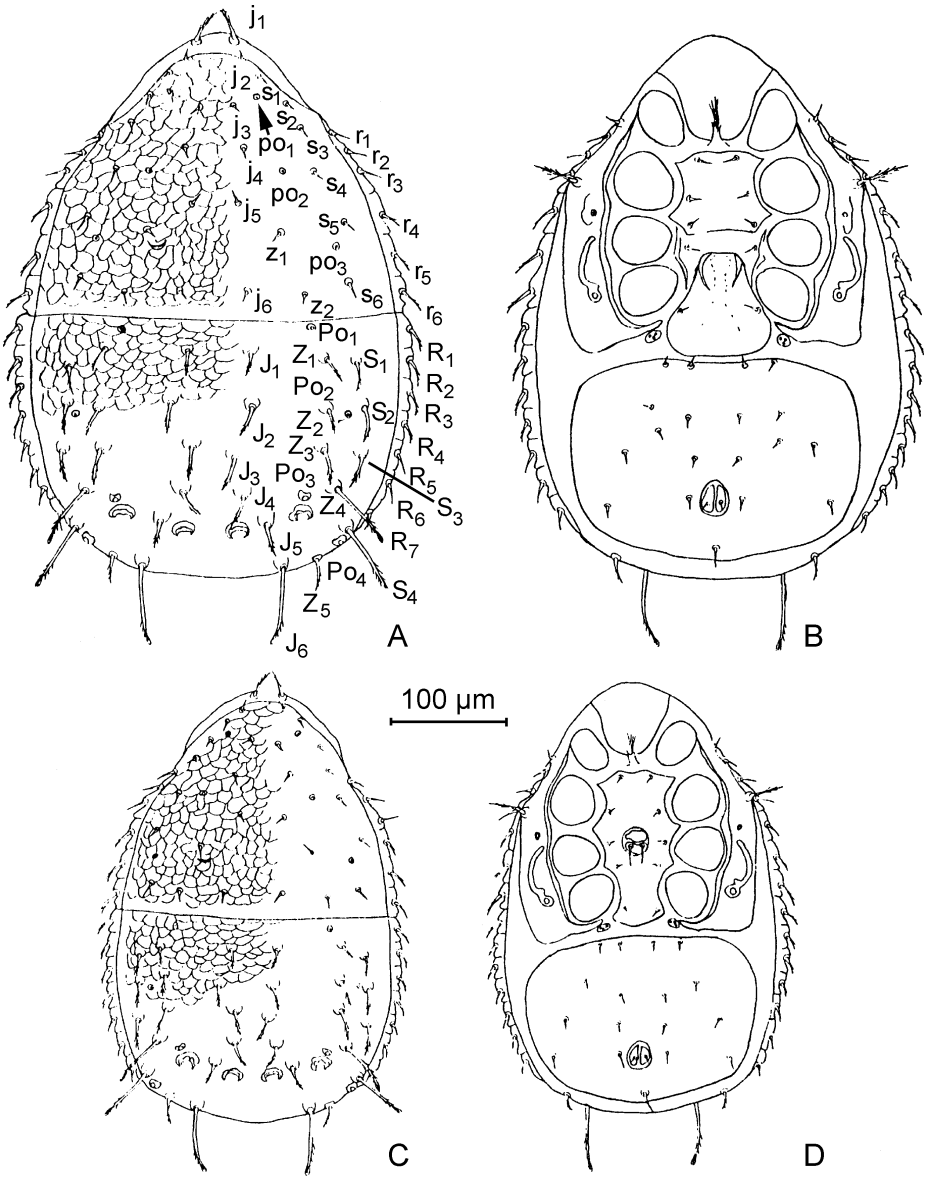

Fig. 1. *Zercon kackaricus* sp. n.: female: (A) dorsal idiosoma; (B) ventral idiosoma; male: (C) dorsal idiosoma; (D) ventral idiosoma

Table 2. Lengths and their mutual distances (M. dist.) of opisthonotal setae

Length	M. dist.	Length	M. dist.	Length	M. dist.
S_1–19 (17–20)	30 (27–31)	Z_1–16 (14–17)	34 (31–37)	J_1–16 (14–17)	34 (31–37)
S_2–28 (27–31)	31	Z_2–20 (17–21)	27 (24–28)	J_2–20 (17–21)	27 (24–28)
S_3–30 (27–31)	51 (48–54)	Z_3–30 (27–31)	34 (31–37)	J_3–25 (24–27)	26 (24–27)
S_4–52 (48–54)		Z_4–48 (44–31)	54 (51–58)	J_4–25 (24–27)	26 (24–27)
		Z_5–20 (17–21)		J_5–25 (24–27)	41 (37–44)
				J_6–60 (58–61)	

