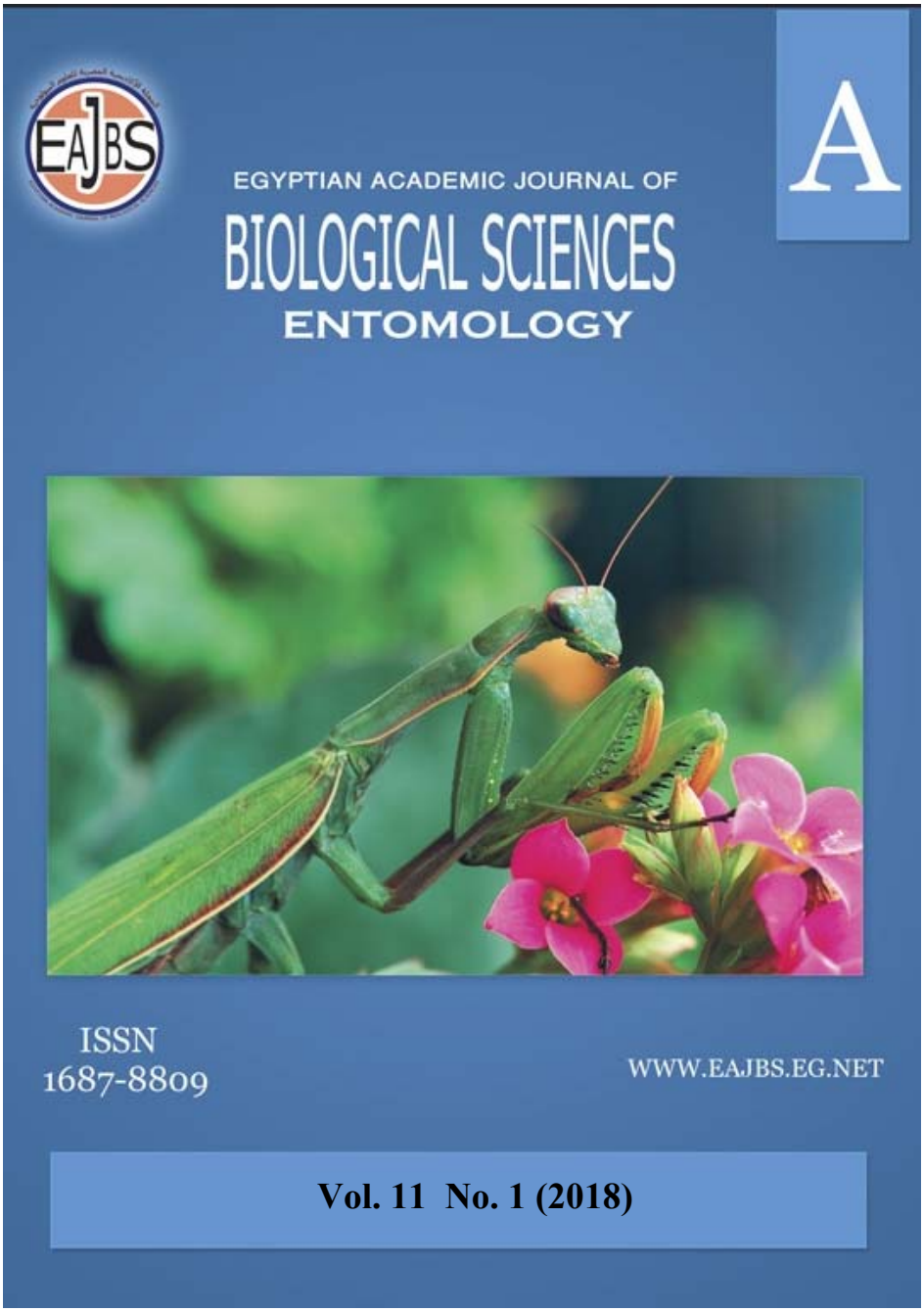

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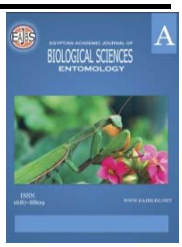

Ecological Notes and Taxonomical Revision of Family Phytoptidae Murray, 1887 (Acari: Eriophyoidea) in Egypt

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ABSTRACT

Ecological notes and taxonomical revision of the species belonging to family Phytoptidae Murray were studied at four provinces (Qualiubiya, Giza, Behera, Sohag) during two years (2016-2017). The results showed that, three species (*Oziella nilotica* (Abou-Awad); *Mackiella phoenicis* Keifer; *Retracus johnstoni* Keifer) belonging to three genera and two tribes (Phytoptini, Murray, 1877; Mackiellini Newkirk & Keifer, 1971) were recorded and illustrated and arranged in taxonomical key. The mentioned species were varied in their occurrence rate according to different provinces and host plants.

