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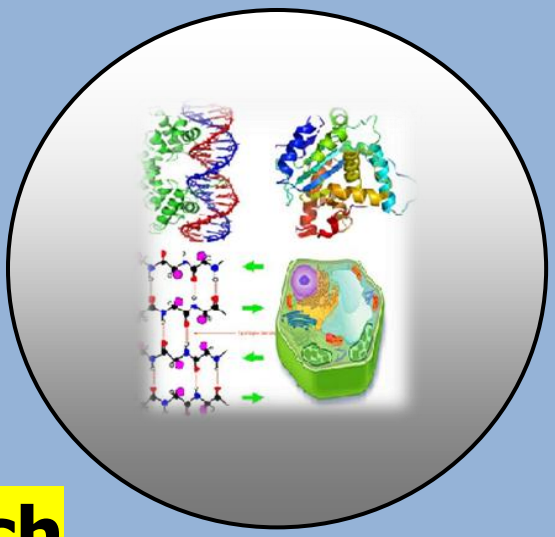

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RESEARCH PAPER
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First Record of two Mite Species Associated with Subterranean Termites in the New Valley Governorate, Egypt

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ABSTRACT

This study description of two Acaridae species,from the nests of sand termite, Psammotermeshypostoma Desneux (Isoptera)Samples (termite nests) were collected monthly from western desert (30 km North of El-Kharga city/ New Valley Governorate / Egypt). Mites inhabiting termite nests were isolated and identified. The identification key for the Acaridae species is simple and easy to understand and the diagnosis is in most cases based on genera and species. The results of taxonomic examination concerning the Acaridae mites living in termite nests found that two new acarid mite species.
Keywords: Acaridae, Isoptera, Mites, Nests and Sand Termite.

INTRODUCTION

Mites are commonly found inside termite nests (Costa-Leonardo and Soares, 1993). Some species of mites are only incidentally presented in the nests of termite, while others are obligate associates (Samsinak, 1964). Most mite species associated with termites were considered as saprophagous or phoretic. They do not have any significant effect on the health of their hosts (termites) in nature. On the other side, some species (such as: *Acotyledon formosani* Phillipsen and Coppel) are abundant in weak termite colonies and cause death. The phoreticdeutonymphs of *A. formosani* appeared to negatively affect a large laboratory colony of *Coptotermes formosanus* Shiraki (Phillipsen and Coppel, 1977a). Conversely, termite-associated mites may benefit the termites by scavenging on other arthropods or fungi (Eickwort, 1990).

In Egypt, there are eight species of subterranean termites. The sand termite, *Psammotermeshypostoma* Desneux is the most important pest causes damage to buildings, furnitures, rural grain stores, papers and almost any materials containing cellulose (Plate 1) (Rizk*et al*., 1982; Abdel Galil, 1986 and Bohibeh, 2010). While, in USA subterranean termites cause serious damage to homeowners each year (Plate 2) (Su, 1994). The subterranean termite species (Viz., *Reticulitermesflavipes* (Kollar); *R. virginicus* (Banks) and *Coptotermes formosanus* Shiraky) are among the most widely distributed and destructive subterranean termites in USA (Su and Scheffrahn, 1988 and Wang *et al*., 2002).

Little is known for termite-associated mites, their diversity, biology, ecology and the nature of their associations with termites.

The study on termite-associated mites has received the attention of certain authors (Krantz, 2001; OC'noor, 2001; Myles, 2002 a&b; Scharf *et al*., 2002; Wang *et al*., 2002; Korb and Fucks, 2006 and Bohibah, 2010). Moreover, many species of mites associated with the subterranean termites have already been described in Upper Egypt by certain authors (Eraky, 1998, 1999 a, b & c; Eraky and Osman, 2008a, b & c; Eraky *et al*., 2010andFakeer *et al*., 2014).

The present course of investigation had to be accomplished in the following: Study the taxonomy of certain Acaridida mite species by using the morphological characteristics of the heteromorphic deutonymphal stages associated with the sand termite, *Psammotermeshypostoma* Desneux and description of new Acaridida mite species if found.

