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First larval description of the genus *Mirabilithrombium* Gabryś, 1999 (Acari, Microtrombidiidae) from Turkey

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Abstract: *Mirabilithrombium turcicum* sp. nov. is described based on both active postlarval forms and larvae. Larvae of *Mirabilithrombium* Gabryś, 1999 were obtained by experimental rearing from a field-collected female and are described for the first time. This is the third species described in the genus; a key to the active postlarval forms is provided. Data on the habitat specificity for the species are provided.

Key words: Acari, Microtrombidiidae, *Mirabilithrombium*, new species, Turkey

1. Introduction

The genus *Mirabilithrombium* was founded by Gabryś (1999) to accommodate *Georgia mirabilis* Willmann, 1950 and *Microthrombium sibilatrix* Robaux, 1968; both species are known exclusively from postlarval forms. Dorsal opisthosomal setae of *Mirabilithrombium* show close similarities to the setae of *Dactylothrombium*. However, while *Dactylothrombium* carries 1 type of dorsal setae, *Mirabilithrombium* carries 2 types.

This is the first description of the larvae of *Mirabilithrombium*. In addition, the adult of *Mirabilithrombium turcicum* sp. nov. is described, and notes on the biology, habitat specificity, and larval developmental time are given.

2. Materials and methods

Two specimens—active postlarval forms—were collected directly from the soil surface in a humid meadow with copses, in the same field but at different times, close to Ergan Mountain, Erzincan, Turkey (39°38′16″N, 39°31′31″E, 1328 m a.s.l., 21.11.2011/06.11.2012, leg. S. Adil). Larvae were reared from eggs deposited by adults collected in the field. Ovigerous females were placed in glass vials (25 × 30 mm) filled with charcoaled plaster of Paris and closed with tight, semitransparent lids. They were kept at room temperature with a natural light/dark cycle. In order to maintain the required humidity, water was added to the substratum. After death, adults were preserved in 70% ethyl alcohol and were cleared with 10% KOH prior to mounting. Specimens for light microscope studies (1 female, 1 postlarval specimen, and 6 larvae) were mounted on slides using Hoyer's medium (Krantz and Walter, 2009). Measurements were taken and drawings were made under a Leica DM 4000 microscope with differential interference contrast and phase contrast. Terminology follows Mąkol (2007) for larvae and Gąbryś (1999) and Mąkol and Gabryś (2005) for postlarval instars. All measurements are given in micrometers.

3. Results

Family Microtrombidiidae Thor, 1935
Genus *Mirabilithrombium* Gabryś, 1999
Type species *Georgia mirabilis* Willmann, 1950
Mirabilithrombium Gabryś, 1999
Diagnosis.
Adult. Medial face of palp tibia with strong paradont, 1 or 2 ctenidia, and a radula. Radula consists of a few spine-like setae. Lateral face of palp tibia with 1 or 2 long, solid basidonts. Crista metopica with anterior and posterior process; in posterior half, a sensillary area bearing 1 pair of filiform sensillary setae. Accessory posterior process present. Double eyes with large lenses situated on short stalks placed at sides of crista metopica at the level of midpoint of anterior process. Dorsal opisthosomal setae of 2 types, both covered with setules distributed along the stem. Setae of type I (pDS I) more robust, gradually longer and thicker towards idiosoma termination, distal part of the stem slightly bent to idiosoma and bearing 2–5 short lobes at the top. Setae of type II (pDS II) smaller, with slightly thickened, apically narrowing stem. Legs without lamellae, shorter than idiosoma**.** Tarsus I dilated, longer than high.

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Larva. Gnathosoma with stephanostome, internal horseshoe-like sclerite distinct, but without lateral teeth. Palps with minute spine-like setae on femur and genu. Tritorostral setae (*bs*, hypostomalae) distally with finger-like projections. Cheliceral blade short and slightly curved. Lateral sclerite with 1 pair of adoral setae. Dorsum of idiosoma with scutum and scutellum. Scutum bent anterolaterally to the venter (stolascutum). Scutum bearing 3 pairs of nonspecialized setae and 1 pair of trichobothria. Scutellum with 1 pair c_1 setae. Dorsal setae barbed, arranged in rows, and situated on plates or platelets. Plates of c_2 and d_1 distinctly enlarged. Coxal setation formula: 2–1–1; all setae with at least 1 setula. All tarsi terminated with paired claws and empodium. Inner claw at tarsus III reduced to a spine. Scopa and lophotrix absent.

Distribution. Austria, Portugal, Spain, Tunisia, Turkey.

***Mirabilithrombium turcicum* sp. nov.**

Adult female.

Standard measurements are given in Table 1. Body is red-colored in life. Idiosoma broadened at shoulders, narrowing posterior (Figure 1A). Body length 1382–1614; width 985–1160.

