

Description of Adults and Complementary Description of Deutonymphs of *Hormosianoetus mahunkai* Eraky and Shoker, 1993 (Acari: Histiostomatidae), with Identification Key for Histiostomatid Genera

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ABSTRACT

A histiostomatid species, colonized from the fungus, *Fusarium oxysporum* (Nectriaceae) cultured in Plant Pathology Department, Shandaweel Agricultural Research Station, Sohag governorate, Egypt, was studied taxonomically. The morphological characters of the deutonymph were identical to those of *Hormosianoetus mahunkai* Eraky and Shoker, 1993 isolated from banana suckers cultivated in the farm of the Faculty of Agriculture, Assiut University, Egypt. The adult male and female are described and illustrated for the first time and the deutonymph is re-described. An identification key for histiostomatid genera was also provided in the present study.

Key words: Acari, Histiostomatidae, *Hormosianoetus*, adult, description, *Fusarium*, identification key.

INTRODUCTION

Mites of the family Histiostomatidae (=Anoetidae Oudemans, 1904) are common inhabitants of wet microhabitat associated with plants and fungi. Dispersal between habitat patches is affected by phoretic association between the specialized deutonymphs and the host which may be either another arthropod or vertebrate (O'Connor, 1982; Houck and O'Connor, 1991). Due to lack of information regarding life cycles of the majority of histiostomatid species, scientists described the new taxa based upon the deutonymphal stages only, despite Hughes and Jackson (1958) and Scheucher (1957) provided information on the life cycles of many species. Scheucher (1957) recognized nine genera in family Histiostomatidae in the European fauna, while Hughes and Jackson (1958) recognized 13 in the world fauna. The number of known genera of the family now reached to 58 genera, with 14 genera having some species described from both adult and deutonymphal stages, the rest are described from deutonymphs only. However, some authors used both adult and deutonymphal stages in the description of the new taxa of such family, i.e., Fashing (2008); Tagami (2007); Bongers *et al.* (1985). Study on the Acaridid mites (Acaridae and Histiostomatidae) has received the attention from several authors (viz., Samsinak, 1966; 1972 in Czech Republic; Griffiths, 1964; 1967 in England; Mahunka, 1969, 1978 a & b; 1979; 1981; 1982 a & b; Mahunka and Eraky, 1987; Mahunka 1991 in Hungary; O'Connor, 1982; 1984 a & b; 1988; 1989; 1990; 1991; 1993; 1997; Bongers *et al.*, 1985 in USA; Tagami, 2004; 2007; 2013; Tagami and Kuwahara, 2005; Kurosa and Tagami, 2006; Tagami and Halliday, 2013 in Japan; Fain, 1987; 1988; Fain *et al.*, 1999 in Belgium; Eraky, 1993; 1994 a & b; 1997; 1998; 1999 a; b & c; 2000 a & b; Eraky and Osman, 2008a; b & c; Eraky and Shoker, 1993; 1994; 1995; Eraky *et al.*, 2010; 2017; Fakeer *et al.*, 2014 in Egypt. On the other side, studying of morphological

characteristics of deutonymphs is very important for the possibility of distinguishing between different histiostomatid taxa; however, the ontogeny, habitat and ecology are also needed. The genus *Hormosianoetus* Fain, 1980 was presented by two species, *Hormosianoetus aeschlimanni* Fain (1980) described from deutonymph phoretic on drosophila bred in Switzerland and *Hormosianoetus mahunkai* Eraky and Shoker (1993) extracted from banana suckers in Egypt. The present study provides information on adult males and females of *Hormosianoetus mahunkai* previously described from deutonymphs. The complete life cycle of *H. mahunkai* collected from *Fusarium oxysporum* (Nectriaceae) was studied by Mohamed (2018).

MATERIALS AND METHODS

The mite specimens identified as *Hormosianoetus mahunkai* Eraky and Shoker, 1993, were isolated from banana suckers cultivated in the farm of the Faculty of Agriculture, Assiut University, Assiut Governorate, Egypt. In the original description, epimeres 1 and 3 with well-observable alveoli each (Eraky and Shoker, 1993), but alveoli absent on epimeres 3 and hardly visible on epimeres 1, epimeres 4 with approximately large disks (4a), in addition to the absence of the Cupule (ia) on idiosoma. The collected specimens of more than 10 well-preserved specimens of each stage (males, females and deutonymphs) were obtained from *Fusarium oxysporum*. Mites were cleared up in lactic acid, mounted in Hoyer's medium on glass slide, dried on hot plate, ringed with nail polish, then examined under a phase contrast microscope (Optika-Vision-Lite_ENG-rev 01, Italy), provided with camera and system of calibration of micrometric slide when put on the stage of microscope. Measurements are given in micrometers (μm) each measurement shows the average for the number of individuals, followed (in parentheses) by the respective ranges; a drawing tube was also used when necessary.

Different morphological characteristics were prepared to be examined under a scanning electronic microscope (SEM). The adult male and female were described and illustrated. Nomenclature by Griffiths *et al.*, 1990 followed for idiosomal setae and Grandjean, 1939 for legs setae.

Genus *Hormosianoetus* Fain, 1980

Hormosianoetus mahunkai Eraky and Shoker, 1993:

Female (Figs. 1 - 16): (Holotype female and seven paratype females measured). Body oval. Idiosoma 352 (345- 360) long, 241 (238- 245) wide. Measurements of dorsal and ventral setae for holotype female are presented in Table (1).

Gnathosoma (Figs. 1- 4) Gnathosoma in holotype female 144 long, 85 wide. Chelicerae with a fixed digit showing membranous spine as a fist hand with index finger-like structure pointed upward, cheliceral seta short located near a base of a blunt paraxial chelicerae spine. Anterior portion of movable digit broadly flattened with internally well-developed 13 sub-apical teeth, and externally with short, filiform, simple sub-apical seta.

Dorsum (Figs. 5 & 7): Cuticle smooth, anterior propodosoma ornamented with punctulate extended posteriorly above legs I, in addition to an oval shapes similar to the beads located in the middle. Setae *vi* (15) and *ve* (18), filiform. Scapular setae filiform, internal scapular setae *si* (36) short and thin, positioned in front to longer and thicker external scapular setae *se* (56). Sejugal furrow very faint, hardly visible. Hysterosoma with well-developed filiform setae, sub-equal in length ranged between (32 - 58), oil gland (*gla*) well-developed, located between setae *e1* and *e2*, the cupules (*ia*, *im* and *ih*) invisible.

Venter (Figs. 6 & 8). Apodemes I fused medially to form a Y-shaped with short extension posteriorly, all other apodemes free medially. Genital seta *3a* minute (6), filiform, positioned in front to genital opening, anterior papillae and posterior one circular, both well-sclerotized. Coxal setae *4a* invisible, two pairs of anal setae (*ps3* and *ps4*) short, filiform and located along the anterior half of anal opening, a pair of anal setae (*ps1*) long and located posteriorly to the anal opening.

Legs (Figs. 9 - 16). Legs slender, with all five segments free. Chaetotaxy: from trochanter to tarsi: trochanter 1-1-1-0; femora 1-1-0-1; genua 2-2-0-0; tibiae 2-2-1-1; tarsi 11-11-9-9. Solenidiotaxy: genua 2-1-0-0; tibiae 3-1-1-1; tarsi 1-1-0-0. Famulus (ϵ) absent. Terminal tarsal setae (*d*) legs I-IV elongated, filiform, longer on legs I - II (29, 28, 18 and 7 on legs

I, II, III and IV, respectively). Tibia I excavated dorsoapically around common base of tarsal solenidia $\omega 1$ and $\omega 2$, the same also observed on genu I solenidia $\sigma 1$ and $\sigma 2$. Most legs setae spine-like, except trochanter setae (*pR* legs I-II, *sR* leg III), filiform. Solenidia on legs I-IV (leg I, $\omega 1$ 14, $\omega 2$ 11, $\omega 3$ 6, Φ 15, $\sigma 1$ 12 and $\sigma 2$ 10 (leg I); ω 11 and Φ 12 (leg II); Φ 10 (leg III) and Φ 8 μm (leg IV).