MATERIAL AND METHODS

The aim of the present work is to study the mite fauna living inside the nests of the sand termite, *Psammotermeshypostoma* Desneux collected from soil of western desert (47 km North of El-Kharga city, New Valley) and from infested date palm trees (El-Monira, 30 km North of El-Kharga, New Valley), during two successive years starting from March, 2012.

The author would like to stress that the present work is principally aimed to study the taxonomy of mite associated with the sand termite, *P. hypostoma*. The present manuscript included also a taxonomical part of the phoretic mite species.

Taxonomical studies

Sampling area and methods

Samples were taken at random from 10 localities representing different soil sites of western desert (47 km North of El-Kharga city) and from infested trees of El-Monira (30 km North of El-Kharga city).

The wetted cartoon papers (10 pieces of 10 x 10 x ½cm^2) were tightly bounded together with rubber band and used as termite cardboard-traps. In each side, the wetted trap was placed in plastic circular tray (12cm diameter & 7cm length) and put at 10 cm under soil surface in order to maintain the trap humidity (Plate: 3). While, part of infested tree was also used. Samples have been taken fortnightly during the studied year (2012/2014). Each trap was collected weekly and placed in wide plastic bag, then translocated into laboratory for extraction.

Extraction method

The modified Berlese's extraction apparatus was used. It proved to be the most suitable one for soil samples. The apparatus used consists of open metal funnels fully closed. Electric lamp bearing cover was sometimes used.

Termite traps and termite sand galleries were spread in these funnels. By means of light and heat termites with associated arthropods were obliged to escape down swiftly. After 10 days until fully dryness of samples, animals were received in glass jar containing ethyl alcohol (70%).

Clearing and preparations

Several modifications of salt-water method have been dealt with by numerous authors (Berlese, 1921; Balogh, 1938, 1953 and 1958). The essence of the method used depending on vaporization of alcohol from accumulated materials in the glass jar carefully. The accumulated materials together with the extracted animals of Berlese's funnels were carefully decanted in saturated brine.

After stirring for a few minutes, the vast majority of the animals congregate on the upper surface of the saturated salt solution, while soil particles stay in the bottom of the jar. The animals on the surface are poured-off through a circular ring (10 cm diameter) padded with filter-muslin, washed out by water, then deposited again in Ethyl alcohol (70%). From the extracted mixture of different animals and arthropods, mites and insects were selected, counted then transferred into other small pots by using a very fine camel hair brush under stereoscopic-microscope of 40-100 times magnification force. The mite individuals were covered with a few drops of lactic acid, then left for one week to be cleared up. Two types of slide preparations were used (temporary and permanent preparations). The first one was proposed by **Grandjean (1949)**, in which a slide with a medium concaved area and a thin glass covers (20 x 20 mm) were used. By using a small drop of lactic acid in the concaved area and put the glass cover over the slide with its margin along the transverse axis of the slide, leaving a space to transfer the mite individual to be examined taxonomically under the research microscope of 1500-2000 times magnification force. The second preparation (permanent preparation) is essential when need to save the slides of the important species for a longer period of time. This latter type of slides were prepared by placing single individual of mite species in the middle of the clean slide with a very small drop of the Berlese's fluid, then covered with a small glass cover on the surface of the animal and fluid using a dissecting needle. This process was carried out by the help of stereoscopic-microscope of 40-100 times magnification force, The mounted specimens were dried at 45-50°C for 2 weeks to be ready for examination.

Identification

Identification process was carried out using the two types of preparations (Plate:4),the open preparation (temporary) made it easy to study all positions of the specimens under the research microscope of 1500-2000 times magnification force. The permanent mounts are easily handled, and ready for an immediate study of different parts of mite individuals. Also, an oil immersion objective lens was used, when necessary. Both preparations were used in the present study especially during the examination of the new taxa. The identification of mites inside the nests of termites was based on the publication of several authors (viz., Zakhvatkin, 1941; Baker and Wharton, 1952; Scheucher, 1957; Hughes & Jackson, 1958 and Hughes, 1961 & 1976). Hypopus in this group is a succeeding stage both in dispersal and behavior, highly resistant to environmental stress. Some are adapted for dispersal by phoresy; in most cases phoretic on insect by having attachment organs in the form of sucker-plate (Zakhvatkin, 1941; Griffiths 1977; Houck & OC'onnor, 1991; OC'onnor, 1994 and Kettle, 1995).