INTRODUCTION

Mites of the super-family Eriophyoidea are worldwide distributed, and extremely small in size, ranging in length from 80–500 µm, so are often invisible to the naked eye (Knihinicki and Boczek, 2002; Halawa, 1998). Eriophyoids are highly host-specific (Al-Atawi & Halawa, 2011; Skoracka *et al*., 2010; Halawa, 2003) and occur on various types of flowering plants, conifers, broadleaf trees, and shrubs (Oldfield & Proeseler, 1996). Some species of this group of mites have two adult female forms, a normal feeding form (protogyne) and an overwintering or otherwise aestivating form (deutogyne) (Bethkeand & Villavicencio, 2014). Furthermore, their impact as specialized phytophagous mites is well known and strongly accented in each of their involvements as direct plant pests, plant pathogen vectors, agents of control of weeds, and food sources for predators (Halawa *et al.*, 2015[b]; Hong and Cheng, 1999; Oldfield, 2002; Zhang, 2003; Gamliel-Atinsky *et al.,* 2009). Until 1998, about 4000 eriophyoid species were known worldwide (De Lillo & Amrine, 1998; Halawa and Mohamad, 2015). Therefore, many species are waiting to be discovered. Reviewing taxonomic literature (Halawa *et al.*, 2015[a]; Xue *et al.*, 2009; Kamali and Jalaeian, 2011; Xue *et al*., 2011; Xue *et al*., 2012; Kamali and Jalaeian, 2013; Xue *et al*., 2012). The family Phytoptidae Murray, 1877 includes the most ancient representatives of Eriophyoidea, which retain the plesiomorphies of more

than two setae on the prodorsal shield (*ve* and *sc*) and having the subdorsal seta (*c1*) and solenidion (*φ*) on tibia I. According to the concept of Sukhareva (1992, 1994) and Bagnjuk *et al.* (1998), this family represents an early evolutionary lineage of eriophyoids on Angiosperm plants and includes equally annulated (subfamilies Phytoptinae Murray, 1877 and Novophytoptinae Roivainen, 1953) and diversely annulated forms (subfamily Sierraphytoptinae Keifer, 1944) (Chetverikov & Suchareva, 2009). Unfortunately, most of these achievements conducted were using random methods in terms of sample preservation and storage, specimen clearing and mounting, drawing, descriptive arrangements and other activities related to taxonomic/systematic investigations/publications (Halawa and Mohamad, 2015; De Lillo *et al*., 2010). As for other mites, eriophyoid systematics depend on the quality of studied specimens and morphological description. Conversely, the microscopic size and ultra fine structural details of these tiny and fragile mites make their morphological study more difficult (De Lillo *et al*., 2010). Furthermore, the accuracy and correctness of descriptions and associated drawings depend on the methods used in processing, mounting and studying the mites. However, today many descriptions and drawings still often do not achieve the required standard and quality, even as set by Keifer, and many relevant taxonomic details may be permanently lost or obscured as a result. These shortcomings can lead to incorrect classification, sometimes making certain identifications impossible, or misinterpretation (for example, the prodorsal shield, scapular setae sc and coxal setae 1b and 1a of Ashieldophyes were not clearly described by Mohanasundaram (1984) which can cause considerable confusion. These inadequacies cannot be justified considering the quality of the microscopes and cameras available today (De Lillo *et al*., 2010). Moreover, description and illustration of same species varied from country to another likely due to handling eriophyoids and tools (differences in preservative liquids, clearing medium, mounting medium, line drawings). In addition, Amrine and Manson (1996) listed the most important body parts that should be illustrated by line drawings. Attempting to standardize the figure layout will make it easier to compare the depiction of different species with each other, and for finding particular details in a drawing , while same authors and Keifer (1975) reported a strong recommendations about the need to include knowledge on the host plant identification, mite habit and host plant relationships. Particular care should be taken in finding and collecting males; their morphology often helps to understand the female status as protogyne/deutogyne mites (Halawa, 2017). In Egypt, only one collective work, conducted through the second half of 20th century included a survey of phytophagous and predacious mites with taxonomical key (Zaher, 1984). From the mentioned date up to now, the taxonomical key of eriophyid mites in Egypt is not updated yet. Consequently, the main target of this paper is producing some ecological notes and illustrated and updated key to genera and species of family Phytoptidae in Egypt.

MATERIALS AND METHODS

This Study Is Based On Two Portions:

1) Survey and occurrence rate of species belonging to family Phytoptidae Murray, 1887 at three zones: upper Egypt represented by Sohag province; Middle Egypt represented by Qualiubiya & Giza province and lower Egypt represented by EL-Behera province during two years as part of a comprehensive work on Eriophyoid mites. The samples were collected during two years (2016 & 2017) from leaves,

buds, branches and grass of fruit farms. The samples were individually bagged in tightly-closed plastic bags and transported the same day to the laboratory. Collected mites were removed using a fine hair brush under dissection stereo-microscope, then preserved in 70% ethanol. Selected mites were cleared and mounted on micro-slides by using Keifer medium according to Keifer (1975), then dried at 40°C for one week (Zhang, 2003) and finally examined under a Carl Zeiss compound microscope. The type materials are deposited as slide-mounted specimens in the mite collection of the Agricultural Research Center, Plant Protection Research Institute, Fruit Acarology Department, Dokki, Egypt (ARC-PPRI). Identification to a specific Family, subfamilies, Genus was made using the key to the world genera by Amrine *et al*. (2003) and the species identification was done using published descriptions of family Phytoptidae species. In addition, the identified specimens were compared with the specimens present in the mite collection of Plant Protection Research Institute (ARC).

2) Survey of literature

Survey of original scientific papers published on eriophyid mites from different libraries in Egyptian Universities and Research Centers. The generic classification used in this paper is of Amrine *et al*. (2003). We have checked most of the papers listed in the references (for a few papers, only the abstracts were seen and these were indicated as such). Figures of described species used in the illustrated key were re-inked from published papers and the original authors were properly attributed.

