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Article

Edaphic mites of the cohort Gamasina (Acari: Mesostigmata) in the Ecological Garden of Nowshahr, Iran

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Abstract

A faunistic survey was carried out on edaphic mites of the cohort Gamasina in the Ecological (Botanical) Garden of Nowshahr, Mazandaran Province, Iran. The samples were taken randomly from different habitats since February 2014 to January 2015. A total of 458 specimens belonging to 34 species, 20 genera, 12 families and five superfamilies were collected and identified from which two species, *Gamasolaelaps whartoni* (Farrier, 1957) (Veigaiidae) and *Pergamasus brevicornis* Berlese, 1903 (Parasitidae), reported for the first time from Iran. Among them, the most frequent species were *Gamasiphis lanceolatus* Karg, 1987 (20.96%), *Pachylaelaps grandis* Koroleva, 1977 (18.78%) and *Laelaspis astronomicus* (Koch, 1839) (18.56%), respectively. Furthermore, Laelapidae (24.23%), Ologamasidae (21.61%) and Pachylaelapidae (20.30%) were the most frequent families.

Key words: Botanical Garden; fauna; *Gamasolaelaps whartoni*; *Pergamasus brevicornis*; soil-inhabiting mites.

Introduction

The cosmopolitan mite assemblage of Mesostigmata is the largest group of Parasitiformes known from a wide range of habitats. Most of them are free-living predators in soil and litter, on the soil surface or on plants, feeding on small invertebrates. The majority of described species of mesostigmatic mites belonging to the cohort Gamasina comprises several known soil predators, biological control agents, and also animal parasites (Karg 1993; Lindquist *et al.* 2009).

The Ecological Garden of Nowshahr (or Botanical Garden of Nowshahr) was created in 1954 with the name of "Agricultural Station of Nowshahr", and currently comprises 640 species of native and exotic species, including 260 species of trees, 190 shrubs, 90 bulbs and also100 species of annual and perennial plants and cacti. This garden extends over 8.5 hectares of plain lands of Nowshahr City (Mazandaran Province) at an elevation of 30 m a.s.l. and with annual precipitation of 1329 mm.

Before the current research, only the following mesostigmatic mite species had been reported from the Ecological Garden of Nowshahr: *Holaspulus tenuipes* (Berlese), *Neogamasus insignis* (Holzmann), *Neparholaspis* sp., *Olopachys compositus* Koroleva, and *Parasitus fimetorum* (Berlese) (Kazemi and Ahangaran 2011; Kazemi and Rajaei 2013; Kazemi *et al*. 2012, 2013). Previously, two more species related to this research were reported from this garden and considered as new records for the acarofauna of Iran: *Neparholaspis arcuata* Petrova and *Veigaia uncata* Farrier (Kazemi *et al.* 2014; Saberi *et al.* 2014). The aim of this research is to represent the fauna of edaphic Gamasina mites of the Ecological Garden of Nowshahr, along with the species, genera and families' relative frequencies. In this paper, we report two new records for the mite fauna of Iran and present some new morphological data for *Pachylaelaps grandis* Koroleva, 1977 and *Gamasolaelaps whartoni* (Farrier, 1957).

Material and methods

Mite specimens were randomly collected from soil and litter of different areas of the Ecological Garden of Nowshahr since February 2014 to January 2015, extracted by Berlese-Tullgren funnels, cleared in Nesbitt's fluid and then mounted in Hoyer's medium on microscope slides.

Morphological observations, measurements and illustrations were made using compound microscopes equipped with differential interference contrast and phase contrast optical systems, and a drawing tube. Measurements were made in micrometers (μm). The lengths of dorsal, sternal and epigynal shields were taken from the anterior to posterior shield margins along the midline. The width of dorsal and epigynal shields were taken from the lateral margins at the broadest level and those of sternal shields at the level of sternal setae *st2*. The anal shield lengths and widths were measured along their midline from the anterior to posterior margins, including the cribrum, and at the broadest point, respectively. The leg lengths were taken from the base of the coxa to the apex of the tarsus, excluding the ambulacrum. The length of the second cheliceral segment was measured from the base to the apex of the fixed digit, and its width at the broadest point. The length of the fixed cheliceral digit was taken from the dorsal poroid to the apex, and that of the movable digits from the base to apex. Notation for idiosomal pore-like structures (poroids) follows Athias-Henriot (1971, 1975).