Study on the Acaridida has received the attention of several authors (viz., Samsinak, 1957, 1960, 1962 a & b, 1966 and 1972 in Czeck Republic; Griffits, 1960, 1964, 1966 and 1967 in England; Mahunka, 1961 a&b, 1962 a & b, 1963 a&b, 1964,1967,1968,1969 a&b, 1972, 1973 a,b,c&d,1974 a&b, 1975 a&b, 1976, 1977, 1978 a,b,c&d, 1979,1981, and 1982 a&b and Mahunka and Eraky, 1987 inHungary**;** Woodring, 1963, 1969 & 1973 and OC'onnor, 1982, 1984 a,b, 1989, 1990, 1991, 1993 and 1997 in USA; Fain, 1967 to 1984 in Belgium; Eraky, 1993 to 2000 a,b,Eraky and Osman, 2008 a,b,c, Eraky and Shoker, 1993 a,b and 1994 and Abdel-Sater and Eraky, 2002in upper Egypt and others).

Description of two new Acaridiidia mite species

Two Acaridiidiamite species extracted from the nests of the sand termite, *P. hypostoma*Desneux are proved to be new to science. The new species were illustrated and described, then compared morphological with their congeners.

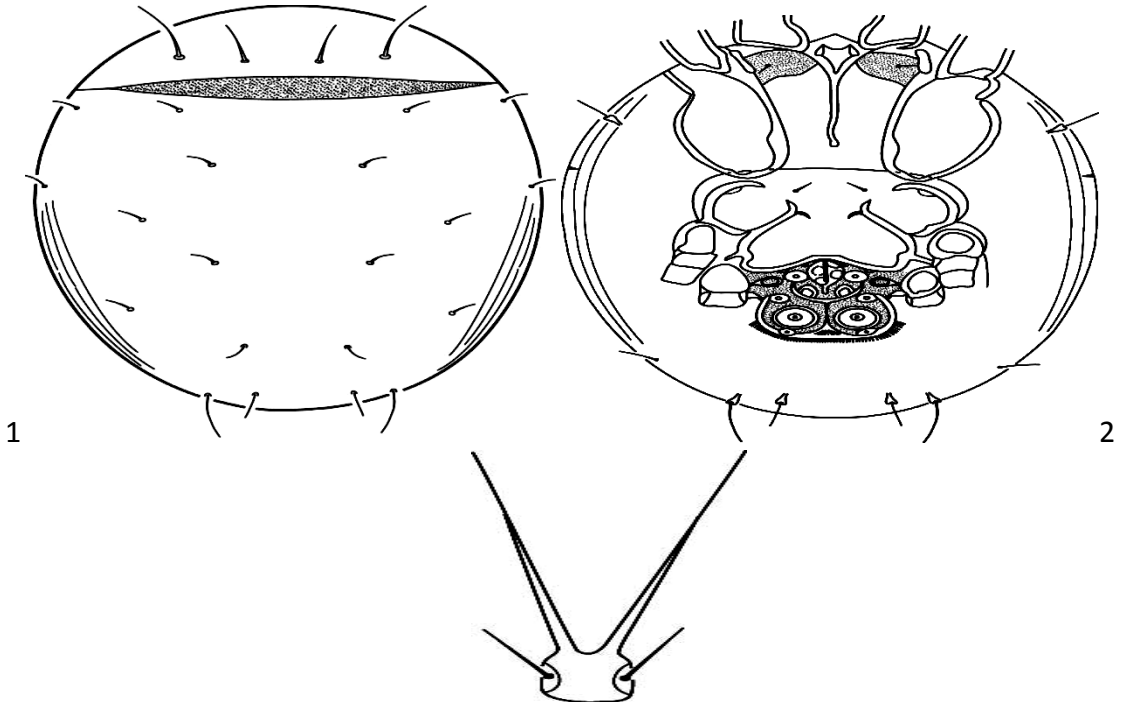
The identification of insects associated with termite was made by comparing specimens with those identified by specialists of Plant Protection Department, College of food & Sciences, King Saud Museum of Arthropods (KSMA), Saudia Arabia.

