TÜBİTAK

Turkish Journal of Zoology

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Research Article

Turk J Zool
(2019) 43: 30-42
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doi:10.3906/zoo-1801-23

A new larval species of *Balaustium* (Acari: Actinotrichida: Erythraeidae) from Turkey

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Received: 16.01.2018 • **Accepted/Published Online:** 09.11.2018 • **Final Version:** 11.01.2019

Abstract: The larvae of *Balaustium izmirensis* Noei & Ersin **sp. nov.** were obtained by rearing adults collected from building walls and window ledges in Bornova, İzmir, Turkey. The larva of *B. izmirensis* Noei & Ersin **sp. nov.** is described and illustrated. A key to larval species of *Balaustium* is provided.

Key words: Balaustiinae, İzmir, larva, Trombidiformes, Turkey

1. Introduction

The subfamily Balaustiinae Grandjean, 1947 (Acari: Trombidiformes: Erythraeidae) consists of 14 genera (Beron, 2008; Mąkol and Wohltmann, 2012, 2013; Noei et al., 2017) with 10 genera based on larvae or adults and larvae. A key to the genera (larvae) of the subfamily Balaustiinae was published by Noei et al. (2017). The genus *Balaustium* consists of 42 species with 21 based on larvae or adults and larvae: *B. murorum* (Hermann, 1804) (syn.: *B. florale*); *B. cristatum* Meyer & Ryke, 1959; *B. kendalli* Welbourn, 1991; *B. kacperi* Haitlinger, 1996; *B. nikae* Haitlinger, 1996; *B. rajmundi* Haitlinger, 1996; *B. wratislaviensis* Haitlinger, 1996; *B. biljanae* (Haitlinger, 2000); *B. leanderi* (Haitlinger, 2000); *B. medardi* Haitlinger, 2000; *B. minodorae* Haitlinger, 2000; *B. soydani* Haitlinger, 2000; *B. zhangi* Saboori, 2001; *B. barloventensis* Haitlinger, 2004; *B. malpaisesensis* Haitlinger, 2004; *B. brunoni* Haitlinger, 2005; *B. innocentae* Haitlinger, 2006; *B. biscutalae* Mayoral & Barranco, 2009; *B. hernandezi* Mąkol, Arijs & Wackers, 2012; *B. yousifi* Kamran & Alatawi, 2014; and *B. akramii* Noei, 2017 (Hermann, 1804; Meyer and Ryke, 1959; Welbourn and Jennings, 1991; Haitlinger, 1996; 2000a, 2000b, 2004, 2005, 2006; Saboori, 2001; Beron, 2008; Mayoral and Barranco, 2009; Mąkol, 2010; Mąkol et al., 2012; Mąkol and Wohltmann, 2012, 2013; Fuentes Quintero et al., 2014; Kamran and Alatawi, 2014; Šundić, 2014; Gabryś, 2016; Noei et al., 2017). One species of *Balaustium*, *B. madeirense* Willmann, 1939, has been reported from Turkey, but this identification was based on postlarval forms (Gabryś, 2000; Beron, 2008; Mąkol and Wohltmann, 2012; Sevsay, 2017).

Here, a new species of *Balaustium* from İzmir, Turkey is described, with a key to the world species (larvae) of *Balaustium* included.

2. Materials and methods

Balaustium adults were collected from building walls and window ledges at Ege University in Bornova, İzmir, Turkey in May 2015. The adults were transferred to plastic containers (95 × 180 mm) containing moistened filter paper, and two holes were made in the side of the containers and they were covered with gauze for ventilation. To feed the *Balaustium* adults, *Ephestia kuehniella* eggs and *Typha latifolia* pollen were added to the containers every second day. The *Balaustium* adults laid eggs soon after being placed in the container. The eggs were transferred with a fine brush into plastic containers (25 × 35 mm) half-filled with a sandy soil. A single hole was made in the lids of the containers and covered with gauze. The soil was moistened once a week to prevent drying of eggs. The eggs were kept in a controlled-environment room (25 ± 1 °C, 65 ± 10% RH, and 16:8 h L:D photoperiod). Larvae hatched at the end of March 2016 after an incubation of about 10 months. Larvae were collected, cleared in lactophenol, and mounted on microscope slides using Hoyer's medium (Walter and Krantz, 2009). Figures were drawn and measurements (in micrometers) were made using a BX51 phase contrast Olympus microscope (Tokyo, Japan) equipped with a drawing tube. The terminology and abbreviations used here follow Saboori et al. (2009) and Wohltmann et al. (2007).

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3. Results

Genus *Balaustium* von Heyden, 1826

***Balaustium izmirensis* Noei & Ersin sp. nov. (Figures 1–13)**

Diagnosis. All scutalae off scutum; palpfemur with one seta; fn Tr 3-3-2; fn BFe 4-4-3; fn Ti I–III 11-11-11; fn Ta (20–22)-(17–19)-(18–20).

Description. (n = 16) Larva.

Dorsum (Figure 1; Table 1). Dorsal surface with 60–79 (fD) barbed setae. Scutum longitudinal, almost parallel-sided, with a crista metopica. Alongside the crista is a lightly chitinized area and scutum distinguished from the propodosomal skin by the absence of the normal cuticular striations; sensillary area with two pairs of trichobothria (ASens and PSens); nonsensillary setae (AL, ML, and PL) located outside of the sclerotized area of the scutum (scutum without ML and PL on the right side in holotype 2a, without ML on the left side in paratype 2b, without PL on the right side in paratype 2c, without ML on both sides in paratype 6f, and with 2 ML on the right side in paratype 2p). AL, ML, and PL subequal in length, all barbed. Posterior sensilla (PSens) longer than anterior pair (ASens) and both barbed along their entire length. One eye (diameter 13–15 μm) placed laterally on each side of scutum.

Venter (Figure 2). Ventral surface of idiosoma with 40–56 (fV) barbed setae behind coxae III (Table 1). Coxal plates punctate; all coxalae (*1b*, *2b*, *3b*) pointed and barbed. A peg-like supracoxal seta (*eI*) present on coxa I, 2 μm long. Sternal seta *1a* inserted on a punctate area (distinguished from the sternal skin by the absence of the normal cuticular striations) next to coxae I and II and longer than sternal seta *3a*, both barbed; 14–20 setae between coxae II and III. NDV = 120–147 (Table 1).

