

ASYMMETRIC VARIATIONS IN SOME SPECIES OF THE GENUS *Raphignathus* Dugès (ACARI: RAPHIGNATHIDAE)

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Cite this article as:

Bingül M., Doğan S., Doğan S. 2018. Asymmetric Variations in some Species of the Genus *Raphignathus* Dugès (Acari: Raphignathidae). *Trakya Univ J Nat Sci*, 19(1) 55-58, DOI: 10.23902/trkjnat.346537

Received: 11 August 2017, Accepted: 13 February 2018, Online First: 27 February 2018, Published: 15 April 2018

Abstract: In this study, asymmetric variations in dorsal and ventral body setae in some adult females in three species of the genus *Raphignathus* Dugès; *R. gracilis* (Rack), *R. hecmatanaensis* Khanjani & Ueckermann and *R. kuznetzovi* Doğan & Ayyıldız were given and photographed. Records on asymmetric variations in *Raphignathus* species found in the literature were also reviewed.

Key words: Anomaly, asymmetric variation, *Raphignathus*, morphology.

Özet: Bu çalışmada, *Raphignathus* Dugès cinsine ait *R. gracilis* (Rack), *R. hecmatanaensis* Khanjani & Ueckermann ve *R. kuznetzovi* Doğan & Ayyıldız türlerinin bazı dişilerinde görülen sırt ve karın kıllarındaki asimetrik varyasyonlar verilmiş ve fotoğrafları alınmıştır. Ayrıca, literatürde geçen *Raphignathus* türleriyle ilgili asimetrik varyasyon kayıtları gözden geçirilmiştir.

Introduction

The mites show a variety of morphological variations, as in other living organisms, among which variations in the form of unilateral or bilateral absences of exoskeletal structures are very common, resulting in asymmetrical individuals. Asymmetric variations can be considered as the deviations from symmetry in bilaterally paired structures and are called as anomalies. Morphological variations in mites are inevitable results of a series of changes in genetic structures and ecological changes occurring in the environments. Considering that fact that asymmetric anomalies of taxonomically important structures may cause taxonomic errors, taxonomists should have more knowledge about morphological anomalies (Bingül *et al.* 2017a).

The genus *Raphignathus* Dugès has a worldwide distribution with 68 species of which 23 have been recorded from Turkey so far (Koç & Ayyıldız 1996, Doğan 2003, Doğan & Ayyıldız 2003, Koç & Akyol 2004, Koç & Kara 2005, Akyol & Koç 2006, Akyol & Koç 2007, Doğan 2007, Erman *et al.* 2007, Bagheri *et al.* 2013, Dönel & Doğan 2013, Khanjani *et al.* 2013, Bingül *et al.* 2017b). Representatives of the genus are predaceous and can be found underneath tree barks and in litter, moss, lichen, soil, stored products, house dust and bird nests. They are easily recognized by the fused cheliceral bases, forming a stylophore, cervical peritremes not embedded in dorsal surface of stylophore

and confluent coxae (Fan & Zhang 2005, Dönel & Doğan 2013).

In spite of many taxonomic and faunal works on mites of the genus *Raphignathus*, data on morphological variations in this group is very limited. Some asymmetric variations in only three species, *Raphignathus gracilis* (Rack), *R. hecmatanaensis* Khanjani & Ueckermann, *R. collegiatus* Atyeo, Baker & Crossley, of the genus were reported by Gerson (1968), Khanjani & Ueckermann (2003), Koç & Akyol (2004), Doğan (2006) and Akyol (2014).

During a faunal study on urban mites of Erzincan province in Turkey (Bingül 2016), asymmetric variations were observed in 13 specimens of *Raphignathus gracilis*, *R. hecmatanaensis* and *R. kuznetzovi* Doğan & Ayyıldız. In this study, we aimed to contribute to the knowledge on anomalies observed in *Raphignathus* mites.

Materials and Methods

Mite specimens were collected from grass, moss, soil and litter under *Pinus nigra* Arnold, *P. sylvestris* L., *Pyrus* sp., *Rosa canina* L. and *Thuja* sp. during a study carried on from 2014 to 2016 on biodiversity of urban mites in Erzincan city center (Turkey). The specimens were extracted by using Berlese funnels, cleared in 60% lactic acid and mounted on microscopic slides in Hoyer's medium. Asymmetric characters of some specimens were

determined and photographed by using Olympus BX63-CBH DIC microscopes.

