

## Article

### **First record of the ant-associate genus *Acinogaster* (Acari: Neopygmephoridae) from Asia with redescription of *A. microchaetosus* (Sevastianov, 1967)**

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#### **Abstract**

In this study, the mite *Acinogaster microchaetosus* (Sevastianov, 1967) (Acari: Heterostigmata: Neopygmephoridae) associated with *Tetramorium* sp. (Hymenoptera: Formicidae) is redescribed based on material collected from northern forests of Iran. It is the first record of the genus *Acinogaster* from Asia including Iran. Distribution and host range of all 11 species of the genus are reviewed.

**Key words:** Ant; Heterostigmata; Iran; mite; phoresy.

#### **Introduction**

Three of four fungivorous families of the superfamily Pygmephoroidae (Acari: Prostigmata: Heterostigmata) including Microdispidae, Scutacaridae and Neopygmephoridae include a wide range of myrmecophilous genera and species (Khaustov 2015). In the family Neopygmephoridae, the genera *Petalomium* and *Acinogaster* are typically associated with variety of ants and their nests. The genus *Acinogaster* created by Cross (1965) to accommodate *A. marianae* associated with some species of the *Eciton* (Hymenoptera: Formicidae). Then, Sevastianov (1967) described another species from Ukraine, however he placed this species in the genus *Pygmephorus* and later (1978) placed it in the genus *Acinogaster*. Cross (1974) added one species from Africa. Seven more species were described by Ross and Cross (1979) from various parts of the New World and finally, Mahunka (1983) added the last species to this genus from Suriname.

Hitherto, the neopygmephorid genera *Bakerdania*, *Pseudopygmephorus*, *Kerdabania*, *Allopygmephorus*, *Parapygmephorus* and *Petalomium* have been recorded from Iran however, the genus *Acinogaster* have never been reported from the country (Kamali *et al.* 2001; Khaustov & Hajiqanbar 2004, 2006; Haddad Irani-Nejad *et al.* 2005; Hajiqanbar *et al.* 2011; Hajiqanbar & Khaustov 2013; Filekesh *et al.* 2014; Loghmani *et al.* 2014).

During a study of the heterostigmatic mites associated with insects in northern parts of Iran, we found one species of the genus *Acinogaster*. The aim of this paper is to redescribe *A. microchaetosus* (Sevastianov, 1976) due to incomplete original description. This is the first record of the genus *Acinogaster* from Asia. Distribution and

host range of this genus are also reviewed.

### Material and methods

The mites were associated with the ants *Tetramorium* sp. (Hym.: Formicidae). Host ants captured directly from their habitat. The mite specimens were cleared in lactophenol and mounted in Hoyer's medium. The morphology of mites was studied with a phase contrast compound microscope (model BX51, Olympus, Tokyo, Japan). All measurements are given in micrometers ( $\mu\text{m}$ ). The terminology follows that of Lindquist (1986) except the nomenclature of subcapitular setae and the designation of cheliceral setae that follow Grandjean (1944, 1947), respectively. The ants were identified at the genus level with the help of Dr. Bernhard Seifert (Department of Entomology, Senckenberg Museum für Naturkunde, Germany). The collected material is deposited in the Acarological Collection, Department of Entomology, Faculty of Agriculture, Tarbiat Modares University, Tehran, Iran.

### Systematics

#### Family Neopygmephoridae Cross, 1965

#### Genus *Acinogaster* Cross, 1965

Type species: *Acinogaster marianae* Cross, 1965, by original designation.

#### *Acinogaster microchaetosus* (Sevastianov, 1967)

*Pygmephorus microchaetosus* Sevastianov 1967, p. 354, fig. 3.

