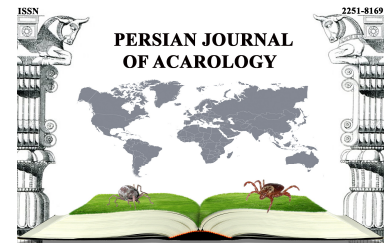




Persian J. Acarol., 2019, Vol. 8, No. 3, pp. 179–187.
<http://dx.doi.org/10.22073/pja.v8i3.46776>
Journal homepage: <http://www.biotaxa.org/pja>



Article

New data on *Nothrotrombidium*, *Southcottella* and *Eatoniana* larvae (Acari: Trombellidae, Neothrombiidae, Erythraeidae) from Iran

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ABSTRACT

Larvae of *Eatoniana lorestanicus* (Saboori & Lachinani, 2003) (Acari: Erythraeidae) were collected ectoparasitic on *Sphingonotus* sp. (Orthoptera: Acrididae: Oedipodinae) in Chahkand village, Birjand city, South Khorasan province, Iran. New morphological data of *E. lorestanicus* is presented. *Eatoniana lorestanicus*, *Southcottella nematii* Saboori, 2002 and *Nothrotrombidium birjandensis* Noei, 2017 were recorded for the second time from Iran. *Caradrina clavipalpis* (Scopoli) (Lepidoptera: Noctuidae) and the genus *Sphingonotus* were recorded as host of *Nothrotrombidium* and *Eatoniana* larvae for the first time, respectively. A key to species of *Eatoniana* of the world (larvae) is provided.

KEY WORDS: *Abalakeus*; Birjand; *Caradrina clavipalpis*; *Southcottella*; *Sphingonotus*.

PAPER INFO.: Received: 26 February 2019, Accepted: 22 May 2019, Published: 15 July 2019

INTRODUCTION

The genus *Abalakeus* Southcott, 1994 was synonymized with *Eatoniana* Cambridge, 1898 by Mağol and Sevsay (2015) and the systematic status was discussed. This genus includes five species: *E. bambusae* (Zhang, 2000), *E. chekei* (Southcott, 1994), *E. gonabadensis* (Ahmadi, Hajiqanbar & Saboori, 2012), *E. lorestanicus* (Saboori & Lachinani, 2003) and *Eatoniana plumipes* (L. Koch, 1856) (Koch 1856; Southcott 1994; Zhang *et al.* 2000; Saboori and Lachinani 2003; Ahmadi *et al.* 2012; Mağol and Wohltmann 2012, 2013). Saboori (2002) established the monotypic genus *Southcottella* (Acari: Neothrombiidae) for *Southcottella nematii* Saboori, 2002, based on specimens collected from *Acheta domesticus* (Linnaeus) (Orthoptera: Gryllidae) in Ahwaz, Iran (Saboori 2002). The genus *Nothrotrombidium* consists of nine species with three based on larvae [L] or post-larval forms and larvae [P, L]; namely *N. africanum* Andre [P] from Congo, *N. birjandensis* Noei [L] from Iran, *N. brevitarsum* Andre [P] from Vietnam, *N. bulbiferum* (Willmann) [P] from Croatia and Malta, *N. lundbladi* (Willmann) [P] from Maderia and Portugal, *N. nothroides* (Berlese) [P] from Brazil and Paraguay, *N. ornatum* Andre [P] from South Africa, *N. otiorum* (Berlese) [P, L] from Italy, Austria, France, Norway, Romania, Sardinia and Spain, and *N. treati* Southcott [L] from *Spaelotis clandestina* (Harris) (Lepidoptera: Noctuidae) from USA (Southcott 1987; Mağol and Wohltmann 2012; Noei 2017). *Nothrotrombidium* larvae have been reported as parasite of Noctuidae (Southcott 1987) and of short-horned grasshoppers of the family Acrididae (Ahmadi *et al.* 2011).

How to cite: Noei, J. & Rabieh, M.M. (2019) New data on *Nothrotrombidium*, *Southcottella* and *Eatoniana* larvae (Acari: Trombellidae, Neothrombiidae, Erythraeidae) from Iran. *Persian Journal of Acarology*, 8(3): 179–187. www.SJD.ir

In this paper, we present new morphological data of *E. lorestanicus*, and record *S. nematii* and *N. birjandensis* for the second time from Iran.

