Case Report

The First Report of *Eustigmaeus johnstoni* (Acari: Stigmaeidae) Parasitic Mite of Phlebotominae Sand Flies from Iran

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Abstract

Background: Stigmaeids mites have been recorded only on Phlebotominae sand flies up to now. Five species of *Eustigmaeus*, and three of *Stigmaeus* were reported on infested sandflies in different country up to the present.
Methods: Sand flies collection was done using CDC light trap and sticky paper. The mites were isolated from infested specimens, mounted in Puri's medium and identified using reliable keys.
Results: A mite infested *Phlebotomus papatasi* was observed during a study on sandflies of one of the southern provinces of Iran, near to the Persian Gulf. Several scars resulting from mite attachment were found on abdominal tergites of this female sand fly. The mites were identified as *Eustigmaeus johnstoni***.**
Conclusion: This parasitic mite is one of the eyeless species, which has a great distribution over the world, reported from Tunisia, Saudi Arabia, Pakistan, Yemen, Cyprus and Palestine. But, this is the first record of this species from Iran.

Keywords: *Eustigmaeus johnstoni*, *Phlebotomus papatasi*, sand flies, Mite, Iran

Introduction

Five species of *Eustigmaeus* and three species of *Stigmaeus* (both Stigmaeidae), also one species of *Dasythyreus* (Dasythyreidae) have been reported as parasitic mites on insects yet. Stigmaeids mites have been recorded only on sand flies *Eustigmaeus dyemkoumai* (Abbonec 1970), *E. gamma, E. gorgasi* and *E. parasitica* (Chaudri 1965), *E. johnstoni* (Zhang and Gerson 1995), (Shehata and Baker 1996), *Stigmaeus smithi* (Mitra and Mitra 1953), *S. sinaei* (Swift 1987) and *S. youngi* (Hirst 1926 and Wood 1972) were reported as parasitic mites of different species of Phlebotominae sand flies comprising *Phlebotomus* and *Sergentomyia* spp.

Mites of genus *Eustigmaeus* Berlese, 1910 (Prostigmata: Stigmaeidae) comprise a group of globate, red acarines whose their bodies are covered by ornamental armour. In females this dorsal armour is separated into propodosomal and hysterosomal plates, the latter being often subdivided in the males. Females carry thirteen pairs variously-shaped dorsal setae, of which three pairs are often ventrally displayed: the humerals (c_2) laterally and the posteriormost b_1 and b_2 caudally. Most species have one pair of eyes, located between propodosomal setae ve and sci. The eyeless species include *E. lirella*, *E. parasitica*, *E. gamma*, *E. gorgasi* and *E. johnstoni* (Zhang and Gerson 1995).

Parasitic mite, *E. johnstoni* has a broad distribution and was reported from different countries including Yemen, Saudi Arabia, Palestine, Cyprus, Tunisia and Pakistan (Eddie et al. 2006). However, this is the first report of this

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mite from Iran. Several reports from different parts of the world provide this evidence that the *Eustigmaeus*-sand fly association is not accidental (Zhang and Gerson 1995).

Materials and Methods

Sand fly collection was done using CDC light trap and sticky trap in July 2010. We observed a sand fly (out of 286 collected specimens) which infested with mite, during a study on the Phlebotominae of Zirah Village (Bushehr Province) located south of Iran, in 2010. The mites were identified using the keys of Zhang and Gerson (1995) and Fan and Zhang (2005). Setal terminology follows Kethley (1990) and Zhang and Gerson (1995). Also some of the morphological characters were measured using gradient lens. All measurements are in micron.

Accordind to Fan and Zang 2005 the following characters were used to identify the *Eustigmaeus spp* from the other genus of Stigmaeidae (Key to genus *Eustigmaeus*, also key to eyeless *Eustigmaeus* species are mentioned at the end of the article**).**

Palptibial claw prominent, sub equal to palptarsus; with 2 pairs of subcapitular setae, Setae e1 and f1 situated on same shield in female (except Villersiella), without genital setae, Chelicerae separate, Prodorsal and dorsal hysterosomal shields separate, Setae sce situated on main prodorsal shield and Setae d1 and e1 situated on same shield.