Results

Our microscopic investigations showed that 13 (1.68%) of the 773 specimens investigated showed asymmetric variations. Most of the variations were

determined on *Raphignathus hecmatanaensis* (n=10, 76.92%), followed by *R. gracilis* (n=2, 15.38%) and *R. kuznetzovi* (n=1, 7.69%). The 13 specimens of the three species differed from others by asymmetric variations in the number of their coxal setae ($4c$), aggenital setae (ag_2), genital setae (g_2), internal pair of humeral setae (c_1) and the location of setae f_1 (Table 1).

Table 1. Morphological variations in *Raphignathus* mites.

Species	Asymmetric variations
<i>R. hecmatanaensis</i>	1 ♀, right seta ag_2 is duplex (Fig. 1)
	2 ♀♀, right genital valve bears an extra seta (Fig. 2)
	3 ♀♀, left genital valve bears an extra seta (Fig. 3)
	1 ♀, left seta g_2 is absent (Fig. 4)
	3 ♀♀, right seta f_1 located on striated integument (Fig. 5)
<i>R. gracilis</i>	1 ♀, left aggenital seta ag_2 is duplex (Fig. 6)
	1 ♀, left seta f_1 located on striated integument (Fig. 7)
<i>R. kuznetzovi</i>	1 ♀, left seta c_1 and left seta $4c$ are absent (Figs 8 and 9)

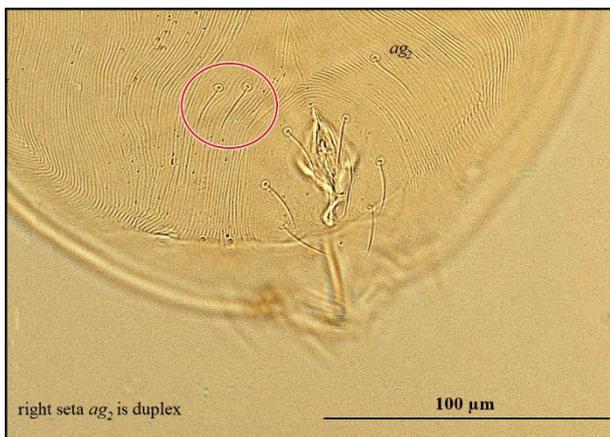


Fig. 1. *Raphignathus hecmatanaensis* (female): variation in the number of aggenital setae.



Fig. 3. *Raphignathus hecmatanaensis* (female): variation in the number of genital setae.

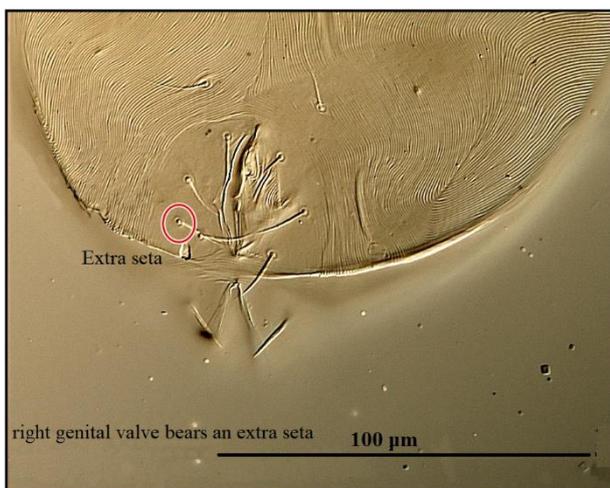


Fig. 2. *Raphignathus hecmatanaensis* (female): variation in the number of genital setae.