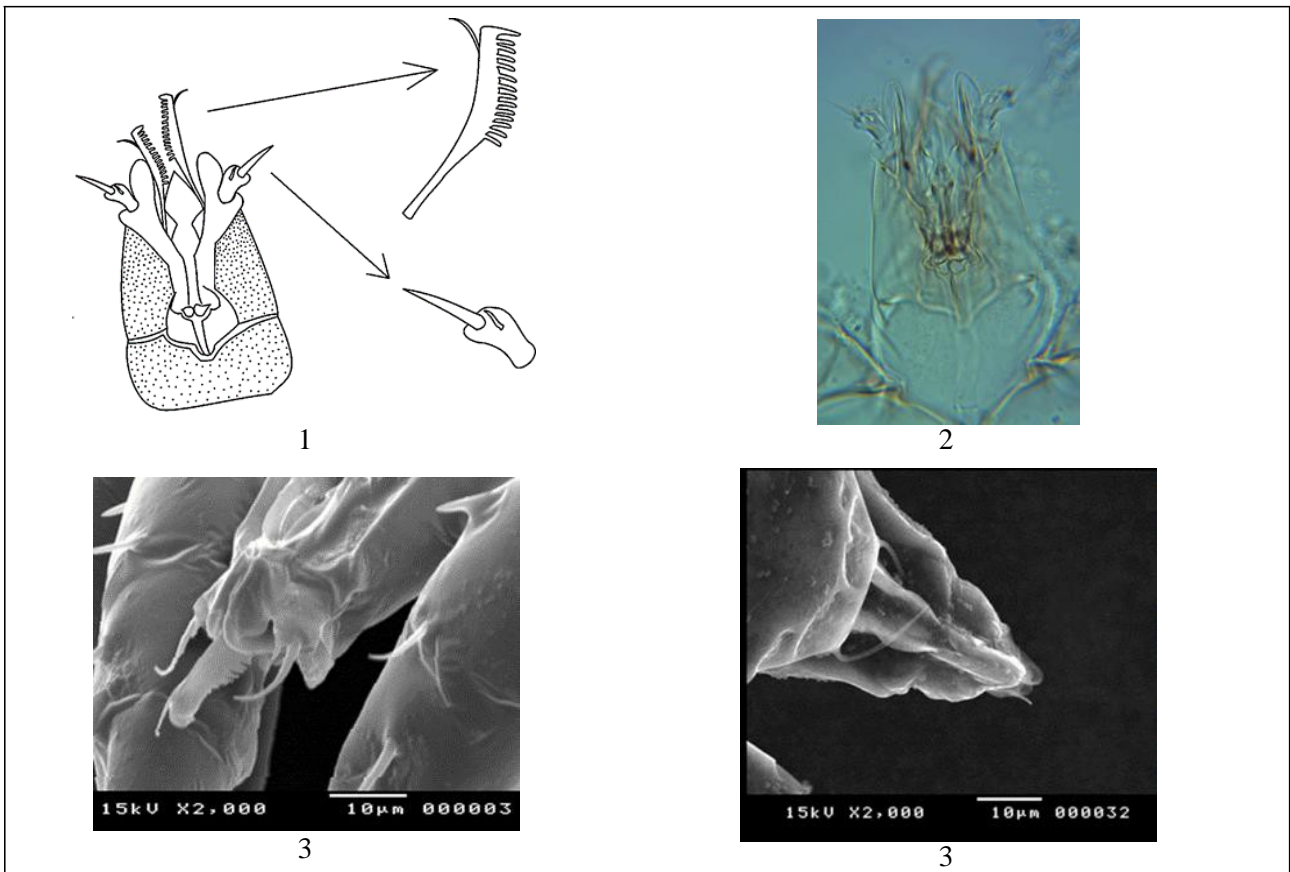
Male (Figs. 17 - 30) (Eight paratype males measured). Body approximately oval in shape. Idiosoma 214 (200 - 229) long, 158 (150 -166) wide. All measurements of setae on dorsal and ventral sides of one paratype male are presented in Table (1).

Gnathosoma (Figs. 17- 18). Gnathosoma in one paratype male 89 long, 49 wide, the shape of gnathosoma is similar to that of adult female.

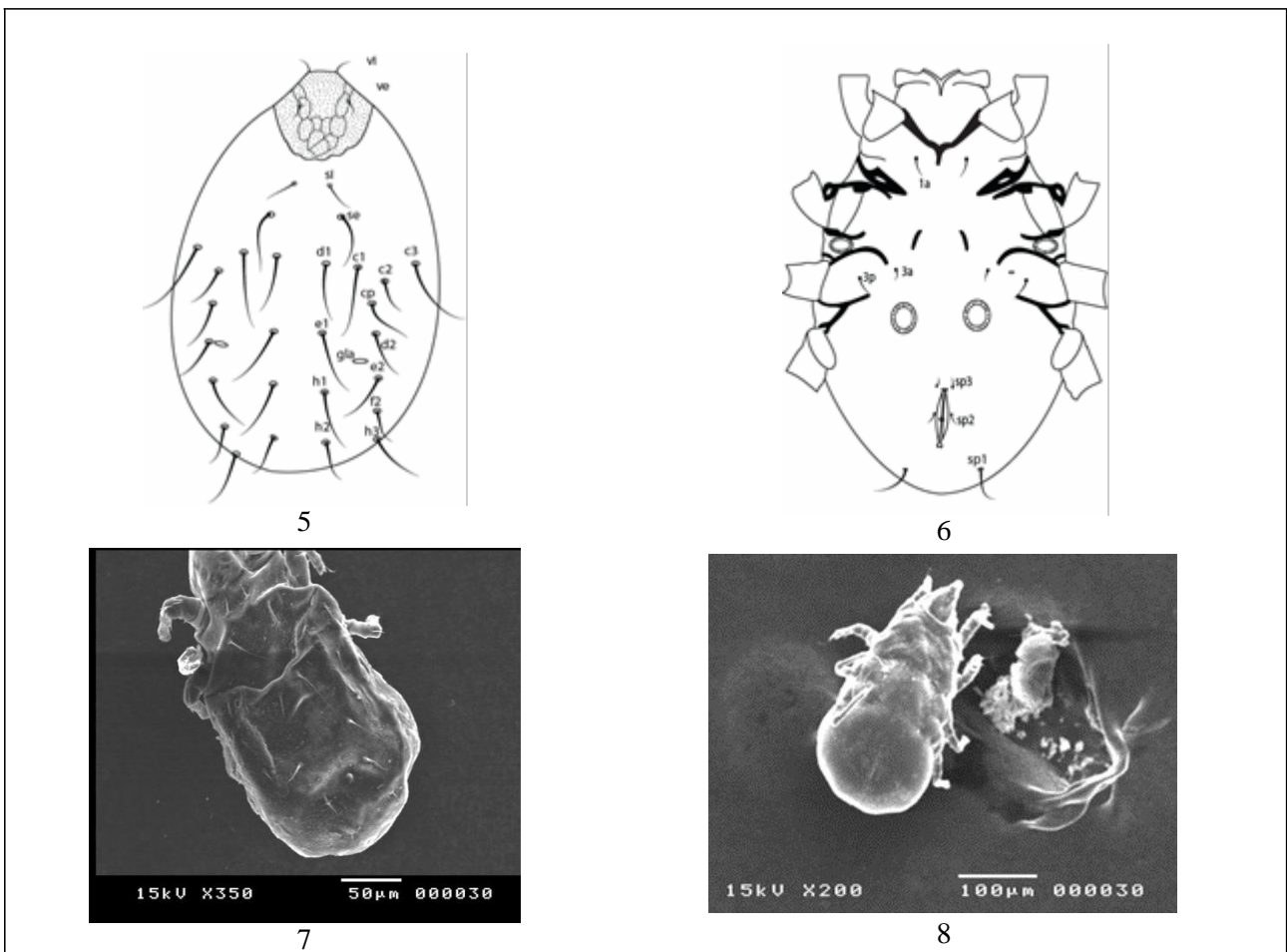
Dorsum (Figs. 19 - 21). Setae *vi* and *ve* approximately equal in length (22 - 23), filiform. Scapular setae filiform, internal scapular setae *si* (24) shorter and thinner than the external ones *se* (60), located in front of them. Sejugal furrow very faint, hardly visible. Hysterosoma with well-developed filiform setae, sub-equal in length (ranged between 34 - 69), oil gland (*gla*) the cupules (*ia*, *im* and *ih*) invisible.

Table 1. Measurements (in μm) of dorsal and ventral setae of *Hormosianoetus mahunkai* male and female (types)