#### Redescription

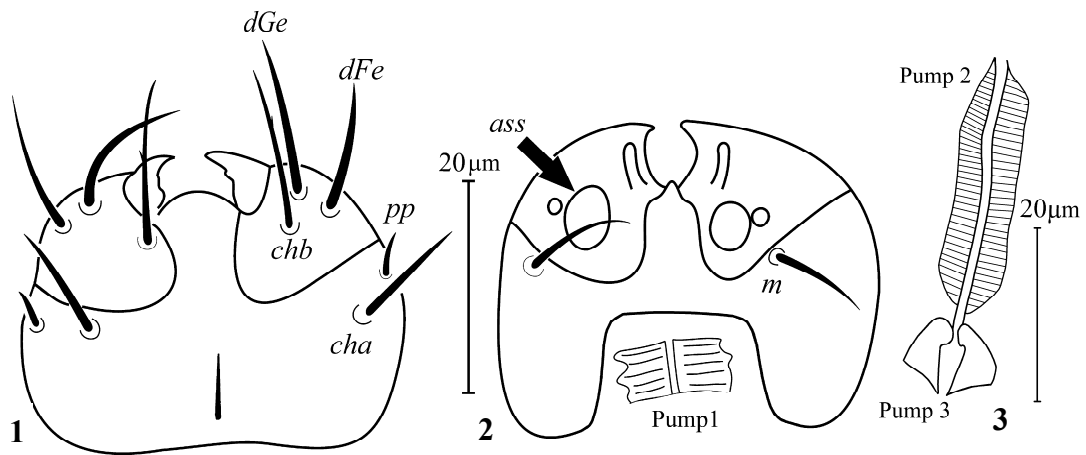
*Female* (Figs. 1–9) – Length of idiosoma 216–231, width 105–118.

*Gnathosoma* (Figs. 1–3) – Length of gnathosoma 18–23, width 21–25. Cheliceral setae *chb* 12–14, *cha* 9–11. Subcapitular setae *m* 8–10. Palps dorsolaterally with two setae *dFe* 10–12 and *dGe* 8–9. Median gnathosomal apodeme present. Pharynx with pump 1 subrectangular (Fig. 2), pump 2 cylindrical and striated (Fig. 3), pump 3 kidney-shape (Fig. 3).

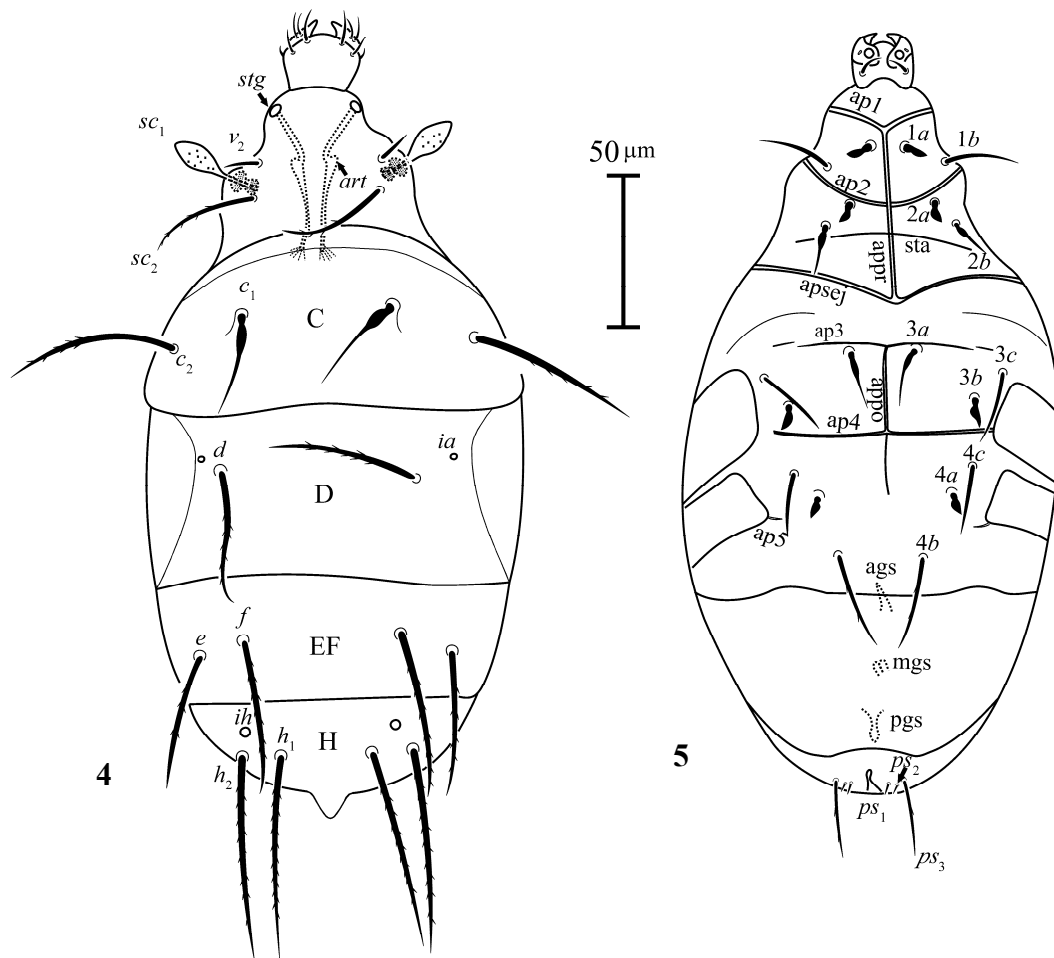
*Idiosomal dorsum* (Fig. 4) – All dorsal plates smooth. Prodorsum with two pairs of setae ( $v_2$ ,  $sc_2$ ), one pair of trichobothria ( $sc_1$ ) and one pair of round stigmata. Posterior margin of tergite C slightly concave in central part. Cupules *ia* on tergite D and *ih* on tergite H round, *ih* larger. Posterior margin of the tergite H with a tongue-like elongation. All dorsal setae barbed except  $c_1$  which is smooth and thickened basally; an oblique line visible near the base of setae  $c_1$ . Length of dorsal setae:  $v_2$  8–9,  $sc_2$  27–38,  $c_1$  31–33,  $c_2$  50–54,  $d$  42–47,  $e$  45–49,  $f$  50–56,  $h_1$  63–67,  $h_2$  66–71. Distances between setae:  $v_2$ – $v_2$  42–48,  $sc_2$ – $sc_2$  40–45,  $c_1$ – $c_1$  49–52,  $c_2$ – $c_2$  93–102,  $c_1$ – $c_2$  25–29,  $d$ – $d$  58–59,  $e$ – $f$  14–16,  $e$ – $e$  64–77,  $f$ – $f$  60–64,  $h_1$ – $h_1$  27–28,  $h_2$ – $h_2$  39–52,  $h_1$ – $h_2$  14–15.