RESULTS AND DISCUSSION

I-Ecological Notes:

Although, five subfamilies from family Phytoptidae have been recorded in the world, the data in table (1) showed that three species (*Oziella nilotica* (Abou-Awad, 1981); *Mackiella. phoenicis* Keifer; *Retracus johnstoni* Keifer) belonging to three genera (*Oziella* Amrine, Stasny & Flechtmann, 2003*; Mackiella* Keifer, 1939 *; Retracus* Keifer, 1965) and two tribes (Phytoptini, Murray,1877; Mackiellini Newkirk & Keifer,1971) were recorded during this study at three zones: upper Egypt represented by Sohag province, Middle Egypt represented by Qualiubiya & Giza province and lower Egypt represented by EL- Behera province during two years. The obtained data reported that the species *O. nilotica* (Abou-Awad, 1981) was recorded with highly rate in Giza and Behera provinces on the weed *Imperata cylindrica* (L.) and recorded with moderately rate in Qualiubiya province while it was recorded with low rate in Sohag province on the same weed, therefore, the mentioned species may play an important role for biological control of weeds (Halawa, 2015). Furthermore, the species *Mackiella phoenicis* was recorded with highly rate in Giza and Behera provinces on the inner frond of date palm *Phoenix dactylifera* L. and recorded with low rate in Qualiubiya province while it was absent in Sohag province on the same host plant. On the other hand, the third species, *Retracus johnstoni* Keifer was recorded with moderately rate in Behera province and recorded with low rate in Giza and Sohag provinces on inner frond of date palm, *Phoenix dactylifera* L. while it was absent in Qualiubiya province on the same host plant.

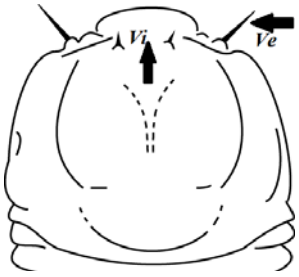
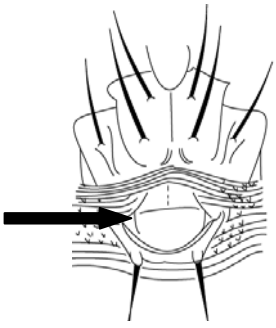
Table (1): Survey and occurrence rate of family Phytoptidae Murray, 1887 during two years (2016 & 2017) at four provinces (Qualiubiya, Giza, Behera, Sohag).

Variability	Sub-family: Phytoptinae Murray,1877		Sub-family: Sierraphytoptinae Keifer, 1944			
	Tribe: Phytoptini, Murray,1877		Tribe: Mackiellini Newkirk & Keifer, 1971			
	Genus: *Oziella*, Amrine, Stasny & Flechtmann, 2003		Genus: *Mackiella* Keifer, 1939		Genus: *Retracus,* Keifer, 1965	
	Sp: *O. nilotica* (Abou-Awad)		Sp: *M. phoenicis* Keifer		Sp: *R. johnstoni* Keifer	
Host plant	*Imperata cylindrica* (L.)		*Phoenix dactylifera* L.		*Phoenix dactylifera* L.	
Localities	GPS	Rate of occurrence	GPS	Rate of occurrence	GPS	Rate of occurrence
Qualiubiya	30◦21'18" N, 31◦13'30" E	++	30◦21'18"N, 31◦13'30"E,	+	All districts	-
Giza	30◦02'6"N, 31◦12'18"E,	+++	30° 16' 60.00" N 31° 11' 60.00" E	+++	30° 16' 60.00" N 31° 11' 60.00" E	+
Behera	30◦36'54"N, 30◦41'6"E,	+++	30◦36'54"N, 30◦41'6"E,	+++	30◦36'54"N, 30◦41'6"E,	++
Sohag	26° 33'25.02" N 31° 41' 41.21" E	+	26° 33'25.02" N 31° 41' 41.21" E	-	26° 33'25.02" N 31° 41' 41.21" E	+

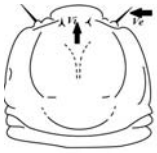
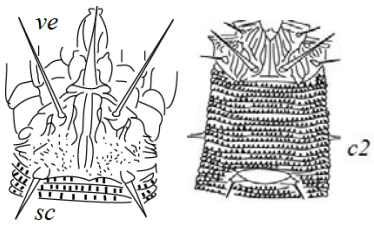
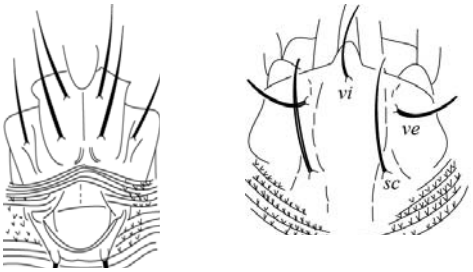
+ = Low rate (from 1: 2 individuals / leaf or frond)
++= Moderate rate (from 3: 5 individuals / leaf or frond)
+++= high rate (more than 5 individuals / leaf or frond)

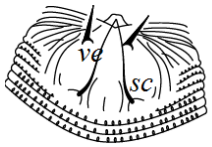
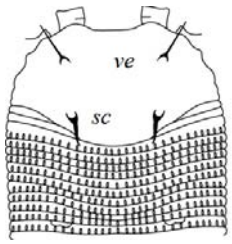
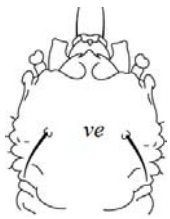
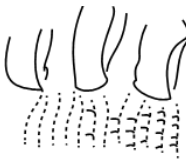
II- Taxonomical Revision

The common taxonomical characters of family Phytoptidae Murray were

Prodorsal shield with anterior setae (*vi* or *ve*)	
Genital coverflap without longitudinal markings	