Results

A total of 458 specimens belonging to 34 species of the cohort Gamasina were collected from soil and litter of the Ecological Garden of Nowshahr. Table 1 shows a list of the species, total number of specimens of each studied family, genus and species, and their percentage. Among the collected mites two species, *Gamasolaelaps whartoni* and *Pergamasus brevicornis* Berlese, are considered as new records for the acarofauna of Iran. Only one individual of the following six species were collected: *Pogonolaelaps beaulieui* Nemati and Gwiazdowicz; *Laelaspis humeratus* (Berlese); *Reductholaspis analis* (Hyatt and Emberson); *Parasitus consanguineous* Oudemans and Voigts; *Epicriopsis palustris* Karg and *Podocinum pacificum* Berlese. On the other hand, the following species showed the highest numbers (in parentheses): *Gamasiphis lanceolatus* Karg (96), *Pachylaelaps grandis* (86), and *Laelaspis astronomicus* (Koch) (85). Also, the families Laelapidae (111), Ologamasidae (99) and Pachylaelapidae (93) had the highest numbers of collected specimens, respectively.

Family Veigaiidae
Genus *Gamasolaelaps* Berlese

Gamasolaelaps whartoni (Farrier, 1957) (Fig. 1)

Gorirossia whartoni Farrier, 1957: p. 91.

Measurements of the studied specimens (female) – Dorsal shield length 310–341, podonotal shield width 227–253; lengths of setae: *j1–3* 20–25, *z1* 11–13, other podonotal shield setae 11–21, opisthonotal setae 12–13. Sternal shield length 93–96, width 73–77, sternal setae *st1* 25–26, *st2* 22–24, *st3* 23–25, *st4* 20–21 long. Width of genitoventral shield at broadest level 73–81, anterior pairs of genitoventral setae 7–10, posterior pair 22–23 long. Anal shield length 55–56, width 54–55, para-anal setae 17, postanal seta 16–17 long. Length of movable digit of chelicera 30–32, length of fixed digit 30–33, length of second segment of chelicera 75–76. Length of palps 142–147. Length of legs I–IV 414–431, 311–319, 282–293, 422–454, respectively; lengths of tarsi I–IV 55–59, 17–18, 15–18, 18–21, respectively.

Note – So far, four species of the genus *Gamasolaelaps*, including *G. whartoni* (Farrier, 1957) [originally described as *Gorirossia whartoni* from USA], *G. pygmaeus* Bregetova, 1961 [originally described from former Russia], *G. cooki* (Woodring, 1964) [originally described as *Gorirossia cooki* from USA] and *G. ctenisetiger* Ishikawa, 1978 [originally described from Japan], have been described with the following shared morphological characters: movable digit of chelicera with five teeth; genitoventral shield of female with three pairs of setae, posterior pair considerably longer; podonotal and opisthonotal shields fused medially; epistome two-tined. After examining the type materials of *G. whartoni* and *G. cooki* and comparing them with the original descriptions of *G. pygmaeus* and *G. ctenisetiger*, Hurlbutt (1983) proposed to synonymize these four species, and Karg (2006) followed him, although several year before (Karg 1998) had considered *G. pygmaeus* and *G. whartoni* as two distinct species and separated them by the smooth lateral margins of the anterior prongs of epistome in the former species and laterally denticulate prongs in *G. whartoni*. Fenďa and Lukáš (2014) reported *G. pygmaeus* from Slovakia and presented a photo of the species. In pers. comm. of the junior author (SK) with Peter Fenďa, we found the epistome with lateral prongs smooth for the Slovakian specimens, as in the original description. Therefore, it seems *G. pygmaeus* can be a different species, and it needs to be carefully re-examined.

Morphological characters of the specimens collected in northern Iran resemble to those reported from Japan and Tanzania (Ishikawa 1978; Hurlbutt 1983), but palptarsus apotele of the species has three longer tines and a short basal tine (Fig. 1), while it was mentioned having a three-tines apotele in Ishikawa (1978) and it was not mentioned in Farrier (1957), Ishikawa (1978) and Hurlbutt (1983).