*Idiosomal venter* (Fig. 5) – Ventral setae smooth except weakly barbed setae *1b*, *4b* and *ps\_1*; setae *1a*, *2a*, *2b*, *3a*, *3b* and *4a* modified (*2b* and *3a* thickened basally, others asymmetrically clavate). Setae *ps\_2* and *ps\_3* very short. Apodemes 1–4 (*ap\_1*–*4*), prosternal apodeme (*appr*), sejugal apodeme (*apsej*) and poststernal apodeme (*appo*) well sclerotized, apodemes 5 (*ap\_5*) weakly developed. Posterior margin of aggenital plate (*Ag*) slightly concave. Anterior genital sclerite (*ags*) acute and subtriangular, posterior genital sclerite (*pgs*) bell-shaped, median genital sclerite (*mgs*) well

developed, oval. Length of ventral setae: 1a 8, 1b 22–26, 2a 8, 2b 19–20, 3a 22–24, 3b 9–10, 3c 22–24, 4a 7–8, 4b 31–34, 4c 26–27,  $ps_1$  3–4,  $ps_2$  3,  $ps_3$  25–27.



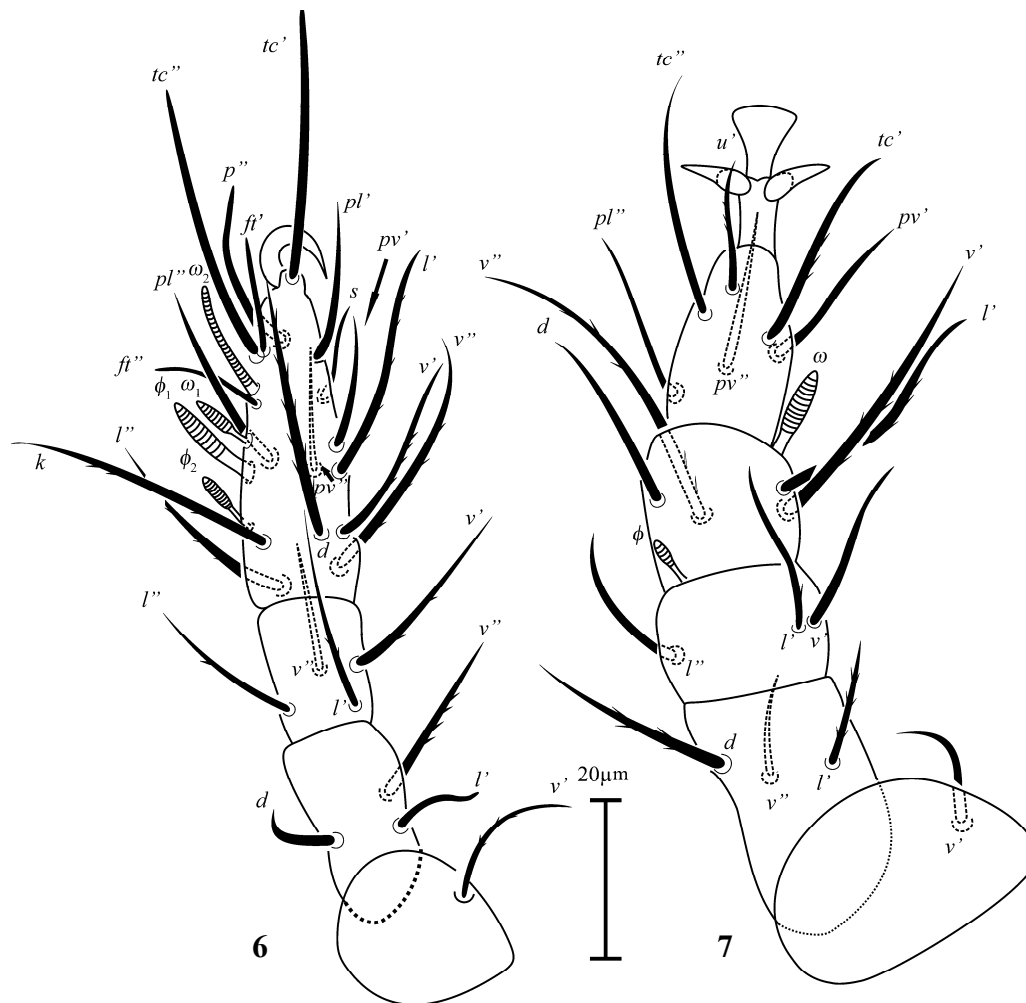
**Figures 1–3.** *Acinogaster microchaetosus* (Sevastianov, 1976) – 1. Dorsal view of Gnathosoma; 2. Ventral view of gnathosoma along with pump 1 of pharyngeal pumps; 3. Pumps 2 and 3 of pharyngeal pumps.