Diagnosis. The new species *Zercon kackaricus* sp. n. is closely related to *Z. colligans* BERLESE, 1920 and *Z. hispanicus* SELLNICK, 1958 (BERLESE 1920, SELLNICK 1958). The distinguishing characters among the three related species of the genus *Zercon* are given in Table 3.

Zercon delicatus sp. n.
(Figs 2 A–D)

Type material. Holotype ♀. "Turkey, Artvin, Yusufeli, Bahceli village, 1350 m, 20 September, 1992, collected by R. Urhan." Sample from moss pads underlying soil in a coniferous forest (mostly *Pinus* sp. and *Picea orientalis*). Paratypes: 30 ♀♀, 6 ♂♂; from the same sample; other paratypes from: Turkey, Artvin, Yusufeli, Cevreli village, 1550 m, 17 August, 1993, collected by R. URHAN. Sample from litter and soil underlying *Pinus* sp. in a mixed forest: 5 ♀♀, 4 ♂♂. Type deposi-

Table 3. The distinguishing characters among the three related species of the genus *Zercon*

	Z. colligans	*Z. hispanicus*	*Z. kackaricus* sp. n.
Setae J_1-J_2, Z_1-Z_2 and S_1	short, smooth	short, smooth	delicately barbed
Setae J_3-J_5, Z_3	barbed with hyaline ending	feathered	delicately barbed
Seta J_6	barbed with hyaline ending	feathered	barbed with hyaline ending
Seta Z_4	barbed with hyaline ending and not reaching posterior margin of ophistonotum	feathered and not reaching posterior margin of ophistonotum	barbed with hyaline ending and exceeding a third of its length posterior margin of ophistonotum
Anterior margin of ventro-anal shield	with two setae	with two setae	with four setae
Setae S_2 and S_3	barbed with hyaline ending	short, smooth	delicately barbed
Setae S_4	long, barbed with hyaline ending	long, feathered	long, barbed with hyaline ending

tion; holotype and 8 paratypes (5 ♀♀, 3 ♂♂) at the Zoological Museum of Atatürk University, Erzurum, Turkey. Other paratypes (30 ♀♀, 7 ♂♂) are deposited in the authors' collection

Female (Figs 2 A, B). Length of idiosoma (excluding gnathosoma) of holotype 520 µm, width 392 µm. Measurement of 35 paratypes; mean length 520 (507–538) µm, mean width 380 (357–398) µm.

Dorsal setae (Fig. 2A). On the podonotum seta j1 feathered the remainder short and smooth. On the opisthonotum setae J_1 and Z_1 short and smooth. Setae J_2–J_6 long, barbed with hyaline ending. Seta J_2 does not reach the base of seta J_3. Seta J_3 reaching to the base of seta J_4. Seta J_5 exceeding posterior margin of opisthonotum. Seta J_6 110 µm (on average) apart from each other. Setae Z_2–Z_4 long, barbed with hyaline ending. Seta Z_3 reaching to the base of seta Z_4. Seta Z_4 exceeding posterior margin of opisthonotum. Seta Z_5 long and smooth. The distance between setae Z_5–J_6 26 µm. Setae S_1–S_4 similar to seta J_6. Seta S_2 exceeding margin of opisthonotum. All marginal setae of opisthonotum short and smooth. Lengths and their mutual distances of opisthonotal setae are given in Table 4.