Subfamilies, tribes, genera and species of family Phytoptidae Murray, 1877

1- Prodorsal shield with four anterior setae paired (internal *vi* and external *ve*), Scapular setae absent…….*Prothricinae* Amrine, 1996 …..... Not recorded in Egypt	
- Prodorsal shield with three (unpaired *vi*+*ve*), two (*ve*) or one (unpaired *vi*) anterior shield setae……2	
2- Vermiform and elongate mites; genitalia located after coxae by 9-15 annuli and posterior to the lateral setae (*c2*); Prodorsal shield with two anterior setae (*ve*) and two scapular setae (*sc*); pedipalps directed anteriorly, apically attenuate; tibia I lacking solenidion; opisthosoma lacking subdorsal setae (*c1*).....…Novophytoptinae Roivainen, 1953……. Not recorded in Egypt	
- The mites either vermiform with annuli subequal, or robust or fusiform with larger dorsal annuli; genetalia relatively close to coxae separated with fewer or smaller annuli; prodorsal shield with variable (3, 2, or 1) anterior setae; pedipalps not as above but directly more ventrally; opisthosoma variable; tibia I and solenidion variable ……...……...…….…3	
3- Prodorsal shield with three (single *vi* + *ve*) or one (single vi) anterior setae; scapular setae (sc) present or absent; spermathecal tubes are 3 to 5 times longer than spermathecae; opisthosoma either vermiform with subdorsal setae (*c1*) present or more robust and fusiform, lacking subdorsal setae (*c1*)....….....*Nalepellinae* Roivainen,1953…….. Not recorded in Egypt	

-. Prodorsal shield with two anterior setae (*ve*) present, internal verticals (*vi*) absent, scapular setae rarely miute or absent; spermathecal tubes short…….....…....4	
4- Body vermiform with opisthosomal annuli narrow and subequal dorso ventrally; scapular setae (*sc*) pointing up if short, forward if long , opithosthomal setae pair (*c1*) present ……..…… *Phytoptinae* Murray, 1877..…… ……..…K1.1	  
-. Body usually fusiform and often flattened; opisthosomal annuli usually broad or with lateral dorso-ventral differentiation, opisthosoma setae pair *c1* present or absent …….……..……***Sierraphytoptinae*** Keifer, 1944 ……..…K1.2	 

K1.1. Tribes, Genera and Species of Subfamily Phytoptinae Murray, 1877

Subfamily Phytoptinae in Egypt is represented by only one genus (*Oziella* Amrine, Stasny and Flechtmann, 2003) and one species namely: *Oziella. nilotica* (Abou-Awad, 1981) **comb. n.** (= *Phytocoptella niloticus* Abou-Awad, 1981) (=*Phytoptus niloticus* Abou-Awad, 1981). This species was recorded in Egypt on leaves of *Imperata cylindrica* (L.) Beauv. (Poaceae) under genus *Phytocoptella* Newkirk & Keifer, 1971. Although, Chetverikov & Suchareva (2009) pointed out the need to be transferred to the genus Oziella based on what was said by Amrine *et al.* (2003) who mentioned that most species of Phytoptinae have five free leg segments. However, some species in *Phytoptus* and *Anchiphytoptus* posses a fused femur and genu in legs *I* and *II*. Recently, a new genus *Oziella* was established for several *Phytoptus* species (*Ph. yuccae* K. and *Ph. rufensis* Manson) that have fused femur and genu in legs *I* and *II* (Amrine *et al*., 2003).

Genus *Oziella* Amrine, Stasny and Flechtmann, 2003.

This genus is distinguished by the following characters:

1- Prodorsal shield lacking gland.

2- Scapular setae (*sc*) short or long but not minute.

3- Microtubercles distributed normally on dorsal opithosomal annuli.
4- Femur and genu are fused.

***Oziella niloticus* (Abou-Awad, 1981) comb. n. (Fig.1):**

This species was recorded on leaves of *Imperata cylindrica* (L.) Beauv. (Poaceae)
The common taxonomic characters are:

1- 5 to 6 rayed feather claw.
2- Dorsal with 92 annuli.
3- Absence of median line on prodorsal shield .

Synonyms: *Phytocoptella niloticus* Abou-Awad, 1981; 1981: 368.
Host plant: *Imperata cylindrica* (L.) Beauv. (Poaceae).
Localisation: on the leaves, no damage observed.
Locality: EI-Qualiubiya, Menufia, Giza, Behera, Sohag.

