

A New Species, New Synonymy and a New Record of Eriophyoid Mites (Acari: Eriophyidae), From Egypt

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ABSTRACT

A new eriophyoid mite species, *Heterotergum zaheri* sp.

nov. from *Ziziphus spina-christi* (L.) Desf (Rhamnaceae) is described and illustrated. This mite is vagrant in the tender apical shoots (between hairs) and on the lower surface of young leaves. It causes no apparent damage. In addition, a supplementary description of *Vittacus bougainvilleae* (Keifer, 1959) comb. nov. (transferred from *Phyllocoptes*), is provided; it is recorded for the first time in Egypt, infesting *Bougainvillea glabra* Choisy (Nyctaginaceae). Moreover, *Aculops guajavae* Abou-Awad, Al-Azzazy & Afia, 2016, which causes rust on terminal leaves of *Psidium guajava* L. (Myrtaceae), is set as a junior synonym of *Tegolophus guavae* (Boczek, 1960) and redescribed.

Key words: Eriophyidae, *Heterotergum*, *Vittacus*, *Bougainvillea*, *Ziziphus*, Guava, taxonomy.

INTRODUCTION

Ziziphus spina-Christi (L.) Desf. (Rhamnaceae), is an evergreen tree which is native to northern, tropical Africa as well as southern and western Asia where it is more commonly known as Christi thorn or Christ's Thorn Jujube (Dafni *et al.*, 2005). Bougainvilleas are climbing ornamental plants that can be used to decorate walls, fences, gates and hedges.

To date more than 94 species have been reported from the family Eriophyidae in Egypt. The Phytoptidae has only three species, the Eriophyidae has 89 species, and the Diptilomiopidae has two species (Zaher, 1984; Elhalawany, 2012, 2017; Elhalawany & El Adl, 2017 and Elhalawany & Ueckermann, 2015 & 2018).

The genus *Heterotergum* was established by Keifer (1955), based on *Heterotergum gossypii* Keifer which causes bronzing of mature cotton leaves, *Gossypium hirsutum* L. (Malvaceae) in Brazil. The main character of the genus *Heterotergum* shows a few dorsal annuli behind the prodorsal shield that are equally narrow, followed by a series of broad dorsal annuli which become narrower towards the rear (Amrine *et al.*, 2003).

Until now, twelve *Heterotergum* species were known to occur in the world according to (de Lillo and Amrine, personal communication) among them, only *Heterotergum flacourti* Abou-Awad and Nasr, 1983 was described from Egypt (Table 1). Thirteen eriophyoid species belonging to other genera have been recorded from the plant genus *Ziziphus* until now, none of them has been found in Egypt (Amrine *et al.*, 2003 and Salari *et al.*, 2018). Only one species of eriophyid mite was recorded on *Ziziphus* from Egypt, *Aceria mauritiana* Amrine & Stasny, 1994 (= *Aceria ziziphi* Mohanasundaram, 1990) on *Ziziphus mauritiana* Lam. reported by Elhalawany, 2012.

The genus *Vittacus* was established by Keifer (1969) based on the type species *Vittacus mansoni* Keifer and characterized by body fusiform; gnathosoma projecting obliquely down; dorsal opisthosoma flat with transverse thickened bands; opisthosoma typically divided into broad dorsal annuli, and narrow microtuberculate ventral annuli. So far, ten species of the genus *Vittacus* are known worldwide, among them only one species was previously recorded from Egypt, *Vittacus plucheae* Abou-Awad & Nasr, 1986 on *Pluchea dioscoridis* L. (Guo *et al.*, 2015).