Table 4. Lengths and their mutual distances (M. dist.) of opisthonotal setae

Length	M. dist.	Length	M. dist.	Length	M. dist.
S_1–29 (27–31)	60 (58–65)	Z_1–18 (17–20)	66 (61–68)	J_1–17	64 (58–72)
S_2–42 (41–44)	60 (51–65)	Z_2–23 (20–24)	58 (51–61)	J_2–24	50 (48–54)
S_3–48 (44–51)	51 (44–58)	Z_3–14	42 (37–48)	J_3–36 (34–37)	36 (34–41)
S_4–48 (44–51)		Z_4–48	34 (31–41)	J_4–46 (44–48)	32 (27–34)
		Z_5–24 (20–27)		J_5–46 (44–48)	28 (24–31)
				J_6–52 (51–54)	

Pores. Pore po_1 located on the line connecting setae s_1–s_2. Pore po_2 on the line connecting setae j_4-s_4. Pore po_3 posterior to the line connecting setae z_1–s_5. Pore Po_1 located anterior to the insertion of seta Z_1. Pore Po_2 posterior to the line connecting setae Z_2–S_2. Pore Po_3 on the line connecting setae Z_4–J_4. Pore Po_4 on the line connecting setae S_4–Z_5.

Sculpturing pattern. The ornamentation of the dorsal shields shown in Fig. 2A. Dorsal cavities distinct, well sclerotized, equal in size with axes parallel to the body axis.

Venter (Fig. 2B). The chaetotaxy and shape of peritremal shield typical for the genus. Adgenital shields present with three pores. With four setae on the anterior margin of ventro-anal shield.

Male (Figs 2C, D). Idiosoma (excluding gnathosoma) in 10 specimens; mean length 405 (388–435) µm, mean width 283 (267–289) µm. Setae, pores and sculpture pattern on the podo- and opisthonotum as in female. The distance between setae J_6–J_6 and Z_5–J_6 avarage 92 µm and 20 µm, respectively. Lengths and their mutual distances of opisthonotal setae are given in Table 5.

Table 5. Lengths and their mutual distances (M. dist.) of opisthonotal setae

Length	M. dist.	Length	M. dist.	Length	M. dist.
S_1–22 (20–24)	43 (41–44)	Z_1–15 (14–17)	50 (44–58)	J_1–12 (10–14)	33 (41–51)
S_2–34	42 (37–44)	Z_2–17 (14–20)	37 (31–44)	J_2–16 (14–17)	40 (37–41)
S_3–40 (37–41)	40 (34–44)	Z_3–37	32 (31–34)	J_3–27 (24–27)	26 (20–27)
S_4–41		Z_4–43 (41–44)	32 (27–34)	J_4–32 (31–34)	22 (17–27)
		Z_5–16 (14–17)		J_5–32 (31–34)	25 (20–31)
				J_6–50 (48–51)	

Distribution. Artvin, Turkey.
Etymology. The specific ephithet refers to the delicate structure and setae of the idiosoma.