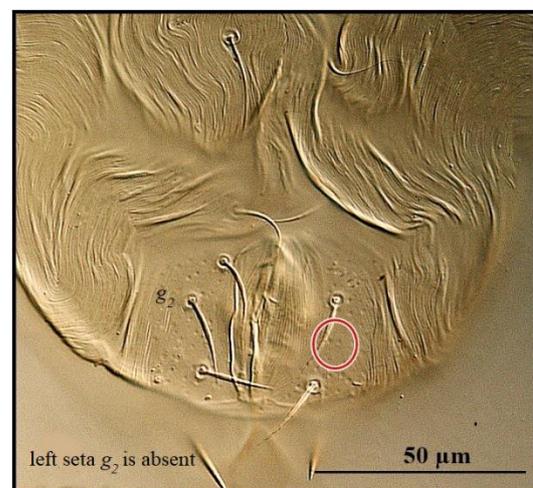


Fig. 4. *Raphignathus hecmatanaensis* (female): variation in the number of genital setae.

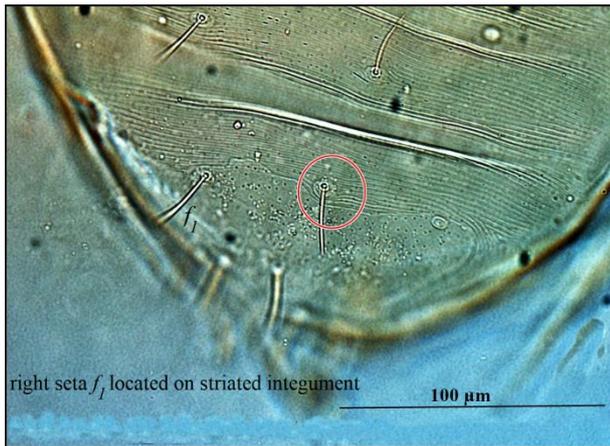


Fig. 5. *Raphignathus hecmatanaensis* (female): variation in the location of setae f_1

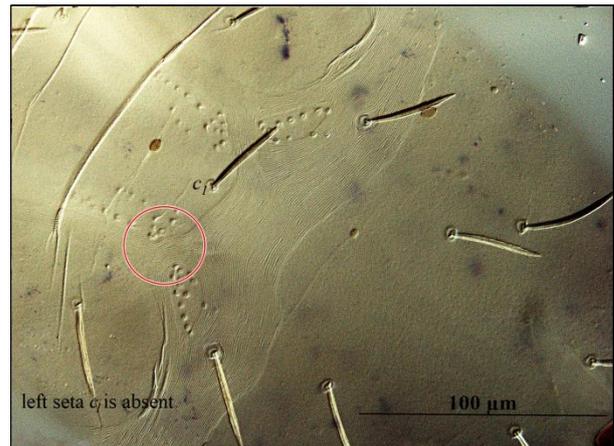


Fig. 8. *Raphignathus kuznetzovi* (female): variation in the number of setae c_1

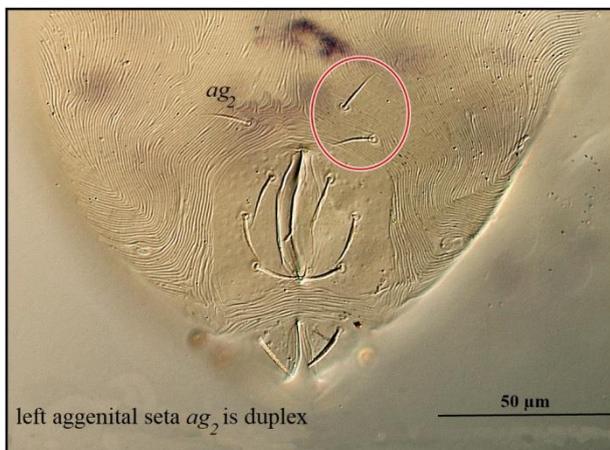


Fig. 6. *Raphignathus gracilis* (female): variation in the number of aggenital setae.