The bougainvillea rust mite, *Phyllocoptes bougainvilleae* Keifer, 1959 was discovered in Florida and California by Ochoa & Amrine, 1998 (unpublished, Amrine personal communication, 2018). Originally described from Brazil, this rust mite was discovered in Kenya and re-described as *Vittacus bougainvilleae* by Abou-Awad & El-Banhawy 1991 (Navia *et al.*, 2010). After careful study by Prof. Amrine & Ron Ochoa, comparing specimens from Egypt (sent by the author) with paratypes of Keifer's material, prepared several different ways, the mite was determined to belong in *Vittacus*, not *Phyllocoptes*. Fresh material, cleared in modified Berlese medium at about 95° C for 3-4 hours always resulted in specimens with characters that matched *P. bougainvilleae* Keifer, 1959; overheated slides produced specimens with obvious characters of *V. bougainvilleae*. But, reconsideration of the characters of this mite places it in *Vittacus*, not in *Phyllocoptes* (Amrine personal communication).

Finally, I compared the characters of *Tegolophus guavae* (Boczek, 1960) with *Aculops guajavae* Abou-Awad, Al-Azzazy & Afia, 2016 from *Psidium guajava* L. (Myrtaceae) in Egypt, *A. guajavae* Abou-Awad *et al.* is recognized as a junior synonym of *Tegolophus guavae* (Boczek, 1960).

In this paper, a new species of *Heterotergum* is described and illustrated. In addition, eriophyid mites

Table 1. *Heterotergum* mite species worldwide and their type host, habits and type locality

Species	Type host	Habits	type locality
<i>Heterotergum gossypii</i> Keifer, 1955	<i>Gossypium hirsutum</i> L. (Malvaceae)	bronze the mature leaves	Brazil
<i>Heterotergum wilsoni</i> Keifer, 1956	<i>Simmondsia chinensis</i> (Link) Schneid. (Simmondsiaceae)	vagrant among leaf hairs	(California) USA
<i>Heterotergum tuttlei</i> Keifer, 1961	<i>Trixis californica</i> Kellogg (Asteraceae)	vagrant among leaf hairs	(Arizona) USA
<i>Heterotergum olneyae</i> Keifer, 1963	<i>Olneya tesota</i> Gray (Fabaceae)	inhabit tomentum of green stems and on lower surface of leaves	(Arizona) USA
<i>Heterotergum yumensis</i> Keifer, 1966	<i>Acacia greggi</i> Gray (Fabaceae)	leaf and twig vagrant	(Arizona) USA
<i>Heterotergum schlingeri</i> Wilson & Oldfield, 1966	<i>Ambrosia chenopodifolia</i> (Benth.) Payne (Asteraceae)	probably inquiline in galls of <i>Aceria franseriae</i>	(Sonora) Mexico
<i>Heterotergum shevtchenkoi</i> Bagdasarian, 1972	<i>Pistacia atlantica</i> Desf. (Anacardiaceae)	vagrant on lower leaf surface	Armenia
<i>Heterotergum zexmeniae</i> Keifer, 1973	<i>Wedelia texana</i> (A. Gray) B.L. Turner. (Asteraceae)	vagrant.	(Estado do Jalisco) Mexico
<i>Heterotergum flacourtae</i> Abou-Awad & Nasr, 1983	<i>Flacourtia indica</i> Merr. (Flacourtiaceae)	vagrant	Giza region, Egypt.
<i>Heterotergum artemisiae</i> Hong & Kuang, 1989	<i>Artemisia lavandulaefolia</i> DC. (Asteraceae)	vagrant	(Hubei) China
<i>Heterotergum crispae</i> Meyer, 1992.	<i>Euclea crispa</i> (Thunb.) (Ebenaceae)	vagrant	(Transvaal) South Africa
<i>Heterotergum munduleae</i> Meyer, 1992.	<i>Mundulea sericea</i> (Willd.) (Fabaceae)	on new growth and new pods	(Transvaal) South Africa

infesting *Bougainvillea* from Egypt are redescribed as *Vittacus bougainvilleae* (Keifer, 1959) *Aculops guajavae* Abou-Awad, Al-Azzazy & Afia, 2016 is redescribed and illustrated as *Tegolophus guavae* (Boczek, 1960) from *Psidium guajava* L..