RESULTS AND DISCUSSION

Description of the new species

Two Acaridiidia mite species proved to be new to science, the description of the two new species are presented hereunder.

***Acotyledon termesi*n sp. (Figs. 1-7).**



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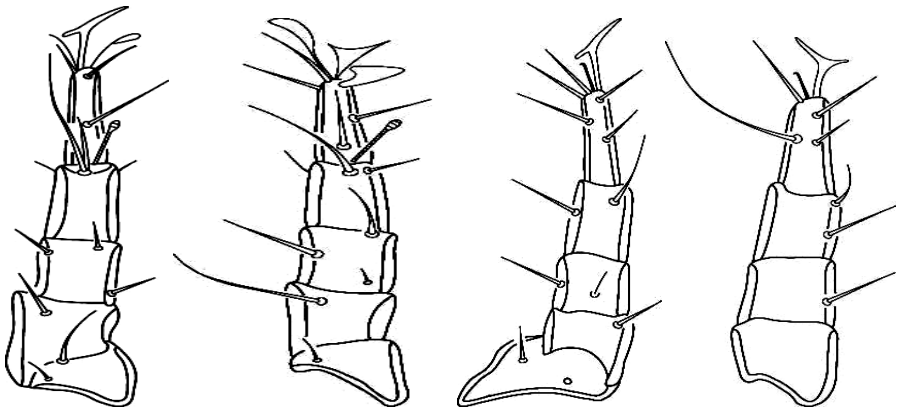
Figures (1-3).*Acotyledon termesi* n. sp. (Deutonymph), 1: dorsal side, 2: venteral side and 3: gnathosoma.



4 5 6 7

Figures (4-7). ***Acotyledon termesi*** **n. sp. (Deutonymph) 4: leg I, 5: leg II, 6: leg III, 7: leg IV.**

Measurements: Length: 320-367 μm, Width: 194-262 μm.

Dorsal side (Fig.1).Body approximately ovoid in outline, anteriorly and posteriorly rounded.Propodosoma comparatively wide and its surface smooth. Inner pair of prodorsal setae (Sci) shorter and thinner than the outer one (Sce).The former standing somewhat posteriorly to the outer pair. Dorsosejugal region wide, ornamented with heavy punctulae. Hysterosomatic surface also smooth. Notogasteral setae simple and short, but well observable.

Ventral side (Fig.2) infracapitulum of gnathosoma (Fig.3) approximately short, hardly longer than wide. Palpi not differentiated, solenidia long, much longer than the infracapitulum. Infracapitular setae thin and short, but well- developed. Apodemes on anterior sternal plate thick and long, except ap. sa. ending freely, Just in front with sejugalapodemes, apodemes 2 fused posteriorly with sejugal ones. On posterior sternal plate, ap.4 short, but well-chitinized, posterior sternal apodeme missing, thus epimeres on posterior sternal plate open. Epimeres I and III with a minute setae each, standing near the base of legs, epimeres IV with a suction disks. Adhering plate comparatively large, removed from the posterior margin of the body. Disks Ds of adhering plate reduced, except Ds_1. Disk D1 standing anteriorly to a very large D2.

Legs (Figs. 4- 7). Tarsi of legs I and II with thin, short and straight claws each, those of legs III and IV shorter and falcate- shaped. Legs I and II with 2 spoon – shaped setae on tarsi of both legs, tarsi of legs III and IV with one spoon-shaped seta each. Tarsi of legs I and II with solenidia ϕ_1 very long, longer than entire tarsi of both legs, much longer on leg I. Solenidia ω_1 of tarsi of legs I and II thicker than ω_3 approximately at the same length. Legs III and IV with majority of simple and thin setae each.