Gnathosoma (Figures 3 and 4). Cheliceral bases punctate; subcapitulum with a barbed galealae (*cs*) and

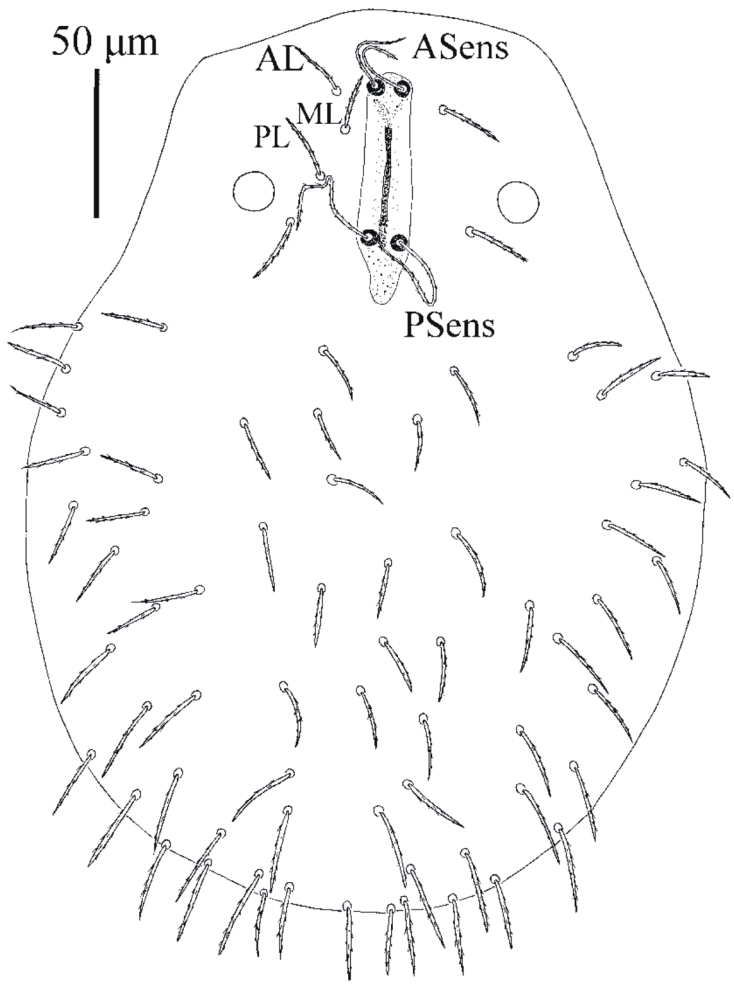


Figure 1. *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva). Dorsal view of idiosoma (scutum without ML and PL on the right side in holotype).

Table 1. Metric data of *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva). 2a, holotype; and 2b–2p, paratypes.

Character	2a	2b	2c	2d	2e	2f	2g	2h	2i
IL	295	297	275	282	297	312	537	450	570
IW	225	222	207	207	230	230	407	350	420
SD	80	87	81	90	92	82	87	85	85
PSB	21	22	20	21	23	20	20	20	20
AW	37	37	35	46	37	36	47	45	47
PW	-	45	-	50	62	46	70	65	72
MW	-	-	25	32	37	-	30	40	35
AA	10	10	10	10	10	10	10	11	10
SB	11	11	10	11	12	11	12	12	12
ISD	51	58	52	57	60	55	62	55	57
AP	27	32	27	30	31	22/27	30/35	32	37
AL	20	20/17	20	22	21	15	25	22	25
ML	20	20	20	20	22	-	25	22	22
PL	22	22	20	20	20	22	25	20	25
ASens	40	42	37	32	35	37	40	40	40
PSens	60	62	62	65	65	62	67	62	67
DS min.	20	22	20	20	17	17	22	20	22
DS max.	32	35	30	32	32	30	37	32	35
PDS min.	27	27	27	27	27	30	32	32	30
PDS max.	27	27	27	27	27	30	37	35	37
1a	37	47	40	40	40	40	50	45	40
1b	37	37	32	35	37	37	50	42	37
2a	35	30/22	27	27	30	27	32	33	27
2b	37	30	30	32	32	30	35	35	35
3a	27	22	22	22	25	27	25	26	27
3b	35	30	30	32	32	32	37	40	37
GL	92	87	87	97	92	92	105	100	110
cs	15	15	15	15	15	15	15	15	15
as	1	1	1	1	1	1	1	1	1
bs	15	15	15	15	17	17	17	17	17
PaScFed	37	37	35	35	37	35	37	37	37
$PaScGed_1$	25	27	27	25	27	25	27	30	27
$PaScGed_2$	25	30	27	25	27	25	27	30	27
Ta I (L)	60	62	60	65	67	62	70	65	65
Ta I (H)	20	17	20	17	22	22	17	17	25
Ti I	77	77	77	80	85	80	87	85	87
Ge I	72	75	75	77	77	75	85	80	82
TFe I	40	47	40	42	42	42	47	45	47
BFe I	42	45	42	47	50	42	52	50	50
Tr I	35	37	37	37	35	35	40	37	37
Cx I	52	50	47	55	55	55	52	50	55
Leg I	378	393	378	403	411	391	433	412	423

Table 1. (Continued).

Ta II (L)	50	50	50	52	55	50	57	52	55
Ta II (H)	17	20	17	17	17	20	17	17	20
Ti II	57	62	57	60	62	60	70	62	65
Ge II	55	60	55	60	57	55	65	60	62
TFe II	30	37	35	32	36	30	37	35	37
BFe II	35	37	35	35	36	35	42	40	37
Tr II	32	32	30	30	32	30	37	35	32
Cx II	52	55	52	57	60	52	60	55	57
Leg II	311	333	314	326	338	312	368	339	345
Ta III (L)	50	52	52	54	54	50	60	57	55
Ta III (H)	17	16	16	15	17	20	15	15	17
Ti III	75	77	72	77	80	73	87	80	85
Ge III	60	62	62	65	67	60	75	67	70
TFe III	37	47	40	42	45	37	45	42	45
BFe III	35	37	32	40	37	40	42	42	42
Tr III	30	32	30	32	32	32	37	35	35
Cx III	52	55	52	54	57	50	55	55	60
Leg III	336	362	340	364	372	342	401	378	392
IP	1025	1088	1032	1093	1121	1045	1202	1129	1160
fD	66	68	76	60	79	70	69	65	66
fV	42	46	40	44	49	47	51	52	56
Setae between Cx II & III	16	17	16	16	19	14	17	20	19
NDV	124	131	132	120	147	131	137	137	141

Table 1. (Continued).