MATERIALS AND METHODS

During period from September 2012 to 2017, plant samples were collected from Qalyubia and Giza governorates. Eriophyoid mites were collected from the plant samples by direct examination with the aid of a stereo-microscope and mounted on microscope slides in Keifer's F-medium (Amrine and Manson 1996). The specimens were examined under a phase contrast microscope (BX46, Olympus). Illustrations were elaborated with the use of drawing tube attached to the phase contrast microscope and using the Adobe Illustrator® CS6 program. Identification to genus level was conducted using a published key to the world genera of the Eriophyoidea (Amrine *et al.*, 2003). Morphological terminology is based on Lindquist (1996) and data measurements follow (Amrine and Manson 1996; de Lillo *et al.*, 2010). All measurements were made using the software computer program (compu Eye) (Baker, 2005) and are given in micrometres (μm) and the number of measured specimens (n) is given within parentheses in the description. For males and immature stages, only the ranges are given. For scanning electron microscope (SEM) images, mites were collected from the laboratory culture, using a fine paint brush 00 from leaf pieces under a dissecting microscope. About 50 individuals of eriophyid mites were placed on aluminum stubs for examination under low vacuum scanning electron microscope (JEOL/EO -

JSM-5200). Live specimens were concentrated to a pellet and affixed to stubs using double-sided sticky tape then sputter-coated with gold-palladium. SEM microscopy was performed at Cairo University, Egypt. They were transferred to the low vacuum chamber of the electron microscope, then examined and photographed.

Holotype and some paratypes are deposited in Fruit Acarology Department, PPRI, ARC, Egypt. While the paratypes are deposited in Arthropod/Mite Collection of the Department of Entomology, Nanjing Agricultural University, Jiangsu Province, China (curator: Dr Xiao-Feng Xue). Two paratypes of each species is deposited at Plant Protection Research Institute collection. Two paratypes of each species is deposited at the Collection of the Department of Zoology and Nematology, Faculty of Agricultural, Cairo University, Egypt. Two paratype slides of each species is deposited in the Department of Soil, Plant and Food Sciences (Di.S.S.P.A.), section of Entomology and Zoology, University of Bari Aldo Moro, Bari, Italy (curator: de Lillo). In addition, two paratype slide of each species is deposited in the College of Agriculture and Forestry West Virginia University USA (curator: Amrine).

RESULTS AND DISCUSSION

Family: Eriophyidae Nalepa, 1898.

Sub family: Phyllocoptinae Nalepa, 1892

Tribe: Anthocoptini Newkrik and Keifer, 1975.

Genus: *Heterotergum* Keifer, 1955.

***Heterotergum zaheri* sp. nov. (Fig. 1)**

Description:

FEMALE: (n=10) body fusiform, 185 (175–190)