Material examined: Holotype: El- Kharga, New Valley, Egypt: Termite nests. Leg. M. Fakeer. 15-03-2012. 7 paratypes from the same locality.Holotype and 5 paratypes deposited in Plant Protection Department, Faculty of Agriculture, Assiut University, Egypt. Two paratypes are deposited in the Arachnoidea collection of the Hungarian Natural History Museum, Budapest, Hungary.

Remarks: The new species stands very near to the *Acotyledon lamiai*Eraky, 1998 collected from termite nests, New Valley, Egypt and the *Acotyledon longsetoses* Eraky, 1999b collected from termite nests, Aswan, Egypt,

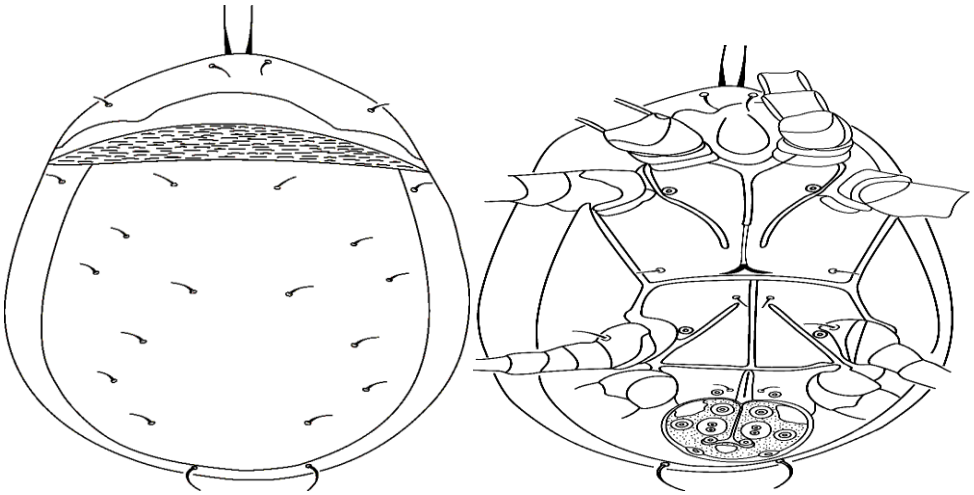
but the new species can easily be separated from the two related congeners of *Acotyledon* Oudemans, 1903, by the short dorsal setae as compared with a very long and thick ones in both *Acotyledon* species mentioned above, in addition to the ornamentation on dorsosejugal region and the unique structure of adhering plate.

***Caloglyphussubterraneousi* n. sp. (Figs. 8- 14)**

Measurements: Length: 253- 272μm, width: 154- 176 μm

Dorsal side (Fig. 8).Propodosoma nearly triangular in its outline, rostrum evenly rounded, an extremely long and thin vi setae projected forward from tip of propodosoma. Inner pair of propodosomatic setae (Sci) short and thin, but hardly longer than the outer one (Sce), originating far anteriorly of them, near the apical margin of propodosoma. Prodorsal surface smooth, anteriorly and laterally with a well observable convexly concaved line decurrent parallel with the body surface, above the dorsosejugal region. Dorsosejugal region ornamented with striations. Hysterosomal, surface smooth, all setae of hysterosoma simple and short, but well observable.

Ventral side (Fig. 8). Infracapitulum of gnathosom (Fig. 10) normal-developed, Palpi not separated off, solinidia comparatively long and thick. Infracapitular setae short and thin,situated behind solenidia. Apodemes (Fig 9) well-developed, On anterior sternal plate ap. sa long, bifurcated posteriorly, situated very near to ap. 3. Ap. 2 short, ending free.Apodemes 3 and sejugal one well separable.