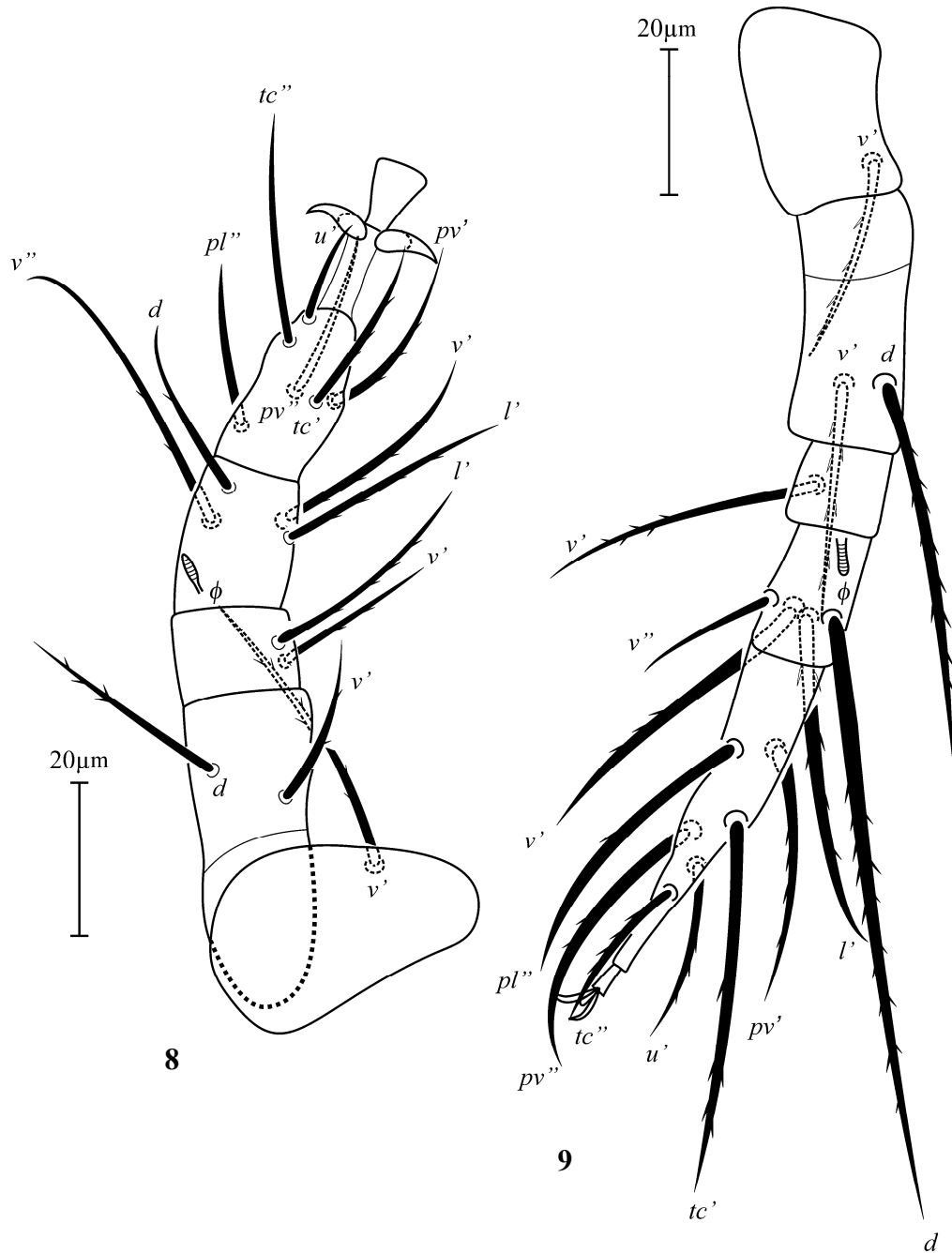
**Figures 4–5.** *Acinogaster microchaetosus* (Sevastianov, 1976) – 4. Dorsal view of body; 5. Ventral view of body.

*Legs* (Figs. 6–9) – Leg I (Fig. 6). Setal formula: 1–3–4–16(4) (number of solenidia in parentheses). Slightly shorter than other legs. Tibiotarsus: with four solenidia,  $\varphi_2$  and  $\omega_1$  stemmed and clavate,  $\varphi_1$  finger-shaped,  $\omega_2$  baculiform; length of solenidia  $\omega_1$  6–7,  $\omega_2$  11–14,  $\varphi_1$  10–12,  $\varphi_2$  8; eupatidial setae  $p''$ ,  $tc'$ ,  $tc''$ ,  $ft'$  and  $ft''$  smooth and blunt-ended; setae  $s$ , ( $pv$ ) and ( $pl$ ) smooth; eupathidion  $tc'$  situated on distinct pinnaculum. Genu: seta  $v''$  smooth, others barbed, setae  $l'$  and  $v'$  subequal. Femur: Seta  $d$  hook-like, seta  $l'$  smooth and blunt-ended,  $v''$  barbed. Leg II (Fig. 7). Setal formula: 1–3–3–4(1)–6(1). Thicker than other legs. Tarsus: solenidion  $\omega$  9–11, finger shaped, setae  $tc''$ ,  $pl''$  and  $pv'$  smooth, others barbed. Tibia: solenidion  $\varphi$  5–6, clavate, seta  $d$  shortest and smooth, others barbed. Genu: seta  $l'$  sparsely barbed, others smooth, all subequal. Femur: seta  $v''$  shortest and smooth, others barbed. Leg III (Fig. 8). Setal formula: 1–2–2–4(1)–6. Tarsus: setae  $tc'$  and  $pv'$  subequal and barbed, others smooth. Tibia: solenidion  $\varphi$  5–6, weakly clavate, seta  $d$  shortest, all setae barbed. Genu: seta  $l'$  longer than  $v'$ , both barbed. Femur: divided, seta  $d$  longer than  $v'$ , both barbed. Leg IV (Fig. 9). Setal formula: 1–2–1–4(1)–6. Longer and thinner than other legs. Tarsus: all setae barbed, seta  $tc''$  shortest,  $tc'$  longest. Tibia: solenidion  $\varphi$  5, weakly clavate, seta  $v''$  shortest and smooth, others barbed. Genu: seta  $v'$  barbed. Femur: divided, seta  $d$  distinctly longer than  $v'$ , both barbed.