long, 42 (36–45) wide, 45 (43–48) thick; light yellow. **Gnathosoma** 20 (19–21) long, projecting obliquely downwards, basal setae (*ep*) 3 (3–4), antapical setae (*d*) 4 (3–4), chelicerae 18 (16–19) long. **Prodorsal shield** 27 (26–28) long, 29 (27–31) wide; sub-triangular with short anterior lobe over gnathosoma, rounded, acuminate, 5 (5–7) long; prodorsal shield ornamentation with dashes laterally, incomplete median line on posterior 2/3 of prodorsal shield, two admedian lines complete, connected just ahead of rear margin with slight curved line inwardly on inner side of tubercles *sc*, submedian lines connected with admedian line at 1/3 and 2/3 of shield. Scapular tubercles on rear shield margin, 19 (17–20) apart, setae (*sc*) 30 (27–31), directed backwards. **Coxigenital area** with distinct granules and dashes, prosternal apodeme present 5 (5–6); anterolateral setae on coxisternum I (*Ib*) 8 (8–9), 9 (8–10) apart; proximal setae on coxisternum I (*Ia*) 18 (17–19), 9 (8–9) apart; proximal setae on coxisternum II (*2a*) 33 (30–35), 19 (18–20) apart. **Leg I** 30 (26–31), femora 8 (7–8), basiventral femoral setae (*bv*) 11 (10–12); genua 6 (5–6), antaxial genual setae (*l'*) 20 (19–21); tibiae 6 (5–6), paraxial tibial setae (*l'*) 5 (4–5), setae located 1/3 from dorsal base; tarsi 5 (4–5); empodia (*em*) simple 6 (5–6), 6-rayed, tarsi solenidia (ω) slightly knobbed, 6 (6–7), paraxial fastigial tarsal setae (*ft'*) 13 (11–13), antaxial fastigial tarsal setae (*ft''*) 20 (17–21), setae (*u'*) 3 (3–4). **Leg II** 25 (23–26), femora 8 (7–8), basiventral femoral setae (*bv*) 10 (10–12); genua 4 (4–5), antaxial genual setae (*l''*) 9 (8–11); tibiae 4 (4–5); tarsi 5 (5–6); tarsal empodia (*em*) simple 5 (5–6), 6-rayed, tarsal solenidia (ω) slightly knobbed 8 (7–8), setae (*ft'*) 11 (10–12), setae (*ft''*) 18 (17–20), setae (*u'*) 3 (3–4). **Opisthosoma** 22 (20–22) dorsal annuli, with about 14 broad dorsal annuli, preceded by 3–4 narrow dorsal annuli directly behind prodorsal shield, elongated microtubercles placed on posterior annuli; broad dorsal annuli with faint elongated microtubercles. Ventral annuli comprise 68 (66–73) annuli (counted from first annulus after coxae II), microtubercles oval, placed on posterior ventral annuli. Lateral setae (*c2*) 45 (45–47), 18 (16–20) apart, on annulus 9 (9–10) from coxae II; ventral setae I (*d*) 34 (30–35), 35 (33–38) apart, on annulus 23 (22–24); ventral setae II (*e*) 10 (8–11), 20 (17–22) apart, on annulus 43 (40–44); ventral setae III (*f*) 18 (17–20), 10 (10–12) apart, on annulus 62 (60–65) or 6th annulus from rear. Setae (*h2*) 45 (42–50), 9 (8–9) apart; setae (*h1*) 3 (2–3). **Internal genitalia** anterior apodeme with normal 12 (11–12), 20 (18–21) wide, coverflap with 12 (12–14) longitudinal ridges, proximal setae on coxisternum III (*3a*), 25 (20–26), 14 (12–14) apart.

MALE. (n=4). Similar to female. Body fusiform, 155 (150–160), 42 (42–45) wide, 37 (35–40) thick;