Results

The infested sand fly was identified as *Phlebotomus papatasi* (female). At least three mites (also female) were observed on the parasitized specimen, one near to the legs and two others attached on the abdomen (Fig. 1a and 1b). Several scars were observed resulting from mite attachment. The scars occurred only on the abdomen, particularly the anterior tergites. They had irregular outline, dark in color with a pale border (Fig. 2).

According to the keys, the mite, was identified as *Eustigmaeus johnstoni* Zhang and Gerson, 1995 (Acai: Stigmaeidae) (Fig. 3a, 3b, 3c, 3d and 3e). According to Zhang and Gerson (1995) variation in the lengths and distances between dorsal setae are evident in specimens from different countries. As Table 1 shows our measurements are comparable with the extent that he was stated, but due to the small number of mite in our access, the statistical comparison was not possible and meaningful.

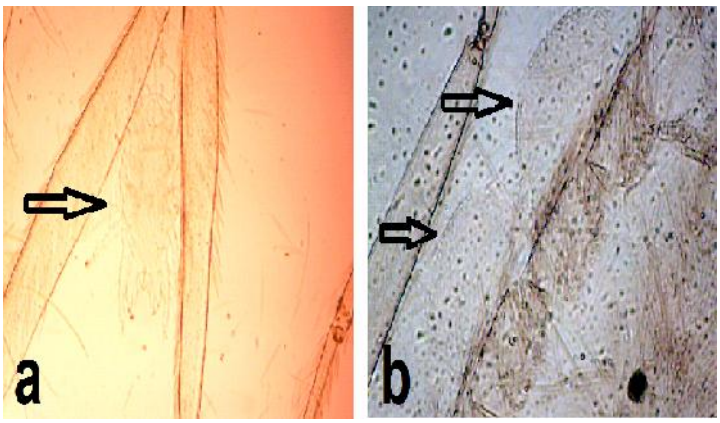

Fig. 1. *Eustigmaeus johnstoni*, located near the legs of infested *Phlebotomus papatasi* (a) and two others attached to its abdomen (b) Iran, 2010

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Table 1. Measurements (µ) of dorsal setae and setal distances in *Eustigmaeus johnstoni* (female), Iran, 2010 in comparison with other countries (Zhang et al. 1995)

	Yemen	Saudi Arabia	Cyprus	Tunis	Pakistan	Iran	n
v_i	22–32	19-23	24	21	21	25	1
v_e	23-28	19-21	23	22	21	27	14
sc_i	18-23	15-20	21	21	19	20	15
sc_e	22-28	19-23	21	21	21-23	25	13
c_1	22-26	19-23	21	23	21	27	14
c_2	22-28	19-23	22	23	22-23	18	15
d_1	19-28	19-21	21	23	21-22	26	14
d_2	19-26	17-21	21	21	20-21	22	15
e_1	22-28	21-23	23	21	20-21	23	14
e_2	20-23	19-23	23	19	20-21	22	15
f	24-35	21-25	28	24	23-24	28	14
b_1	22-32	20-26	24	21	24	24	15
b_2	23-24	19-23	21	19	21	25	13
v_i-v_i	32-34	23-32	30	28	26-27	31	13
v_e-v_e	54-56	41-49	47	47	42-50	58	13
sc_i-sc_i	91-95	80-86	86	86	78-81	100	13
sc_e-sc_e	112-120	100-114	109	103	105	130	13
c_1-c_1	51-60	41-54	50	50	52-53	54	12
d_1-d_1	40-56	43-52	54	53	47-52	57	13
d_2-d_2	133-140	106-128	126	116	116	135	13
e_1-e_1	44-49	34-45	43	42	40	48	12
e_2-e_2	110-116	84-111	100	92	90	120	12
f-f	56-59	48-60	54	50	52-57	65	11
b_1-b_1	24-26	19-25	23	22	17-21	25	12
b_2-b_2	56-71	49-63	58	54	54	70	12