Male and larva unknown.



**Figures 6–7.** *Acinogaster microchaetosus* (Sevastianov, 1976) – 6. Leg I; 7. Leg II.



**Figures 8–9.** *Acinogaster microchaetosus* (Sevastianov, 1976) – 8. Leg III; 9. Leg IV.

*Material examined*

4 females, phoretic on *Tetramorium* sp., Mazandaran Province, Tonekabon, Sehezar Forest (36° 41' N, 50° 51' E, altitude 330 m a.s.l.) from *Populus nigra* logs, 22 August 2013, coll. Alihan Katlav.

*World distribution*

Ukraine, associated with *Camponotus* sp., *Tetramorium caespitum* and *Messor clivorum* (Hym.: Formicidae) (Sevastianov 1967); Iran, associated with *Tetramorium* sp. (current study).

## Discussion

Eleven species of the genus *Acinogaster* are distributed in Nearctic, Neotropical, Afrotropical and Palaearctic realms (Table 1). *Acinogaster microchaetosus* and *A. quadridens* are the only representatives in Palaearctic and Afrotropical, respectively. *Acinogaster kanensis* is the only species distributed in both Nearctic and Neotropical. Other eight species of the genus have been originated from Neotropical region.

Except *A. balazsi*, extracted from soil, mites of the genus *Acinogaster* have been so far found on nine formicid genera belonging to three subfamilies, Dorylinae (*Eciton*, *Dorylus*, *Neivamyrmex*, *Labidus*, *Nomamyrmex*, *Cheliomyrmex*), Myrmicinae (*Tetramorium*, *Messor*) and Formicinae (*Camponotus*) (see Table 1). Based on current data and collections, the subfamily Dorylinae constitutes the most associations with the genus *Acinogaster*, primarily in the New World. Two other subfamilies are associated with *Acinogaster* mites in the Old World. In other words, only *A. microchaetosus*, distributed in Palaearctic, is associated with ants of the subfamilies Myrmicinae and Formicinae, while other congeners are phoretic on ants of the subfamily Dorylinae.