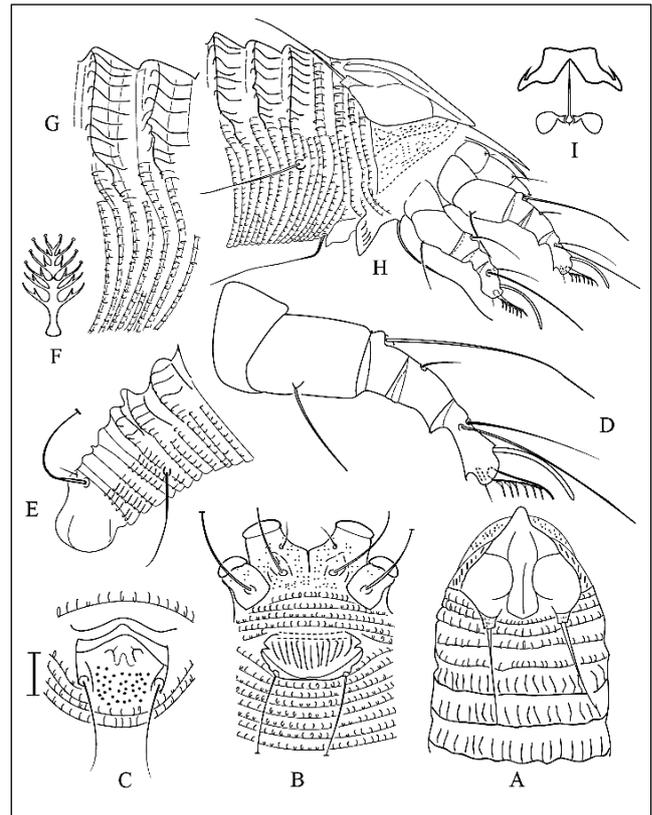


Fig. (1): Line drawings of *Heterotergum zaheri* sp. nov.: A - prodorsal shield; B - female coxigenital region; C - genital region of male; D - Legs I; E - lateral view of posterior opisthosoma; F - empodium; G - lateral view of annuli; H - anterior lateral view of mite; I - internal genital of female. Scale bars: 10 μ m for A, B, C, H, I; 5 μ m for D and 2.5 μ m for F.

light yellow. **Gnathosoma** 19 (19–20), chelicerae 17 (16–17), setae (*ep*) 3 (3–4), setae (*d*) 4 (3–4). **Prodorsal shield** 26 (26–28), 25 (22–27) wide, ornamentation same as female. Scapular tubercles on rear shield margin, 18 (17–19) apart with setae (*sc*) 27 (25–28), directed backwards. Ornamentation of coxae same as female: setae (*Ib*) 5 (5–6), 9 (8–10) apart; setae (*Ia*) 15 (14–17), 7 (7–9) apart; setae (*2a*) 25 (24–26), 16 (16–18) apart. **Leg I** 25 (23–26), femur 7 (7–8), setae (*bv*) 10 (10–12); genua 5 (4–5), setae (*l''*) 20 (19–21); tibiae 6 (5–6), setae (*l'*) 5 (4–5); tarsi 5 (4–5); tarsal empodia (*em*) simple 6 (5–6), 6-rayed, tarsal solenidia (ω) distally slight knobbed 6 (6–7), setae (*ft'*) 13 (11–13), antaxial, fastigial, tarsal setae (*ft''*) 20 (17–21), tarsal setae (*u'*) 3 (3–4). **Leg II** 23 (20–24), femur 6 (6–7), (*bv*) 10 (10–12); genua 4 (3–4), (*l''*) 9 (8–11); tibiae 4 (4–5); tarsi 5 (5–6); (*em*) simple 5 (5–6), 6-rayed, solenidia (ω) 8 (7–8), (*ft'*) 11 (10–12), (*ft''*) 18 (17–20), (*u'*) 3 (3–4). **Opisthosoma** with 22 (20–22) dorsal annuli, about 14 broad dorsal annuli, preceded by 3–4 annuli behind prodorsal shield. Ventral annuli 66 (65–70). Microtubercles same as female. Lateral setae (*c2*) 43 (41–45) apart 18 (16–18), on annulus 9 (9–10)

(counted from first annulus after coxae II); setae (*d*) 32 (30–33), 33 (33–35) apart, on annulus 22 (19–22); setae (*e*) 10 (8–11), 20 (17–22) apart, on annulus 39 (39–42); setae (*f*) 15 (15–18), 10 (10–11) apart, on 6th annulus from rear. Setae (*h2*) 42 (42–50), 8 (8–9) apart; setae (*h1*) 3 (2–3). **External genitalia** 9 (8–10), 18 (17–18) wide, with granules, proximal setae on coxisternum III (*3a*) 18 (18–20), 15(14–15) apart.

Host plant. *Ziziphus spina-christi* (L.) Desf. (Rhamnaceae).

Relation to the host plant. Vagrant in the tender apical shoots between hairs and on lower surface of young leaves, causing no apparent damage.

Type Locality. Shebeen Al-Qanater region, Qalyubia Governorate, Egypt, 30°18'19.01"N, 31°18'8.66"E, 15 September 2013 and 26 September 2015 coll. Ashraf S. Elhalawany.