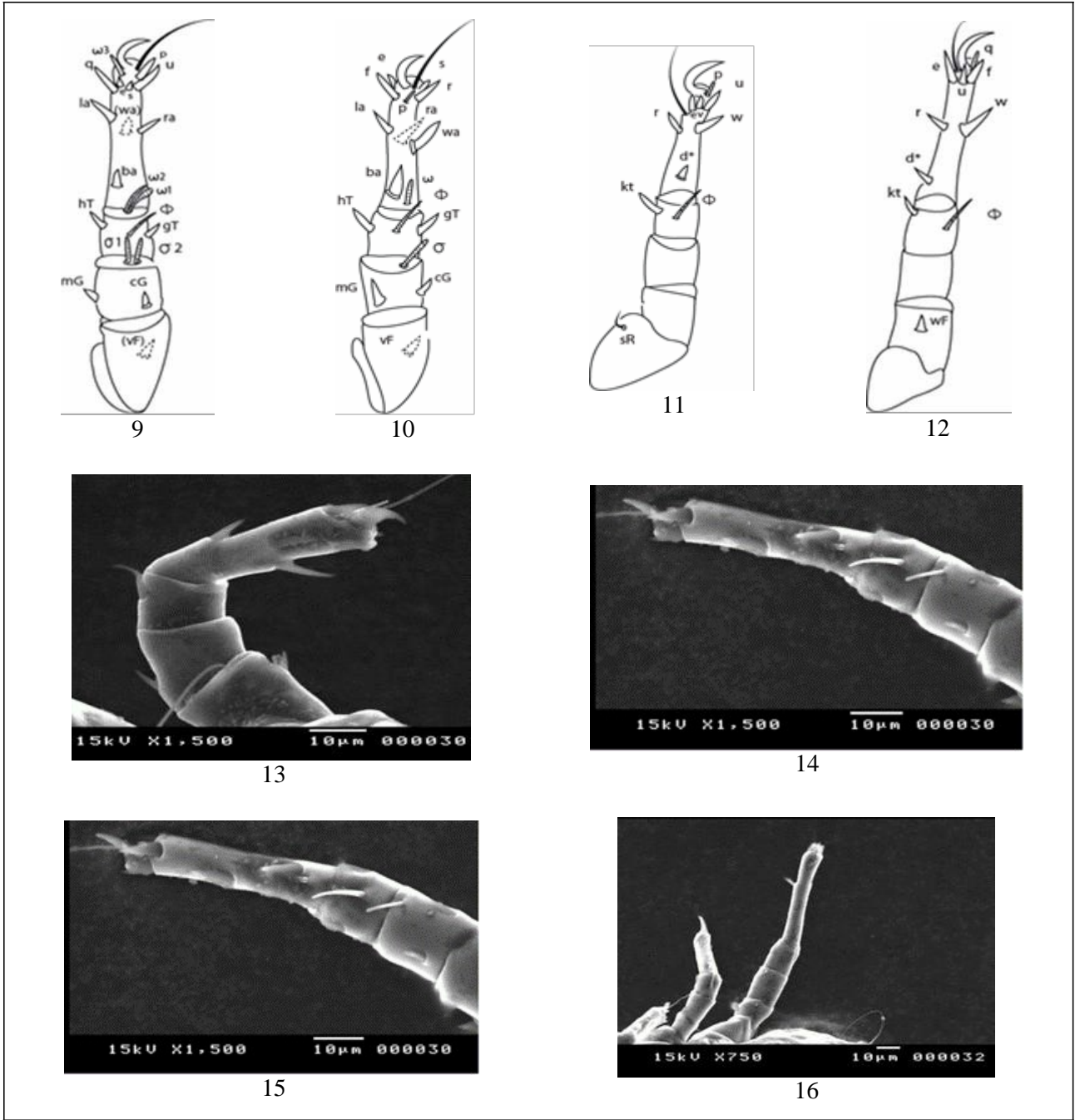
Setae	Female	Male
<i>Vi</i>	15	22
<i>Ve</i>	18	22
<i>Si</i>	36	24
<i>Se</i>	56	59
<i>c1</i>	36	36
<i>c2</i>	32	45
<i>c3</i>	59	41
<i>Cp</i>	50	62
<i>d1</i>	58	69
<i>d2</i>	48	62
<i>e1</i>	54	34
<i>e2</i>	52	37
<i>h1</i>	57	63
<i>h2</i>	38	67
<i>f2</i>	46	37
<i>1a</i>	15	18
<i>3a</i>	6	17
<i>4a</i>	-	6
<i>3b</i>	16	11
<i>Ps1</i>	21	45
<i>Ps2</i>	8	6
<i>Ps3</i>	7	8



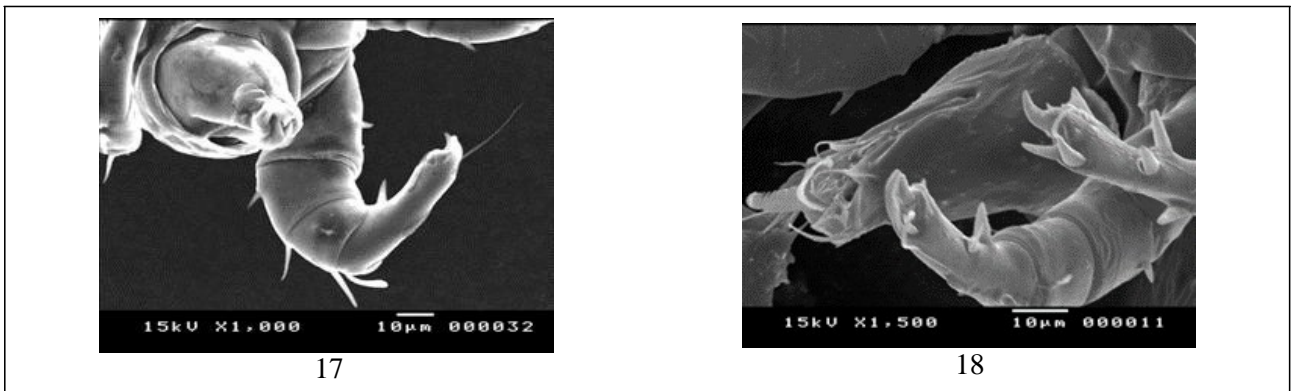
Figs. (1 - 4): *Hormosianoetus mahunkai* Gnathosoma of female.



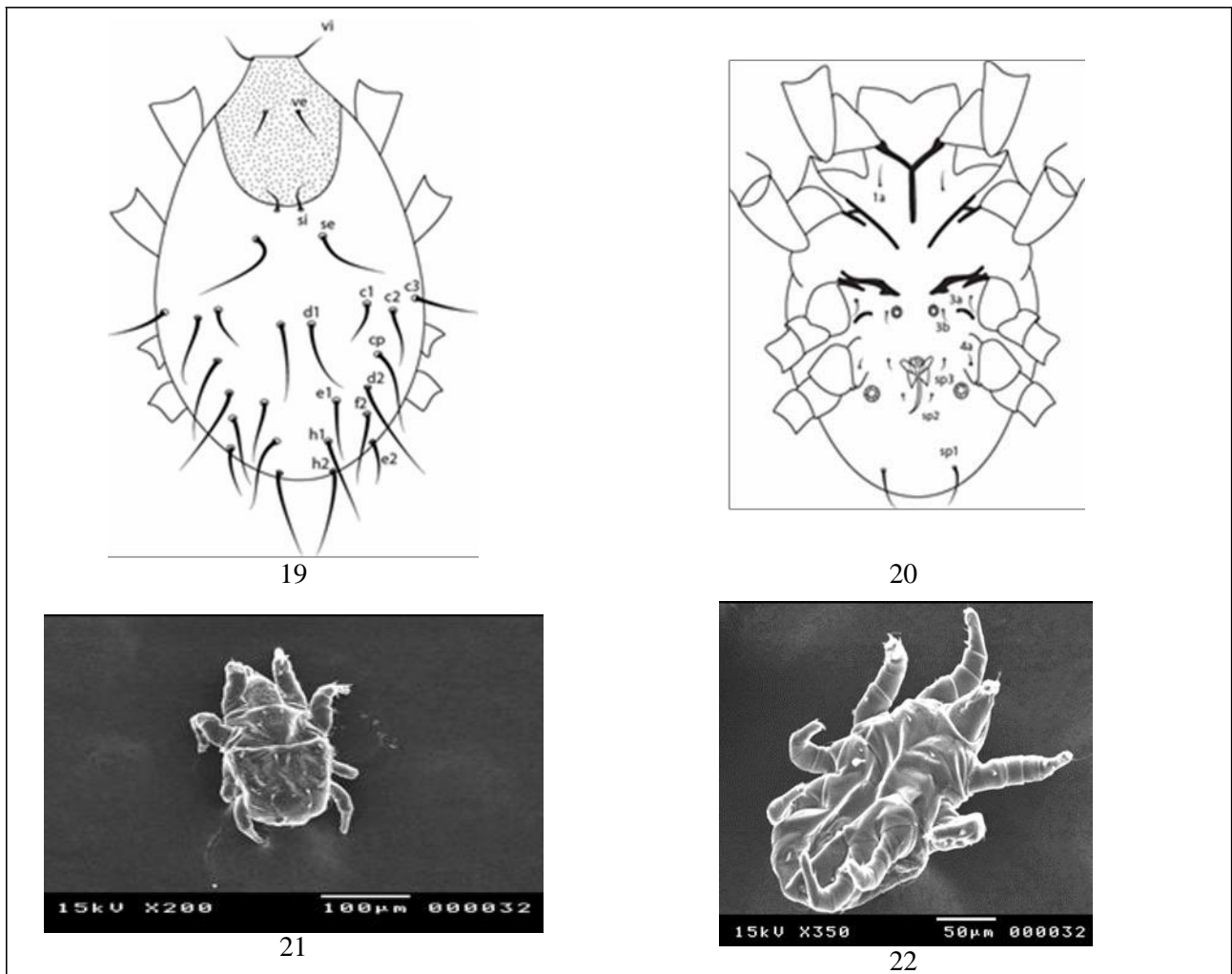
Figs.: (5 - 8): *Hormosianoetus mahunkai* female, 5 & 7 dorsal side; 6 & 8 ventral side



Figs.(9 - 16): *Hormosianoetus mahunkai* female, 9 & 13 leg I; 10 & 14 leg II; 11 & 15 leg III; 12 & 16 leg IV.



Figs. (17- 18). *Hormosianoetus mahunkai* male, 17 & 18 gnathosoma.