Table 1. Morphometric data on postlarval forms of *Mirabilithrombium turcicum* sp. nov.

Character	*M. turcicum* sp. nov. holotype	*M. turcicum* sp. nov. paratype (n = 1)
L	1614	1382
W	1160	985
L/W	1.39	1.4
Ch BS (L)	185	168
Ch BS (W)	68	59
Ch Cl	78	79
PaTr (L)	65	55
PaTr (W)	83	72
PaFe (L)	195	113
PaFe (W)	130	105
PaGe (L)	63	45
PaGe (W)	93	86
PaTi (L)	92	82
PaTi (W)	65	52
Odo (L) (Lf–Rt)	67/68	72/72
Par (L) (Lf–Rt)	42/43	42/43
diCt(n) (Lf–Rt)	4/4	4/4
prCt(n) (Lf–Rt)	7/6	5/4
Bas (n) (Lf–Rt)	2/2	½
Bas (Lf–Rt)	56–54/57–56	62/57–58
Rad (n) (Lf–Rt)	5/5	6/6
PaTa (L)	74	68
PaTa (W)	23	24
mdS I [S] min.	54	75
mdS I [S] max.	75	86
mdS II [S] min.	20	46
mdS II [S] max.	30	40
pdS I [S] min.	70	70
pdS I [S] max.	85	84
pdS II [S] min.	35	45
pdS II [S] max.	45	60
vS [S] min.	28	21
vS [S] max.	34	28
CML	257	270
CMW	30	34
ASB	32	23
PSB	21	21
AM (n)	9	8
AM (L) min.	70	72
AM (L) max.	91	95
RCM	201	177

Table 1. (Continued).

SAL	55	66
SAW	111	60
SB	29	25
SE	135	110
pPr	111	44
acpPr	15	not visible
OL	86	83
OCM	117	114
ao	35	29
pO	30	33
O-O	248	246
OaD	113	111
OSD	103	73
GOP (L)	193	184
gs [S] min.	not visible	not visible
gs [S] max.	24	not visible
pgs [S] min.	not visible	not visible
pgs [S] max.	not visible	not visible
An (L)	60	not visible
An La min.	20	not visible
An La max.	24	not visible
Cx_I	164	147
Tr_I	105	94
Bf_I	222	175
Tf_I	164	143
Ge_I	172	155
Ti_I	193	176
Ta_I (L)	291	255
Ta_I (W)	158	137
Ta_I (L/W)	1.84	1.86
Leg I	1311	1145
Cx_II	191	162
Tr_II	97	89
Bf_II	120	94
Tf_II	93	89
Ge_II	103	98
Ti_II	126	125
Ta_II	209	178
Leg II	939	835
Cx_III	139	145
Tr_III	84	76
Bf_III	136	81
Tf_III	87	75
Ge_III	98	86
Ti_III	126	118
Ta_III	196	167
Leg III	866	748
Cx_IV	185	127
Tr_IV	121	130
Bf_IV	181	174
Tf_IV	130	116
Ge_IV	153	139
Ti_IV	188	179
Ta_IV	242	228
Leg IV	1200	1093
IP	4316	3821