Type material. Holotype, single female on a microscope slide (slide no. EGP-Erio18.1), deposited at Fruit Trees Mites Dept., Collection, Plant Protection Research Institute (PPRI), Dokki, Egypt. Paratypes, 30 females and 10 males on 30 separate microscope slides deposited at Fruit Trees Mites Dept., Collection, Plant Protection Research Institute (PPRI), Dokki, Egypt. Two slides at Plant Protection Research Institute collection. Four females and one male (slide number: NJAUAcariEriEgypt32.1–32.5), deposited as slide mounted specimens in the Arthropod/Mite Collection of the Department of Entomology, Nanjing Agricultural University, Jiangsu Province, China; Two paratypes slide mounts are also deposited in the Department of Soil, Plant and Food Sciences (Di.S.S.P.A.), section of Entomology and Zoology, University of Bari Aldo Moro, Bari, Italy. Two paratypes slides is deposited at Plant Protection Research Institute collection. Two paratypes slide is deposited in the College of Agriculture and Forestry West Virginia University USA.

Etymology. This species is named after the Emeritus Prof. Dr. Mohammed Abdel-Aziz Zaher, Department of Zoology and Nematology, Agri. Cairo Univ., Egypt.

Differential diagnosis. The new species herein described was compared with all *Heterotergum* species and no similarities among any of them were observed. A few similarities were observed with *Heterotergum yumensis* Keifer 1966 collected from *Acacia greggi* Gray (Fabaceae). The new species differs from *H. yumensis* in shape and rays number of empodial rays (6-rayed compared to *H. yumensis* which bears 7-rays), prodorsal shield pattern (the new species shows a pattern of distinctive lines versus a series of granules appear to form lines in *H.*

yumensis), number of dorsal semiannuli (14 in the new species versus 18 in *H. yumensis*), number of ventral semiannuli (68 with oval microtubercles in the new species versus 53 with round and bead-like microtubercles in *H. yumensis*). The new species differs from *Heterotergum flacourtia* Abou-Awad and Nasr 1983 collected from *Flacourtia indica* Merr., by prodorsal shield pattern (presence of sub-median lines in the new species versus absent in *H. flacourtia*), and number of dorsal and ventral semiannuli (14 and 68 in the new species versus 10 and 59 annululi in *H. flacourtia*).

Genus *Vittacus* Keifer, 1969, C2: 13–14.

Vittacus bougainvilleae (Keifer, 1959) **comb. nov.** (Figs 2-5)

Synonyms

Phyllocoptes bougainvilleae Keifer, 1959, 28(2): 9–10, Fig. 7.

Vittacus bougainvilleae Abou-Awad & El-Banhawy, 1991:331-332.

Phyllocoptes bougainvilleae Keifer, 1959; *Navia et al.*, 2010: 236.

Redescription:

FEMALE: (n=15) body fusiform, 180 (178–185) long, 60 (57–60) wide, 52 (52–57) thick; light yellow.

Gnathosoma 22 (21–23) long, projecting obliquely downwards, basal setae (*ep*) absent, antapical setae (*d*) 4 (4–5), chelicerae 16 (14–16) long. **Prodorsal shield** 38 (37–39) long including frontal lobe, 44 (43–45) wide; prodorsal shield frontal lobe over gnathosoma, rounded, acuminate, 6 (5–6) long; Prodorsal shield ornamentation network, median and admedian lines complete, sinuate, forming four cells with cross lines on each side of median line, two submedian lines diverging from anterior lobe ending at 1/2, the outer submedian line meeting in inwardly curves back just inside the dorsal tubercles, forming elongate cells laterally on prodorsal shield and some granules on lateral lobe. Scapular tubercles near the rear shield margin, 22 (20–22) apart, setae (*sc*) 22 (20–24), projecting up and diverging.

