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Three New Species of Mites (Acari: Acaridae and Histiostomatidae) Extracted from the Soil under Pomegranate Trees, Assiut, Upper Egypt

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ABSTRACT

Three new species (*Caloglyphus punicum* n. sp., *C. azzai* n. sp. and *Myianoetus granatum* n. sp.) represented only by their hypopial nymphs (heteromorphic deutonymphs), extracted from the soil under pomegranate trees, Assiut, Upper Egypt. The holotype deutonymph and paratype deutonymphs of each species are deposited in the Acari collection of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut 71526 Egypt. The descriptions and illustrations of the three new species are given below

INTRODUCTION

Mites of the families Acaridae Latreille, 1802 are considered to be major pests of stored products. Their feeding on foodstuffs causes direct damage, while indirect injury occurs by transmitting certain microorganisms such as fungi and bacteria. Some species of the genus *Caloglyphus* Berlese, 1923 (= *Sancassania* Oudemans, 1916), have been recorded from several regions of the world by many scientists (e.g., Mahunka, 1973, 1974, 1978 & 1979; Samšínák, 1980 & 1988; Zou and Wang, 1989; Eraky, 1999 & 2000; Klimov, 1996 & 2000; OC'onnor, 2003; Klimov and OC'onnor, 2003; Sarwar and Ashfaq, 2004, 2006, 2010 & 2012; Negm, 2007; Eraky and Osman, 2008; Fakeer *et al.*, 2014 & Eraky *et al.*, 2017). On the other side, species of the genus *Myianoetus* Oudemans, 1916 (Family: Histiostomatidae Berlese, 1897), are associated with flies inhabiting decaying organic materials such as manure of animals and dung-hills. Of the 41 recognized *Myianoetus* species, 10 are known from adult and heteromorphous deutonymphal stages, two from adult-only, and 29 from the deutonymph only (OC'onnor *et al.*, 2015). Some species of the genus *Myianoetus* were previously collected from different habitats (i.e., potato tubers, onion bulbs, barley, rice, wheat, flour, and chicken feeds (Ostovan and Kamali, 1995). In Upper Egypt, only one species of the genus *Myianoetus* (*Myianoetus lili* Eraky, 1998), was described from the manure of animals. Hence, the study herein presents descriptions and illustrations of three new species belonging to the genera *Caloglyphus* Berlese, 1923 and *Myianoetus* Oudemans, 1916, based on hypopial nymphs (heteromorphic deutonymphs), extracted from the soil under pomegranate trees.

MATERIALS AND METHODS

Mites inhabiting the soil under pomegranate trees were extracted from the pomegranate orchards, Assiut Governorate, Upper Egypt. The collected materials yielded some mite species. Of these, three hypopial nymphs (heteromorphic deutonymphs) of the genera *Caloglyphus* and *Myianoetus* proved to be new to science. The collected deutonymphs were cleared up in lactic acid, mounted in Hoyer's medium on a glass slide, dried in an oven at 50-55°C, ringed with nail polish, then examined under a phase-contrast of the microscope (Optika-Vision-lite_ENG-rev01, Italy), provided with camera and system of calibration of a micrometric slide, a drawing tube was also used when necessary. The examination of the collected deutonymphs showed some interesting morphological characteristics which did not appear in the described species of both genera. Measurements are given in micrometers (μm), each measurement shows the average for a number of individuals, followed (in parentheses) by a respective range. The deutonymphs of the three new species were described and illustrated. Nomenclature by Giffiths *et al.*, 1990 was followed for idiosomal chaetotaxy and Grandjean, 1939 for legs chaetotaxy. Holotype deutonymph and six paratype deutonymphs (*C. punicum*); Holotype deutonymph and seven paratype deutonymphs (*C. azzai*); holotype deutonymph and three paratype deutonymphs (*M. granatum*) were measured for gnathosoma, propodosoma, idiosoma, idiosomal chaetotaxy; holotype deutonymph of each of the three new species was measured for legs, tarsi and legs chaetotaxy.

RESULTS AND DISCUSSION

Cohort Astigmatina (Astigmata) Canestrini, 1891

Superfamily Acaroidea Latreille, 1802

Family Acaridae Latreille, 1802

Genus *Caloglyphus* Berlese, 1923

1- *Caloglyphus punicum* n. sp.