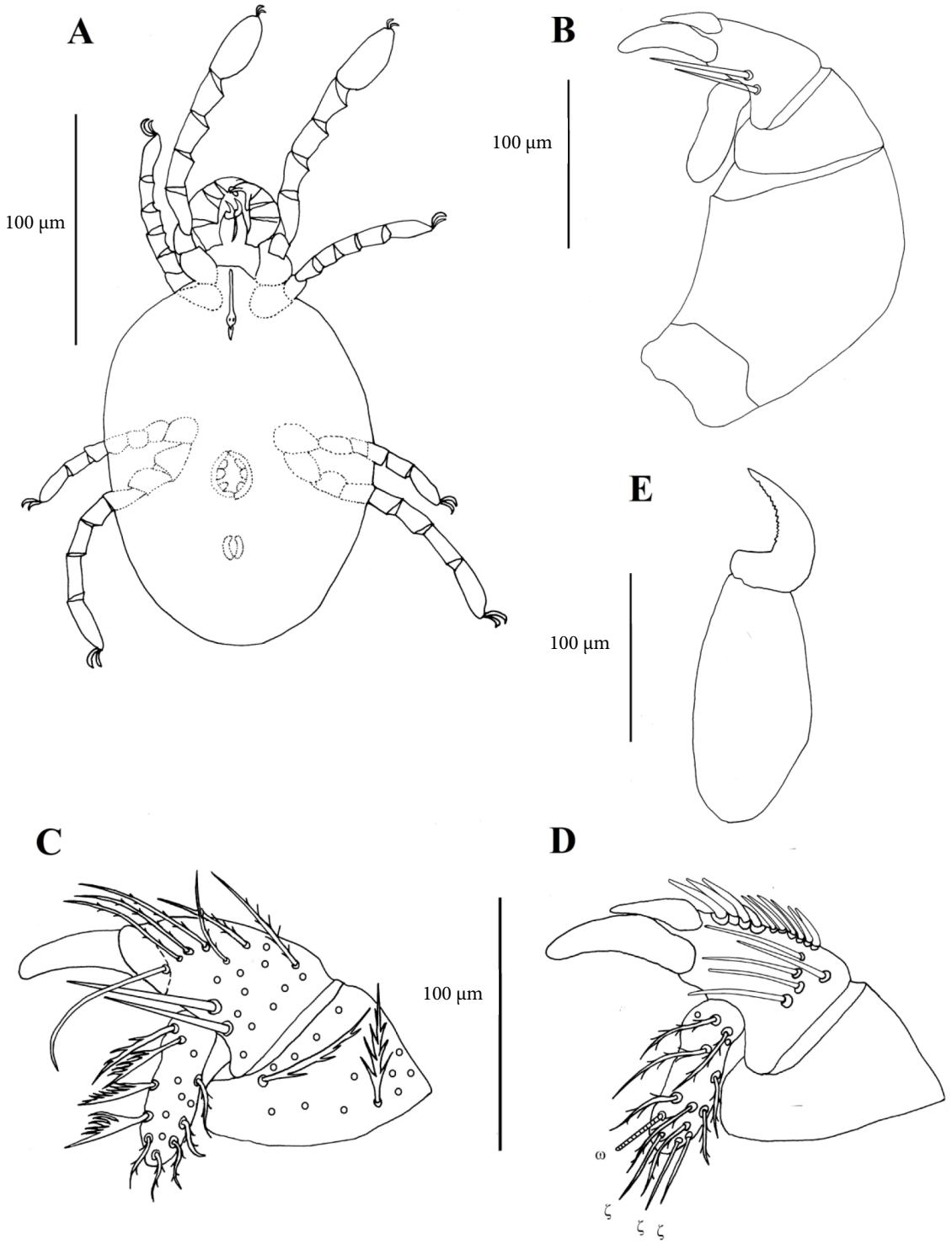


Figure 1. *Mirabilithrombium turcicum* sp. nov. female (holotype). A) General view, body and setae omitted for transparency; B) palp general view, setae omitted; C) palp lateral aspect; D) palp medial aspect; E) general view, chelicerae.

Gnathosoma. Palps strong (Figure 1B). Lateral face of palp tibia (Figure 1C) covered with numerous setulose setae, whip-like seta placed terminally near odontus; at the base of palp tarsus 2 long basidonts, distal ones usually the strongest and the longest. Medial face of palp tibia (Figure 1D) with 2 often overlapping ctenidia and radulae;

distal ctenidium composed of 4–5 spinisetae situated behind paradont; proximal ctenidium composed of 6–7 uniform spinisetae; radula consists of 5–6 long and very strong spine-like setae. Palp tarsus characteristic, long and cylindrical, with numerous feather-like setae (Figure 1D) and with 3 eupathidia (ζ) distally and 1 solenidion (ω) laterally. Chelicerae typical for the family (Figure 1E).

Idiosoma. Aspidosoma (Figure 2A) triangular in outline. Anterior part of crista metopica relatively broad, almost-sclerotized vertex bears 9–10 long, setulose