Character	2j	2k	2l	2m	2n	2o	2p	Range
IL	590	390	580	470	450	420	500	275–590
IW	430	330	390	340	350	330	400	207–430
SD	-	75	77	80	80	80	75	75–92
PSB	-	17	15	20	17	20	15	15–23
AW	42	40	42	42	40	35	45	35–47
PW	75	57	77	60	62	57	75	45–77
MW	27	32	35	32	35	32	27	25–40
AA	10	8	10	10	10	10	10	8–11
SB	12	12	12	12	12	12	12	10–12
ISD	55	50	55	55	55	55	55	50–62
AP	42/30	32	35/37	37/35	32	37/35	35/37	22–42
AL	22	22	25	22	22	20	20	15–25
ML	22	25	25	22	22	22	20	20–25
PL	25	25	25	22	25	22	22	20–25
ASens	37	42	35	40	40	40	35	32–42
PSens	67	70	65	65	75	70	62	60–75
DS min.	22	22	20	20	20	20	20	17–22
DS max.	35	32	32	27	32	30	30	27–37

Table 1. (Continued).

PDS min.	35	32	32	30	32	30	27	27–35
PDS max.	37	35	35	32	40	35	32	27–40
1a	40	40	40	40	42	40	40	37–50
1b	40	37	40	40	40	40	37	32–50
2a	30	32	35	35	37	32	30	27–35
2b	35	35	35	35	37	37	30	30–37
3a	30	25	27	27	27	30	25	22–30
3b	40	37	35	37	40	37	37	30–40
GL	102	100	105	100	107	105	95	87–110
cs	15	15	15	15	16	16	15	15–16
as	1	1	1	1	1	1	1	1
bs	17	17	15	15	17	17	17	15–17
PaScFed	37	37	35	40	37	37	35	35–40
$PaScGed_1$	27	30	25	30	30	30	30	25–30
$PaScGed_2$	27	27	27	30	30	27	27	25–30
Ta I (L)	67	67	62	70	67	65	62	60–70
Ta I (H)	25	22	18	17	20	22	22	17–25
Ti I	87	85	87	85	85	85	82	77–87
Ge I	85	83	85	82	80	82	77	72–85
TFe I	47	47	50	45	47	45	42	40–50
BFe I	52	55	50	50	50	50	50	42–55
Tr I	37	40	40	37	40	40	35	35–40
Cx I	55	55	52	55	55	52	50	47–55
Leg I	430	432	426	424	424	419	398	378–433
Ta II (L)	57	55	52	57	60	55	52	50–60
Ta II (H)	20	20	17	20	20	17	18	17–20
Ti II	67	67	65	67	67	62	65	57–70
Ge II	65	65	67	65	65	62	60	55–67
TFe II	37	37	40	37	37	37	35	30–40
BFe II	42	40	40	37	37	37	35	35–42
Tr II	35	35	35	35	35	32	32	30–37
Cx II	55	57	55	57	60	60	55	52–60
Leg II	358	356	354	355	361	345	334	311–368
Ta III (L)	55	57	55	57	57	52	52	50–60
Ta III (H)	17	17	17	17	17	17	15	15–20
Ti III	85	82	82	87	87	77	80	72–87
Ge III	75	70	72	72	72	67	67	60–75
TFe III	50	47	50	45	45	45	43	37–50
BFe III	47	42	42	45	45	42	37	32–47
Tr III	35	30	35	32	35	35	32	30–37
Cx III	55	60	55	60	60	57	52	50–60
Leg III	402	385	391	398	401	375	363	336–402
IP	1190	1173	1171	1177	1186	1139	1095	1025–1202
fD	71	79	73	72	70	69	69	60–79
fV	53	48	53	45	43	52	52	40–56
Setae between Cx II & III	19	20	19	19	20	19	19	14–20
NDV	143	147	145	136	133	140	140	120–147

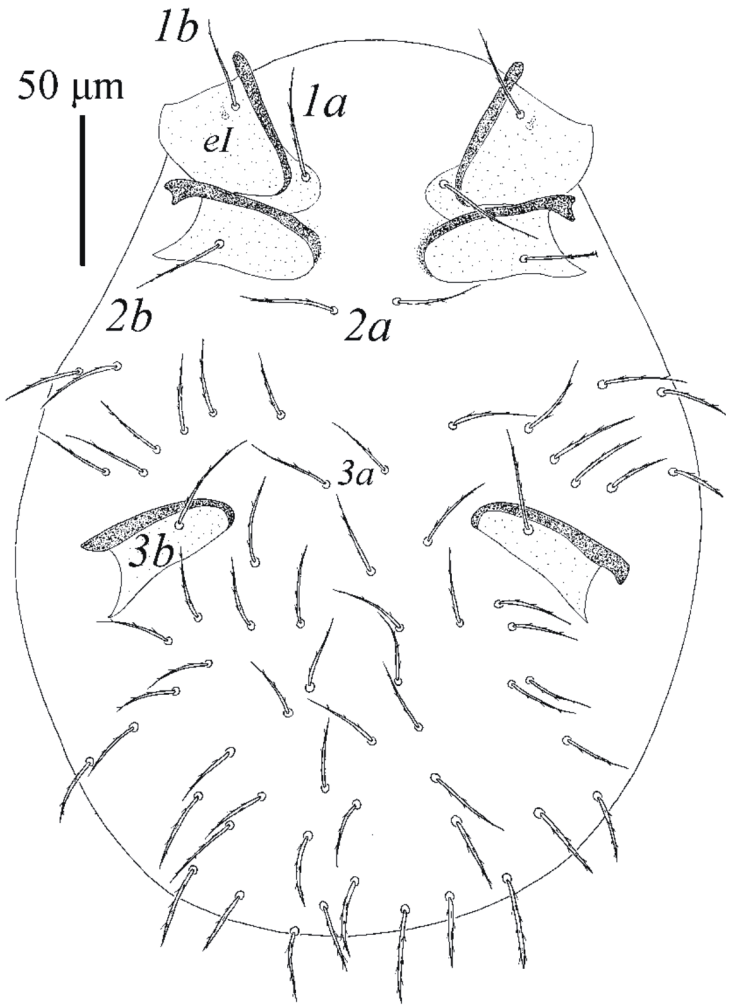


Figure 2. *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva). Ventral view of idiosoma.

two hypostomalae, anterior (*as*) minute, spine-like, and posterior (*bs*) barbed; palptrochanter (17–25 µm) with one barbed seta (32–42 µm) (palptrochanter without seta on the left side in holotype 2a); palpfemur (37–50 µm) with one barbed dorsal seta (palpfemur without seta on the left side in paratype 2b) and palpgenu (27–32 µm) with two barbed dorsal setae (palpgenu with one seta on the left side in paratype 2d); palptibia (12–16 µm) with 3 barbed setae (Figure 3); palpal tibial claw (15–20 µm) entire, with a ventral median tooth; palptarsus (15–20 µm) with 3 barbed and one smooth seta, an eupathidium, and a solenidion; fPp = B-B-BB-BBB-3BNωζ (Figure 4). Supracoxal seta of palp peg-like (*eP*), 4 µm long.