Fig. 2. Abdominal scars left on female *Phlebotomus papatasi* which was infested by three *Eustigmaeus johnstoni* mite, Iran, 2010

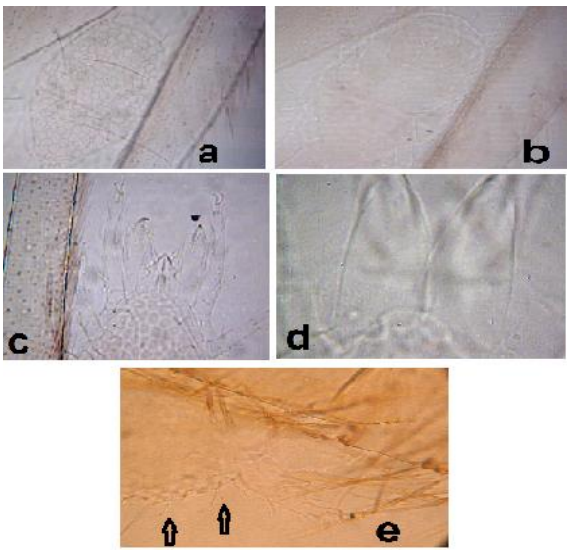

Fig. 3. Parasitic mite, *Eustigmaeus johnstoni*, on *Phlebotomus papatasi* from Iran, 2010, a. Idiosoma, dorsal view, b. Idiosoma, ventral view, c. upper part of Idiosoma, palp and legs, d. Chelicera, e. setae with long branches

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Discussion

Parasitic mite, *E. johnstoni* has a broad distribution and was reported from different countries, however this is the first report of this parasitic mite from Iran. Members of Stigmaeidae are soil or plant dwelling mites which are regarded as predators of other small arthropods (Swift 1987). Little is known about the relationship between mites and sand flies, whether this association is phoretic or parasitism? But several reports of scars, left by mites on infested sand flies (Mitra and Marta 1953, Abbonec 1970, Lewis and Macfarlane 1982) strengthen the parasitic relationship.

However, the nature of *Eustigmaeus*-sand fly association remains indeterminate. There is no report of males or immature of *Eustigmaeus* on phlebotominae sandflies. It could be postulated that development and mating of the mentioned mite were done elsewhere, probably in the habitat where sandflies breed and rest. So, additional work at different times of the year also in other areas, with investigations of sand fly breeding and resting sites are essential to provide further insight to the significance of the mite-sand fly association. Also the exact nature of these parasitic mites infestation is poorly understood and further works are required to determine if such heavily infected sand flies have reduced longevity.

Key to eyeless *Eustigmaeus* Genus (Zhang and Gerson 1995)

1- Dorsal hysterosomal setae c_1 and d_1 short, not reaching the bases (alveoli) of any neighboring setae..... 2
- Dorsal hysterosomal setae c_1 and d_1 long, over reaching the bases (alveoli) of at least two neighbouring setae..... 4
2- Distance between alveoli of dorsal setae pairs, c_1-c_1, d_1-d_1 and e_1-e_1 subequal..... 3
- Distance c_1-c_1 and d_1-d_1 subequal, both mach less than e_1-e_1 (setae e_1 laterally displaced) ……..…… ***Eustigmaeus gamma***
3- Dorsal setae flat, with short barbs on distal ¾; all intercoxal setae (1a, 3a and 4a) weakly barbed……...…….. ***E. lirella***
- Dorsal setae thin, with long branches throughout; intercoxal setae (1a, 3a, and 4a) with long branches……..... ***E. johnstoni***

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