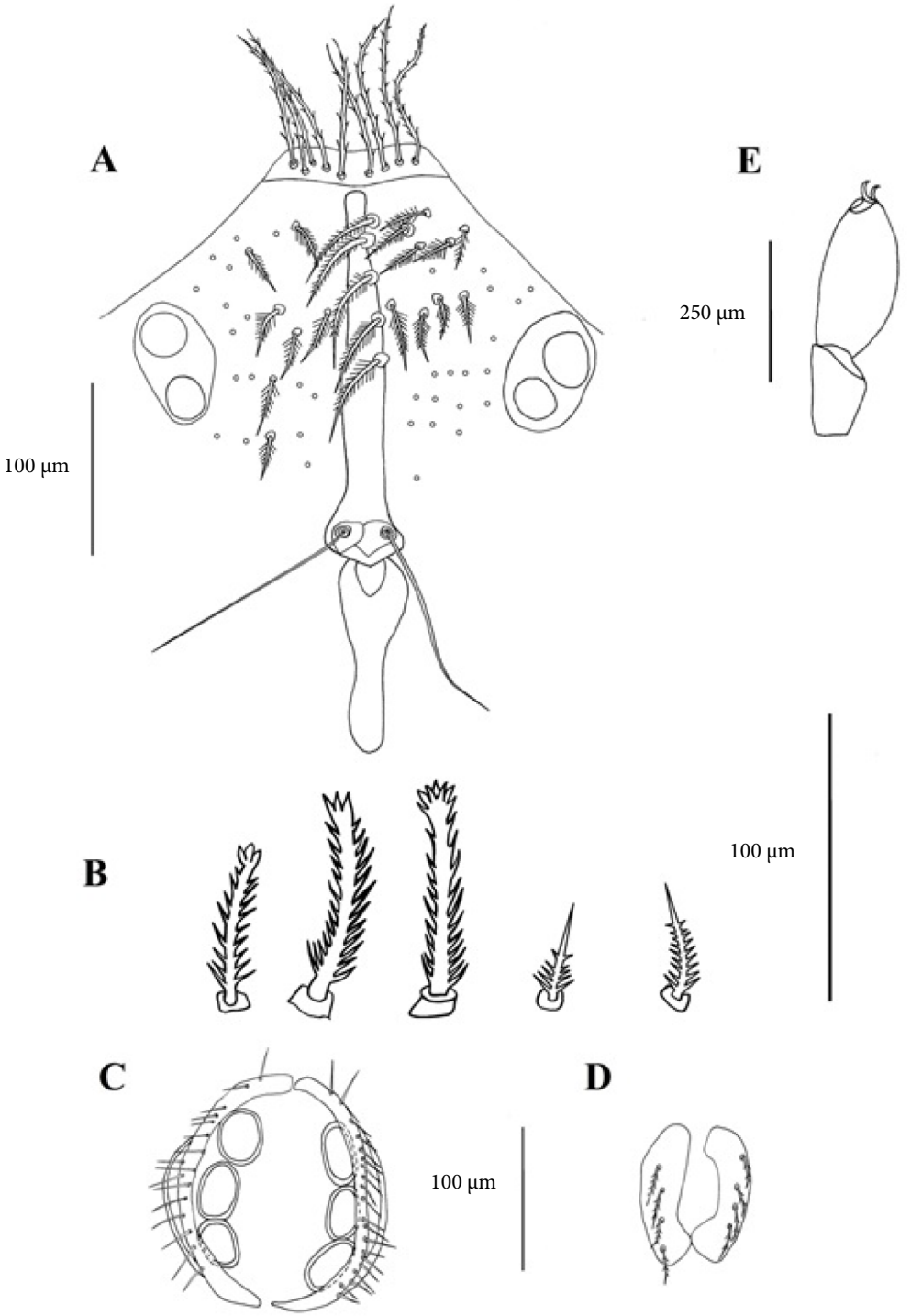


Figure 2. *Mirabilithrombium turcicum* sp. nov. female (holotype). A) Crista metopica region; B) dorsal opisthosomal setae (pDS I and pDS II); C) genital opening; D) anus; E) leg I, tibia–tarsus.

nonsensillary setae (AM); rounded sensillary area bears 2 short, smooth sensillary setae; posterior process relatively short according to anterior process; accessory posterior process present. Two pair of eyes with large lenses on short stalks placed half-length on each side of anterior part of crista metopica; anterior lenses distinctly larger than posterior ones. Dorsal opisthosomal setae of 2 types (Figure 2B). Setae of type I (pDS I) more robust, clearly longer, and distal part of the stem slightly bent to idiosoma bearing 2–5 short lobes at the top. Setae of type II (pDS II) smaller, with thinner, apically narrowing stem, and covered with setulae but only on 1/2 to 2/3 their length from base. Ventral setae of 1 type, similar to type II of dorsal ones and comparable in length. Three pairs of genital acetabula. External genitalia (Figure 2C) consist of a pair of epivalves and centrovalves covered densely with setae; epivalval setae setulose, centrovalval setae smooth. Anus covered with setulose setae (Figure 2D).

Legs. Legs without lamellae, much shorter than idiosoma; tarsus I at least 1.8× longer than wide (Figure 2E).

Deutonymph and male. Unknown.

Larvae.

Morphometric data are given in Table 2. Color in life is reddish.

Gnathosoma (Figure 3A). Movable gnathosoma with stephanostome composed of distinct internal horseshoe-like sclerite without lateral teeth and inserted between outer and inner cuticular sheaths. Ventrally a pair of thick subcapitular setae (*bs*) with 6–7 finger-like digitations. Chelicera (45–50) typical (Figure 3B), cheliceral blade fine, slightly curved, with 1 tiny hook at distal part of its internal edge. One pair of spine-like adoral setae (*cs*). Pedipalp formula: 0–N–N–NNN–NNNNNNNωζ. Palp femur and genu each with 1 minute, spine-like seta placed dorsally. Palp tibia (Figure 3C) with 1 long and 1 shorter smooth seta and with 1 spine-like seta. Odontus divided almost its entire length. Palp tarsus (Figure 3D) with 2 long and 4–5 shorter spine-like setae, 1 solenidion, and 1 eupathidium.