Description (Deutonymph). **Gnathosoma** (**Fig. 3**). Infracapitulum of gnathosoma 24 (22-26) long, 17 (16-18) wide, pear-shaped, bifurcated anteriorly; palps 7 (6-8) long, 3 (2-4) wide, well-separated off, apical palpal solenidia (ω) 37 (36-38), stout; palpal supracoxal setae (*elcp*) 10 (9-11) and infracapitular setae (*m*) 8 (7-9), each thin, filiform.

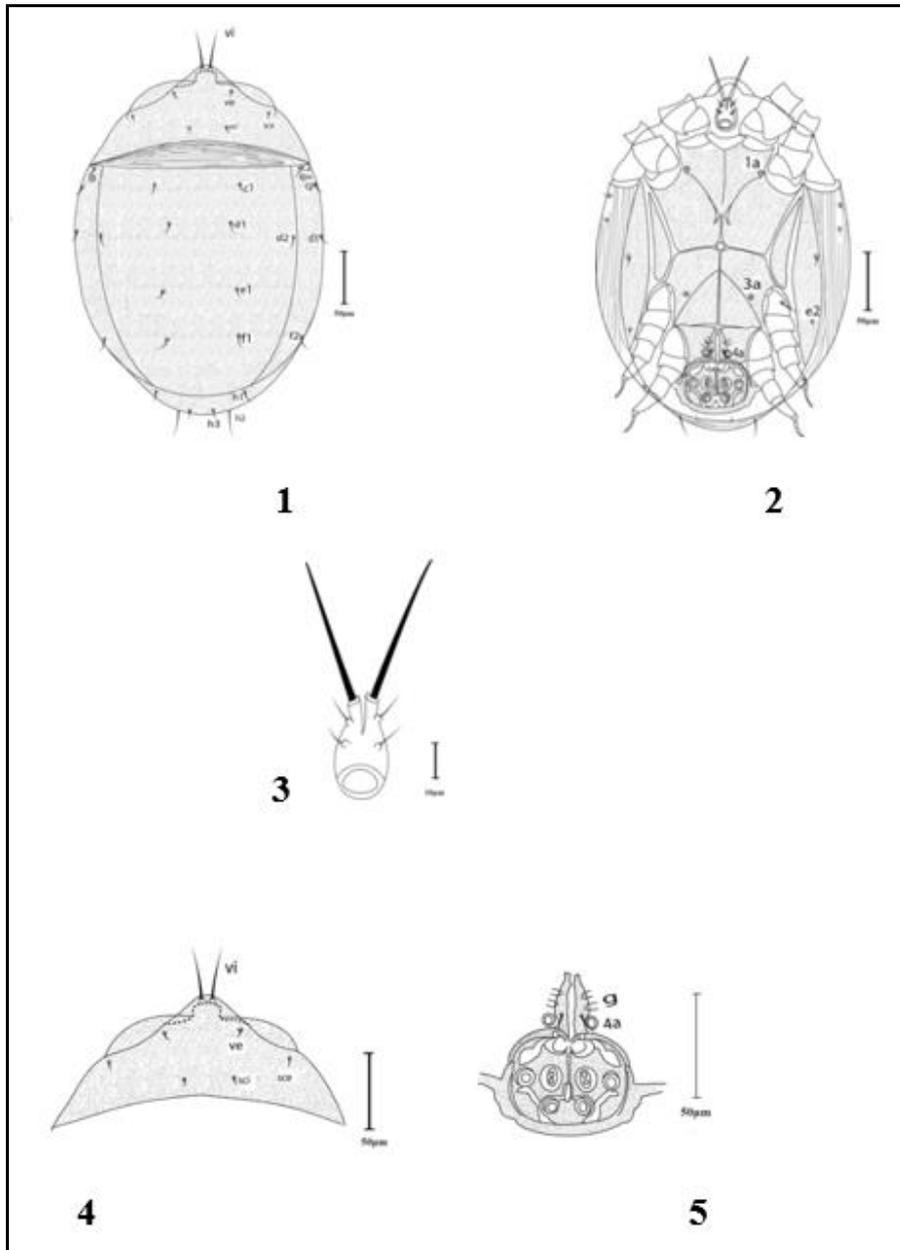
Dorsum (**Fig. 1**). Idiosoma 341 (336-346) long, 235 (230-240) wide. Body broadly ovoid. Propodosoma and hysterosoma each covered with punctulate.