Figs. (19 - 22): *Hormosianoetus mahunkai* male, 19 & 21 dorsal side; 20 & 22 ventral side.

Venter (Figs. 20 - 22). Apodeme I fused medially to form a Y-shaped sternum, with long extension posteriorly, apodemes II and III long, both free medially. All apodemes well-sclerotized. Anterior genital papillae very small and circle-shaped, located medially beside apodeme IV and *3b*. Posterior papillae circle-shaped, slightly larger and located outside of a rose-like structure anal slit. Anal setae *sp3* and *sp2* minute, *sp1* longer and thicker. Coxal setae (*3a*, *3b* and *4a*) very short. All ventral setae filiform.

Legs (Figs. 23 - 30). Legs normal, developed, setae and solenidia on legs I-IV as in adult female, setae spine-like, except for trochanter setae (*pR* on legs I & II - *sR* on leg III). The length of setae on dorsal and ventral sides for one paratype male are presented in Table (1). Solenidia on legs I-IV ($\omega 17$, $\omega 27$, $\omega 3$ 14, $\Phi 10$, $\sigma 18$ and $\sigma 26$ (leg I); ω 11 and Φ 10 (leg II); Φ 7 (leg III) and Φ 12 (leg IV).

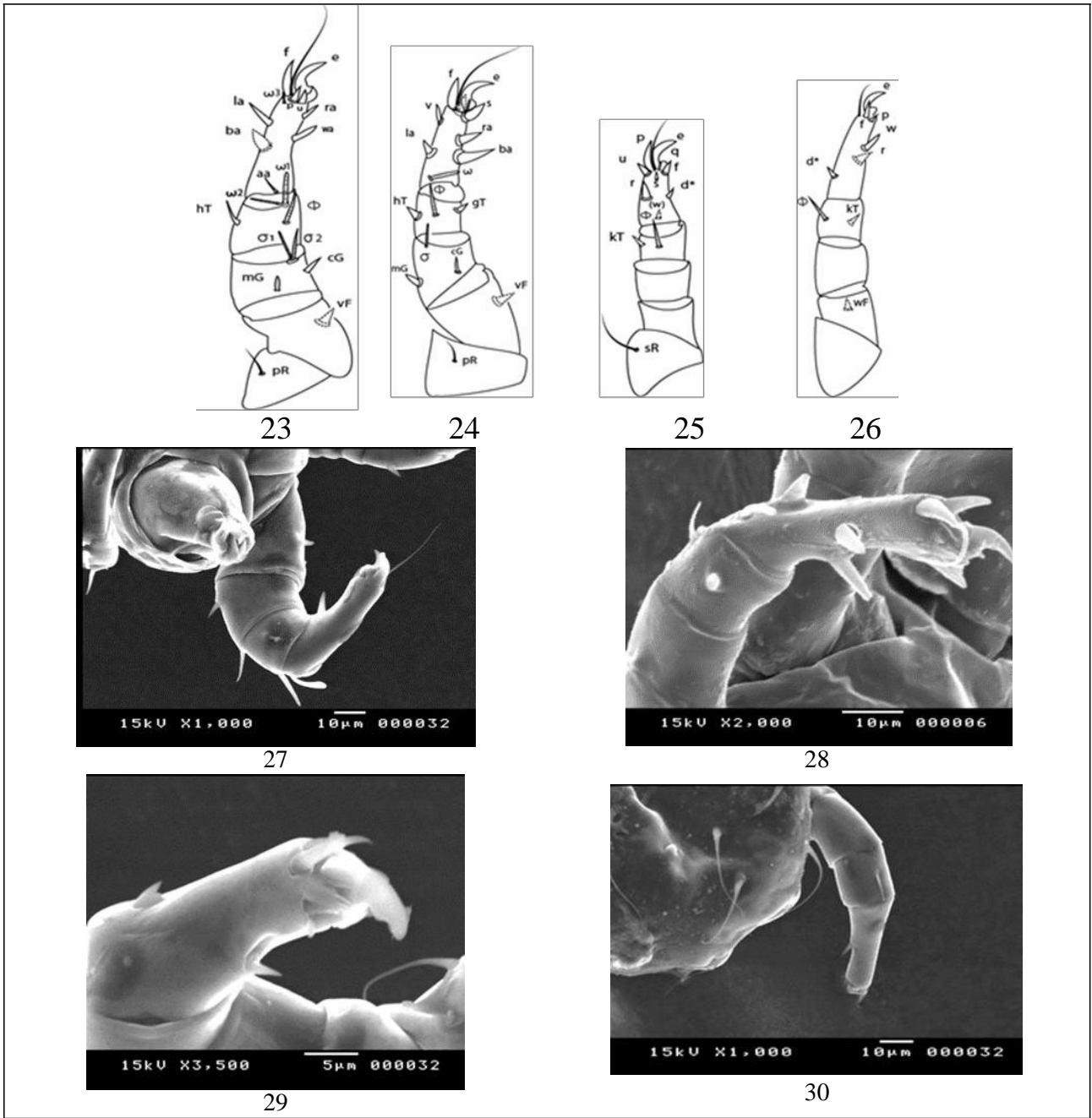
Deutonymph (Figs. 31 - 44). Body ovoid, widest in its shoulders, idiosoma 152 (140 - 165) long, 107 (100 - 115) wide.

Gnathosoma (Figs. 31 - 32). Gnathosoma

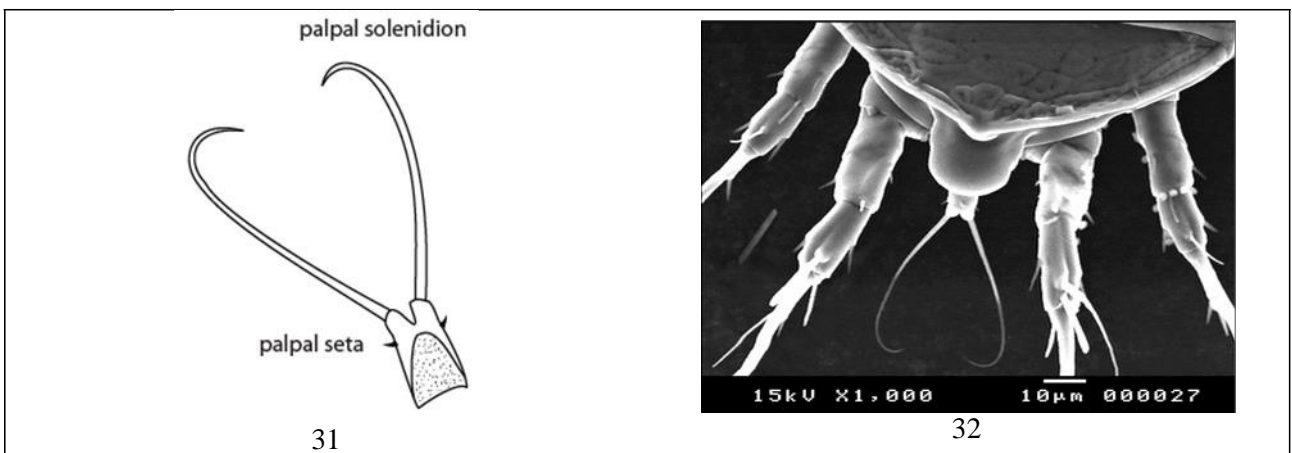
approximately short, its infracapitulum oblong (9 long, 7 wide). Palpal solenidia long, curved inside (46 long), palpal setae very short 2 long, situated behind a well discernable palp.

Dorsum (Figs. 33 & 35). Propodosoma triangular with a well discernible definite line decurrently approximately parallel with body margin. Internal scapular setae *si* and the external ones very short, *si* (7), shorter and thinner than external ones *se* (8), the former located in front of the latter, together with these, all idiosomal setae, short and simple (6 - 10). Dorsosejugal region smooth, without any sculpture. Surface of hysterosoma ornamented by longitudinal lines regular along the surface. No observable cupules presented on dorsal surface.

