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Introduction of two rare mites (Acari) species from northern Iran

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Abstract: In the study of mite's fauna in Guilan province, northern Iran two rare mites species belonging to different orders were collected and identified from Rasht and Anzali counties. The first species, *Trichotrombidium muscarum* (Riley, 1878) (Prostigmata: Microtrombidiidae) was collected ectoparasitic on the adult house fly *Musca domestica* L. (Insecta: Diptera) from Rasht city. The second species, *Protodinychus punctatus* Evans (1957) (Mesostigmata: Protodinychidae) was collected in the deutonymph stage from soil under broad-leaved trees from Anzali city. These species are rare mites that are reported for the first time from Guilan province, northern Iran.

Keywords: Parasite mites; House fly; Edaphic mites; Rasht; Anzali; New records.

1 Introduction

The house fly *Musca domestica* L. (Diptera: Muscidae) is one of the most widely distributed as a medical importance pest in the world and it can cause problems for public health (Mullen and Durden, 2009). This pest is attacked by a number of natural enemies. Some mites from Mesostigmata and Prostigmata were recorded as predators of egg and larvae or parasite of larvae and pupa of house fly (Malik et al., 2007; Kontschán and Hornok, 2019). For example, *Macrocheles muscaedomesticae* (Scopoli), *M. glaber* (Müller), *M. peniculatus* Berlese, *M. robustulus* (Berlese) and *M. virgo* Halliday from the family Macrochelidae feed on eggs and larvae of house fly (Willis and Axtell, 1968; de Azevedo et al., 2015). Predation of *Cosmolaelaps claviger* (Berlese) from family Laelapidae on house fly eggs and larvae has been proven (Moreira and de Moraes, 2015).

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Mites of the genus *Trichotrombidium* Kobulej (Prostigmata: Microtrombidiidae) were recorded as ectoparasites on adult stage of house fly (Saboori, 2002; Karakurt and Sevsay 2013; Hakimitabar and Saboori, 2018). Larvae of *Trichotrombidium muscarum* (Riley, 1878) was recorded as ectoparasite on adult stage of house fly (Riley, 1878; Hakimitabar and Saboori, 2018).

Mites of the infraorder Uropodina is divided into three superfamilies: the primitive Thinozerconoidea Halbert, the modern Polyaspidoidea Evan and Uropodoidea Evans (Kontschán and Kiss, 2015). Primitive superfamily Thinozerconoidea has two small families Thinozerconidae and Protodinychidae. Family Protodinychidae Evans, 1957 contain of three described species: *Protodinychus punctatus* Evans, *P. evansi* Huţu and Călugăr and *P. ainscoughi Huţu* Călugăr; the *P. punctatus*, occurs in the Northern Europe (Kontschán and Kiss, 2015). The original description of *Protodinychus punctatus* by Evans, 1957 base on female specimens collected from England referred to the unique combination of gamasine and uropodine features (Athias-Binche and Evans, 1981). The description of the deutonymph and male stages of *P. punctatus* by Athias-Binche and Evans (1981) provided better complementary characteristics of the species.

During the study of mite's fauna in Guilan province, northern Iran two rare species were collected and identified. The *Trichotrombidium muscarum* (Riley, 1878) and *Protodinychus punctatus* Evans (1957) are reported from only a few regions in the world. In this article, these two rare species are introduced and their taxonomic characteristics are also provided base on specimens collected from northern Iran.

2 Materials and Methods

This study was carried out in Rasht and Anzali counties, Guilan province northern Iran. Five larvae of *T. muscarum* (Riley, 1878) were collected ectoparasitic on *Musca domestica* L. from Rasht city. Specimens were detached by minute insect pin. One deutonymph of *Protodinychus punctatus* Evans (1957) was collected from soil sample using Berlese funnel. The samples were deposited temporary in 75% ethanol and then dipped in Nesbitt's solution for clarification. Mites were examined under an Hp-41 phase-contrast microscope (HP Co., Shanghai, China) at 1000× magnification. Mites were identified by use of valid references and keys (Riley, 1878; Athias-Binche and Evans, 1981; Saboori, 2002; Karakurt and Sevsay, 2013; Kontschán and Kiss, 2015; Hakimitabar and Saboori, 2018). All the measurements are given in micrometer (m); the average followed (in parentheses) by the respective ranges. The terminology and abbreviations are adapted from Saboori et al. (2009). The voucher specimen of each species was preserved as slide-mounted specimens and they are deposited in the Mite Collection of the Acarology Laboratory, Department of Plant Protection, Faculty of Agricultural Sciences, University of Guilan, Rasht, Iran.