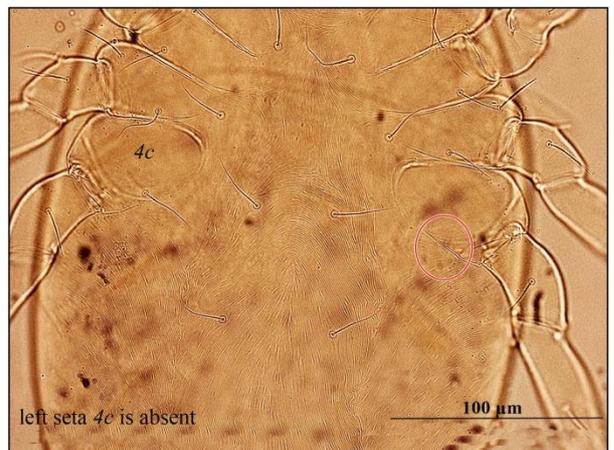


Fig. 9. *Raphignathus kuznetzovi* (female): variation in the number of setae $4c$

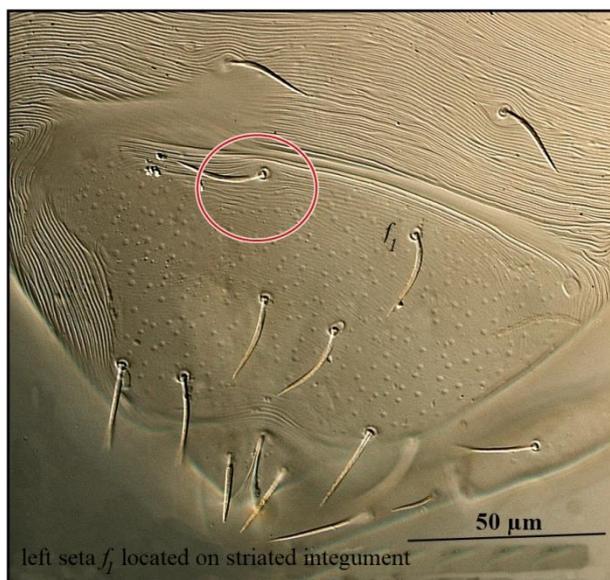


Fig. 7. *Raphignathus gracilis* (female): variation in the location of setae f_1

Discussion

Some authors reported asymmetric variations in the genus *Raphignathus*. Gerson (1968) reported that some specimens of *R. gracilis* either had ventral aggenital setae duplicated or had four genital setae on one side. Khanjani & Ueckermann (2003) determined variation in the number of genital setae in *R. hecmatanaensis*. The authors observed in one specimen that there were three setae on one side and four setae on other side on genital valves. Similar variations in the number of genital setae were recently reported for females of *R. hecmatanaensis* by Akyol (2014). Nine of the females Akyol (2014) investigated had 7 genital setae and one female had 5 genital setae. Koç & Akyol (2004) reported that one adult specimen of *R. collegiatus* Atyeo, Baker & Crossley had four genital setae on one of the genital valves while another specimen had two genital setae. Doğan (2006) reported two genital setae, instead of three, were present on the left side of holotype of *R. ozkani* Doğan.

The authors observed asymmetric variations only in the number of aggenital and genital setae in the studied mite group. Variations in the number of coxal setae ($4c$),

humeral setae (c_1) and the location of setae f_1 are reported for the first time with this study. Furthermore, asymmetric variation in *R. kuznetzovi* is reported for the first time.

Within the same faunal study (Bingül 2016) with which the current study material was collected, morphological abnormalities in some stigmatid species were also reported by Bingül *et al.* (2017a). Bingül *et al.* (2017a) mentioned numerical variations on some body setae and differences in length and shape of some body setae in the stigmatid species. In our observations on *Raphignathus* mite specimens, numerical variations were also found in some setae as in the case of stigmatid species.

Data on asymmetric variations in *Raphignathus* is very limited. Observed structural changes in the present work are easily detectable variations distorting bilateral

symmetry. Such morphological variations, in other words anomalies, can be considered as minor changes distorting bilateral symmetry. These asymmetric variations may be induced by random environmental stresses, genetic problems during development or epigenetic changes, and are accord with the concept of fluctuating asymmetry (Bingül *et al.* 2017a). More detailed studies should be performed for confirmation of factors causing asymmetric variations.

Acknowledgement

This study is a part of the first author's MSc thesis, and was presented as a short summary with oral presentation at 3rd International Symposium on EuroAsian Biodiversity (SEAB 2017), held from July 5 to 8, 2017 in Minsk, Belarus.

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