Propodosoma (**Fig. 4**), elongated medially, posterior and lateral margins slightly concaved, approximately triangular in outline. Propodosomal length: 73 (68-78) long, 174 (168-180) wide. Internal vertical setae *vi* 34 (32-36), filiform, located anterior to propodosomal apex; external vertical setae *ve* 8, filiform, positioned posterior and lateral to propodosomal apex; internal scapular setae *sci* and external scapular setae *sce*, short and filiform, sub-equal in length, in a range of 7- 9, the external setae originating in front of the internal ones; supracoxal setae *scx* invisible. Dorsosejugal region well-developed, ornamented with transversal lines. Hysterosoma with 13 pairs of simple, filiform setae, approximately at the same length with those of propodosoma (*ve*, *sci*, *sce*), except for setae *h2* 22 (21-23), setae *h3* 5 (4-6). A pair of ovoid cupules *ia* observed on both lateral sides, between setae *c2* and *cp*.

Venter (**Fig. 2**). All coxal fields ornamented with punctulae. Apodemes thin, but well-developed. Anterior apodemes of coxal field I fused medially forming sternum, the later short, ending free. Anterior apodemes of coxal fields II slightly curved in the middle. Posterior apodemes of coxal fields II long, fused with anterior ones. Anterior and posterior apodemes of coxal fields III medially fused with each other and with posterior sternal apodemes. Posterior sternal apodeme well-developed, extending from genital opening to

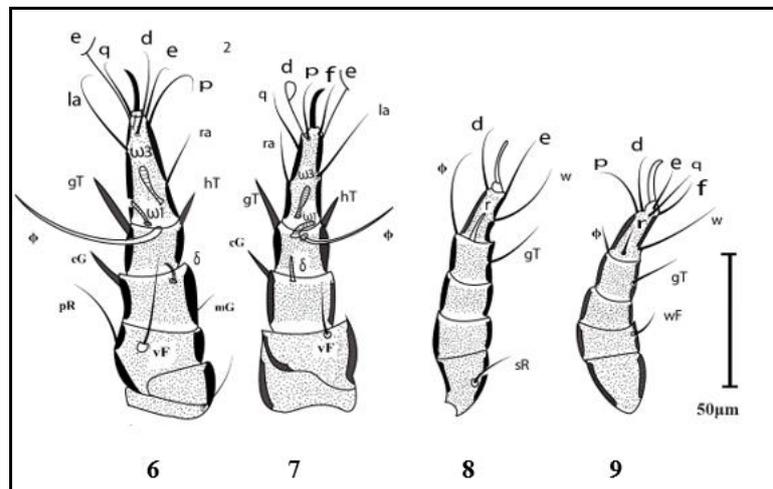
anterior apodemes of coxal fields II, Anterior sternal apodeme fused with all apodemes of coxal fields II, III and IV, thus all coxal fields closed, except coxal fields I. Dorsal hysterosomal sclerite separated from the ventral surface by a distinct suture on each side, lateral margins of ventral surface ornamented with longitudinal lines. Coxal fields I, III, and IV with discs each (1a, 3a, and 4a), slightly larger on coxal fields IV; genital setae (g) located on both sides of the genital opening, between 4a.

Adhering plate (Fig. 5), approximately large 50 long, 66 wide, entirely filling a space between legs IV, positioned not far from posterior body margin. Anterior suckers undeveloped, only sclerotized margins present; a pair of alveoli positioned at the top of anterior suckers; median suckers approximately large, ovoid, consisting of large sclerotized margins surrounding a pair of alveoli. Lateral and posterior suckers well-developed, the area between all suckers in adhering plate ornamented with punctulae.



Figs. 1-5. *Caloglyphus punicum* n. sp. (Deutonymph): **1.** dorsal side; **2.** ventral side; **3.** gnathosoma; **4.** propodosoma; **5.** adhering plate.