3 Results and Discussions

Trichotrombidium muscarum (Riley, 1878)
Trombidium muscarum (Riley, 1878)

Larva description: Idiosoma swollen, colour in life red (Figs. 1(a-b)), length of idiosoma 702 (620-760), width of idiosoma (in leg III region) 510 (460-550) (Figs. 1(c-d)), scutum pentagonal,

scutellum narrowed, slightly convex at the mid of its anterior border, broader than scutum, scutum and scutellum with longitudinal striations in their lateral parts, a pair of eye plates located posterolaterad of scutum, each contain of two eyes (Figs. 2(e-f)), hysterosoma dorsally with 24 setae arranged in 4 rows and terminally with a row of 4 setae, setae with fine barbs, hysterosoma ventrally with 3 pairs of barbed setae, anus located between the second and third opistosomal setae, coxae 1-3 punctuated, claparéde's organs laterally between coxae I and coxae II (Fig. 2(h)), pretarsus of legs I and II with paired claws and claw-like empodium, pretarsus of leg III with outer claw and empodium, inner claw deformed (Fig. 2(i)). Gnathosoma small with horseshoe-like mouth, mouth bearing large denticles in outside surface, cheliceral blade short and slightly curved, pedipape 5 segmentred (Fig. 2(g)), palpal segments trochanter, femur and genu without setae, tibia with 2, tarsus with 5 setae, 1 eupathidion and 1 solenidion. Measurements result of some body parts base on collected specimens are given in table 1, other morphological features are confirming with the described samples from Iran.

Table 1. Metric data of *Trichotrombidium muscarum* from Guilan province, Iran (measurements in micrometer).

Character	Specimen1	Specimen2	Specimen3	Medium (Range)
IL	725	760	620	701(620-760)
IW	550	520	460	510(460-550)
MA	55	54	52	54(52-55)
AW	103	105	101	103(101-105)
PW	115	112	110	112(110-115)
AA	63	60	60	61(60-63)
SB	92	95	88	92(88-95)
ASB	104	98	93	100(93-104)
PSB	32	29	28	30(28-32)
SD	112	110	109	110(109-112)
AP	45	47	42	45(42-47)
AM	50	52	49	50(49-52)
AL	42	44	40	42(40-44)
PL	55	56	52	54(52-56)
S	62	64	60	62(60-64)
HS	33	34	32	33(32-34)
LSS	143	145	140	143(140-145)
SL	59	52	49	53(49-59)
SS	77	75	64	72(64-77)
DS	30-68	27-54	25-49	27-57(25-68)
DS min.	30	27	25	27(25-30)
DS max.	68	54	49	57(49-68)
Ta I	100	100	100	100(100-100)
Ti I	48	40	40	43(40-48)
Ge I	23	20	20	21(20-23)
Fe I	45	40	40	45(40-45)
Tr I	42	40	40	41(40-42)
Cx I	50	50	50	50(50-50)

Continued Table 1.