**Table 1.** Current knowledge on distribution and host range of mites of the genus *Acinogaster* associated with ants.

Mite	Host ant/Habitat	Locality	Reference
<i>A. marianae</i> Cross, 1965	<i>Eciton hamatum</i> (Fabricius, 1781); <i>E. burchellii</i> (Westwood, 1842); <i>E. lucanoides</i> Emery, 1894; <i>E. rapax</i> Smith, 1855	Mexico, Costa Rica, Panama, Trinidad (British West Indies), Ecuador, British Guiana	Cross (1965), Ross & Cross (1979)
<i>A. microchaetosus</i> (Sevastianov, 1967)	<i>Camponotus</i> sp.; <i>Tetramorium caespitum</i> (L., 1758); <i>Messor clivorum</i> Ruzsky, 1905; <i>Tetramorium</i> sp.	Ukraine, Iran	Sevastianov (1967), This study
<i>A. quadridens</i> Cross, 1974	<i>Dorylus (Anomma)</i> sp.; <i>Dorylus</i> spp.	Angola, Tanzania	Cross (1974), Ross & Cross (1979)
<i>A. crassisetosus</i> Ross & Cross, 1979	<i>Labidus praedator</i> (Smith, 1858); <i>L. coecus</i> (Latreille, 1802); <i>Eciton mexicanum</i> Roger, 1863; <i>E. dulcium</i> Forel, 1912; <i>E. rapax</i> ; <i>E. burchellii</i> ; <i>Neivamyrmex legionis</i> (Smith, 1855); <i>Ne. adneops</i> (Wheeler, 1922); <i>Ne. gibbatus</i> Borgmeier, 1953; <i>Ne. cristatus</i> (Andre, 1889); <i>Ne. grandualis</i> Borgmeier, 1953; <i>Ne. diana</i> (Forel, 1912), <i>Ne. pilosus</i> (Smith, 1858); <i>Nomamyrmex esenbeckii</i> (Westwood, 1842); <i>No. hartigii</i> (Westwood, 1842)	Brazil, Ecuador, Costa Rica, Panama	Ross & Cross (1979)
<i>A. kansensis</i> Ross & Cross, 1979	<i>Neivamyrmex nigrescens</i> (Cresson, 1872); <i>Ne. carolinensis</i> (Emery, 1894); <i>Ne. opacithorax</i> (Emery, 1894); <i>Ne. pilosus</i> ; <i>Ne. gibbatus</i> ; <i>Ne. pauxillus</i> ; <i>Ne. moseri</i> ; <i>Eciton burchellii</i> ; <i>Labidus praedator</i> ; <i>L. coecus</i>	USA (Kansas, Texas), Mexico, Costa Rica, Panama, Brazil, Ecuador	Ross & Cross (1979)

**Table 1.** Continued.

Mite	Host ant/Habitat	Locality	Reference
<i>A. gladius</i> Ross & Cross, 1979	<i>Labidus praedator</i> ; <i>L. coecus</i>	Ecuador	Ross & Cross (1979)
<i>A. obovatus</i> Ross & Cross, 1979	<i>Neivamyrmex pauxillus</i> (Wheeler, 1903); <i>Ne. moseri</i> Watkins, 1969	USA (Texas)	Ross & Cross (1979)
<i>A. parvisetosus</i> Ross & Cross, 1979	<i>Labidus praedator</i> ; <i>L. coecus</i> ; <i>Neivamyrmex legionis</i>	Brazil	Ross & Cross (1979)
<i>A. panamanus</i> Ross & Cross, 1979	<i>Eciton burchellii</i> ; <i>E. hamatum</i> ; <i>E. mexicanum</i> ; <i>E. dulcium</i> ; <i>E. vagans</i> (Olivier, 1792); <i>E. rapax</i> ; <i>E. lucanoides</i> ; <i>Labidus praedator</i> ; <i>L. coecus</i> ; <i>Nomamyrmex esenbeckii</i> ; <i>No. hartigii</i> ; <i>Neivamyrmex pilosus</i> ; <i>Ne. grandualis</i> ; <i>Ne. cristatus</i> ; <i>Ne. legionis</i> ; <i>Cheliomyrmex morosus</i> (Smith, 1859)	Panama, Costa Rica, Ecuador, Brazil, British Guiana	Ross & Cross (1979), Berghoff & Franks (2007)
<i>A. triangularis</i> Ross & Cross, 1979	<i>Neivamyrmex pauxillus</i> ; <i>Ne. moseri</i>	USA (Texas)	Ross & Cross (1979)
<i>A. balazsi</i> Mahunka, 1983	Soil from litter of tropical rain forest	Suriname	Mahunka (1983)

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نخستین گزارش از جنس مرتبط با مورچه *Acinogaster* (Acari: Neopygmephoridae) از آسیا همراه با بازتوصیف *A. microchaetosus* (Sevastianov, 1967)

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### چکیده

در این مطالعه، کنه *Acinogaster microchaetosus* (Sevastianov, 1967) (Acari: Heterostigmata) مرتبط با مورچه *Tetramorium* sp. (Hymenoptera: Formicidae) بر اساس نمونه‌های جمع‌آوری شده از جنگل‌های شمال ایران بازتوصیف می‌شود. این نخستین گزارش از جنس *Acinogaster* از آسیا از جمله ایران است. پراکندگی و دامنه میزبانی هر ۱۱ گونه این جنس بازبینی شده‌اند.

واژگان کلیدی: کنه؛ مورچه؛ هم‌سفری؛ هترواستیگمایان؛ ایران.

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