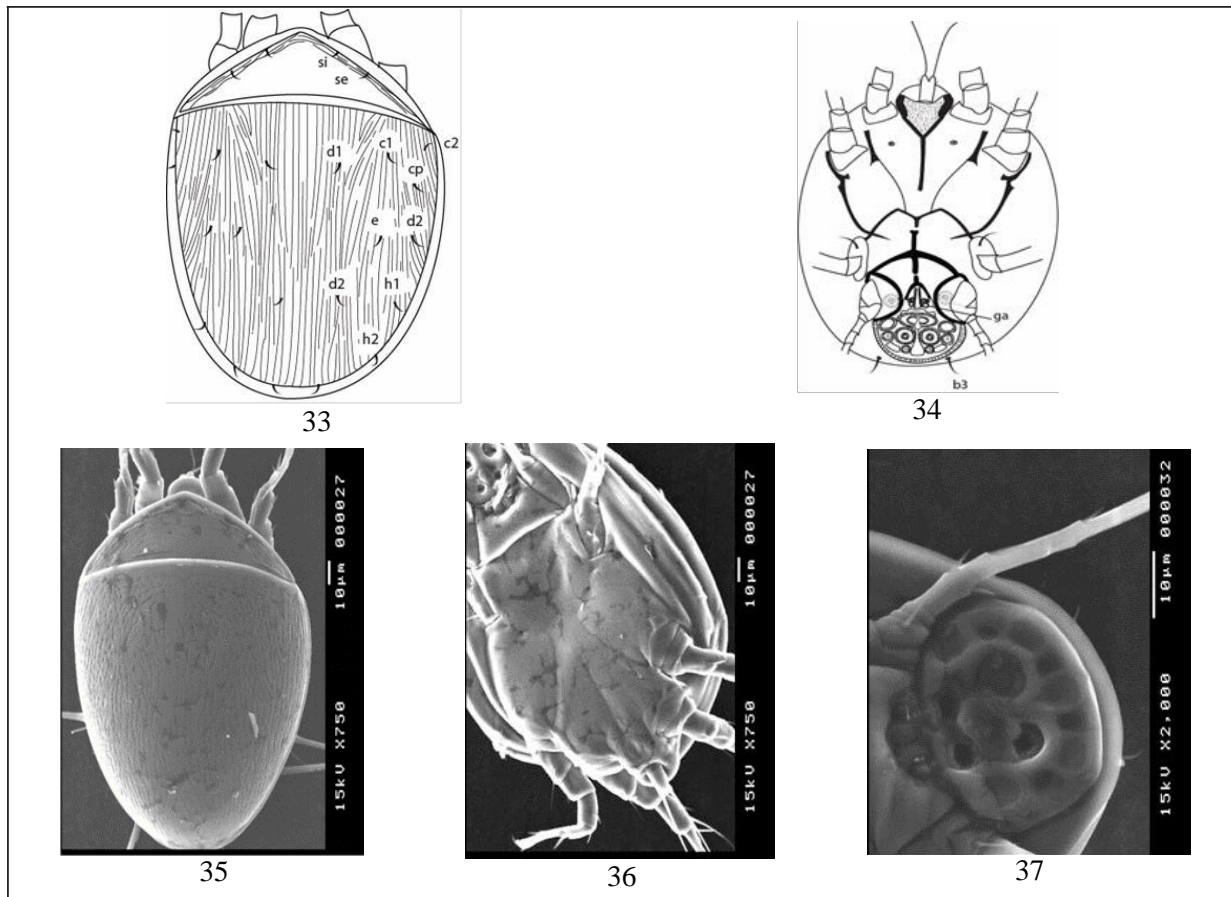
Venter (Figs. 34, 36 & 37). Apodemes I well-sclerotized, surrounded with punctate halo. Apodemes well-developed, but anterior sternal apodeme short, ending free, apodemes 2 reaching arc of sejugal apodemes. Intermediate sternal apodeme long, forming a Y-shaped end. Epimeres 4 with well-developed disk. Sucker plate (Figs. 34 & 37) normal, medium suckers larger than the other ones.



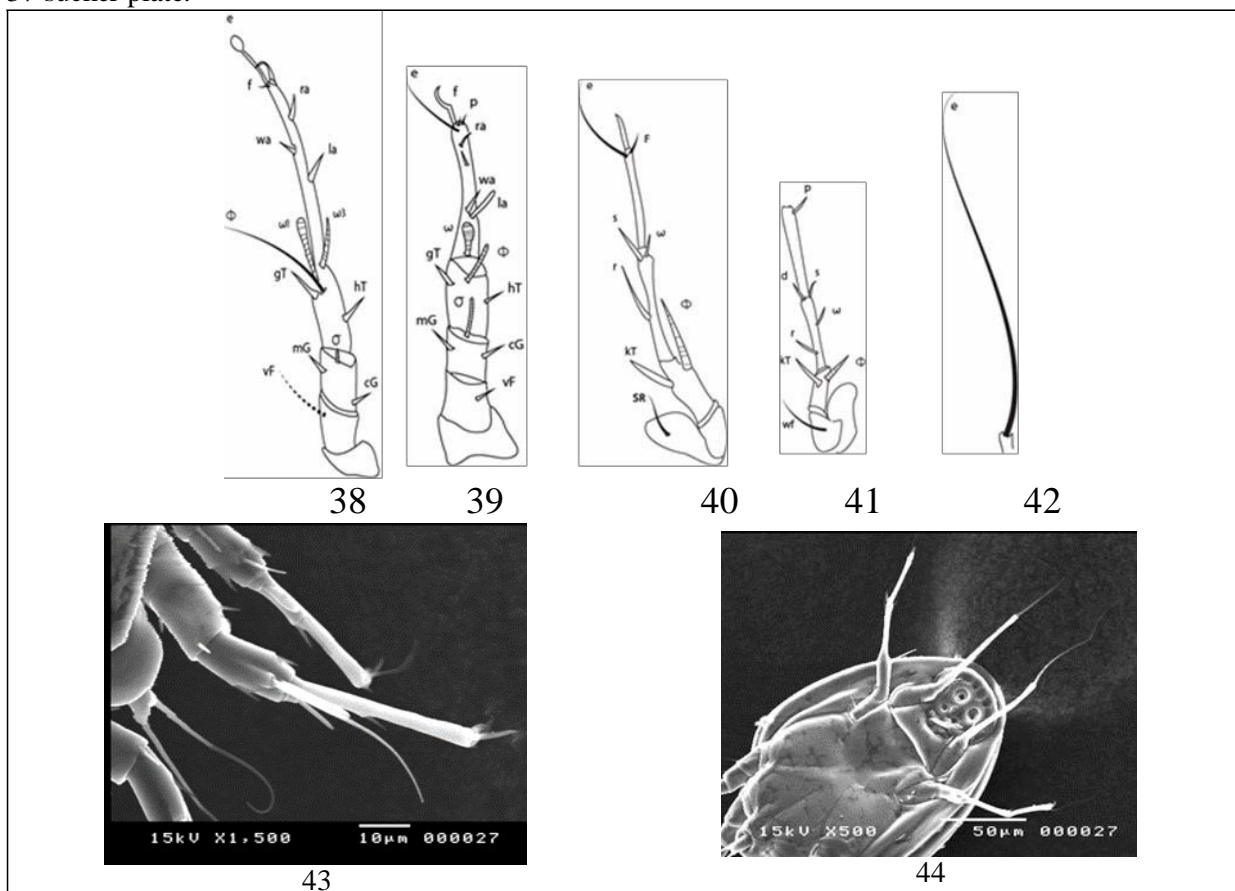
Figs. (23 - 30): *Hormosianoetus mahunkai* male, 23&27 leg I; 24 & 28 leg II; 25 & 29 leg III;26 & 30 leg IV.



Figs. (31 - 32). *Hormosianoetus mahunkai* deutonymph, 31 & 32 gnathosoma.



Figs. (33 - 37): *Hormosianoetus mahunkai* deutonymph, 33 & 35 dorsal side; 34 & 36 ventral side; 37 sucker plate.



Figs. (38 - 44). *Hormosianoetus mahunkai*, 38 & 43 leg I; 39 & 43 leg II; 40 & 44 leg III; 41 & 44 leg IV; 42 terminal tarsal seta on leg IV, 43 group of solenidia on legs I - II.

Legs (Figs. 38 - 44). Legs normal, developed, setae spine-like, except the trochanter setae (*vF* on legs I and II, *sR* on leg III and *wF* on leg IV). Solenidia on legs I-IV (leg I: $\omega 125$, $\omega 332$, $\Phi 96$, $\sigma 1$ 13; Leg II: $\omega 29$ and $\Phi 17$; Leg III: $\Phi 29$ and leg IV: $\Phi 16$). Solenidium ϵ not discernible in solenidial group of leg I. Terminal setae on leg I, spoon-shaped 30 μm . On legs II- IV, setiform 21, 30 and 148, respectively.

Discussion. The description herein provided agrees with those of Eraky and Shoker's (1993) of *H. mahunkai*, except the absence of alveoli (*3a*) on epimere 3 and cupule (*ia*) on idiosoma, in addition to large size and situation of disk (*4a*). Otherwise, all

morphological characteristics are identical for specimens collected from both banana suckers and *F. oxysporum*.

Materials examined: One holotype female, 7 paratype females, 8 paratype males and 8 paratype deutonymph collected from *Fusarium* culture, at Sohag governorate, Egypt, June 15, 2018. One holotype females and three paratype females deposited in the Acari collection of Plant Protection Department, Faculty of Agriculture, Assiut University, Egypt; four paratype females deposited in Plant Protection Research Institute, Sohag governorate, Egypt.