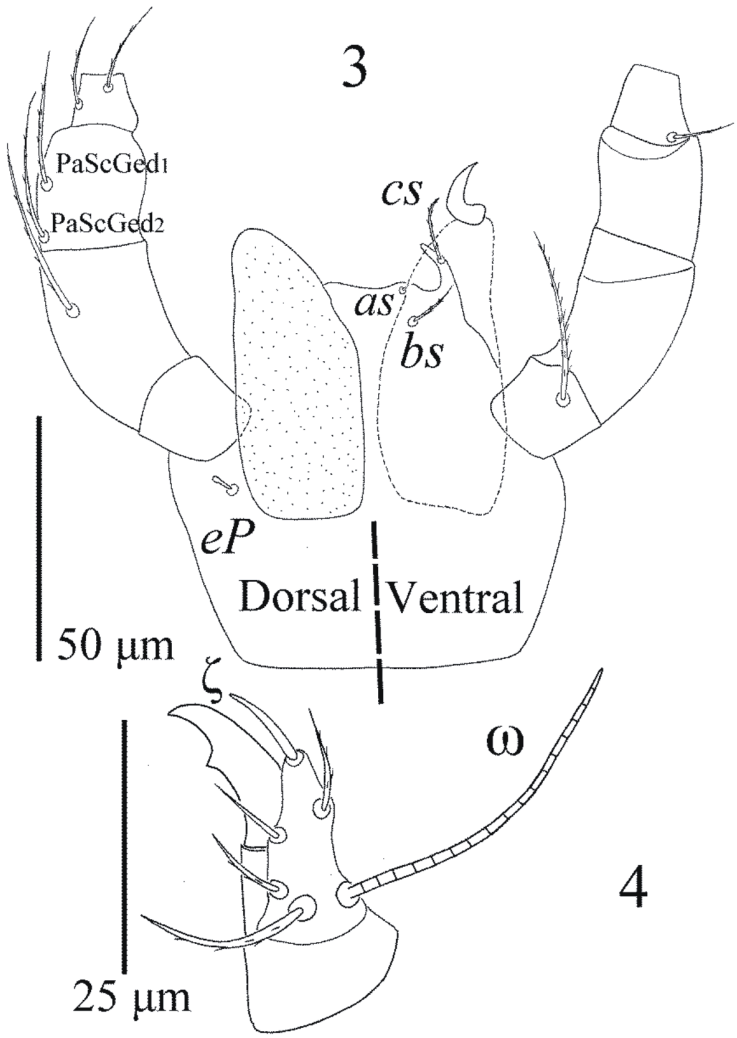
Legs (Figures 5 to 13). Leg segmentation formula 7-7-7. Leg setal formulae are given in Table 2. All leg tarsi with 2 claws and an empodium. Posterior claws bifurcate, one branch pulvilliform and another sickle-shaped with ciliations. Anterior claw and empodium of all leg tarsi falciform with ciliations. IP = 1025–1202.

Metric data are given in Table 1.

Etymology. The specific epithet is derived from the city of origin, İzmir, Turkey.

Type material. The holotype (ARS-20170911-2a) and 5 paratype larvae (ARS-20170911-2b, 2c, 2d, 2e, 2f) were obtained (23, 24, and 27 March and 3 April 2016) by laboratory rearing from females collected from building walls and window ledges in Bornova, İzmir, Turkey, 38°28′N, 27°13′E, 30 m a.s.l., May 2015, coll. F. Ersin; 10 paratype larvae (ARS-20170911-2g, 2h, 2i, 2j, 2k, 2l, 2m, 2n, 2o, 2p), same date except 15, 16, 17, 20, 22, 23, and 27 March 2018.

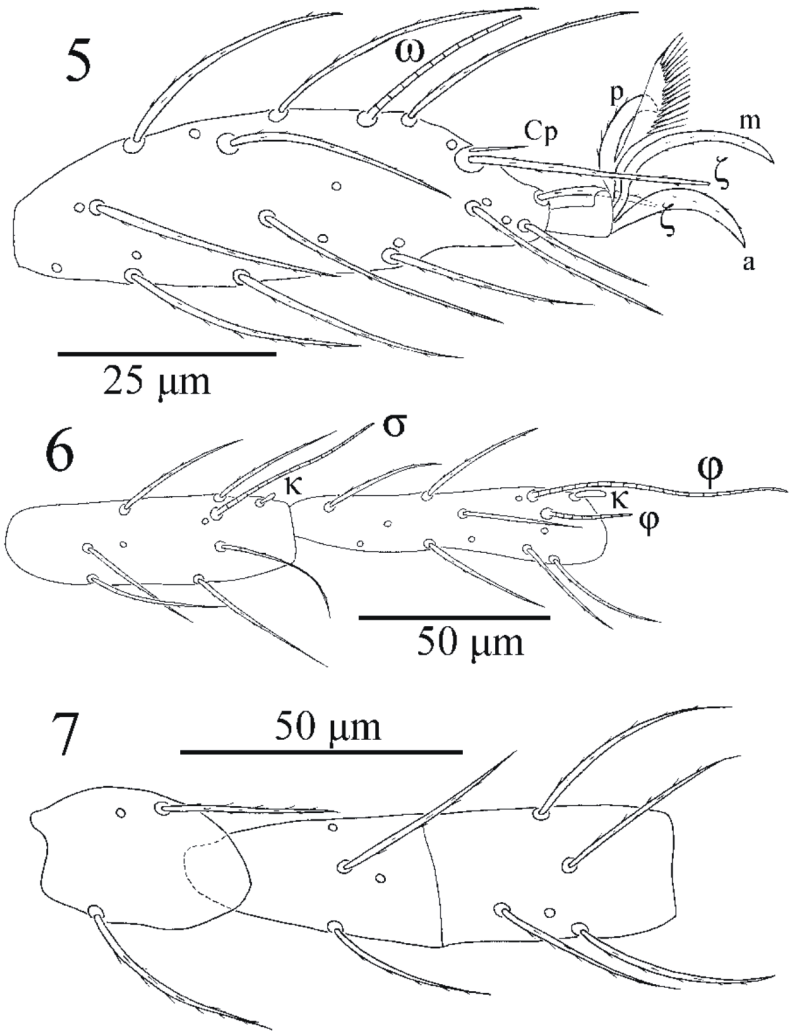
Type deposition. The holotype (ARS-20170911-2a) and 9 paratype larvae (ARS-20170911-2b, 2c, 2d, 2e, 2f, 2g, 2h, 2i, 2j) are deposited in the Acarological Collection of Jalal Afshar Zoological Museum (JAZM), Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran, and 6 paratype larvae (ARS-20170911-2k, 2l, 2m, 2n, 2o, 2p) in the Acarological



Figures 3–4. *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva). 3- Dorsal (left) and ventral (right) view of gnathosoma; 4- Ventral view of palpal tibia and tarsus.