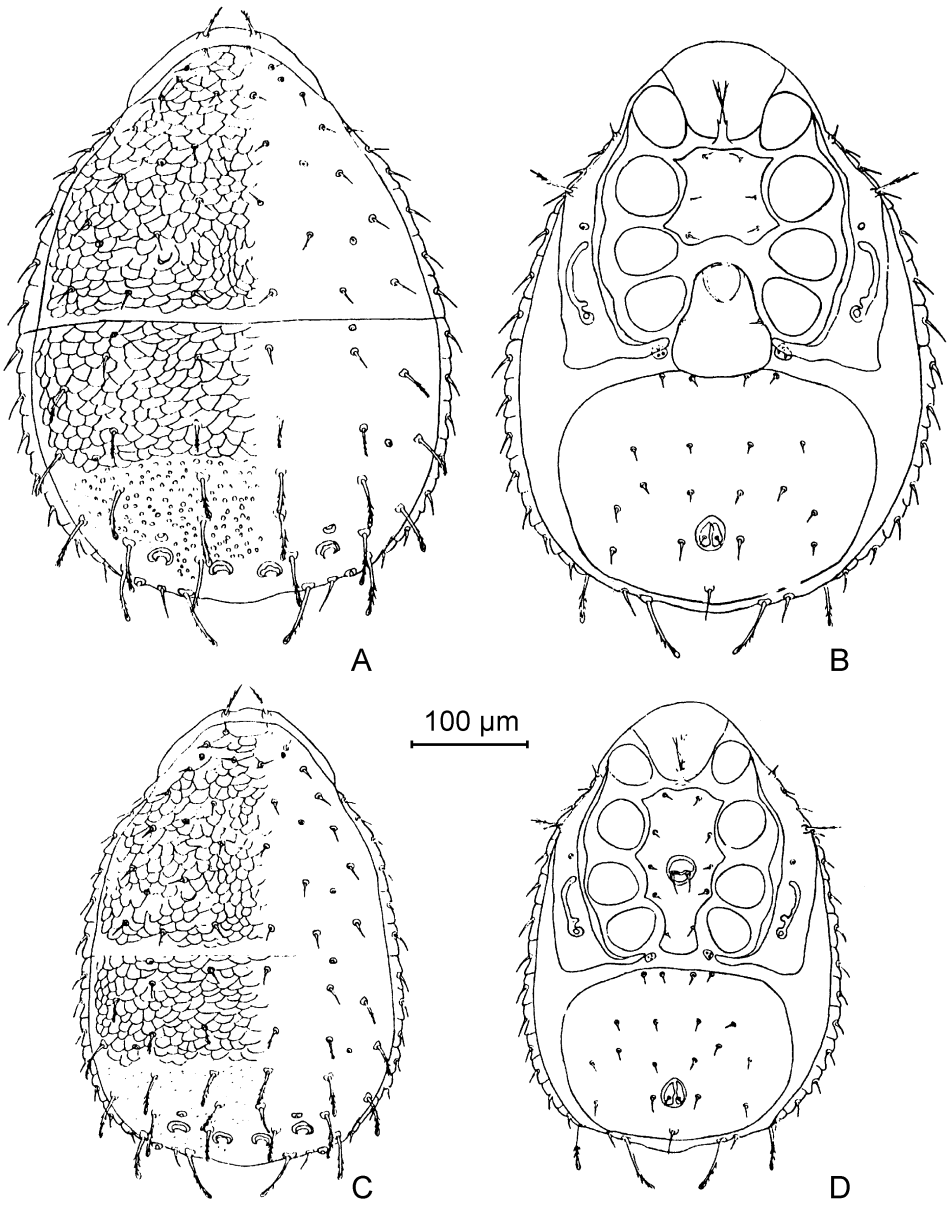

Fig. 2. *Zercon delicatus* sp. n.: female: (A) dorsal idiosoma; (B) ventral idiosoma; male: (C) dorsal idiosoma; (D) ventral idiosoma

Diagnosis. The new species *Zercon delicatus* sp. n. is closely related to *Z. kaszabi* BŁASZAK, 1978 and *Z. embersoni* BŁASZAK, 1985 (BŁASZAK 1978, 1985). The distinguishing characters among three the related species of the genus *Zercon* are given in Table 6.

Table 6. The distinguishing characters among the three related species of the genus *Zercon*

	Z. kaszabi	*Z. embersoni*	*Z. delicatus* sp. n.
Seate r_1–r_6	delicately barbed	delicately barbed	smooth
Setae J_1–J_3	short, barbed	seta J_1 short and smooth, seta J_2 delicately barbed and seta J_3 long, barbed with hyaline ending	seta J_1 short and smooth seta J_2 and J_3 long, berbed with hyaline ending
Setae Z_1 and Z_2	short, barbed	seta Z_1 short and smooth, seta Z_2 delicately barbed	setae Z_1 short and smooth, seta Z_2 long, barbed with hyaline ending
Seta Z_5	delicately barbed	delicately barbed	smooth
All marginal setae of opisthonotum	delicately barbed	delicately barbed	smooth
Pore Po_3	on the line connecting setae Z_3–Z_4	on the line connecting setae Z_4–J_4	on the line connecting setae Z_4–J_4
Seta J_5	exceeding posterior margin of opisthonotum	not reaching posterior margin of opisthonotum	exceeding posterior margin of opisthonotum
The sculpture of posterior part of opisthonotum	delicately and finely maculate	smooth	covered with distinct spots

KEY TO THE ADULTS OF THE GENUS ZERCON KNOWN FROM TURKEY

1	Anterior margin of ventro-anal shield with two setae	2
–	Anterior margin of ventro-anal shield with four setae	12
2	The long setae of opisthonotum with hyaline ending	3
–	The long setae of opisthonotum without hyaline ending	10
3	Setae J_4–J_5 delicately barbed or with hyaline ending	6
–	Setae J_4–J_5 smooth	4