Family Parasitidae
Genus *Pergamasus* Berlese

Pergamasus brevicornis Berlese, 1903

Pergamasus brevicornis Berlese, 1903: p. 263.

Figures 1–2. 1. *Gamasolaelaps whartoni* (female), subcapitulum; 2. *Pachylaelaps grandis* (female), position of *gd7* and *gd8* on dorsal shield.

Measurements of the studied specimens (female) – Dorsal shield length 1098–1141, width 811–835. Sternal shield length 160–166, width 224–229, length of sternal setae *st1* 108–113, *st2* 123–126, *st3* 126–129. Metasternal setae *st4* 98–102 long. Epigynal shield length 257–262, width 344–351, setae *st5* 100–106 long. Length of second segment of chelicera 331–336, length of movable digit of chelicera 162–164, length of fixed digit 142–145. Length of palp 369–376. Length of legs I–IV 1401–1443, 978–994, 778–805, 1259–1288, respectively.

Family Pachylaelapidae
Genus *Pachylaelaps* Berlese

Pachylaelaps grandis Koroleva, 1977 (Fig. 2)

Pachylaelaps grandis Koroleva, 1977: p. 127.

Note – Previously, *P. grandis* had been reported from Golestan and Tehran provinces (Zakeri *et al.* 2011; Ahadyiat and Cheraghali 2012), and in this research we found several specimens of the species. Mašán (2007) removed this species from the key for the genus because in the original description of the species by Koroleva (1977) no information about the situation of hypertrophied gland pores *gd7* and *gd8* [respectively, *gdZ1* and *gdS4* in Mašán (2007) following Johnston and Moraza (1991)], as an important diagnostic character of the species, was presented. After examination of the

specimens collected from the Ecological Garden of Nowshahr, we found that they are situated in an adjacent situation and between setae *Z2* and *S4* (Fig. 2).

Discussion

Kazemi and Rajaei (2013) reported 348 species belonging to 128 genera of Iranian mesostigmatic mites, excluding the family Phytoseiidae. Among them, 54 species belonging to the cohort Gamasina have been recorded from soil habitats in Mazandaran Province. In this research, 34 species were collected of which half of them were not presented in Kazemi and Rajaei (2013). So, it indicates that acarofauna of the Ecological Garden of Nowshahr is very diverse and that may be related to rich flora of this garden. The results suggest that this ecological garden, as an especial ecosystem, should be carefully protected and conserved.

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Table 1. List of the collected Gamasina mites in Nowshahr Ecological Garden, total number of each family, genus and species and their percentage.

Family and species	Number of collected specimens (male, female, deutonymph)	percentage
Family Blattisociidae	11	2.40
Cheiroseius Berlese	11	2.40
C. sp.	11 ♀	2.40
Family Podocinidae	1	0.22
Podocinum Berlese	1	0.22
P. pacificum Berlese	1 ♀	0.22
Family Ameroseiidae	1	0.22
Epicriopsis Berlese	1	0.22
E. palustris Karg	1 ♀	0.22
Family Ologamasidae	99	21.61
Gamasiphis Berlese	99	21.61
G. lanceolatus Karg	88 ♀, 8 ♂	20.96
G. sp.	3 ♀	0.65
Family Eviphididae	2	0.44
Evimirus Karg	2	0.44
E. uropodinus (Berlese)	2 ♀	0.44
Family Macrochelidae	7	1.53
Glyptholaspis Filipponi & Pegazzano	2	0.44
G. americana (Berlese)	2 ♀	0.44
Nothrholaspis Berlese	4	0.87
N. montanus Willmann	4 ♀	0.87
Redoctholaspis Emberson	1	0.22
R. analis (Hyatt & Emberson)	1 ♀	0.22
Family Rhodacaridae	6	1.31
Rhodacarellus Willmann	4	0.87
R. silesiacus Willmann	4 ♀	0.87
Multidentorhodacarus Karg	2	0.44
M. denticulatus (Berlese)	2 ♀	0.44
Family Parasitidae	54	11.79
Neogamasus Tikhomirov	41	8.95
N. insignis (Holzmann)	16 ♀, 19 ♂, 6 DN	8.95
Pergamasus Berlese	11	2.40
P. brevicornis Berlese	6 ♀, 4 ♂, 1 DN	2.40

Table 1. Continued.