Legs (Figs. 6-9). Legs elongate, broad and stout, segments free; segments of all legs ornamented with punctulae. Length of legs and chaetotaxy (holotype deutonymph): les I 112, legs II 100, legs III 84, legs IV 77; tarsi I 40, tarsi II 31, tarsi III 24, tarsi IV 25. All legs with broad, hooked empodial claws arising from tarsal apices. Trochanter I, III each with filiform setae (pR 27, sR 19). Femoral setation: 1-1-0-1; setae vF I, II (27, 28), wF IV 20, filiform and smooth. Genua setation: 2-1-0-0; setae cG I, II 13, spine-like, setae mG I 9, filiform. Tibial setation: 2-2-1-1; setae gT and hT I, II spine-like, gT III, IV filiform; gT I 27, hT I 16, gT II 22, hT II 15, gT III 24, gT IV 21. Tarsal setation: 7-7-4-7; all setae on tarsi I-IV filiform, except setae r on tarsi III, somewhat spine-like; on tarsi I, setae ra 23, q 17, d 25, p 12, f 17, e 25, la 21; on tarsi II, setae ra 23, q 17, p 12, d 25, p 12, f 17, e 25, la 21; on tarsi III, setae w 19, e 24, d 21, r 8; on tarsi IV, setae r 11, f 9, w 21, q 19, e 15, d 13, p 16. Tibiotarsal group of solenidia consisting of following: $\omega 1$ on tarsi of legs I, II clavate, longer on tarsi I; $\omega 2$ on both tarsi approximately short, cylindrical, located more basal and posterior to $\omega 1$; ϵ of legs I, II absent; ϕ of tibiae I, II elongate, tapering, longer and thicker on tibiae I, ϕ of tibiae III, IV filiform, longer on tibiae III; σ of genua I, II short, cylindrical, curved on genua I. Length of solenidia: $\omega 1$ 16, $\omega 2$ 10 (tarsi I), $\omega 1$ 13, $\omega 2$ 10 (tarsi II); ϕ 44 (tibiae I), 35 (tibiae II), 22 (tibiae III), 12 (tibiae IV); σ 5 (genua I), 10 (genua II).



Figs. 6-9. *Caloglyphus punicum* n. sp. (Deutonymph): **6.** leg I; **7.** leg II; **8.** leg III; **9.** leg IV.

Material examined: Holotype deutonymph and sixteen paratype deutonymphs extracted from the soil under pomegranate trees, Assiut, Upper Egypt, 27° 02' 28.20" N, 31° 00' 25.80" E, leg. A.S. Abdelgayed, 17 Feb. 2019, are deposited in the Acari collection of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut 71526 Egypt.

Remarks: The new species differs from its congeners by the course of apodemes, the shape of gnathosoma and adhering plate and legs chaetotaxy. These characteristics distinguished the new species from all other related *Caloglyphus* taxa.

2- *Caloglyphus azzai* n. sp.

Description (Deutonymph).