4	Seta S_2 with hyaline ending	*solenites* HAARLOV, 1942
–	Seta S_2 smooth	5
5	Seta S_3 smooth	*lepurus* BŁASZAK, 1979
–	Seta S_3 with hyaline ending	*separatus* URHAN, 2001
6	Setae J_4–J_5 delicately barbed	7
–	Setae J_4–J_5 with hyaline ending	8
7	Seta S_2 delicately barbed and without hyaline ending	*fragilis* URHAN, 2001
–	Seta S_2 with hyaline ending	*nemoralis* URHAN, 2001
8	Seta S_3 not reaching margin of opisthonotum	*colligans* BERLESE, 1920
–	Seta S_3 reaching margin of opisthonotum	9
9	Seta J_3 with hyaline ending	*plumatopilus* ATHIAS-HENRIOT, 1961
–	Seta J_3 smooth	*insperatus* BŁASZAK, 1979
10	Pores Po_3 on the line connecting setae Z_4–J_5, seta Z_4 not reaching posterior margin of opisthonotum	*ignobilis* BŁASZAK, 1979
–	Pores Po_3 anterior to the line connecting setae Z_4–J_4, seta Z_4 reaching posterior margin of opisthonotum	11
11	Seta j_2 short and smooth	*adoxyphes* BŁASZAK, 1979
–	Seta j_2 long and barbed	*caucasicus* BŁASZAK, 1979
12	Between the setal rows J–J and J–Z eight extra setae	*trabzonensis* URHAN, 1997
–	Between the setal rows J-J and J-Z no extra setae	13
13	Setae J_4–J_5 smooth	14
–	Setae J_4–J_5 delicately barbed or with hyaline ending	23
14	Seta S_3 absent	*beleviensis* URHAN, 2001
–	Seta S_3 present	15
15	Seta S_3 delicately barbed	*serratus* URHAN, 2001
–	Seta S_3 smooth or with hyaline ending	16

16	Setae S_3 and S_4 with hyaline ending	17
–	Setae S_3 and S_4 smooth	19
17	Seta Z_3 short and smooth	*ozkani* URHAN et AYYILDIZ, 1994
–	Seta Z_3 long and with hyaline ending	18
18	Seta S_2 short and smooth	*pinicola* HALASKOVA, 1970
–	Seta S_2 long and with hyaline ending	*andrei* SELLNICK 1958
19	Long setae of opisthonotum thick and terminally broad	*berlesei* SELLNICK, 1958
–	Long setae of opisthonotum thin and smooth	20
20	Seta S_3 exceeding the margin of opisthonotum	21
–	Seta S_3 not reaching the margin of opisthonotum	*perforatulus* BERLESE, 1904
21	Pores Po_3 between setal rows J–Z and the outer dorsal cavities twice bigger than inner cavities	22
–	Pores Po_3 between setal rows Z–S and the dorsal cavities equal in size	*montanus* WILLMANN, 1943
22	Seta J_3 not reaching the bases of seta J_4	*cayblus* ATHIAS-HENRIOT, 1961
–	Seta J_3 reaching the bases of seta J_4	*bulgaricus* BALOGH, 1961
23	Pores Po_3 between setal rows Z–S	*notabilis* BŁASZAK, 1979
–	Pores Po_3 between setal rows J–Z	24
24	Setae J_4–J_5 delicately barbed	25
–	Setae J_4–J_5 with hyaline ending	26
25	Setae S_2 and S_3 delicately barbed	**kackaricus** sp. n.
–	Setae S_2 and S_3 with hyaline ending	*septemporus* URHAN, 2001
26	Seta J_3 short and smooth	*burdurensis* URHAN 2001
–	Seta J_3 long and with hyaline ending	27
27	Seta S_1 smooth	*quadricavum* URHAN, 2001

–	Seta S_1 delicately barbed or with hyaline ending	28
28	Seta S_1 delicately barbed	*turcicus* URHAN et AYYILDIZ, 1994
–	Seta S_1 with hyaline ending	29
29	Setae R_1–R_7 smooth	**delicatus** sp. n.
–	Setae R_1–R_7 delicately barbed or with hyaline ending	30
30	Setae R_1–R_7 delicately barbed	*apladellus* BŁASZAK, 1979
–	Setae R_1–R_7 with hyaline ending	31
31	Setae J_1 and Z_1 with hyaline ending	*ayyildizi* URHAN, 1997
–	Setae J_1 and Z_1 smooth	32
32	Setae J_5 and Z_4 not reaching posterior margin of opisthonotum	*agnostus* BŁASZAK, 1979
–	Setae J_5 and Z_4 reaching posterior margin of opisthonotum	*salmani* URHAN, 2001

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