**Identification key for the genera of the family: Histiotomatidae
(based on heteromorphic deutonymphs)**

1(62)	Sucker plate normal (e.g., two pairs of movable, two pairs of immovable suckers in 1-2-1 position and 5 other structures: ring or cup).
2(21)	Epimeres 1 and 3 with well-developed normal suckers or cups.
3(12)	All legs with claws.
4(7)	Dorsosejugal region with Suckers consists of transversal lines or ribs.
5(6)	All Joints of legs nearly rounded, without any blade-shaped lateral or ventral formation <i>Histiotoma</i> Kramer, 1876
6(5)	Some joints of legs I and II with broad lateral crest <i>Scutanoetus</i> Mahunka, 1969
7(4)	Dorsosejugal region without any Suckers.
8(9)	Sucker plate with two pairs of conoids, epimeres 1 and 3 with cups <i>Austranoetus</i> Fain, 1976
9 (8)	Sucker plate with suckers and rings, epimeres 1 and 3 with a vestigial aspect of seta. <i>Traskorchestianoetus</i> Fain and Collff, 1990
10(11)	Suckers on epimeres 3 originating on the transversal apodemes 3. Suctorial plate very large, more than one third long as the body <i>Hauserania</i> Mahunka, 1972
11(10)	Discs on epimeres 3 originating on the longitudinal marginal apodemes. Sucker plate normal-developed.
12 (3)	One or two pairs of legs without claws.
13(20)	Legs III with claws, legs IV clawless. Terminal setae of legs III and IV normal developed not needle- shapd
14(19)	Gnathosoma normal. Humeral part of hysterosoma anteriorly protruding covering the posterior part of the propodosoma..... <i>Stercoranoetus</i> Mahunka and Mahunka-Papp, 1991
15(16)	Dorsosejugal suture straight, without any Suckers. Suckers of epimeres 3 originating on the longitudinal marginal apodemes <i>Spinanoetus</i> Scheucher, 1957
16(15)	Dorsosejugal suture arched anteriorly. Suckers of epimeres 3 originating on the 3 (transversal apodems).
17(18)	Dorsosejugal suture sinuous or waved. No differences between the shape of the discs on epimeres 1 and 3 <i>Pelzneria</i> Scheucher, 1957
18(17)	Dorsosejugal suture smooth. Discs on epimeres 1 greater and well-developed than that on epimeres 3..... <i>Psyllanoetus</i> Fain and Beaucournu, 1973
19(14)	Gnathosoma modified, very broad, sitting on a large median elevation of the coxisternal region. Anterolateral part of the notogaster protruding anteriorly like a wing. <i>Pteranoetus</i> Mahunka, 1973
20(13)	Both pairs of posterior legs without claws. Terminal setae of legs III and IV needle-Shaped <i>Rhaphidothrix</i> Mahunka, 1967
21 (2)	No discs on both epimeres 1 and epimeres 3.

22(33)	One pair of discs presented, either on epimeres 1 or epimeres 3.
23(28)	Discs presented on epimeres 1.
24(27)	All legs with claws.
25(26)	All joints of legs normally developed, rounded. Gnathosoma normal, much longer than wide, its palpi well observable. Hymenanoetus Mahunka, 1963
26(25)	Legs modified all joints of legs I and II wide and flasky-like structure. Gnathosoma shorter than its diameter. Palpi completely reduced ... Kaszabanoetus Mahunka, 1976
27(24)	legs III and IV without claws Anoetoglyphus Oudemans, 1927
28(23)	Discs presented on epimeres 3.
29(30)	Anterior part of podosoma elongated, therefore a very long distance existed between the first and second pairs of legs. Teinokyra Mahunka, 1973
30(29)	Anterior part of podosoma normal, no long distance existing between legs I and II.
31(32)	Sejugal apodemes well-developed. Legs I and II normal in length Glyphanoetus Oudemans, 1929
32(31)	Sejugal apodemes reduced. Legs I twice as long as legs II Porrhanoetus Mahunka, 1963
33(22)	Discs on epimeres 1 and 3 never exist, setae or alveoli or no any structure on them.
34(43)	All legs with claws.
35(38)	One pairs of rounded field exist on the anterolateral part of notogaster. Solenidia $\Phi 1$, originating far posteriorly from Solenidia $\omega 1$.
36(37)	Claws on legs IV normal in length and shape Probonomoia Fain and Rack, 1987
37(36)	Claws on legs IV very long, setiform Bonomoia Oudemans, 1911
38(35)	No round field on the anterolateral part of the notogaster. Solenidia $\Phi 1$ and $\omega 1$ stand near each other.
39(40)	Anterior part of podosoma and gnathosoma modified, very large. A pair of large cups exist on epimeres I Chiloanoetus Fain, 1974
40(39)	Anterior part of podosoma normal-developed. No cups exist on epimeres 1.
41(42)	Terminal tarsal setae of legs III and IV spoon-shaped. A pair of small setae exist on epimeres 1. Lipstoria Oudemans, 1911
42(41)	Terminal tarsal setae on legs III and IV simple. No any structure on epimeres 1 Mauduytia Oudemans, 1929
43(34)	One or two pairs of legs without claws.
44(57)	Legs IV without claws.
45(46)	Two pairs of alveoli exist on epimeres 3 Insulanoetus Sevastianov, 1973
46(45)	One pair of alveoli exists on epimeres 3.
47(48)	Very strong cup-shaped structures exist on epimeres 1 and 3 Congolanoetus Mahunka, 1978
48(47)	Epimeres 1 and 3 with fine setae or alveoli.
49(54)	Body surface with very strong Suckers consists of pits, foveolae and / or crests.
50(51)	Notogasteral surface ornamented by equal great pits ordered in longitudinal. Prodorsom without any Suckers Hormosianoetus Fain, 1980
51(50)	Notogasteral surface ornamented by irregular Suckers. Prodorsom also sculptured.
52(53)	Notogaster with one pair of oval field on the anterolateral region. Solenidia $\Phi 1$ arising behind $\omega 2$ Copronomoia Mahunka, 1976
53(52)	Notogaster with one unpaired median field exists on the notogaster. Solenidia $\Phi 1$ and $\omega 2$ arising beside to each other Ameranoetus Ide and Mahunka, 1978
54(49)	Body surface without any Suckers.
55(56)	Sucker plate small, wide inverse trapezoidal in shape. Alveoli on epimeres 1 and 3 originating normally Sarraceniopus Fashing and Oconnor, 1984
56(55)	Sucker plate normal developed. Setae or alveoli on epimeres 1 and 3 originating marginally or missing Peripatetes Mahunka, 1976
57(44)	Both posterior pairs of legs clawless.
58(59)	Dorsosejugal region without any sculpture. Cup-shaped structures exist on epimeres 1 Bothanoetus Fain and Camerik, 1978
59(58)	Dorsosejugal region ornamented with Suckers consists of transversal lines or ribs. Seta exist on epimeres 1

60(61)	Solenidia $\Phi 1$ originating far behind $\omega 2$. Setae on epimeres 1 and 3 arising on the middle of these regions Ghanoetus Mahunka, 1973
61(60)	Solenidia $\Phi 1$ originating close to $\omega 2$. Setae or alveoli on epimeres 1 and 3 arising marginally Semianoetus Mahunka, 1976
62(1)	Sucker plate strongly modified or reduced (e.g., either less than 2+2 suckers presented or not in 1-2-1 position).
63(70)	Well-developed discs exist on epimeres 1 and 3.
64(67)	All legs with claws.
65(66)	Sucker plate with one large pair of suckers and three much smaller existed behind the former ones Prowichmannia Radford, 1950
66(65)	The position of suckers on the suctorial plate normal, but one pair of the posterior suckers having syringe-like excrescence Syringanoetus, Fain, 1980
67(64)	Two pairs of legs without claws.
68(69)	Gnathosoma reduced, hardly visible. Sucker plate with four pairs of suckers Scolianoetus Fain, 1974
69(68)	Gnathosoma widened, very large. Sucker plate with one pair of sucker Kanoetus Samsinak, 1966
70(63)	At least one of the epimeres 1 or 3 without discs.
71(74)	One disc presented on epimeres 1 or epimeres 3.
72(73)	Setae arising on epimeres 1, and discs on epimeres 3. Prodorsom strongly modified, gnathosoma reduced. Curculanoetus Fain, 1974
73(72)	Discs placed on epimeres 1, alveoli on epimeres 3. Gnathosoma and prodorsum normally developed Fibulanoetus Mahunka, 1973
74(71)	Only setae, their alveoli presented on epimeres 1 and 3, or all of these structures missing.
75(82)	All legs with well-developed claws.
76(77)	Notogaster strongly elongated posteriorly, its end with deep incision. Three pairs of suckers originated behind each other in the suctorial plate..... Scheucheria Mahunka, 1969
77(76)	Notogaster normal-developed, the numbers and position of suckers in the sucker plate differed.
78(79)	Sucker plate reduced, only two pairs of suckers originating on its place. Notogaster with deep hollow posteriorly Ceylanoetus Mahunka, 1973
79(78)	Sucker plate observable. Posterior end of Notogaster rounded.
80(81)	One pair of large and three pairs of small suckers presented on the sucker plate. Gnathosoma modified, extremely reduced, only long palpal solenidia arising directly from subcapitulum. Nepenthacarus Fashing, 2002
81(80)	Only four pairs of very small suckers presented on the sucker plate. Gnathosoma normal-developed Amyzanoetus Fain, 1976
82(75)	At least one pair of legs clawless.
83(88)	Claws of legs elefted.
84(88)	Gnathosoma modified, very large. Tarsi and tibia of legs I much thinner than the other joints Xenaoetus Mahunka, 1969
85(84)	Gnathosoma normal-developed. Tarsi and tibia of legs I gradually narrowed from the other joints.
86(87)	At least one pair of large suckers presented on the sucker plat... Myianoetus Oudemans, 1929
87(86)	No suckers on the sucker plate Synanoetus Mahunka, 1972
88(83)	Claws of legs normal, simple.
89(90)	Strong spine existed on epimeres 1. Only one pair of suckers on sucker plate Chiropteroetus Womersley, 1942
90(89)	No spine on epimeres 1. More than one pair of suckers on sucker plate Zwickia, Oudemans 1924