Idiosoma dorsum (Figure 4A). Scutum and scutellum punctuations on the whole surface and striation. Scutum triangular in outline, rounded anteriorly, with almost straight posterior edge, and bent anterolaterally to the venter (stolascutum). Scutum striate longitudinally after *AM* setae and slightly rounded anteriorly; lateral borders concave near *S* and convex in line with *PL* bases. Setae *AM* smooth, setae *AL* and *PL* thinner and serrate. Sensillary setae covered with distinct setulae in distal part of stem. Paired eyes located on oval sclerites at the level of posterior part of scutum. Scutellum punctuate and with little striation, bears 1 pair of barbed c_1 setae situated ca. at half length of the sclerite. Dorsal setae barbed, arranged in rows and situated on plates or platelets. Plates of c_2 and d_1 distinctly enlarged. *f*D formula = (2)4–6–6–6–4 (setae d_1 on the largest plates, setae c_2 on the second largest plates, setae c_3–d_3 on small platelets, setae $e_{1–3}$ and $f_{1–3}$ on smaller platelets). H row h_1–h_2. Plates of setae h_1 united. Setae h_2 of comparable length (52–58) with other dorsal setae (23–53) and placed on tubercle-like protrusions.

Idiosoma ventrum (Figure 4B). Cuticle smooth, folded in lines. Claparede's organs placed laterally between coxae I and II. Coxa I with a long and setulose bifurcate seta *1a* (15–17) and seta *1b* (15–22). Supracoxala I absent. Coxa II with bifurcate seta *2b* (19–21). Coxa III directed posterolaterally, with seta *3b* with 3 long setules (16–18). Seta *3a* (14–17) located outside coxa III, with 3–4 setules. Anal opening not sclerotized, located posterior to coxae III. Two pairs of setulose pseudanal setae (*ps*) placed anterolaterally to anal pore. Setae h_2 distinctly longer (37–44) than other ventral setae (23–41) and placed on tubercle-like protrusions.

Leg segmentation formula: 6–6–6. Leg setal formula: Leg I: Tr–1n; Fe–6n; Ge–4n, 2σ; Ti–6n, 2φ, 1κ; Ta–15n, 2ζ, 1ω, 1ε (Figure 5A). Leg II: Tr–1n; Fe–4n; Ge–2n, 1σ, 1κ; Ti–5n, 2φ; Ta–13n, 1ζ, 1ω, 1ε (Figure 5B). Leg III: Tr–1n; Fe–4n; Ge–2n, 1σ; Ti–5n; Ta–11n (Figure 5C). All normal setae on legs covered with barbs. Pretarsi I–II with paired claws and claw-like empodium. Outer claw of tarsus III prominent, with splinters, inner claw reduced to a spine and empodium normal.

Key to the species of *Mirabilithrombium* (adults)

1. Distal end of pDS I bears 3 short lobes and pDS II covered with setules distributed along the stem…… ……..... *Mirabilithrombium sibilatrix*

- Distal end of pDS I bears 2–5 short lobes and pDS II covered with setules but only on ½ to $^2/_3$ their length from base..... 2

2. pDS I <50 and tarsus I length/tarsus I height >2.6..... ..... *Mirabilithrombium mirabilis*

- pDS I >70 and tarsus I length/tarsus I height >1.8..... ..... *Mirabilithrombium turcicum* **sp. nov.**

Etymology. The specific epithet '*turcicum*' refers to the type locality of this species, Turkey.

Type material. Holotype female collected on Ergan Mountain, Erzincan Province, Turkey (39°38′16″N, 39°31′31″E, 1328 m, 06.11.2012, leg. S. Adil). One paratype: same data as for holotype but collected 21.11.2011. Six larvae obtained from holotype females by experimental rearing. The type material and other specimens were deposited in the collection of the Biology Department, Erzincan University, Erzincan, Turkey.

Distribution. Turkey.

Biology. The sampling area is characterized by forest and grass. A female, after being collected in the field (21 November 2011), laid eggs on the 22nd day of

Table 2. Morphometric data on larvae of *Mirabilithrombium turcicum* sp. nov.

Character	*M. turcicum* sp. nov. holotype	*M. turcicum* sp. nov. paratype (n = 5), min–max
L	269	261–326
W	156	155–192
L/W	1.72	1.68–1.74
Scutum L	101	101–103
Scutum W	95	95–104
AA	35	35–38
AW	77	77–81
PW	92	92–103
SB	59	59–65
ASB	82	80–88
PSB	20	16–20
AP	38	30–38
AM	47	40–54
AL	31	31–35
PL	45	38–45
S	58	58–59
MA	44	43–46
HS	49	48–50
LSS	109	103–109
SL (= c1)	53	50–53
SS	39	39–46
1a	18	15–17
1b	18	15–22
2b	21	19–21
3a	16	14–17
3b	20	16–18
Cx I	55	51–55
Tr I	27	26–33
Fe I	49	42–53
Ge I	15	15–18
Ti I	39	39–44
Ta I	74	70–76
Leg I	259	249–269
Cx II	47	47–60
Tr II	26	25–26
Fe II	50	50–51
Ge II	16	15–18
Ti II	35	31–35
Ta II	60	59–61
Leg II	234	228–245
Cx III	43	43–46
Tr III	30	26–32
Fe III	50	50–53
Ge III	17	15–18
Ti III	37	36–38
Ta III	60	58–64
Leg III	237	236–241
IP	730	713–755