MATERIAL AND METHODS

Twelve specimens (larvae) were extracted with Berlese funnel or detached from the hosts by an insect pin under the stereomicroscope. The specimens were cleared in lactic acid and mounted on glass microscope slides using Faure's medium. Measurements (given in micrometers, μm) were made using a CH30 Olympus microscope. The terminology and abbreviations follow Robaux (1974), Wohltmann *et al.* (2006) and Saboori *et al.* (2009).

RESULTS AND DISCUSSION

Erythraeidae Robineau-Desvoidy, 1928 Genus *Eatoniana* Cambridge, 1898

Syn.: *Abalakeus* Southcott, 1994

Eatoniana lorestanicus (Saboori & Lachinani, 2003)

Diagnosis of larva [after Saboori and Lachinani (2003)]:

Solenidion on TFe I and Ge III present; two pairs of setae between coxae III; fn Ti 14-15-15; fn Ta 27-23-23; fPp: 0-B-B-BBN₂-B3N ω ζCp.

Remarks

The recent re-examination of the holotype of *E. lorestanicus* by Prof. Alireza Saboori upon request showed that the number of normal setae on Ti II is 15 instead of 14. Also, the number of setae on leg Tarsi I–III and palp setal formula are as follows: fn Ta 27-23-23; fPp: 0-B-B-BBN₂-B3N ω ζCp. Furthermore, Saboori and Lachinani (2003) did not mention the presence of "as" on ventral side of gnathosoma in their description and illustration. However, this seta is present and is short and smooth (5 long) (Fig. 1). Table 1 shows the metric data of *E. lorestanicus* from Lorestan province, and South Khorasan province, Birjand (this study).

Table 1. Metric data for *Eatoniana lorestanicus* from South Khorasan province (present study) and from Lorestan province [Saboori and Lachinani (2003)].

Character	1a	1b	1c	1d	1e	1f	1g	Range	Saboori and Lachinani (2003) N = 9
IL	360	490	610	820	380	540	350	350–820	514–1154
IW	240	260	320	450	260	310	250	240–450	223–534
SD	125	120	125	125	122	127	127	120–127	114–131
W	140	137	150	135	132	135	135	132–150	122–145
AW	107	97	102	100	97	95	100	95–107	85–97
PW	97	95	90	95	97	92	92	90–97	78–90
MA	42	40	43	40	40	40	41	40–43	36–42
AA	17	16	16	16	15	17	17	15–17	10–15
SB	42	42	40	42	42	40	47	40–47	32–39
ISD	75	82	85	80	77	77	85	75–85	73–82
AP	60	55	72	65	57	65	60	55–72	41–68
AL	57/52	52	52	60	60	57	57	52–60	51–65

Table 1. Continued.