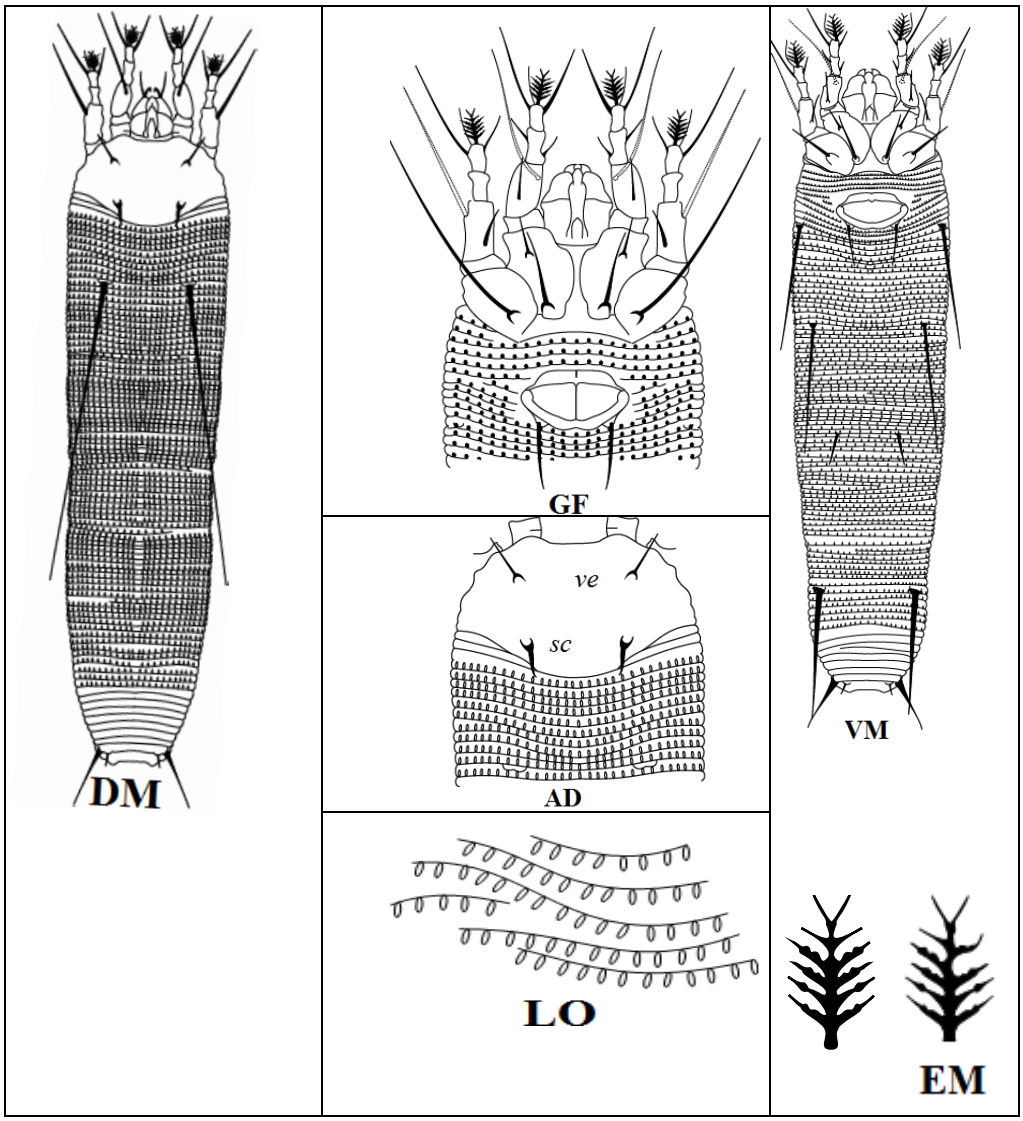
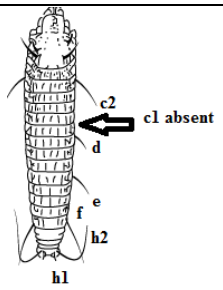


Fig. (1) *Oziella niloticus* (Abou-Awad,) comb.

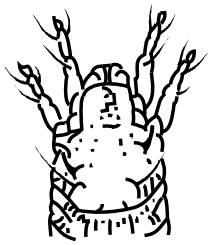
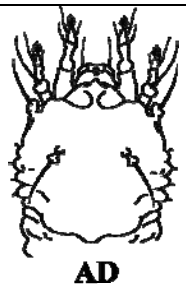
K1.2. tribes, genera and species of subfamily *Sierraphytoptinae* Keifer, 1944

Subfamily *Sierraphytoptinae* in Egypt includes one tribe, two genera and two species.

Opisthosomal setae pair (*c1*) absent …….Tribe. ***Mackiellini*** Newkirk & Keifer.…….……..K1.2.1	

K1.2.1 genera and species of tribe *Mackiellini* Keifer, 1946

Only two genera from tribe *Mackiellini* Keifer were recorded in Egypt.

1-Prodorsal shield with four setae (*ve* +*sc*), scapular setae (*sc*) with normal tubercles directing forward.....genus ***Mackiella*** Keifer…… ……...……K1.2.1.1	
-. Prodorsal shield with four setae (*ve* +*sc*), scapular setae (*sc*) with bulbous, enlarged tubercles, directing setae cauded; anterior setae (*ve*) with similar enlarged tubercles, directing setae forward…….…… genus ***Retracus*** Keifer….....……..K1.2.1.2	

K1.2.1.1 species of genus *Mackiella* Keifer,1939.

One species from genus *Mackiella* was recorded in Egypt.

***Mackiella phoenicis* Keifer, 1939 (Fig.2)**

This species can be distingueshed by the following characters:

1- 7-rayed feather claw.
2- 4 shield setae and the anterior lobe is board.
3- The tergites much broader than the sternites and have longitudinal lines.

Synonyms: No synonyms.

Host plant: *Phoenix dactylifera* L. (*Arecaceae*).

Localisation: in fold in emerging fronds.

Locality: Qualiubiya and other governorates.