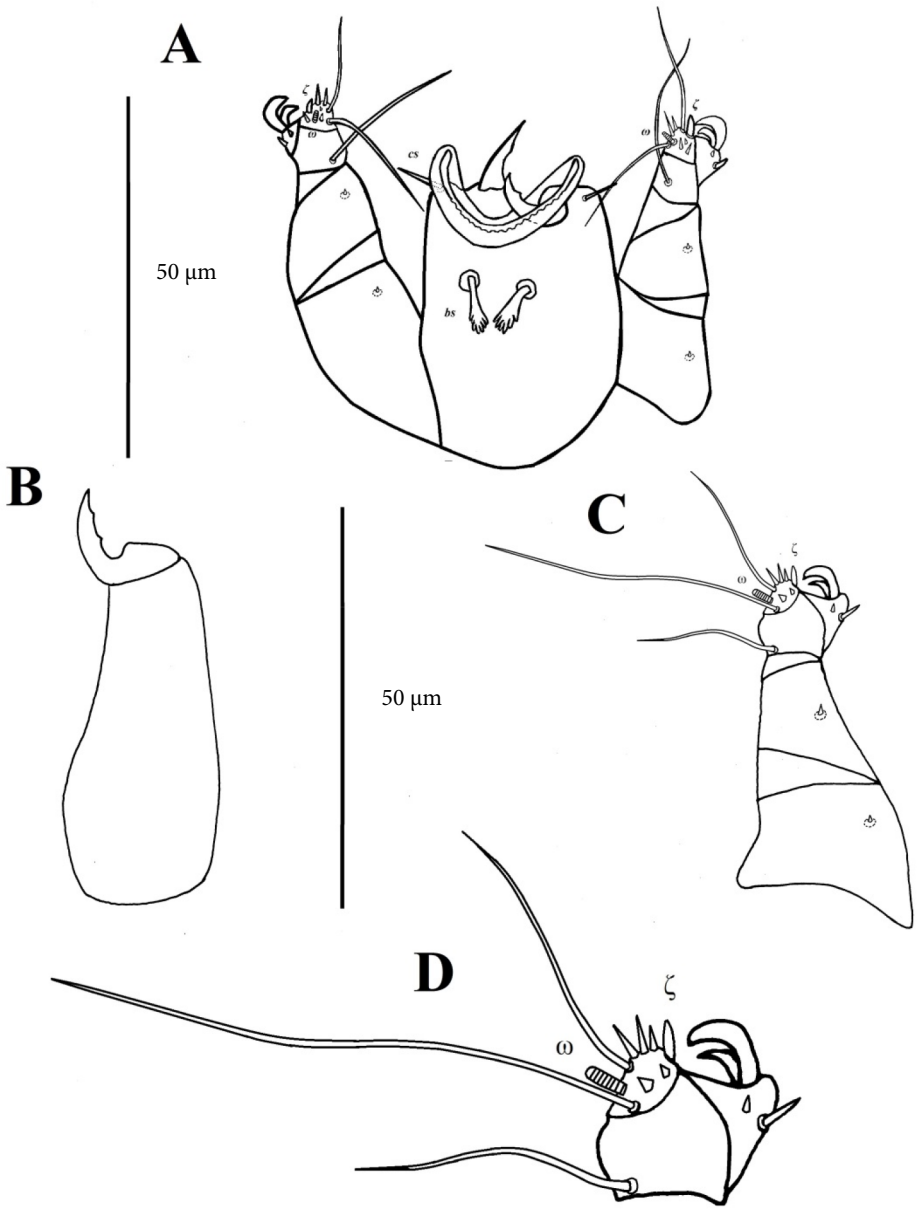


Figure 3. *Mirabilithrombium turcicum* sp. nov. larvae. A) Gnathosoma ventral view; B) chelicerae; C) palp femur–genu–tibia–tarsus dorsolateral view; D) palp tibia–tarsus dorsolateral view.

being kept under laboratory conditions; no larvae were obtained because the eggs were contaminated with mold. Another female (holotype) collected from the same field at a different time (6 November 2012) laid eggs on the 18th day of being kept under laboratory conditions (24 November). The eggs were spherical and clustered in 1 package. Although the eggs were also moldy, 10 days later (4 December) they turned into prelarvae; 6 larvae were obtained and transferred to alcohol (25 December).