Character	1a	1b	1c	1d	1e	1f	1g	Range	Saboori and Lachinani (2003) N = 9
PL	37	40	40	40	40	37	37	37-40	36-44
ASens	65	67	67	62	65	62	55	55-67	58-64 (AM)
PSens	100	107	107	100	100	92	97	92-107	82-97 (S)
DS Min.	32	35	40	35	40	35	40	32-40	34-41
DS Max.	42	50	50	50	55	42	50	42-55	47-53
PDS Min.	32	30	30	40	32	32	27	27-40	27-39
PDS Max.	42	47	40	42	40	42	45	40-47	34-46
1a	20/42	47	40	47	47	45	42/47	40-47	37-48
2a	37	35	37	35	27	30	35	27-37	39 (1)
3a	32	35	30	32	25/32	27	27	25-35	32 (1)
1b	62/75	80	77/70	70/77	87/82	87/75	77/82	62-87	68-80
2b	45	35/42	45	47	47	47	47	35-47	41-51
3b	37	30	30	40	37	30	40	30-40	36-47
GL	190	172	177	167	185	177	180	167-190	170-206
PSFd	50	37	45	40	42	40	40	37-50	32-46
PSGd	32	30	32	30	35	32	30	30-35	20-34
cs	-	45	-	-	42	-	45	42-45	39 (Ga)
as	5	5	5	5	5	5	5	5	-
bs	37	40	42	50	50	42	45	37-50	39-51 (Hy)
Ta I (L)	170	165	175	175	180	175	180	165-180	182-194
Ta I (H)	22	22	22	23	22	22	22	22-23	19-22
Ti I	190	192	177	197	190	195	202	177-202	192-213
Ge I	175	172	177	177	177	175	187	172-187	177-199
TFe I	125	125	122	130	127	130	132	122-132	116-131
BFe I	117	107	125	115	112	110	115	107-125	102-114
Tr I	85	82	82	82	82	82	82	82-85	65-85
Cx I	92	95	100	97	100	92	97	92-100	75-94
Leg I	954	938	958	973	968	959	995	938-995	934-1002
Ta II (L)	142	145	150	150	155	150	150	142-155	150-165
Ta II (H)	23	25	26	25	25	25	24	23-26	19-24
Ti II	165	167	180	172	170	175	175	165-180	172-187
Ge II	147	145	142	147	145	147	152	142-152	138-155
TFe II	112	112	115	117	115	115	117	112-117	102-109
BFe II	92	87	90	90	90	82	92	82-92	85-90
Tr II	80	80	80	77	80	75	77	75-80	63-73
Cx II	95	87	92	87	85	87	87	85-95	70-90
Leg II	833	823	849	840	840	831	850	823-850	803-861
Ta III (L)	150	157	162	152	160	152	155	150-162	160-170
Ta III (H)	20	22	22	21	21	20	20	20-22	17-20
Ti III	267	265	267	265	272	282	287	265-287	262-301
Ge III	142	135	135	137	135	140	145	135-145	133-145
TFe III	135	137	135	140	137	147	150	135-150	128-138
BFe III	105	105	112	102	110	105	117	105-117	97-111
Tr III	85	82	82	82	82	82	85	82-85	65-78
Cx III	87	87	87	85	85	80	87	80-87	71-94
Leg III	971	968	980	963	981	988	1026	963-1026	945-999
IP	2758	2729	2787	2776	2789	2778	2871	2729-2871	2708-2862

This species was described from undetermined grasshoppers (Orthoptera: Acrididae) from Khorram Abad (Lorestan province), Iran. In this study, the species is collected as ectoparasite of *Sphingonotus* sp. (Orthoptera: Acrididae: Oedipodinae). The genus *Sphingonotus* is recorded as new host for *Eatoniana* larvae.

Saboori and Lachinani (2003) in their description of *E. lorestanicus* clearly stated "posterior claw a rod which may be spoon-like". Therefore, it cannot be a difference between *E. lorestanicus* and *E. gonabadensis* as written in identification key in Mağol and Sevsay (2015) and corrected identification key is presented here.

Material examined

Seven specimens (ARS-20190321-1a-1g) were collected as ectoparasites of *Sphingonotus* sp. (Orthoptera: Acrididae: Oedipodinae), IRAN: South Khorasan province, Birjand city, Chahkand village (32° 83' 66" N, 59° 15' 56" E, 1624 m a.s.l.), 18 June 2017, coll. J. Noei. The specimens are deposited in the Acarological Collection, Jalal Afshar Zoological Museum (JAZM), Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.



Figure 1. Ventral view of gnathosoma in the holotype of *Eatoniana lorestanicus* (Saboori & Lachinani, 2003) (larva); *as*, anterior hypostomala, *bs*, posterior hypostomala.

Key to *Eatoniana* larvae of the world [modified after Mağol and Sevsay (2015)]

1. Solenidion on TFe I absent; anterior claw on Ta I–III feather-like and with or without distal hook; posterior claw on Ta I–III feather-like 2
- Solenidion on TFe I present; anterior claw on Ta I–III simple, falciform; posterior claw on Ta I–III with spoon-like rod and covered with numerous onychotrichs 3

- 2. Intercoxalae II absent; anterior claw on Ta I–III without distal hook; AL 49–70*; PL 33–48*; DS 25–48* *E. plumipes* (L. Koch, 1856)
- Intercoxalae II (one pair) present; anterior claw on Ta I–III with distal hook; AL 130–140; PL 106–120; DS 100–140 *E. bambusae* (Zhang, 2000)
- 3. Solenidion on Ge III absent *E. chekei* (Southcott, 1994)
- Solenidion on Ge III present 4
- 4. Two pairs of setae between coxae III; Ti III = 262–301, IP = 2708–2871 *E. lorestanicus* (Saboori & Lachinani, 2003)
- One pair of setae between coxae III; Ti III = 118–179, IP = 1893–2015..... *E. gonabadensis* (Ahmadi, Hajiqaanbar & Saboori, 2012)