Collection, Acarological Society of Iran, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.

Remarks. The new species belongs to the genus *Balaustium* based on the following characters: palptrochanter and palpfemur each with one seta, fn Cx 1-1-1, fn trochanter 3-3-2, fn BFe 4-4-3, posterior claw on leg tarsi I–III bifurcate, composed of a sickle-shaped and a pulvilliform branch (see diagnostic characters of *Balaustium* presented by Fuentes Quintero et al., 2014). *Balaustium izmirensis* Noei & Ersin **sp. nov.** is most similar to *B. yousifi* in having one seta on palpfemur, fn BFe 4-4-3, fn TFe 5-5-5, Ti III ≤104, and two setae on palpgenu, but differs from it in the number of normal setae on Ge I (8 vs. 9 in *B. yousifi*), shorter ISD (50–62 vs. 64–69), AL (15–20 vs. 28–32), ML (20–25 vs. 28–32), PL (20–25 vs. 32–36), ASens (32–42 vs. 50–56), Ta I (60–70 vs. 82–91), Ti I (77–87 vs. 86–94), Ge I (72–85 vs. 88–93), Ta II (50–60 vs. 75–83), Ti II (57–70 vs. 75–79), Ge II (55–67 vs. 68–74), Ta III (50–60 vs. 75–85), Ti III (72–87 vs. 89–97), Ge III (60–75 vs. 74–79), *2b* (30–37 vs. 46–50), *3b* (30–40 vs. 45–48), NDV (120–147 vs. 159–160), and IP (1025–1202 vs. 1294–1363). *Balaustium izmirensis* Noei & Ersin **sp. nov.** also differs from the other species as follows: from *B. cristatum* in the number of setae on palpfemur (1 vs. 2) and crista metopica (present vs. absent); from *B. biscutalae* in the eupathidium on Ta III (present vs. absent), NDV (120–147 vs. 174), scutalae (all off scutum vs. only PL off scutum); from *B. leanderi* in the number of setae on palpfemur (1 vs. 2), fn Tr (3-3-2 vs. 3-3-3), fn BFe (4-4-3 vs. 4-4-4), scutalae (off scutum vs. on scutum); from *B. barloventensis* in the number of setae on palpgenu (2 vs. 3), fn TFe (5-5-5 vs. 5-5-4), scutalae (off scutum vs. on scutum); from *B. malpaisesensis* in the number of setae



Figures 5–7. *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva), leg I: 5- Ta; 6- Ti–Ge; 7- TFe–Tr.

on palpgenu (2 vs. 3), scutalae (off scutum vs. on scutum); from *B. brunoni* in the number of setae on palpgenu (2 vs. 4), scutalae (off scutum vs. on scutum); from *B. kendalli* in the fn TFe (5-5-5 vs. 6-6-5) and scutalae (off scutum vs. on scutum); from *B. innocentae*, *B. medardi*, *B. minodorae*, and *B. soydani* in the fn BFe (4-4-3 vs. 4-4-2) and scutalae (off scutum vs. on scutum); from *B. akramii*, *B. biljanae*, *B. kacperi*, *B. nikae*, *B. rajmundi*, and *B. wratislaviensis* in fn BFe (4-4-3 vs. 4-4-2); from *B. murorum* and *B. zhangi* in fn BFe (4-4-3 vs. 4-4-2) and the number of solenidia on Ti I (2 vs. 3); from *B. hernandezi* in the fn TFe (5-5-5 vs. 7-6-6) and IP (1025–1121 vs. 1687–1851).

Key of larval species of the genus *Balaustium*

1. Palpfemur with two setae 2
- Palpfemur with one seta 3
2. With crista metopica and scutalae on scutum .... *B. leanderi* (Haitlinger, 2000)
- Without crista metopica and scutalae off scutum .... *B. cristatum* Meyer & Ryke, 1959
3. fn BFe 4-4-3 4
- fn BFe 4-4-2 10
4. fn TFe 7-6-6, Ti III 128–138 .... *B. hernandezi* Mąkol, Arijs & Wackers, 2012
- fn TFe 5-5-4, or 5-5-5 and Ti III ≤104 5
5. Palpgenu with two setae, two pairs of scutalae on scutum or scutalae off scutum 6
- Palpgenu with three or four setae, three pairs of scutalae on scutum 8
6. Two pairs of scutalae on scutum .... *B. biscutalae* Mayoral & Barranco, 2009
- Scutalae off scutum 7
7. Ge I with eight normal setae, Ta III 50–60, Ti III 72–87, with 14–20 setae in the area between coxae II and III, NDV 120–147..... *B. izmirensis* Noei & Ersin **sp. nov.**

Table 2. Leg chaetotaxy of *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva). 2a, holotype; 2b–2p, paratypes.