4. Discussion

In his diagnosis of the genus *Mirabilithrombium* (1999), Gabryś stated that the lateral face of the palp tibia has 1 basidont and the medial face has 1 ctenidium; additionally, the adults of this genus carry 2 eyes with large lenses situated on prominent stalks. Our specimens have 2 basidonts on the lateral face of the palp tibia (only 1 on left palp tibia of paratype), medial face of palp tibia has 2 ctenidia; eyes with large lenses situated on short stalks**.**

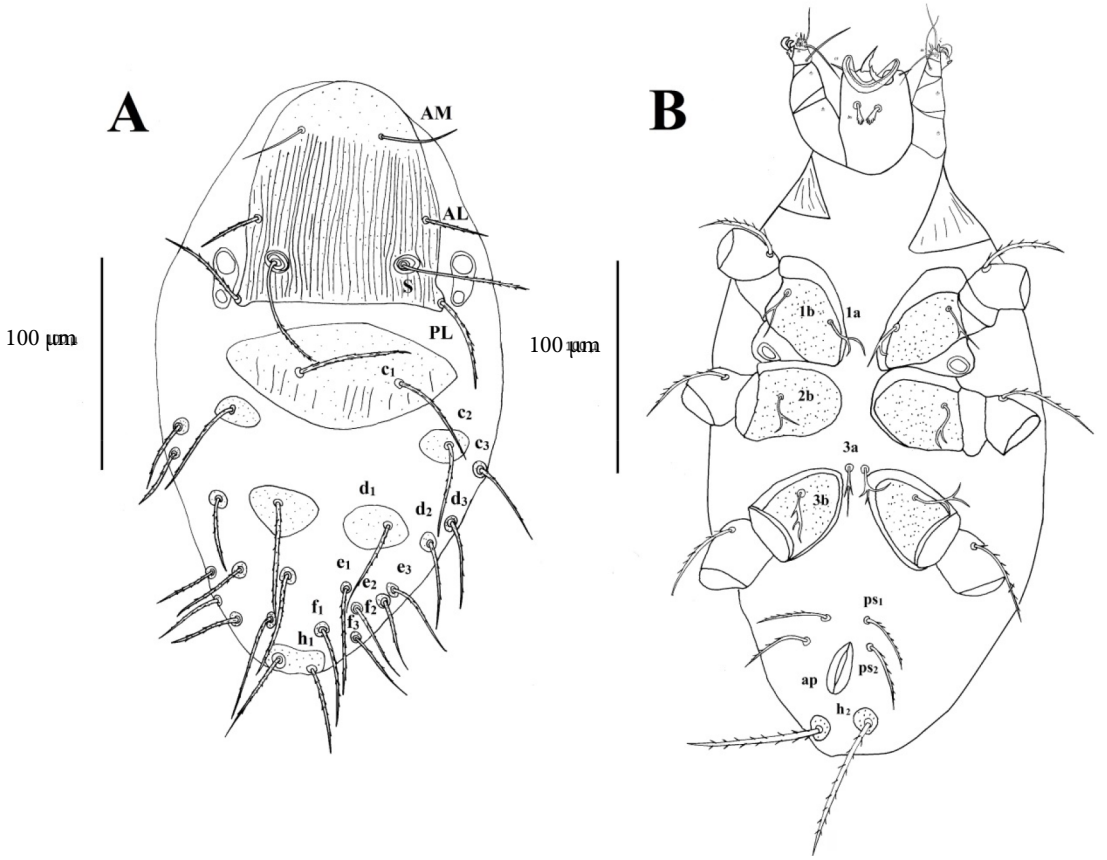


Figure 4. *Mirabilithrombium turcicum* sp. nov. larvae. A) Idiosoma, dorsal view, legs omitted; B) idiosoma, ventral view, legs omitted beyond trochanter.