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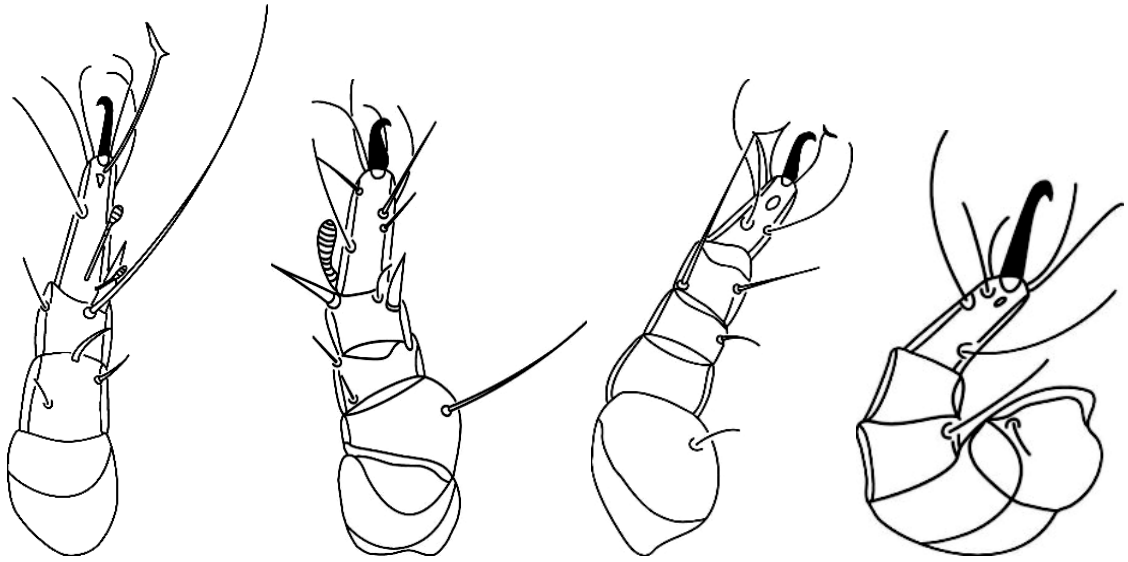
Figures (8-10). *Caloglyphussubterraneousi* n. sp. (Deutonmyph), 8: dorsal side, 9: ventral side, 10: gnathosoma.



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Figures(11-14). ***Caloglyphus subterraneousi*** **Fakeer *et al*., 2014 (Deutonymph) 11: leg I, 12: leg II, 13: leg III, 14: leg IV.**

Posterior sternal plate with ap. 4 and ap. sp. well-developed, ap. sp fused anteriorly with sejugalapodeme, ap. 4 ending anteriorly with short setae. Epimeres I, III and IV bear normal suction disks each. A pair of well discernible setae standing beside primordium of genital opening.Adhening plate (Fig. 9) normal-developed, originating adjacent to the posterior body margin. Disks D and Ds normal-developed.

Legs (Figs. 11-14). Legs generally well-developed, tarsi of all legs with large, sickle-shaped claws each.Solenidia φ of tarsus of leg I very long, much longer than entire tarsus.Solenidia ω_1 on tarsus of leg I longer and thicker than Solenidia ω_2. On leg II, solenidia ω_1 very thick, solenidia ϕ_1 thinner and longer than ω_1. The famulus of both legs, thin and short, but well-developed.

Material examined: Holotype and 2 paratypes are extracted from the nests of sand termite. *Psammotermeshypostoma*Desneux (Isoptera), New Valley, Egypt. Leg. M. Fakeer. 12. 05. 2012. Holotype and one paratype are deposited in the Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut/ Egypt. One paratype is deposited in the Arachnoidea Collection of the Hungarian Natural History Museum, Budapest, Hungary.

Table 1.Remarks: the new species stands very near to *Caloglyphusornatus*Eraky, 2000b and may be distinguished from it by the following characters.

***C. ornatus*Eraky, 2000 b**	***C. subterraneousi* n. sp.**
The anterior part of propodosoma ornamented with heavy granulae	The anterior part of propodosoma smooth.
Gnathosomalpalpi well recognizable	Gnathosomalpalpi not separated off
Ap. 4 fused anteriorly with ap. sp.	Ap. 4 standing far anteriorly from ap. sp.
Ap. sa short, ending free, far from ap. Sejugal	Ap. sa long, ending with bifurcate-shaped posteriorly, very near to ap. sejugal
Suctorial plate originating far anteriorly from the posterior body margin	Suctorial plate originating close to the posterior margin of the body

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