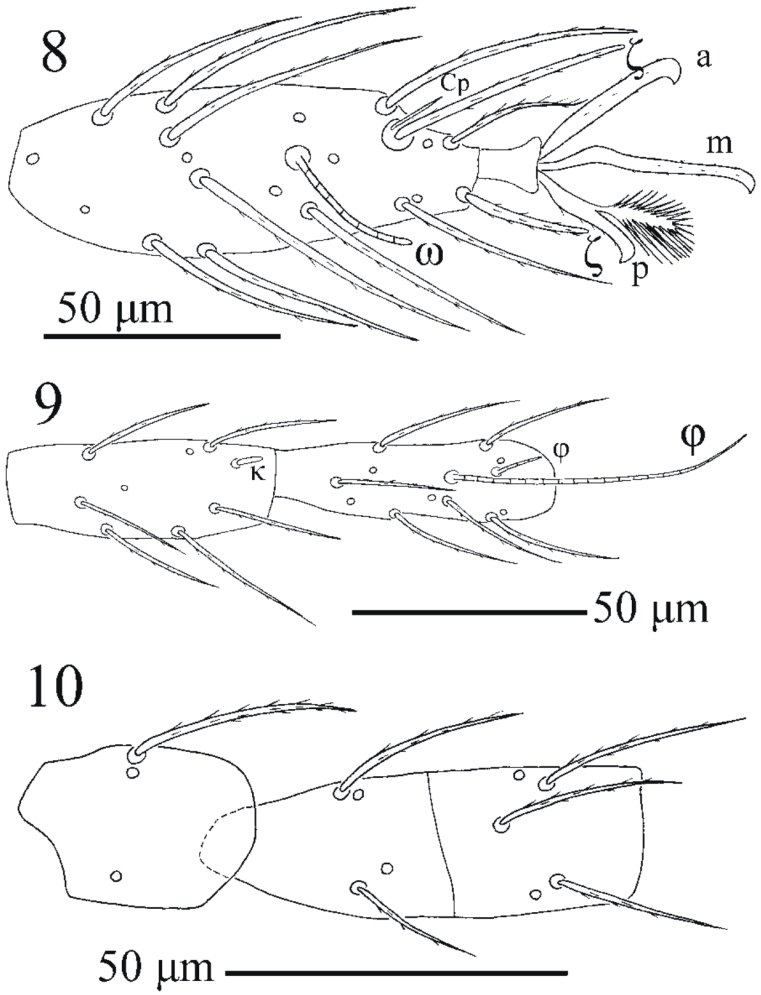
Character	2a	2b	2c	2d	2e	2f	2g	2h
Ta I	1ω, 2ζ, 1Cp, 21n	1ω, 2ζ, 1Cp, 20n	1ω, 2ζ, 1Cp, 22/21n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n
Ti I	2φ, 1κ, 11n	2/1φ, 1κ, 11n	2/1φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n
Ge I	1s, 1κ, 8n	1s, 1κ, 7/8n	1s, 1κ, 7/9n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n
TFe I	5n	5n	5/4n	5n	5n	5n	5n	4/5n
BFe I	4n	4n	4n	4n	4n	4n	4n	4n
Tr I	3n	3n	3n	3n	3n	3/2n	3n	3n
Cx I	1n	1n	1n	1n	1n	1n	1n	1n
Ta II	1ω, 2ζ, 1Cp, 18n	1ω, 2ζ, 1Cp, 17n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19/18n	1ω, 2ζ, 1Cp, 19/18n	1ω, 2ζ, 1Cp, 17/19n
Ti II	2φ, 11n	2/1φ, 11/8n	2φ, 11n	2φ, 11/10n	2φ, 11n	2φ, 11n	2φ, 11n	2φ, 11n
Ge II	1κ, 8/7n	1κ, 8/7n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 7/8n
TFe II	5n	4/2n	5n	5n	5n	5n	5n	4/5n
BFe II	4n	4n	4n	4n	4n	4n	4n	4n
Tr II	2/3n	2/3n	3n	3n	3/2n	2/3n	3n	3n
Cx II	1n	1n	1n	1n	1n	1n	1n	1n
Ta III	1ζ, 20n	1ζ, 19n	1ζ, 18/20n	1ζ, 20n	1ζ, 18/20n	1ζ, 20n	1ζ, 19n	1ζ, 19/18n
Ti III	1φ, 11n	0/1φ, 11/10n	1/0 φ, 11n	1/0φ, 11n	1/0φ, 11n	1φ, 11n	1φ, 11n	1φ, 11n
Ge III	7/8n	8n	8n	8n	8n	7/8n	8n	8n
TFe III	5n	5/4n	4/5n	5n	5n	5n	5n	5n
BFe III	3/2n	2/3n	3n	3n	3n	3n	3n	3n
Tr III	2n	2n	2n	2n	2n	2n	2n	2n
Cx III	1n	1n	1n	2/1n	1n	1n	1n	1n

Table 2. Continued.

Character	2i	2j	2k	2l	2m	2n	2o	2p
Ta I	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 22n	1ω, 2ζ, 1Cp, 21n	1ω, 2ζ, 1Cp, 22n
Ti I	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n	2φ, 1κ, 11n
Ge I	1s, 1κ, 8n	1s, 1κ, 8/9n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n	1s, 1κ, 8n
TFe I	5n	5n	5/4n	5n	5n	5n	5n	5n
BFe I	4n	4n	4n	4n	4n	4n	4n	4n
Tr I	3n	3n	3n	3n	3n	3n	3n	3n
Cx I	1n	1n	1n	1n	1n	1n	1n	1n
Ta II	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 19n	1ω, 2ζ, 1Cp, 18n	1ω, 2ζ, 1Cp, 19n
Ti II	2φ, 11n	2φ, 11n	2φ, 11n	2φ, 11n	2φ, 11n	2φ, 11n	2φ, 11n	2φ, 11n
Ge II	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n	1κ, 8n
TFe II	5n	5n	5n	5n	5n	5n	5n	5n
BFe II	4n	4n	4n	4n	4n	4n	4n	4n
Tr II	3n	3n	3n	3n	3n	3n	3n	3n

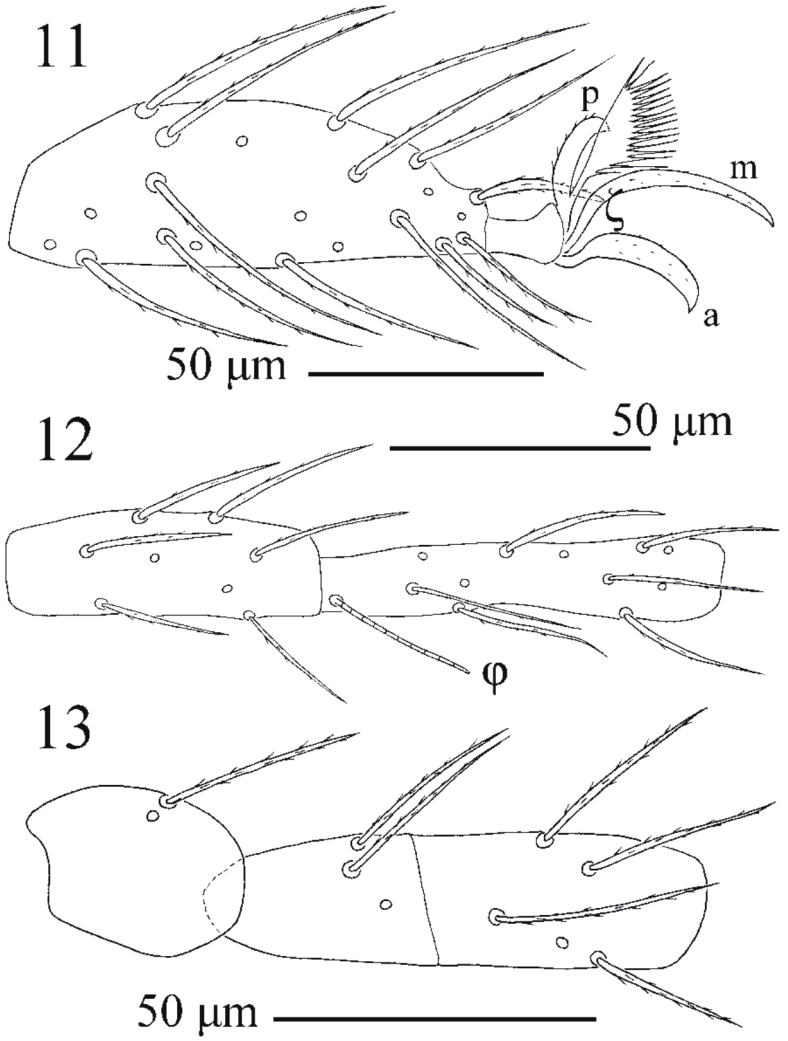
Table 2. (Continued).