* Based on Sedghi *et al.* (2010) and Mağkol and Sevsay (2015)

Neothrombiidae Feider, 1959

***Southcottella* Saboori, 2002**

***Southcottella nematii* Saboori, 2002**

Remarks

Southcottella nematii Saboori, 2002 was described from *Acheta domesticus* (Linnaeus) (Orthoptera: Gryllidae) in Khuzestan province, Ahwaz, Iran (Saboori 2002). The specimen collected in South Khorasan province, Birjand (present study) as ectoparasite of *Acheta domesticus* (Linnaeus) (Orthoptera: Gryllidae) fits to the data of *S. nematii* given by Saboori (2000) except for the longer AW (54 vs. 44–46), ASens (47 vs. 22–28) and AA (45 vs 31–37) (Table 2).

Ahwaz is located in Khuzestan province at the southwest of Iran. This region has a subtropical hot desert climate with long, extremely hot summers and, mild, short winters. In contrast, Birjand (the center of South Khorasan province) at the east of Iran has a desert climate with hot summers and cool winters and a significant difference between day and night temperatures. The observed differences between Ahwaz and Birjand specimens could be due to the different weather conditions and natural vegetation. Collecting further specimens of *S. nematii* from the original locations will allow interpreting the range of species variability. This is a second record from Iran.

Table 2. Metric data for *Southcottella nematii* Saboori, 2002 from Birjand (present study) and from Ahwaz [Saboori (2002)].

Character	Present study	Saboori (2002)	N	Character	Present study	Saboori (2002)	N
IL	630	437–688	5	3b	40	24–41	4
IW	520	359–524	5	cs	11	8	1
SD	83	71–88	5	bs	23	25	1
W	75	63–70	5	Ta I (L)	72	68–71	4
AW	54	44–46	5	Ta I (H)	17	17	4
PW	67	56–61	5	Ti I	37	31–36	4
AA	45	31–37	5	Ge I	27	27–29	4
SB	38	30–36	5	Fe I	50	36–39	4
ASB	55	~44–61	5	Tr I	30	27–36	5
PSB	27	27	5	Cx I	57	48–53	5
MA	16	14–17	4	Leg I	237	243–253	5
AP	41	30–41	5	Ta II (L)	65	61–65	5
AL	31	24–29	4	Ta II (H)	15	15	5
PL	27	24–26	3	Ti II	35	31–36	5

Table 2. Continued.

Character	Present study	Saboori (2002)	N	Character	Present study	Saboori (2002)	N
AM	47	22–28	3	Ge II	22	20–22	5
S	70	~48–65	5	Fe II	42	31–32	5
LSS	77	60–78	5	Tr II	35	24–33	5
HS	23	12–24	5	Cx II	62	49–53	5
SL	42	32–41	4	Leg II	261	222–238	5
SS	28	17–22	5	Ta III (L)	77	72–78	5
DS Min.	45	22–29	5	Ta III (H)	13	14	5
DS Max.	45	36–44	5	Ti III	47	36–46	5
PDS Min.	37	31	4	Ge III	26	22–24	5
PDS Max.	37	36	4	Fe III	50	31–43	5
1a	40	24–34	4	Tr III	50	36–42	5
1b	35	34–41	5	Cx III	57	51–56	5
2a	45	24–34	5	Leg III	307	256–274	5
2b	30	32–46	4	IP	805	725–761	4
3a	29	15–32	5				

Material examined

One specimen (ARS-20190321-2a) is collected as ectoparasite of *Acheta domesticus* (Linnaeus) (Orthoptera: Gryllidae), IRAN: South Khorasan province, Birjand city, Amirabad village (32° 87' 24" N, 59° 13' 66" E, 1421 m a.s.l.), 6 July 2018, coll. J. Noei. The specimen is deposited in the Acarological Collection, Jalal Afshar Zoological Museum (JAZM), Department of Plant Protection, Faculty of Agriculture, University of Tehran, Karaj, Iran.