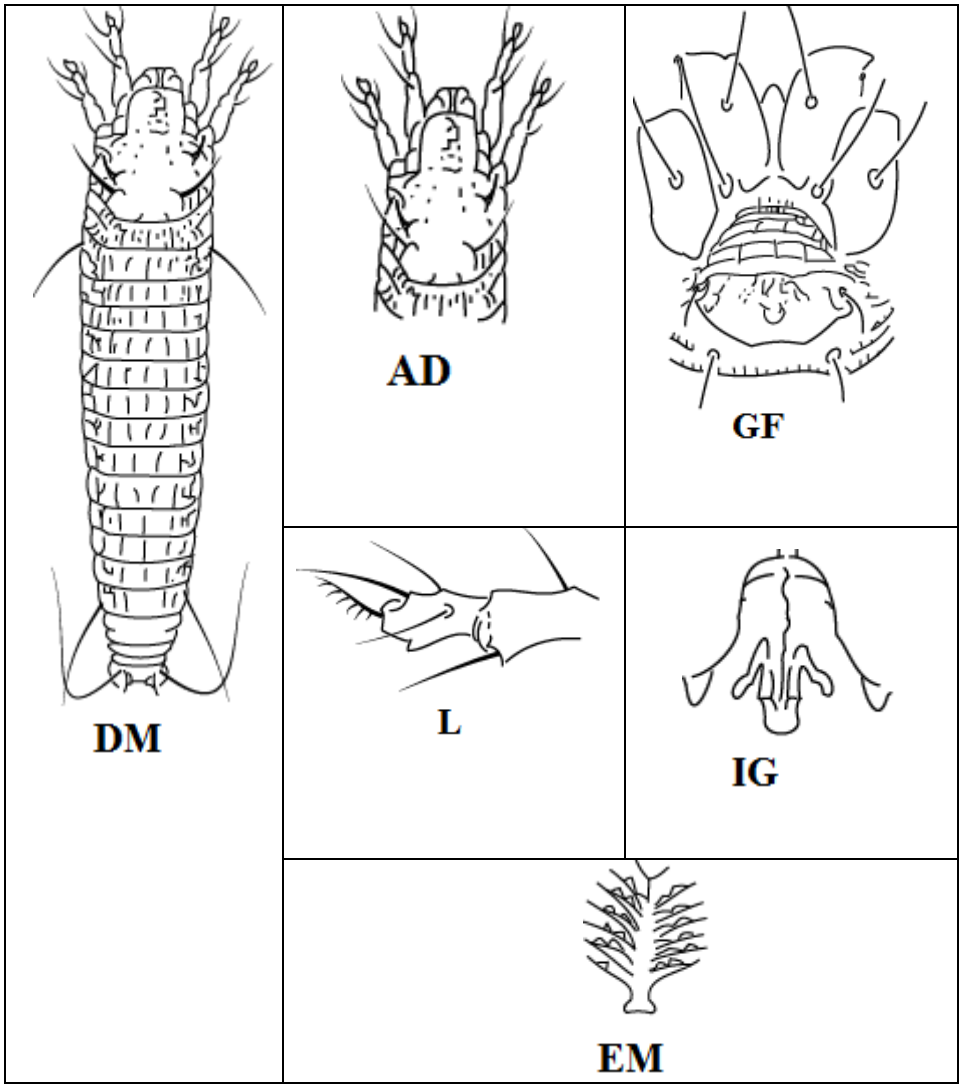


Fig.(2). *Mackiella phoenicis* Keifer .

K1.2.1.2 species of genus *Retracus* Keifer,1965.

Only one species from genus *Retracus* Keifer was recorded in Egypt

***Retracus johnstoni* Keifer, 1965 (Fig.3)**

This species can be distinguished by the following characters:

1- 6-rayed feather claw.
2- 4 shield setae.
3- Lack of the subdorsal abdominal setae.
4- Prodorsal shield setiferous tubercles are produced and bulbous.
5- No shield design but the dorsal tubercles unusual.
6- The foretibial lateral spur and tarsal claws have the same form.
7- Partial tergites below the dorsal tubercles end in points.
8- The tergites broader than the sternites.

Synonyms: No synonyms.

Host plant: *Phoenix dactylifera* L. (*Arecaceae*).

Localisation: underside of fronds makes black blotches .

Locality: Kafr El-Sheikh and other governorates.