Character	Specimen1	Specimen2	Specimen3	Medium (Range)
Leg I	300	280	280	287(280-300)
Ta II	80	90	80	83(80- 90)
Ti II	35	30	30	32(30-35)
Ge II	18	17	15	17(15-18)
Fe II	45	42	47	45(42-47)
Tr II	33	30	28	30(28-33)
Cx II	45	45	44	45(44-45)
Leg II	250	250	250	250(250- 250)
Ta II	80	80	76	79(76-80)
Ti II	33	30	32	32(30-33)
Ge II	15	20	15	17(15-20)
Fe II	50	42	43	45(42-50)
Tr II	25	25	25	25(25-25)
Cx III	45	40	42	42(40-45)
Leg III	250	240	240	243(240-250)

Remarks: The larvae of this parasitic mite have been reported from Australia, India, Madagascar, Turkey and Iran (Arak and Tehran) (Karakurt and Sevsay, 2013; Hakimitabar and Saboori, 2018; Kontschán and Hornok, 2019). *Trichotrombidium muscarum* is the senior synonym of *T. hemistriatum* (Womerslay, 1942) and *T. rafieiae* Saboori, 2002 (Hakimtabar and Saboori 2018). Larvae of *T. muscarum* is true parasite of *Musca domestica*, known only from Iran (Saboori, 2002; Hakimitabar and Saboori, 2018) and from Turkey (Karakurt and Sevsay 2013). Larvae of of *T. muscarum* have been reported from Hungary as parasites of Stable fly *Stomoxys calcitrans* (L.) (Kontschán and Hornok, 2019). This is the first record of *T. muscarum* from Guilan province, northern Iran.

Material examined: Five larvae were obtained as ectoparasites on adult *Musca domestica*, Bint Al-Huda student dormitory of University of Guilan located in the Faculty of Physical Education of University of Guilan, 37°11'09.1"N 49°39'48.4"E, 14 July 2021, collected by Seyedeh Kimia Mirhaghparast.

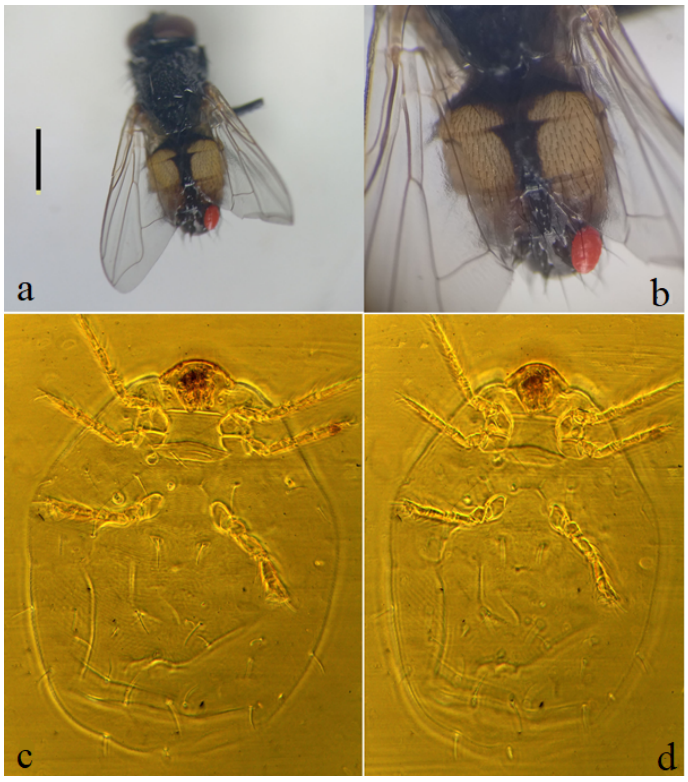

Figure 1: a and b. *Musca domestica* parasitized by *Trichotrombidium muscarum*; c. Dorsal view of *T. muscarum*; d. Ventral view of *T. muscarum*. Scale bar 1300 µm for a-b; 100 µm for c-d.