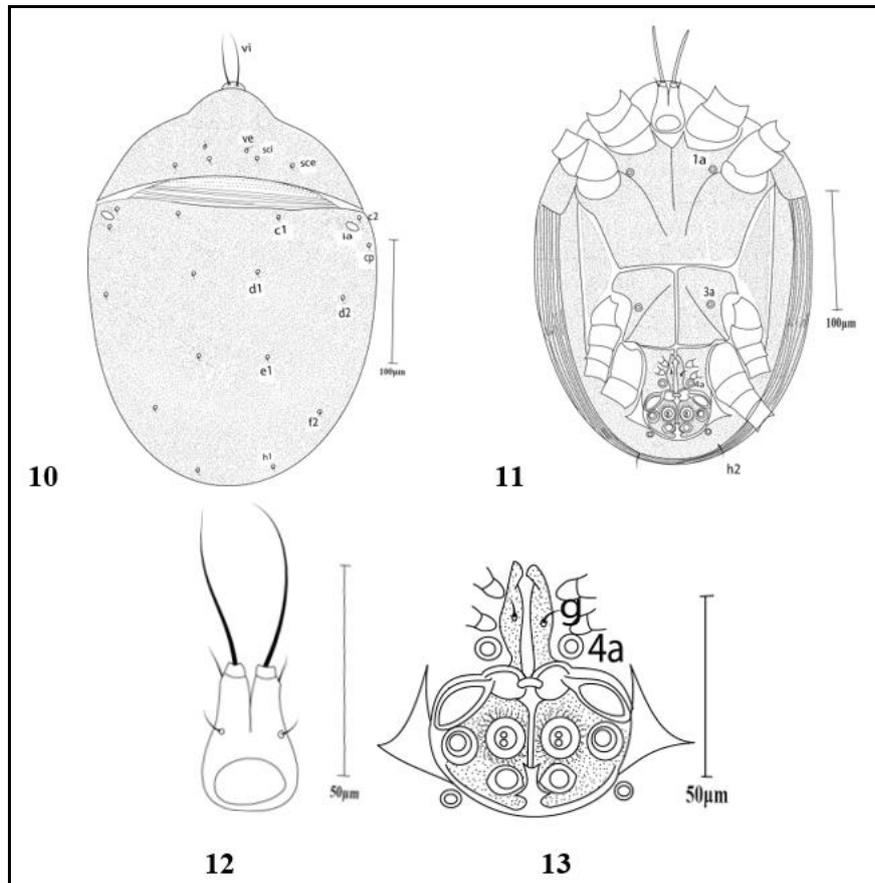
Gnathosoma (Fig. 12). Infracapitulum of gnathosoma 29 (27-31) long, 22 (21-23) wide, approximately pear-shaped, wide basally, bifurcated anteriorly; palps very short, but well discernible 6 (6-6) long, 5 (5-5) wide; apical palpal solenidia (ω) 41 (40-42), filiform; palpal supracoxal setae (*elcp*) 10 (10-10) filiform, infracapitular setae (*m*) 8 (8-8).

Dorsum (Fig. 10). Idiosoma 337 (328-346) long, 229 (223-235) wide. Body ovoid. Propodosoma and hysterosoma each covered with punctulate. Propodosoma medially elongated into a cone, posterior and lateral margins of propodosoma concaved,

approximately triangular in outline. All dorsal setae (*ve*, *sci*, *sce*, *c1*, *c2*, *cp*, *d1*, *d2*, *e1*, *f2*, *h1*) minute, ranged for 2-3, except internal vertical setae *vi* 39 (37-41) filiform, positioned anterior to propodosomal apex; supracoxal setae *scx* invisible. Dorsosejugal region well-developed, ornamented with transversal lines on basal portion and punctulae on anterior one. Hysterosoma with 9 pairs of setae. Propodosomal length: 76 (73-79) long, 200 (197- 203) wide. A pair of cupules *ia* positioned between setae *c2* and *cp*.

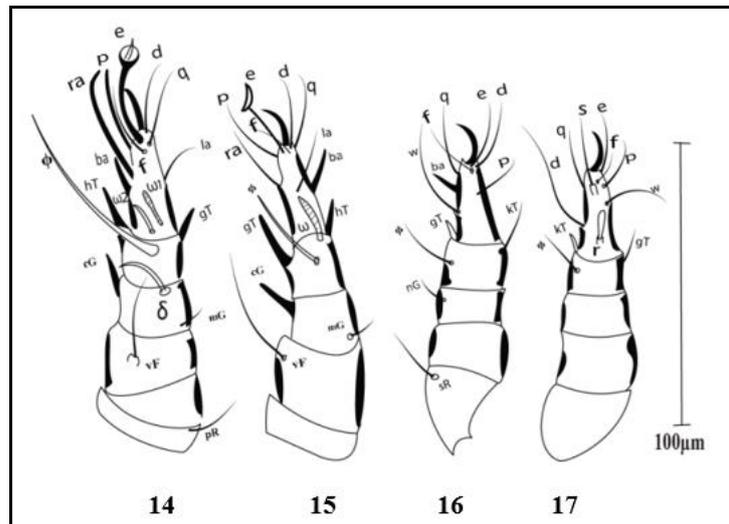
Venter (Fig. 11). All ventral fields ornamented with punctulae. Apodemes thin, but well-developed. Anterior apodemes of coxal field I fused medially forming sternum, the later short, ending free. Anterior apodemes of coxal fields II short, ending free, not fused medially with posterior ones. Anterior apodemes of coxal fields III medially fused with posterior sternal apodeme, posterior apodemes of coxal fields III also short, not fused medially with each other. Anterior and posterior apodemes of coxal fields IV well-developed. All coxal fields open, except IV. Posterior sternal apodeme well-developed extending from genital opening to anterior apodemes of coxal fields III. Dorsal hysterosomal sclerite separated from the ventral surface by a distinct suture on each side, lateral margins of ventral surface ornamented with longitudinal lines. Coxal fields I, III, and IV with discs each (*1a*, *3a*, and *4a*), slightly larger on coxal fields IV; genital setae (*g*) positioned lateral of genital opening, anterior to *4a*.