Cx II	1n	1n	1n	1n	1n	1n	1n	1n
Ta III	1ζ, 18/20n	1ζ, 20/19n	1ζ, 20n	1ζ, 19/18n	1ζ, 19n	1ζ, 20/19n	1ζ, 19n	1ζ, 19n
Ti III	1φ, 11n	1φ, 11n	1φ, 11n	1φ, 10/11n	1φ, 11n	1φ, 11n	1φ, 10/11n	1φ, 11n
Ge III	8n	8n	8n	8n	8n	8n	8n	8n
TFe III	5/4n	5n	5n	5n	5n	5n	5n	5n
BFe III	3n	3n	3n	3n	3n	3n	3n	3/2n
Tr III	2n	2n	2n	2n	2n	2n	2n	2n
Cx III	1n	1n	1n	1n	1n	1n	1n	1n



Figures 8–10. *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva), leg II: 8- Ta; 9- Ti–Ge; 10- TFe–Tr.

- Ge I with nine normal setae, Ta III 75–85, Ti III 89–97, with 26 setae in the area between coxae II and III, NDV 159–160 ..... *B. yousifi* Kamran and Alatawi, 2014
8. Palpgenu with four setae .... *B. brunoni* Haitlinger, 2005
- Palpgenu with three setae 9
9. fn TFe 5-5-4, Ti III 92–104, fn Ti I–III 11-11-11, ISD 64–72 ..... *barloventensis* Haitlinger, 2004
- fn TFe 5-5-5, Ti III 78–84, fn Ti I–III 13-13-13, ISD 52–56 ..... *B. malpaisesensis* Haitlinger, 2004
10. fn TFe 6-6-5 ..... *B. kendalli* Welbourn, 1991
- fn TFe 5-5-5 11
11. Ti I with three solenidia 12
- Ti I with one or two solenidia 13



Figures 11–13. *Balaustium izmirensis* Noei & Ersin **sp. nov.** (larva), leg III: 11- Ta; 12- Ti–Ge; 13- TFe–Tr.

12. Ti II with 10 normal setae, Ti I 58–73 ..... *B. zhangi* Saboori, 2001
- Ti II with 11 normal setae, Ti I 72–83 ..... *B. murorum* (Hermann, 1804)
13. Ti III ≥98, TFe III ≥50, scutalae on scutum 14
- Ti III ≤90, TFe III ≤48, scutalae on or off scutum 16
14. Ti I with one solenidion, number of normal setae on Ti I 12, fn Ge 7-7-8, ISD 80 ..... *B. kacperi* Haitlinger, 1996
- Ti I with two solenidia, number of normal setae on Ti I 10, fn Ge 8-8-8, ISD ≤74 15
15. Number of normal setae on Ti II 10, Ti III 98–100, scutalae on scutum ..... *B. medardi* Haitlinger, 2000
- Number of normal setae on Ti II nine, Ti III 108–114, scutalae off scutum ..... *B. biljanae* (Haitlinger, 2000)
16. Scutalae on scutum 17
- Scutalae off scutum 19
17. fn Ti 10-10-11 ..... *B. innocentae* Haitlinger, 2006
- fn Ti 9-9-9 or 11-11-10 18
18. fn Ti 9-9-9, PSens 72–82, ASens 48–54, ISD 56–58 .. *B. minodorae* Haitlinger, 2000
- fn Ti 11-11-10, PSens 62, ASens 40, ISD 50 ..... *B. soydani* Haitlinger, 2000
19. Ge II & III each with seven normal setae 20
- Ge II & III each with eight normal setae 21
20. Ge I with nine normal setae, fn Ti 10-12-12, ISD 52, PL 52, Ti III 68, NDV 106 ..... *B. nikae* Haitlinger, 1996
- Ge I with seven normal setae, fn Ti 11-10-11, ISD 62, PL 36–40, Ti III 82–90, NDV 152 ..... *B. wratislaviensis* Haitlinger, 1996
21. fn Ti 11-11-11, fn Ta (21–23)-(18–19)-(19–20), AW 30–40, ASens 30–37, PSens 45–60 ..... *B. akramii* Noei, 2017
- fn Ti 12-12-10, fn Ta 19-19-17, AW 54, ASens 48, PSens 80 ..... *B. rajmundi* Haitlinger, 1996

4. Discussion

This paper presents a description of larvae of *Balaustium izmirensis* Noei & Ersin **sp. nov.** obtained by experimental rearing from adults. There are some abnormalities in larval specimens that may be due to the laboratory rearing. These abnormalities are as follows: presence or absence of nonsensillary setae on the left or right sides of the scutum (see the description of the dorsum); presence or absence of setae on palptrochanter, palpfemur, and palpgenu (see the description of gnathosoma); number of solenidia on Ti I–III; and number of normal setae on Ge I–III, TFe I–II, BFe III, and Tr I–II (see Table 2). However, despite the presence of abnormalities in these larval specimens, the normal numbers of solenidia and setae on legs were predictable, as follows:

Leg I: Ta—1ω, 2z, 1Cp, 20—22n; Ti—2φ, 1k, 11n; Ge—1s, 1k, 8n; TFe—5n; BFe—4n; Tr—3n (Figures 5–7). Leg II: Ta—1ω, 2z, 1Cp, 17–19n; Ti—2φ, 11n; Ge—1k, 8n; TFe—5n; BFe—4n; Tr—3n (Figures 8–10). Leg III: Ta—1z, 18–20n; Ti—1φ, 11n; Ge—8n; TFe—5n; BFe—3n; Tr—2n (Figures 11–13).

Nomenclatural acts: This work and the nomenclatural acts it contains have been registered in ZooBank. The ZooBank Life Science Identifier (LSID) for this publication is http://zoobank.org/urn:lsid:zoobank.org:pub:24174502-EECC-4AA6-8169D63C47C99CD5.

Acknowledgments

We thank Professor Alireza Saboori (Jalal Afshar Zoological Museum, Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran) and Dr Ian Riley (language editor of the Turkish Journal of Entomology) for valuable comments that improved the manuscript's English considerably. The project was partially supported by the Faculty of Agriculture, University of Birjand, Birjand, Iran and partially by the Department of Plant Protection, Faculty of Agriculture, Adnan Menderes University, Aydın, and the Department of Plant Protection, Faculty of Agriculture, Ege University, Bornova, İzmir, Turkey; this support is greatly appreciated.