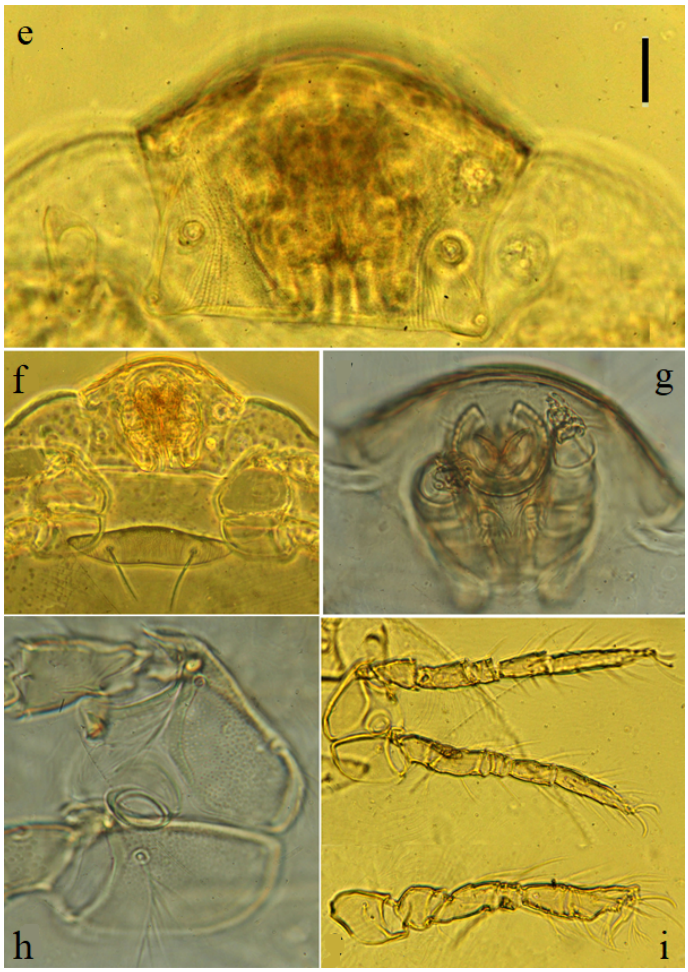

Figure 2: Different body parts of the *Trichotrombidium muscarum*: e. Scutum and oval plate; f. Scutum and scutellum; g. Gnathosoma; h. Claparéde's organs; i. Legs I-III. Scale bar 25 µm for e; 55 µm for f; 20 µm for g; 15 µm for h; 50 µm for i.

Protodinychus punctatus Evans, 1957

Deutonymph description: Length of idiosoma 608, width of idiosoma 504 (in coxa III region); dorsum of idiosoma covered by a small vertex shield bearing setae *j1* and a large oval dorsal shield with 22 pairs of setae comprising: ten pairs of dorsal setae (*j2-j6*, *J1-J5*), one pair of median setae (*z5*) and 11 pairs of lateral setae (*s1-s6*, *S1-S5*). Setae *j3-j5*, *z5* and *s1* are considerably shorter than other setae on the dorsal shield (Fig. 3(j)). Marginal setae (*r1-r6*, *R1-R4*) located on unsclerotized cuticle. In idiosomal venter the narrow rectangular sternogenital shield is fused anterolaterally with the endopodal shields, it bears 5 pairs of needle shape and short setae (*st1-st5*), length of sternogenital shield 284, width of sternogenital shield 100 (in sternal setae III region) (Fig. 3(k)). The anterior margin of the sternogenital shield in region of the tritosternum with a small U-shaped depression. Anterior margin of the sternogenital shield is produced into two triangular processes which partially separated coxa I from gnathosoma and tritosternum. Tritosternum with two pilose laciniae, base of tritosternum cylindrical with 40 µm long, length of laciniae 84 (Fig. 6(p)). The expodal shields are entirely fused with the peritremal shield and are separated from the endopodal shields between and posterior to the coxa. The stigmata are situated at the level of the anterior margin of coxae IV and the peritremes extend to the level of setae z1, margins of the peritremal canal are serrated (Fig. 3(j)). Ventrianal shield with 212 long and 132 wide, with 4 pairs of *JV* setae and 4 pairs of *ZV* setae. Metapodal shield triangular with 250 lengths. The anal opening located on a hairless sub-circular disc, length 68. Apodemes in the anal region are clearly visible. Tectum arcuate with depression in the anterior margin (Fig. 5(n)). Chelicera pincer like, movable digit with one tooth and 40 long, fixed digit with 2 teeth and 42 long (Fig. 4(l)). Pedipalp 5 segmented with two-tined apotele (Fig. 4(m)). Conrniculus horn shape (Fig. 5(o)), hypostome with 3 pairs of long hypostomal setae (*h1-h3*) (Fig. 6(q)).