Adhering plate (Fig. 13), 40 (38-42) long, 53 (50-56); entirely filling a space between legs IV, not far from posterior body margin. Anterior suckers vestigial, only external sclerotized margins present; a pair of discs positioned on lateral sides of the posterior margin of sucker plate. Median suckers approximately large, ovoid, consisting of large sclerotized margins surrounded a pair of alveoli. Lateral and posterior suckers well-developed; adhering plate internally ornamented with punctulae between suckers.



Figs. 10-13. *Caloglyphus azzai* n. sp. (Deutonymph): **10.** dorsal side; **11.** ventral side; **12.** gnathosoma; **13.** adhering plate.

Legs (Figs. 14-17). Legs elongate, stout, segments free. Length of legs and chaetotaxy (holotype deutonymph): leg I 112, leg II 101, leg III 81, leg IV 80. Length of tarsi: Tarsi I 40, tarsi II 35, tarsi III 28, tarsi IV 28. All legs with broad, hooked empodial claws arising from tarsal apices. Trochanter I, III each with filiform setae (*pR* 14, *Sr* 18). Femoral setation: 1-1-0-0: setae *vF* I, II (27, 24) filiform. Genual setation: 2-2-1-0; setae *cG* I–II 19, 12, spine-like, setae *mG* I 8, *mG* II 7, *nG* III 21 filiform. Tibial setation: 2-2-2-2; setae *gT* 11 and *hT* 25 (legs I) spine-like; *gT* 21 and *hT* 17 (legs II) spine-like; *gT* 12 spine-like, *kT* 18 filiform (legs III); *kT* 8 spine-like, *gT* 14 filiform (legs IV). Tarsal setation: 8-8-7-8; setae *ba* 10, *ra* 34, *p* 19 (tarsi I) broad and spine-like; *la* 21, *f* 13, *q* 25, *d* 17 filiform, setae *e* 37, rose-like structure, with broad, curved, long peduncles and bulbous apices; legs II with setae *ba* 12 spine-like, *la* 20, *q* 22, *d* 16, *p* 18, *f* 13, *ra* 33 filiform; legs III with setae *e* 17 with crescent-like apices; legs IV, setae *s* 22, *w* 20, *f* 15, *e* 20, *p*, 15, *q* 17, *d* 34 filiform, setae *r* 8 cylindrical. Tibiotarsal group of solenidia consisting of following: on tarsi I, ω 1 11 cylindrical, slightly broad in the anterior portion, ω 2 11 cylindrical, positioned posterior, lateral to ω 1; ε absent (tarsi I); ϕ 59 (tibiae I) elongate, tapering, σ 22 (genua I) tapering, curved; ω 17, fusiform (tarsi II), longer and thicker than ω 1 and ω 2 on tarsi I; solenidia ϕ 24 (tibiae II), shorter and thinner than solenidia ϕ 1 (tibiae I); σ of genua II missing; solenidia ϕ (tibiae III) 25, ϕ (tibiae IV) 20, both filiform.



Figs. 14-17. *Caloglyphus azzai* n. sp. (Deutonymph): 14. leg I; 15. leg II; 16. leg III; 17. leg IV.

Material examined: Holotype deutonymph and seven paratype deutonymphs extracted from the soil under pomegranate trees, Abou-Tig city, 27°02'38.3"N, 31°19'23.7"E, Assiut Governorate, Upper Egypt, leg. A.S. Abdelgayed, 23 Feb. 2019, are deposited in the Acari collection of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut 71526 Egypt.

Remarks: Owing to the shape of gnathosoma, the course of apodemes, the structure, and chaetotaxy of legs, the construction of adhering plate, the length and situation of dorsal chaetotaxy and the ornamentation on both dorsal and ventral sides, the new species may readily be separated from all other related congeners of the genus *Caloglyphus* Berlese, 1923 (e.g., *C. dorylini* Mahunka, 1979, *C. armatus* Mahunka, 1979; *C. verto* Sarwar and Ashfag, 2010 and *C. captus* Sarwar and Ashfag, 2012).