Family and species	Number of collected specimens	percentage
Parasitus Latreille	2	0.44
P. consanguineous Oudemans & Voigts	2 ♀	0.44
Family Veigaiidae	18	3.93
Gamasolaelaps Berlese	6	1.31
G. whartoni (Farrier)	6 ♀	1.31
Veigaia Oudemans	8	1.75
V. planicola (Berlese)	4 ♀	0.87
V. uncata Farrier	4 ♀	0.87
Family Parholaspididae	55	12.00
Gamasholaspis Berlese	13	2.84
G. incisus Petrova	6 ♀, 7 ♂	2.84
Holaspina Berlese	36	7.86
H. alstoni (Evans)	23 ♀, 13 ♂	7.86
Holaspulus Berlese	4	0.87
H. tenuipes Berlese	4 ♀	0.87
Neparholaspis Evans	2	0.44
N. arcuata Petrova	2 ♀	0.44
Family Pachylaelapidae	93	20.30
Olopachys Berlese	5	1.09
O. caucasicus Koroleva	4 ♀, 1 ♂	1.09
Pachylaelaps Berlese	86	18.78
P. grandis Koroleva	32 ♀, 49 ♂, 5 DN	18.78
Pseudolaelaps Berlese	2	0.44
P. doderoi (Berlese)	2 ♀	0.44
Family Laelapidae	111	24.23
Cosmolaelaps Berlese	5	1.09
C. lutegiensis Shcherbak	5 ♀	1.09
Gaeolaelaps Evans & Till	7	1.53
G. aculeifer (G. Canestrini)	3 ♀	0.65
G. angustus (Karg)	4 ♀	0.87
Gymnolaelaps Berlese	4	0.87
G. longiosetae Ramrudi *et al.*	1 ♀, 1 ♂	0.44
G. myrmecophillus (Berlese)	2 ♀	0.44
Hypoaspis G. Canestrini	4	0.87
H. maryamae Joharchi & Halliday	4 ♀	0.87
Laelaspis Berlese	86	18.78
L. astronomicus (Koch)	73 ♀, 12 ♂	18.56
L. humeratus (Berlese)	1 ♀	0.22

Table1. Continued.

Family and species	Number of collected specimens	percentage
Pogonolaelaps Nemati & Gwiazdowicz	5 ♀	1.09
P. canestrinii (Berlese)	4 ♀	0.87
P. beaulieui Nemati & Gwiazdowicz	1 ♀	0.22

کنه‌های خاکزی گروه گامازینا (Acari: Mesostigmata) در باغ اکولـوژی نوشـهر، ایران

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چکیده

فون کنه‌های خاکزی گروه گامازینا (Acari: Mesostigmata) در باغ اکولوژی (باغ گیاه‌شناسی) نوشهر، استان مازندران، ایران مطالعه شد. نمونه‌برداری‌ها به طور تصادفی از زیستگاه‌های مختلف از بهمن ماه ۱۳۹۲ تا دی ماه ۱۳۹۳ صورت گرفت. در مجموع ۴۵۸ نمونه متعلق به ۳۴ گونه، ۲۰ جنس، ۱۲ خانواده و پنج بالاخانواده جمع‌آوری و شناسایی شدند که دو گونهٔ *Gamasolaelaps whartoni* (Farrier, 1957) (Veigaiidae) و *Pergamasus brevicornis* Berlese, 1903 (Parasitidae) برای نخستین‌بار از ایران گزارش می‌شوند. از میان نمونه‌های جمع‌آوری شده بیشترین فراوانی به ترتیب متعلق به گونه‌های *Gamasiphis lanceolatus* Karg, 1987 (۲۰/۹۶٪)، *Pachylaelaps grandis* Koroleva, 1977 (۱۸/۷۸٪) و *Laelaspis astronomicus* (Koch, 1839) (۱۸/۵۶٪) بود. افزون بر این، خانواده‌های Laelapidae (۲۴/۲۳٪)، Ologamasidae (۲۱/۶۲٪) و Pachylaelapidae (۲۰/۳۰٪) بیشترین فراوانی را داشتند.

واژگان کلیدی: باغ گیاه‌شناسی؛ فون؛ *Gamasolaelaps whartoni*؛ *Pergamasus brevicornis*؛ کنه‌های خاکزی.

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