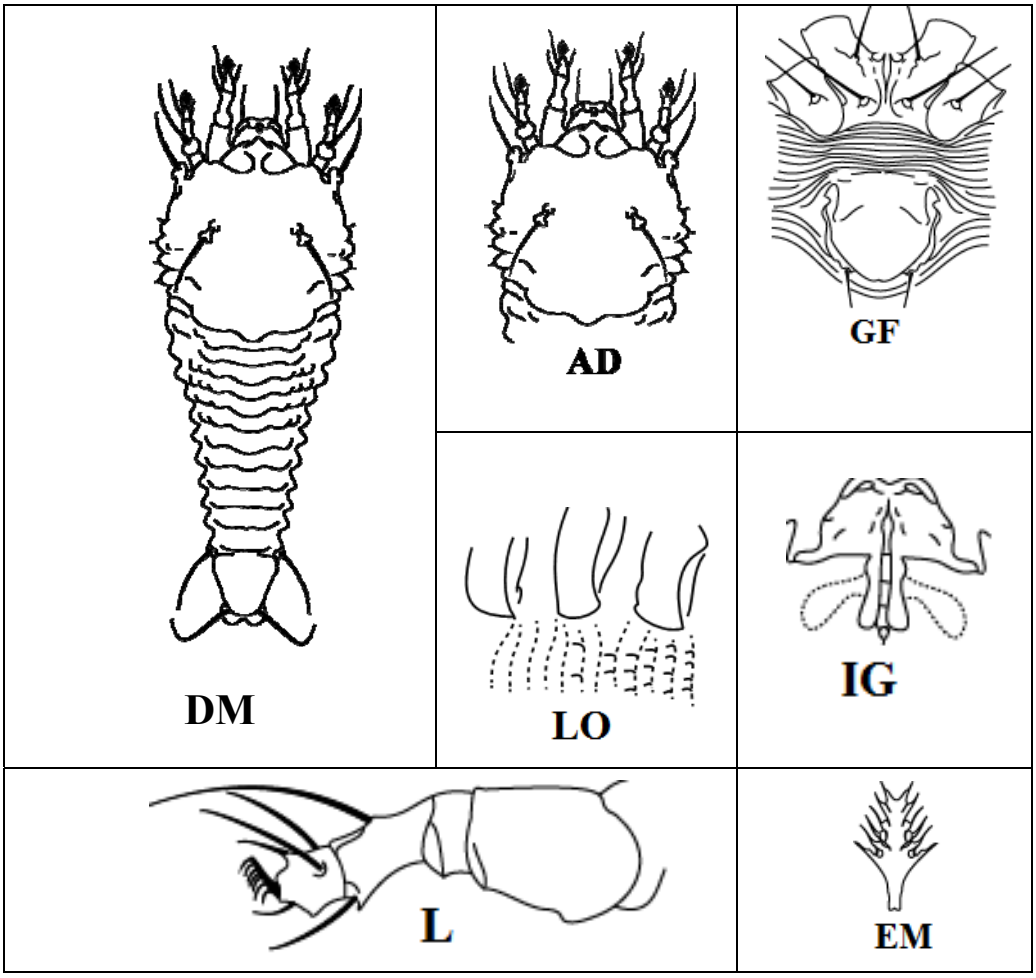


Fig. (3). *Retracus johnstoni* Keifer.

REFERENCES

Abou-Awad, B.A. (1981) Some eriophyoid mites from Egypt with descriptions of two new species (Acari: Eriophyoidea). *Acarologia, 22(4): 367-372.*

Al-Atawi, F.J., Halawa, A.M. (2011) New records of Eriophyoid mites (Acari: Prostigmata: Eriophyoidae) from Saudi Arabia. *Pakistan J. Biol. Sci. 14(2): 112–117.*

Amrine, J.W., Manson, D.C.M. (1996) Preparation, mounting and descriptive study of Eriophyoid mites. In: Lindquist E.E., Sabelis M.W., Bruin J. (eds), Eriophyoid Mites - Their Biology, Natural Enemies and Control. *Elsevier Science Publ., Amsterdam, The Netherlands, World Crop Pests, vol. 6: 383-396.*

Amrine, J.W.,Jr. ., Stasny, T.A.H. & Flechtmann, C.H.W. (2003) Revised keys to world genera of the Eriophyoidea (Acari: Prostigmata). *Indira Publishing House, West Bloomfield, Michigan, USA, 244 pp.*

Bagnjuk, I.G., Sukhareva, S.I. & Shevchenko, V.G. (1998) Major trends in the evolution of four-legged mites as a specialized group (using families Pentasetacidae Shev., Nalepellidae Roiv. and Phytoptidae Murray (Acari: Tetrapodili) as examples). *Acarina, 6(1–2), 59–76.*

Bethke, J.A. & Villavicencio. L.(2014) Eriophyid Mites on Ornamental Plants. Pp 37-50. In (eds. J. Hall, A. Palmateer, C. Palmer, and S. Tjosvold). Proceedings 2014 Society of American Florists Pest and Production Management Conference. *Society of American Florists. Alexandria, VA. 89pp.*

Chetverikov, P.E. & Sukhareva, S.I. (2009) A revision of the genus *Sierraphytoptus* Keifer 1939 (Eriophyoidea, Phytoptidae*), Zootaxa 2309: 30-42.*

De Lillo, E. & Amrine, J.W. (1998) Eriophyoidea (Acari) on a computer database. *Entomologica 31:137–146*.

De Lillo, E., Craemer, C.,Amrine, J.W. & Nuzzaci, G. (2010) Recommended procedures and techniques for morphological studies of Eriophyoidea (Acari: Prostigmata). *Experimental and Applied Acarology 51(1–3): 283–307.*

Gamliel-Atinsky, E., Freeman, S., Maymon, M., Belausov, E., Ochoa, R., Skoracka, A., Peña, J. & Palevsky, E. (2009) The role of eriophyoids in fungal pathogen epidemiology, mere association or true interaction? *Exp. Appl. Acarol. doi:10.1007/s10493-009-9302-y.*

Halawa, A.M. (1998) Studies on some mites associated with fruit trees *Msc. Benha University, Faculty of Agriculture 2119pp.*

Halawa, A.M. (2003) Studies on some mites and their relationship with virul diseases.*Ph.D Benha University, Faculty of Agriculture 231pp.*

Halawa, A.M. (2015) New species and new record of the genera *Aceria* Keifer and *Calepitrimerus* Keifer (Prostigmata: Acari: Eriophyidae) from Egypt. Egyptian Academic Journal of Biological Sciences 8(3): 43-48.

Halawa, A.M. (2017) Possibility of utilizing the predatory mite, Neoseiulus californicus (McGregor) (Acari: Phytoseiidae) for controlling two eriophyoid fig mites , *Aceria ficus* (Cotte) & *Rhyncaphytoptus ficifoliae* Keifer(Acari: Eriophyidae). *Menoufia J. Plant Protec. (3). 223-230.*

Halawa, A.M. & Mohamad, Azza (2015) New species and new record of the subfamilies Phyllocoptinae Nalepa and Cecidophyinae Keifer (Acari: Eriophyidae) from Egypt. *International Journal of Scientific Research in Agricultural Sciences, 2(Proceedings): 120-126.*

Halawa, A.M., Ebrahim, A.M., Abdallah, A.A., Azza, Mohamad, El-gebaly,H. & El-Sebaay, M.M. (2015[a]) An updated and illustrated review to the identification of the genera *Aceria* Keifer and *Eriophyes* Von Siebold (Acari : Eriophyidae) in Egypt. *Egyptian Academic Journal of Biological Sciences 9 (2): 33-59.*

Halawa, A.M., Ebrahim, A.M., Abdallah, A.A., Azza, Mohamad (2015[b]) Taxonomical Revision of the Genus *Colomerus* Newkirk & Keifer (Acari:Eriophyidae). in Egypt. *Middle East Journal of Agriculture Research 4(1): 67-76.*

Hong, X.Y. & Cheng, N.H. (1999) Review of virus diseases transmitted by eriophyid mites. *Acta Phytopath Sin 26:177–184.*

Kamali, H. & Jlaeian, M. (2011) Infestation of white mulberry trees to bud mite, Aceria mori kEifEr (Acari: Eriophyoidea: Eriophyidae). *First Persian Congress of Acarology, Kerman, Iran, p. 73* .