We dedicate the new species to Prof. Dr. Azza A. Mohamed (acarologist), Plant Protection Research Institute, Dokki, Giza, Egypt, for many assistances during preparing the current study.

Cohort Astigmatina (Astigmata) Canestrini, 1891

Superfamily Histiostomatoidea Berlese, 1897

Family Histiostomatidae Berlese, 1897

Genus *Myianoetus* Berlese, 1916

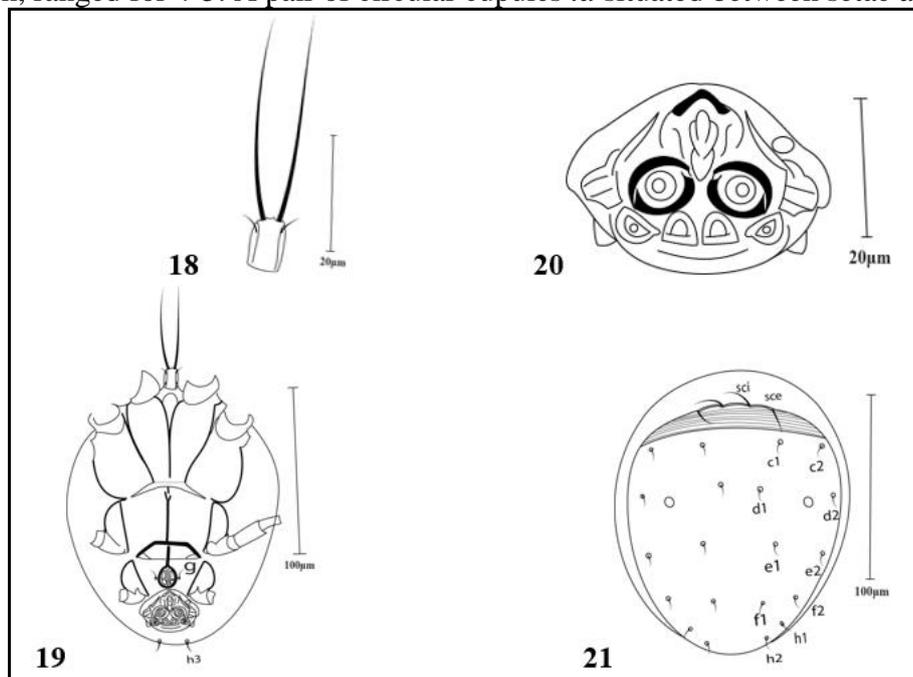
3-*Myianoetus granatum* n. sp.

Description (Deutonymph). Body ovoid, 164 (160-168) long, 126 (123-129) wide. **Gnathosoma** (Fig. 18). Infracapitulum of gnathosoma 10 (9-11) long, 6 (5-7) wide; not elongated, approximately short and wide, unusual in the described species of the genus *Myianoetus*. Palps not separated off, palpal solenidia (ω) 34 (32-36) arising directly from infracapitular apex, palpal supracoxal setae 4 (3-5) positioned on less distance posterior and lateral of infracapitular apex.

Venter (Fig. 19). Anterior coxal apodemes I fused medially to form a long sternum, however, the latter not fused posteriorly with apodemes II, posterior apodemes II short, not fused with each other's medially, both of anterior and posterior apodemes III and IV fused medially, but not fused with longitudinal sternal apodeme. therefore, coxal fields I-II open, III-IV closed. Posterior sternum apodeme long ends by Y-shaped and free anteriorly; genital opening surrounded by thick apodemes with anterior median one, two pairs of genital papillae within the genital atrium. Genital setae g filiform positioned laterally of genital opening. Coxal fields I, III, IV without any sculptures (setae or alveoli).