References

Beron P (2008). Acarorum Catalogus I. Acariformes: Calyptostomatoidea (Calyptostomatidae), Erythraeoidea (Smarididae, Erythraeidae). Edition of Pensoft Publishers and the National Museum of Natural History, Sofia. Sofia, Bulgaria: Bulgarian Academy of Sciences.

Fuentes Quintero LS, Muñoz-Cárdenas K, Combita O, Jimeno E, Getiva De La Hoz JC, Cantor F, Rodriguez D, Mąkol J (2014). A re-description of *Balaustium leanderi* comb. nov. (Actinotrichida, Erythraeidae) with first report on characteristics of all active instars and taxonomic notes on the genus. Fla Entomol 97: 937-951.

Gabryś G (2000). *Balaustium xerothermicum* sp. nov. from Poland with remarks on all world species of the genus (Acari: Actinedida: Erythraeidae). Ann Zool 50: 47-56.

Gabryś G (2016). Commentaries on synonyms within Palaearctic Erythraeidae (Acari: Actinotrichida: Parasitengona). Annals of the Upper Silesian Museum (Bytom). Natural History. Rocznik Muzeum Górnośląskiego (Bytom), Przyroda 22: 139-146.

Grandjean F (1947). Au sujet des Erythroides. Bulletin du Muséum national d'Histoire naturelle Paris 19: 327-334 (in French).

Haitlinger R (1996). Seven new larval species of mites (Acari, Prostigmata: Erythraeidae and Trombidiidae) from Poland. Wiad Parazytol 42: 443-460.

Haitlinger R (2000a). New larval mites (Acari: Prostigmata: Erythraeidae, Microtrombidiidae, Trombidiidae) from Turkey, Peru and Poland. Wiad Parazytol 46: 379-396.

Haitlinger R (2000b). Five new species of Balaustiinae (Acari: Prostigmata: Erythraeidae) from Guatemala, Mexico and Italy. Zesz Nauk Akad Roln Wrocł Zootechnika 47: 69-84.

Haitlinger R (2004). New records of mites (Acari: Prostigmata: Erythraeidae, Trombidiidae) from La Palma, Canary Islands, Spain, with descriptions of four new species and a new genus. Rev Iber Aracnol 10: 215-223.

Haitlinger R (2005). A new genus and four new species of mites from Argentina, Brazil and Nicaragua (Acari: Prostigmata: Erythraeidae, Eutrombidiidae). Genus 16: 513-525.

Haitlinger R (2006). Eight new species and new records of mites (Acari: Prostigmata: Erythraeidae, Trombidiidae, Johnstonianidae) from China including Macao. Syst Appl Acarol 11: 83-105.

Hermann JF (1804). Memoire apterologique (published posthumously). Strasbourg: Hammer FL, F.G. Levrault (in French).

Mąkol J (2010). A redescription of *Balaustium murorum* (Hermann, 1804) (Acari: Prostigmata: Erythraeidae) with notes on related taxa. Ann Zool 60: 439-454.

Mąkol J, Arijs Y, Wackers F (2012). A new species of *Balaustium* von Heyden, 1826 (Acari: Actinotrichida, Erythraeidae) from Spain. Zootaxa 3178: 1-21.

Mąkol J, Wohltmann A (2012). An annotated checklist of terrestrial Parasitengona (Actinotrichida: Prostigmata) of the world, excluding Trombiculidae and Walchiidae. Ann Zool 62: 359-562.

Mąkol J, Wohltmann A (2013). Corrections and additions to the checklist of terrestrial Parasitengona (Actinotrichida: Prostigmata) of the world, excluding Trombiculidae and Walchiidae. Ann Zool 61: 15-27.

Mayoral JG, Barranco P (2009). Description of the larva *Balaustium bisculatae* sp. n. (Acari: Erythraeidae) from the southeast of Spain. Biologia 64: 1161-1164.

Meyer MKP, Ryke PAJ (1959). Nine new species of the superfamily Erythraeoidea (Acarina: Trombidiformes) associated with plants in South Africa. Acarologia 1: 304-323.

Noei J, Asadollahzadeh S, Cakmak I, Hadizadeh A (2017). A new larval species of *Balaustium* (Acari: Erythraeidae) from northern Iran and Turkey with a key to the genera of larval Balaustiinae and species of *Balaustium*. Syst Appl Acarol 22: 2218-2232.

Saboori A (2001). Description of the larva, deutonymph and adult of *Balaustium zhangi* sp. nov. (Acari: Erythraeidae) from Iran. Syst Appl Acarol 6: 171-178.

Saboori A, Khaustov A, Hakimitabar M, Hajiqanbar H (2009). A new genus and species of larval Erythraeinae (Acari: Prostigmata: Erythraeidae) from Ukraine and the taxonomic state of *Zhangiella*. Zootaxa 2203: 22-30.

Sevsay S (2017). A checklist of the Erythraeoidea and Trombidioidea (Actinotrichida: Prostigmata) of Turkey. Turk J Zool 7: 175-196.

Šundić M (2014). New morphological data on *Balaustium nikae* larvae and new records of mites (Acari: Prostigmata: Erythraeidae) from specimens collected in Serbia and Montenegro. Agricult Forest 60: 213-221.

von Heyden CHG (1826). Versuch einer systematischen Eintheilung der Acariden. Isis von Oken 18: 609-613 (in German).

Walter DE, Krantz GW (2009). Collecting, rearing, and preparing specimens. In: Krantz GW, Walter DE, editors. A Manual of Acarology. 3rd ed. Lubbock, TX, USA: Texas Tech University Press, pp. 83-96.

Welbourn WC, Jennings DT (1991). Two new species of Erythraeidae (Acari: Prostigmata) associated with the spruce budworm, *Choristoneura fumifera* (Clemens) (Lepidoptera: Tortricidae) in Maine. Can Entomol 123: 567-580.

Willmann C (1939). Die Arthropodenfauna von Madeira nach den Ergebnissen der Reise von Prof. Dr. O. Lundblad Juli-August 1935. Archiv fur Zoologi, 31A: 1-42 (in German).

Wohltmann A, Gabryś G, Mąkol J (2007). Terrestrial Parasitengona inhabiting transient biotopes. In: Gerecke R. Editor. Süßwasserfauna von Mitteleuropa. Vol. 7/2–1, Chelicerata, Araneae, Acari I. Munich, Germany: Elsevier GmbH, Spektrum Akademisher Verlag, pp. 158-240.