REFERENCES

- Bongers, M.G.H.; B.M. Oconnor and F.S. Lukoschus 1985. Morphology and ontogeny of histiostomatid mites (Acari: Astigmata) associated with cattle dung in the Netherlands. *Zoologische Verhandelingen* 223, 1:56.
- Eraky, S.A. 1993. *Myianoetus lili* sp. n. (Acari : Anoetidae) educed from manure, Assiut, upper Egypt. *Folia Entomol. Hung.*,54:47-49.
- Eraky, S.A. 1994a. Three new anoetid mites extracted from animal excrement and from garlic (Acarina : Anoetidae). *Folia Entomol. Hung.*, 55: 217- 223.
- Eraky, S.A. 1994b. Two new hypopi of *Histiostoma* Kramer, 1876 (Acari: Astigmata) recovered from pomegranate and date fruits. *Assiut J. of Agric. Sci.*, 25 (2): 157-162.
- Eraky, S.A. 1997. A key to new and old histiostomatid deutonymphs recorded in Assiut area with a descriptions of two new species (Acari: Histiostomatidae). *Assiut J. of Agric. Sci.*, 28(1): 99-116.
- Eraky, S.A. 1998. *Mahunkaglyphus solimanig.* sp. n. and three new species (Acari: Astigmata) described from termite nests, western desert, Egypt. *Folia Entomol. Hung.*, 59: 241-250.
- Eraky, S.A. 1999a. A new genus and three new species of mites (Acari: Acaridida) phoretic on termites infesting the camphor trees in Aswan, Egypt. *Annals hist. -nat. Mus. Hung.*, 91: 209-217.
- Eraky, S.A. 1999b. Five new hypopial nymphs (Acari: Acaridae and Histiostomatidae) described from different habitats. *Folia Entomol. Hung.*, 60: 45-56.
- Eraky, S.A. 1999c. Seven new species of mites (Acari: Acaridida) educed from different habitats in Upper Egypt. *Assiut J. of Agric. Sci.*, 30 (5): 65-80.
- Eraky, S.A. 2000a. Identification key for some Acarididia mites (hypopi) (Acari: Astigmata) with descriptions of two new species. *Assiut J. of Agric. Sci.*, 31: 341-371.
- Eraky, S.A. 2000b. Four new species of genus *Histiostoma* kramer, 1876 (Acari: Astigmata) subsistent in manure and dunghills. *Folia Entomol. Hung.*, 61: 5-16.
- Eraky, S.A. and M.A. Osman 2008a. *Caloglyphusmanuri* n. sp. (Acaridida: Acaridae) extracted from chicken manure, Mansoura, Egypt. *Acarines*: 2:43-44.
- Eraky, S.A. and M.A. Osman 2008b. Some biological aspects and life table parameters of *Caloglyphusmanuri* Eraky and Osman (Acaridida: Acaridae) fed on different kinds of food. *Acarines*: 2: 5- 48.
- Eraky, S.A. and M.A. Osman 2008c. New identification key for some Acaridides (Acaridida) from Upper Egypt with description of a new species. *Acarines*. 2: 49-60.
- Eraky, S.A. and N.I. Shoker 1993. Mites extracted from uprooted banana sucker (Acari: Anoetidae). *Folia Entomol. Hung.*, 54: 51-56.
- Eraky, S.A. and N.I. Shoker 1994. Two new deutonymphs of the genus *Histiostoma* Kramer, 1876 (Acari : Histiostomatidae) existing in stored onions. *Assiut J. Agric. Sci.* 25 (2): 163-168.
- Eraky, S. A. and N.I. Shoker 1995. The description oftwo new anoetid mites Acari: Anoetidae deriving from different habitats. *Folia Entomol. Hung.* 56: 21-26.
- Eraky, S.A.; Abdel-Galil, F.A. and Bohibah, M.K. 2010. Identification key for some phoretic acaridides (Acari: Acaridida) from Upper Egypt with description of two new species. *Assiut J. Agric. Sci.* 41(3): 76-92.
- Eraky, S.A.; Abdelgayed, A.S.; Negm, M.W.; Helal, T.Y. and Moussa, S.F.M. 2017. Two New Species of *Histiostoma* Kramer and *Caloglyphus* Berlese (Acari: Acaridida) from citrus orchards in Assiut, Egypt. *Assiut J. Agric. Sci.*, 48 (1): 182-190.
- Fain, A. 1974. Notes sur quelques hypopes d'Anoetidae (Acarina: Sarcoptiformes). *Bull. Ann. Soc. r. Beige Ent.*, 110 :58-68.
- Fain, A. 1976. lies subantarctiques. 2- Families Acaridae, Anoetidae, Ereyenetidae et Tarsonemidae (Astigmata, Prostigmata). *Acarologia*. 18: 302-328.
- Fain, A. 1980. *Hormosianoetus aeschlimanni* n.g., n.sp.(Acari, Anoetidae) phoretique sur des Drosophiles d'elevage en Suisse. *Rev. Sui. Zool.* 87 (3): 753-756.
- Fain, A. 1987. Notes on the mites living in the flowers of *Espletia* spp. (Asteraceae) in Colombia. *Espletiacarus andinus*gen. n., spec. n. (Hemisarcoptidae) and *Michaelopusinconus* sp. n. (Acaridae). *Entomol. Mitt. Zoo I. Mus. Hamburg* 9: 37-47.
- Fain, A. 1988. Observation on *Congovidia* Fain & Elsen, 1971 and allied genera (Acari:

- Hemisarcoptidae). Bull. Ann. Soc. r. Beige Ent. 124: 125-130.
- Fain, A. and Camerik, A. 1978. New hypopi phoretic on Brazilian coleoptera and hymenoptera (Acari: Astigmata). Internat. J. Acarol. 4: 169-178.
- Fain A. and Colloff, M.J. 1990. A new genus and two new species of mites (Acari: Histiostomatidae) phoretic on *Traskorchestia traskiana* (Stimpson, 1857) (Crustacea, Amphipoda) from Canada. J. Nat. Hist. 24: 667-667.
- Fain, A. and Rack, G. 1987. Notes on the mites living in the flowers of *Espeletia* spp. (Compositae) in Colombia. IV. *Probonomoia columbiana* g. n., sp. n. (Acari, Anoeidae). Ent. Mitt. Zool. Mus. Hamburg, 9(131): 69-74.
- Fain, A. and Beaucournu, J.C. 1973. Description de trois nouveaux hypopes d' Anoeidae phorétiques sur des puces de Mammifères. Acarologia, 15: 414-520.
- Fain, A., Engel, M.S.; Flechtmann, C.H.W. and O'Connor, B.M. 1999. A new genus and species of Acaridae (Acari) phoretic on *Thectochlora alaris* (Hymenoptera: Halictidae: Augochlorini) from South America. - Intern. J. Acarol. 25: 163-172.
- Fashing, N. J. 2002. *Nepenthacarus* a new genus of Histiostomatidae (Acari: Astigmata) inhabiting the pitchers of *Nepenthes mirabilis* (Lour.) Druce in Far North Queensland, Australia. - Australian J of Entomology 41:7-17.
- Fashing, N. J. 2008. Biology of the genus *Hericia* (Algophagidae: Astigmata), with the description of a new species from the eastern United State. Systematic & Applied Acarology. 13: 3-25.
- Fashing, N. J. and O'Connor, B.M. 1984. *Sarraceniopus* a new genus forhistiostomatid mites inhabiting the pitchers of the Sarraceniaceae (Astigmata: Histiostomatidae). Intern. J. Acarol. 10 (4):217-227.
- Fakeer, M.; Eraky, S.A.; Ahmed, M.A.I. and Suleiman, A.S. 2014. Identification key for some acarid mites (Acari: Acaridae) extracted from termite nests with description of two new species. Assiut J. Agric. Sci. 45(2): 68-83.
- Grandjean, F 1939. La chaetotaxy des pattes chez les Acaridae. Bull. Soc. Zool. France 64: 50-60.
- Griffiths, D.A. 1964. A revision of the genus *Acarus* (Acaridae, Acarina) Bull. Brit. Mus. Nat. Hist. 59 (Zool.) 11 (6): 415-464.
- Griffiths, D.A. 1967. A new family of astigmatid mites from lies Crozet, Sub-Antractia: Introducing a new concept relating to ontogenetic development of the idiosomal setae. J Zool. Lond., 182: 291-308.
- Griffiths, D.A.; Atyeo, W.T.; Norton, R.A. and Lynch, C.A. 1990. The idiosomal chaetotaxy of astigmatid mites. J Zool. (London) 220: 1-32.
- Houck, M. A. and O'Connor, B. M. 1991. Ecological and evolutionary significance of phoresy in the Astigmata. Ann. Rev. Entomol. 36: 611-636.
- Hughes, R.D. and Jackson, C. G. 1958. A review of the Anoeidae (Acari). Virginia J. Sci. 9. New Series, 1-198.
- Ide, G. S. and Mahunka, S. 1978. *Ameranoetus hematobii* gen. et sp. Nov. from the U.S.A. (Acari: Anoeidae). Folia Entomol. Hung., 31: 47-49.
- Kramer, P. 1876. Beitrage zur Naturgeschichte der Milben. Arch. Naturgesch., 42: 28-45.
- Kurosa, K. and Tagami, K. 2006. Studies on histiostomid mites (Acari: Astigmata) associated with the burying beetle *Nicrophorus concolor* Krantz (Coleoptera: Silphidae). Journal of Acarological Society of Japan 15(2): 129 – 138.
- Mahunka, S. 1963. Neue Anoeiden und Acariden (Acari) aus Angola. Publ. Cult. Co. Diam. Ang., Lisboa, 63: 49-66.
- Mahunka, S. 1967. The scientific results of the Hungarian soil. Zoological expedition to the Congo. Acta Zool. Hung., 13: 149-181.
- Mahunka, S. 1969a. *Xenanoetus vestigialis* gen. n., and two new species of the genus *Myianoetus* Oudemans, 1913 (Acari: Anoeidae). Annls. Hist. Nat. Mus. Natn. Hung., 61: 359-362.
- Mahunka, S. 1969b. The scientific results of the Hungarian zoological expendations to Tanganyika 14. Mites extracted from animal excrement and the nests of *Tachyoryctes* species. Annls. Hist. Nat. Mus. Natn. Hung., 61: 363-376.
- Mahunka, S. 1972. Neue auf Tenebrioniden (Coleoptera) gesammelte Anoeidenarten (Acarina) van den Salomon Inse In. Parasit. Hung., 5: 349-360.
- Mahunka, S. 1973b. *Xenanoetus grandiceps* sp. n., sowie weitere Angaben fiber die Anoeiden-fauna der Mongolei (Acari). Foliaent. Hung., 26: 57-63.
- Mahunka, S. 1978a. The examination of myrmecophilous Acaroidea mites based on the investigations of Dr. C.W. Rettenmeyer (Acari: Acaroidea). Folia Entomol. Hung., 31: 135-166.
- Mahunka, S. 1978b. Schizoglyphidae fam. n. and new taxa of Acaridae and Anoeidae (Acari: Acaridida). Actazool. Hung., 24: 107-131.
- Mahunka, S. 1979. The examination of myrmecophilous. Acaroidea mites based on the investigation of Dr. C.W. Rettenmeyer (Acari: Acaroidea). Acta Zool. Hung, 25: 311-342.
- Mahunka, S. 1981. Uber die Acariden und Anoeiden aus Tunesien (Acari) I. Folia Ent. Hung, 42: 135-137.
- Mahunka, S. 1982a. Two new mites from the Juan Fernandez Islands (Acari: Acarida and Oribatida). Folia Entomol. Hung., 43: 63-68.
- Mahunka, S. 1982b. Neue und interessante Milben

- aus der Genfer Museum XXII. Über zwei neue Milbenarten aus der Neogaea (Acari: Pygmephoridae, Anoetidae). Arch. Sc. Geneve, 35: 81-86.
- Mahunka, S. and Eraky, S. A. 1987. Mites extracted from manure and silo (Acari: Acaridae, Anoetidae and Tarsonemina), I. Folia Entomol. Hung., 48: 129-140.
- Mahunka, S. 1991. New and interesting mites from the Genera Museum LXXII: some anoetid and tarsonemid mites from the Cape Verde islands (Acari). Archs Sci. Geneve, 44(3): 283-287.
- Mohamed, A. A. 2018. Observations on the biology of *Hormosianoetus mahunkai* Eraky and Shoker, 1993 (Acari: Histiostomatidae). Acarines, 12: 39-44.
- Oudemans, A.C. 1904. Acarologisch Aanteekeningen, 14 Ent. Ber., (1) 20: 190-195.
- Oudemans, A.C. 1911. Acarologisch anteeekeningen, 37 Ent. Ber., (3) 61: 171-175.
- Oudemans, A.C. 1924. Acarologische Aanteekeningen, 74 Ent. Ber., 6:300-310.
- Oudemans, A.C. 1929. Acarogische Aanteekeningen, 97 Ent. Ber., 7: 449-452.
- O'Connor, B. M. 1982. Evolutionary ecology of astigmatid mites. Ann. Rev. Entomol.27: 385-409.
- O'Connor, B. M. 1984a. Phylogenetic relationships among higher taxa in the Acariformes, with particular reference to Astigmata. In Griffiths, D.A. and C.E. Bowman (eds.), Int. Congress *Acarology VI*, vol. 1. Ellis Horwood, Ltd., Chichester: 19-27.
- O'Connor, B.M. 1984b. Nomenclatural status of some family-group names in the non psoroptidid Astigmata (Acari: Acariformes), Internat.J Acarology, 10: 203-207.
- O'Connor, B.M. 1988. Coevolution in astigmatid mite-bee association. In Africanized Honey Bees and Bee Mites, ed. G. R. Needham, R. E. Paige, Jr., M. Delfinado-Baker, C. E. Bowman, pp. 339-46. Chichester: Harwood. 572pp.
- O'Connor, B.M. 1989. Systematic, ecology and host associations of *Naiadacarus* (Acari: Acaridae) in the great lakes region. The Great Lakes Entomologist, 22 (2): 79-94.
- O'Connor, B.M. 1990. Ecology and host associations of *Histiogaster arborigms* (Acari: Acaridae) in the great lakes region, particularly in the Huron Mountains of Northern Michigan. The Great Lakes Entomologist, 23 (4): 205-209.
- O'Connor, B.M. 1991. A preliminary report on the arthropod-associated astigmatid mites (Acari: Acariformes) of the Huron Mountains of Huron Mountains of Northern Michigan, Academician 24: 307-320.
- O'Connor, B.M. 1993. Generic relationships in the Chaetodactylidae (Acari: Astigmata) with description of a new genus. Acarologia, 34 (4): 345-362.
- O'Connor, B.M. 1997. Two new mites (Acari: Acaridae) associated with long-tongued (Hymenoptera: Apidae) in North America. J. Kansas Entomol. Soc, 69: 15-34.
- Radford, C.D. (1950). Systematic check list of mite genera and type species, Union Internationale des Sciences Biologiques. Se'rie C, Section Entomologique 1, 232pp.
- Samsinak, K. 1966. Zwei interessate auf Insekten Lebende hypopi (Acari: Acaridoidea). Zool. Anz., 176:124-127.
- Samsinak, K. 1972. Die auf *Formica lemani* Bondr. (Hymenoptera) lebenden hypopi der Gatting *Anoetus* Dujardin, 1842 (Acari). Abh. Ber. Nat. Gorlitz, 45 (13): 33-36.
- Scheucher, R. 1957. Systematik und okologie der deutscher Anoetina, In Betrage zur systematik und okologie mitteleuropdische Acarina. (ed. Stammer, H.J.). I: 233-284.
- Sevastianov, V.D. 1973. Zur Kenntnis der Dauerformen (Hypopi) der Mehlmilbe *Tyreglyphus farina* L. Zentralbl. Bakt.Parasit. Und infect., 116 (22124):536-549.
- Tagami, K. 2004. *Sarraceniopus nipponensis* sp. nov. and *S. hughesi* (Astigmata, Histiostomatidae) from sarraceniaceous pitchers bred in Japan. 13 (2), 169.
- Tagami, K. 2007. Description of adults and redescription of deutonymphs of *Histiostoma darwishii* Eraky, 1994 (Acari: Histiostomatidae), an associate of *Parasitus fimetorum* Berlese (Mesostigmata: Parasitidae). Intern. J. Acarol. 33(1): 79-85.
- Tagami, K. 2013. A histiostomatid associated with a common earwig, *Gonolabis marginalis* (Dohrn) (Dermaptera: Anisolabididae) in Japan. J Acarol. Soci. Japan, 22(2):91-99.
- Tagami, K. and Kuwahara, Y. 2005. Remarkable species of *Histiostoma* (Histiostomatidae, Astigmata) from Japan with a pairof newly identified ventral coxal organsand sexual dimorphism of chemicals components. Acarologia,. XLV, I: 83-98.
- Tagami, K and. Halliday, R. B 2013. Mites of the family Histiostomatidae associated with the Australian giant earwig, *Titarolabis colossea* (Dohrn)(Dermaptera: Anisolabididae). Australian J. Entomol., 52: 218-226.
- Womersley, H. 1942. Miscellaneous additions to Acarina, Trans. Roy. Soc. S. Aust., 66:89-92.