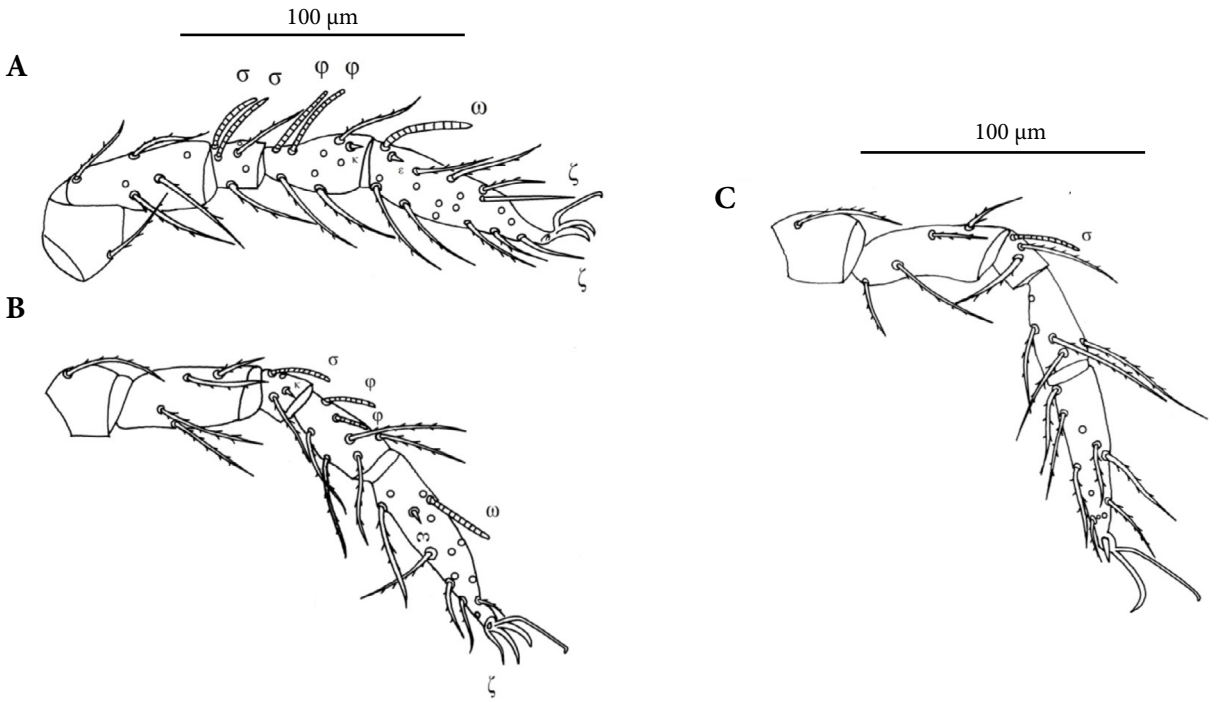


Figure 5. *Mirabilithrombium turcicum* sp. nov. larvae. A) Leg I; B) leg II; C) leg III.

Mirabilithrombium comprises 2 species, *Mirabilithrombium mirabilis* (Willmann, 1950) and *Mirabilithrombium sibilatrix* (Robaux, 1968). These species are known exclusively from postlarval forms (Makol and Wohltmann, 2012, 2013). Gabryś (1999) stated that in the descriptions of palpal tibia given by Willmann (1950) and Robaux (1968), both authors might have confused the adult with the nymph.

The postlarval species of *Mirabilithrombium* are similar in their total length (min. 1300, max. 1680), and pDS I is approximately twice as long as pDS II. Adults of *M. turcicum* sp. nov. are similar to *M. sibilatrix*. However, they differ from *M. sibilatrix* in several respects: pDS I (80) of *T. turcicum* sp. nov. is robust, clearly longer, and the distal part of the stem bears 2–5 sharp processes; pDS II (40) is smaller, with slightly thickened, apically narrowing stem, and is covered with setulae, but only 1/2 to 2/3 the length from the base. The distal part of the stem of pDS I (60) of *M. sibilatrix* is bent parallel to the idiosoma and diverges equally into 3 sharp processes; pDS II is smaller (30), with slightly thickened, apically narrowing stem, and additionally covered with setules along the stem. Relatively sclerotized vertex bears 5 nonsensillary setae (AM) in *M. sibilatrix*; strongly sclerotized vertex bears 9 nonsensillary setae (AM) in *M. turcicum* sp. nov.

M. turcicum sp. nov. is also similar to *M. mirabilis*. However, the lengths of pDS I and pDS II of *M. turcicum* sp. nov. (80 and 40) differ from those of *M. mirabilis* (45 and 25). Additionally, tarsus I length/tarsus I height of *M. turcicum* is 1.84 (291/158), but in *M. mirabilis* is 2.6 (240/90).

With this paper, the larvae of the genus *Mirabilithrombium* are described for the first time. The larvae of *Mirabilithrombium* are similar to those of *Trischidothrombium* and *Empitrombium* in the presence of a reduced claw at tarsus III and the concurred absence of scopa and lophotrix, and by the presence of a stolascutum. However, they differ from both genera in the structures of the scutum and scutellum (Makol et al., 2010; Sevsay and Karakurt, 2013), as well as in the separate plates of setae h_1 (in *M. turcicum*, plates of setae h_1 are united). The larvae of *Mirabilithrombium* are much closer in appearance to those of *Trischidothrombium* than *Empitrombium*. The larvae of *Mirabilithrombium* are similar to *Trischidothrombium* in the following characters: the presence of a smooth nondentate mouth; the position of solenidia on tibia I and genu I at the proximal end of the respective segments.

The larvae of these 3 genera are known with few specimens. After diagnosis of the new species from both larvae and the active postlarval form, correlations of the genera should be more explicit.

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