Material examined: One deutonymph was collected from soil under broad leaves trees in Anzali city, Guilan province, northern Iran, 37°11'09.1"N 49°39'48.4"E, 28 June 2018, collected by Jalil Hajizadeh.

Remarks: *Protodinychus punctatus* has been recorded from Europe (England, Germany, Latvia, Poland and Hungary) and Asia (Iran) (Karg, 1989; Napierała and Błoszyk, 2013; Kontschán and Kiss, 2015, Babaeian, 2016).

Figure 3: Deutonymph of *Protodinychus punctatus*: j. Dorsal view of body, k. Ventral view of body. Scale bar 100 µm.

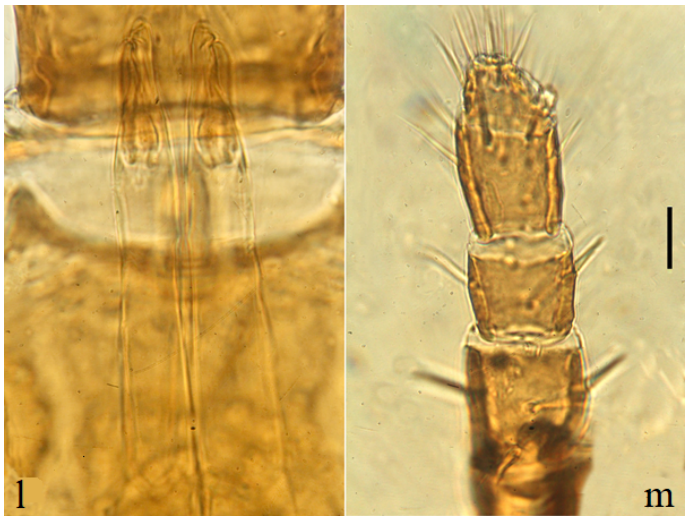

Figure 4: Deutonymph of *Protodinychus punctatus*: l. Chelicerae, m. Palp. Scale bar 20 µm

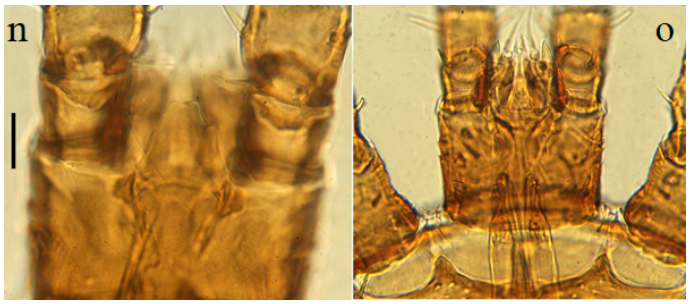

Figure 5: Deutonymph of *Protodinychus punctatus*: n. Tectum, o. Corniculi. Scale bar 20 µm.

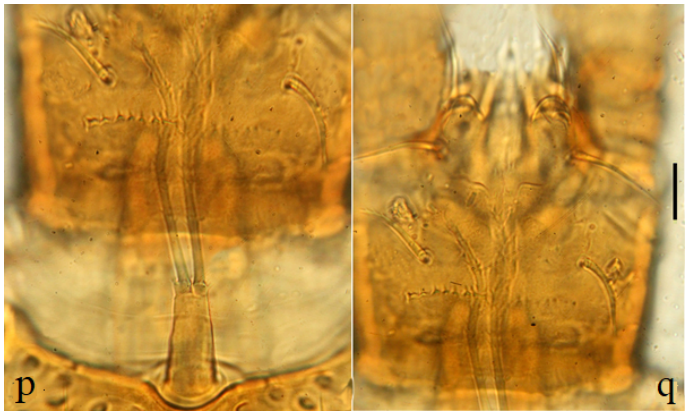

Figure 6: Deutonymph of *Protodinychus punctatus*: p. Tritosternum, q. Hypostome. Scale bar 20 µm.

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Conflict of interests

The authors declare that there are no competing interests.

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