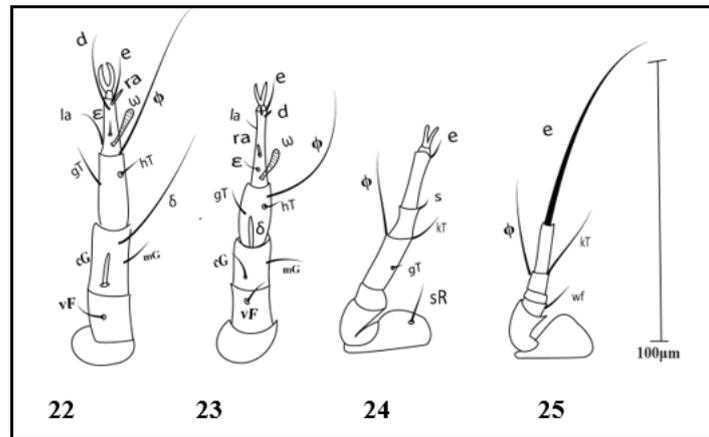
Adhering plate (Fig. 20). Wide, with a thin margin, positioned not far from posterior body margin; anterior suckers undeveloped; median suckers large, with broad margin, an internal ring surrounding single alveoli; posterior lateral and median suckers normal-developed. Length of adhering plate: 28 (26-30) long, 34 (31- 37) wide.

Dorsum (Fig. 21). Propodosoma approximately short. Length of propodosoma: 22 (19-25) long, 98 (94-102) wide. Length of setae *sci* 14, *sce* 15, both setiform, longer and thicker than hysterosomal ones, positioned on anterior margin of dorsosejugal region. The latter ornamented with heavy transversal lines. Propodosomal and hysterosomal surfaces smooth, without any sculptures. Hysterosoma with 11 pairs of filiform setae, approximately at the same length, ranged for 4-5. A pair of circular cupules *ia* situated between setae *d1* and *d2*.



Figs. 18-21. *Myianoetus granatum* n. sp. (Deutonymph): **18.** gnathosoma; **19.** ventral side; **20.** adhering plate; **21.** dorsal side

Legs (Figs. 22-25). Legs slightly long, segments free; legs I-III with bifurcate empodial claws, legs IV clawless. Length of legs and chaetotaxy (holotype deutonymph): legs I 97, II 84, III 66, IV 37. Length of tarsi: I 20, II 21, III 22, IV 12. Chaetotaxy of legs I-IV: o-1-2-2-4 (legs I); 0-1-2-2-4 (legs II); 1-0-0-2-2 (legs III); 0-1-0-0-1-1 (legs IV). All setae on legs I-IV, filiform short or long, except setae *cG* of genua I and *ra* of tarsi I and II cylindrical, setae *e* of tarsi IV setiform. Length of legs setae: setae *sR* III 17, *vF* I 12, *vF* II 16, *wF* IV 17; setae *mG* 17, *cG* 9(I), *mG* 11, *cG* 7 (II); *gT* 14, *hT* 8 (I), *gT* 6, *hT* 5 (II), *gT* 5, *kT* 12 (III), *kT* 17 (IV); setae *la* 9, *ra* 6, *d* 28, *e* 12 (I), setae *la* 6, *ra* 5, *d* 5, *e* 9 (II), setae *s* 6, *e* 5 (III), *e* 62 (IV). Solenidiotaxy of legs I-IV: 0-0-1-1-2 (I); 0-0-1-1-2 (II); 0-0-01-0 (III); 0-0-0-1-0 (IV). Length of solenidia: Legs I ω 14 clavate, ε 4, ϕ 62, δ 38 filiform; legs III ω 10 clavate, ε 8, ϕ 53 filiform, δ 8 cylindrical; legs IV ϕ 19 filiform.



Figs. 22-25. *Myianoetus granatum* n. sp. (Deutonymph): **22.** leg I; **23.** leg II; **24.** leg III; **25.** leg IV.

Material examined: Holotype deutonymph and three paratype deutonymphs extracted from the soil under pomegranate trees, Assiut, Upper Egypt, 27°02'28.20"N, 31°00'25.80"E, leg. A.S. Abdelgayed, 20 Oct. 2019, are deposited in the Acari collection of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut 71526 Egypt.

Remarks: The shape of gnathosoma, the length of dorsal setae, the construction of adhering plate, the shape and chaetotaxy of legs I and II, differentiate the new species from other closely related species of *Myianoetus* described by Mahunka (1972); Fain (1980) and Eraky (1993).

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