Trombellidae Thor, 1935

Nothrotrombidium Womersley, 1954

Nothrotrombidium larvae were reported as parasites of Lepidoptera (Noctuidae) and of short-horned grasshoppers of the family Acrididae (Southcott 1987; Ahmadi *et al.* 2011). During this study two species of *Nothrotrombidium* were collected, *Nothrotrombidium* sp. and *Nothrotrombidium birjandensis* Noei, 2017.

Nothrotrombidium sp.

Remarks

This species was collected as ectoparasite of *Caradrina clavipalpis* (Scopoli) (Lepidoptera: Noctuidae). *Caradrina clavipalpis* (Scopoli) is recorded as a new host of *Nothrotrombidium* larvae (Fig. 2). We need more specimens for identification the species because of the bad condition of the specimen. Collecting further specimens of *Nothrotrombidium* sp. from the original location will allow identifying the species.

Material examined

One specimen (ARS-20190321-3a) was collected from IRAN: South Khorasan province, Birjand city, Hotel Kouhestan region (32° 82' 83" N, 59° 17' 82" E, 1706 m a.s.l.), 13 May 2018, coll. J. Noei. The specimen is deposited in the senior author's collection.

***Nothrotrombidium birjandensis* Noei, 2017**

Remarks

Nothrotrombidium birjandensis Noei, 2017 was collected from the original location, South Khorasan province, Birjand.



Figure 2. *Caradrina clavipalpis* (Scopoli) (Lepidoptera: Noctuidae) the host of *Nothrotrombidium* sp. larva.

Material examined

Two specimens (ARS-20190321-4a–4b) were collected from soil litter, IRAN: South Khorasan province, Birjand city, Giok village (32° 79' 22" N, 59° 12' 56" E, 1956 m a.s.l.), 3 June 2018, coll. J. Noei. One specimen (ARS-20190321-4c), same data except 32° 79' 30" N, 59° 12' 45" E, 1951 m.a.s.l. The specimens (ARS-20190321-4a–4c) are deposited in the senior author's collection.

ACKNOWLEDGEMENTS

We are very grateful to Prof. Alireza Saboori for re-examination of the holotype and paratypes of *Eatoniana lorestanicus* (Saboori & Lachinani, 2003) and sending us the photos. The project was supported by a grant (No. 16974) from University of Birjand, Birjand, Iran which is greatly appreciated.

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داده‌های جدید از لاروهای جنس *Nothrotrombidium*، *Southcottella* و *Eatoniana* (Acari: Trombellidae, Neothrombiidae, Erythraeidae) از ایران

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چکیده

لاروهای *Eatoniana lorestanicus* (Saboori & Lachinani, 2003) (Acari: Erythraeidae) به صورت انگل بیرونی از روی ملخ‌های جنس *Sphingonotus* sp. (Orthoptera: Acrididae: Oedipodinae) از روستای چهکند، شهر بیرجند، استان خراسان جنوبی جمع‌آوری شدند. داده‌های ریخت‌شناسی جدیدی از *E. lorestanicus* ارائه می‌شود. گونه‌های *E. lorestanicus* Saboori, *Southcottella nematii* Saboori, *Caradrina clavipalpis* و *Nothrotrombidium birjandensis* Noei, 2017 و 2002 برای دومین بار از ایران گزارش می‌شوند. گونه *Caradrina clavipalpis* (Scopoli) (Lepidoptera: Noctuidae) و جنس *Sphingonotus* به ترتیب به عنوان میزبان برای لاروهای جنس *Nothrotrombidium* و *Eatoniana* برای نخستین بار گزارش می‌شوند. کلید شناسایی گونه‌های *Eatoniana* جهان (لارو) ارائه می‌شود.

واژگان کلیدی: *Abalakeus*؛ بیرجند؛ *Caradrina clavipalpis*؛ *Southcottella*؛ *Sphingonotus*.

اطلاعات مقاله: تاریخ دریافت: ۱۳۹۷/۱۲/۷، تاریخ پذیرش: ۱۳۹۸/۳/۱، تاریخ چاپ: ۱۳۹۸/۴/۲۴