Kamali, H. & Jalaeian, M. (2013): Present status of gall mites (Acari: Prostigmata: Eriophyoidea) on Almond trees in Khorasan Razavi Province (North East of Iran) *The proceedings of the 2nd International Persian Congress of Acarology, Karaj, Iran, p. 17.*

Keifer, H. H. (1944) Eriophyid Studies XIV. *Bulletin of the California Department of Agriculture. 33:18–38.*

Keifer, H.H. (1939) Eriophyid studies III. *Bull. Calif. Dept. Agr., 28: 144-162.*

Keifer, H.H. (1946) Eriophyid studies XVI. *Bull. Calif. Dept. Agr., 35: 39-48.*

Keifer, H.H. (1965): Eriophyid studies B-16. *Bur. Ent., Calif. Dept. Agric.: 1-20.*

Keifer, H.H. (1975) Eriophyoidea Nalepa. Injurious eriophyoid mites. In: Jeppson LR, Keifer HH, Baker EW (eds) Mites injurious to economic plants. University of California Press, Berkeley, pp 327–533.

Knihinicki, D. & Boczek,J. (2002) New eriophyoid mites (Acari: Eriophyoidea) from Australia. *Int J Acarol 28(3):241–249.*

Mohanasundaram, M. (1984) New eriophyid mites from India (Acarina: Eriophyoidea). *Oriental Insects, 18: 251-283.*

Murray, A. (1877) Economic Entomology, Aptera. So. Kensington Mus. *Handbooks, Chapman & Hall. London. 433 pp.*

Newkirk, R.A. & H.H. Keifer, 1971. "Revision of types of Eriophyes and Phytoptus", In Keifer, H.H.(Author), Eriophyid studies *C-5. ARS-USDA, pp. 1–10.*

Oldfield, G. (2002) Biology, ecology, and evolution of gall-inducing arthropods. Science Publishers, *Inc., Endfield (NH), USA.*

Oldfield, G.N. & Proeseler. G. (1996) Eriophyoid mites as vectors of plant pathogens. In: Lindquist EE, Sabelis MW, Bruin J (eds) Eriophyoid mites—their biology, natural enemies and control, vol 6. *Elsevier Science Publishing, Amsterdam, The Netherlands, World Crop Pests, pp 259–273*.

Roivainen, H. (1953) Subfamilies of European Eriophyid Mites. *Acta Entomologica Fennica, 19(2), 83–87.*

Skoracka, A., Smith, L., Oldfield, G., Cristofaro, M. & Amrine, J.W. (2010) Host-plant specificity and specialization in eriophyoid mites and their importance for the use of eriophyoid mites as biocontrol agents of weeds. *Exp Appl Acarol. 2010; 51: 93–113.*

Sukhareva, S.I. (1992) Four-legged mites from grasses. *Saint-Petersburg State University Press, 232 pp. [in Russian]*.

Sukhareva, S.I. (1994) Family Phytoptidae Murray, 1877 (Acari: Tetrapodili), its consisting, structure and suggested ways of evolution. *Acarina, 2(1–2), 47–72.*

Xue, M., Lin, Y.Q., Pan, H., Reim, K., Deng, H., Bellen, H.J. & Rosenmund, C. (2009). Tilting the balance between facilitatory and inhibitory functions of mammalian and Drosophila Complexins orchestrates synaptic vesicle exocytosis. *Neuron 64(3): 367--380*.

Xue, X.F., Sadeghi, H., Hong, X.Y. & Sinaie, S. (2011) Nine eriophyoid mite species from Iran (Acari, Eriophyidae). *ZooKeys 143: 23–45.*

Xue, X.F., Sadeghi, H. & Hong, X.Y. (2012) Four new eriophyoid mite species (Acari: Eriophyoidea: Eriophyidae) from Iran. Zootaxa 3544: 28–40.

Zaher, M.A. (1984) Phytophagous mites in Egypt. *PL.480 Programme U.S.A. Project No. EG-ARS-30. GrantNo. FG-EG, 228 pp.*

Zhang, Z.Q. (2003) Mites of Greenhouses: Identification, Biology and Control. Centre of Agriculture and Biosciences .*International Publishing, Wallingford, United Kingdom, xii + 244 pp.*

ARABIC SUMMARY

ملاحظات بيئية ومراجعة تصنيفية لعائلة فيتوبتيدى فى مصر

علاء محمد عبد الغنى حلاوه ، عادل أمين محمد عبدالله ، أحمد عبد الحميد ابراهيم ، خالد عبد العزيز عياد
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اظهرت الدراسة التى اجريت على الانواع التابعة لعائلة فيتوبتيدى فى أربع محافظات هى القليوبية والجيزة والبحيرة وسوهاج خلال سنتين متتاليتين ٢٠١٦-٢٠١٧ تسجيل ثلاثة أنواع تمثل هذه العائلة هى *Mackiella phoenicis* Keifer و *Retracus johnstoni* Keifer على الخوص الداخلى للنخيل بينما *Oziella. nilotica* (Abou-Awad) تم تسجيله على حشيشة الحلفا وتم عمل مفتاح تصنيفى مزود بالرسم. واختلفت معدلات تواجد هذه الأنواع باختلاف المحافظة والعائل النباتى.