Coxigenital area with few curved lines and granules, prosternal apodeme present 6 (5–6); anterolateral setae on coxisternum I (*Ib*) 6 (6–7), 12 (10–12) apart; proximal setae on coxisternum I (*Ia*) 16 (16–18), 8 (7–8) apart; proximal setae on coxisternum II (*2a*) 31 (29–32), 20 (20–21) apart. **Leg I** 32 (30–35), femur 9 (9–10), basiventral femoral setae (*bv*) 12 (11–13); genu5 (5–6), antaxial genual setae (*l''*) 25 (24–27); tibiae 7 (7–8), paraxial tibial setae (*l'*) 5 (4–5), setae located 1/4 from dorsal base; tarsi 7 (6–7); empodia (*em*) simple 5 (4–5), 3-rayed, tarsi solenidia (ω) slightly knobbed, 7 (6–7), paraxial fastigial tarsal setae (*ft'*) 13 (12–14), antaxial fastigial tarsal setae (*ft''*) 21 (18–21), setae (*u'*) absent. **Leg II** 30 (28–31), femur 9 (8–9), basiventral femoral

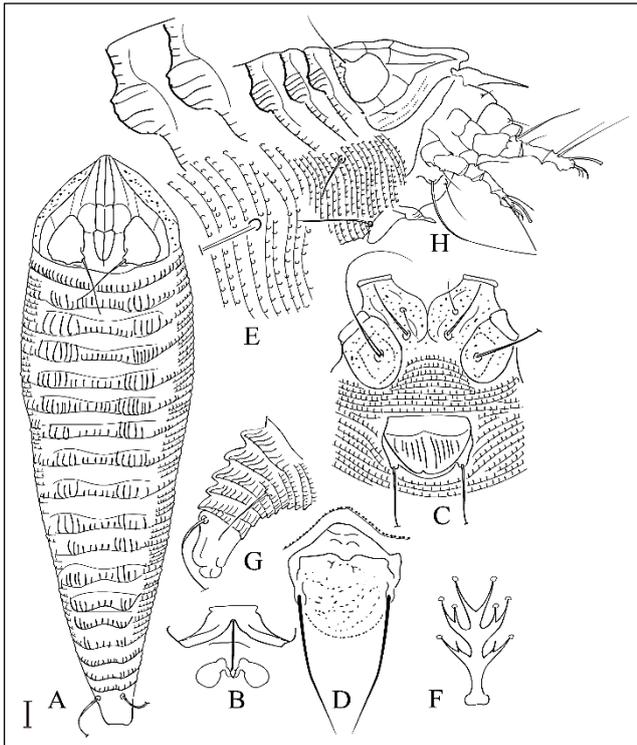


Fig. (2): Line drawings of *Vittacus bougainvilleae* (Keifer) comb. nov.: A- dorsal view of female; B- internal female genitalia; C- female coxigenital region; D- male genitalia; E- lateral view of annuli; F- empodium; G- lateral view of posterior opisthosoma; H. anterior lateral view of mite. Scale bars: 10 μ m for A, G, H; 5 μ m for B,C, D; 2.5 μ m for F.

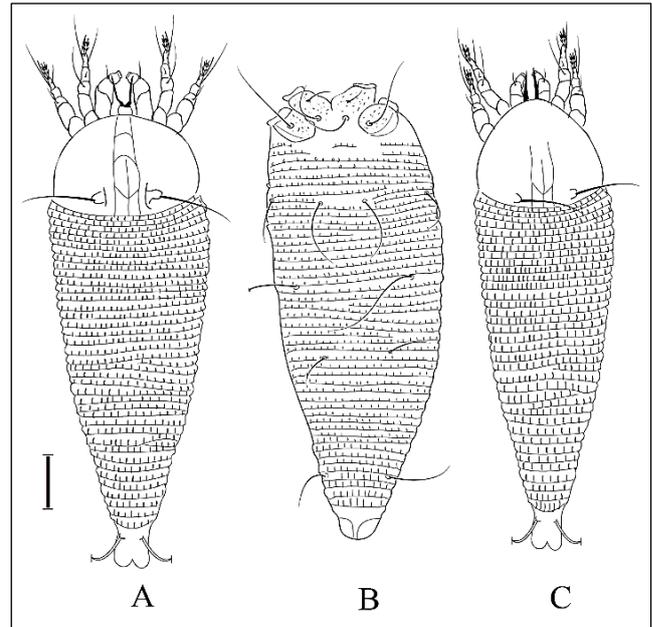


Fig. (3): Line drawings of *Vittacus bougainvilleae* (Keifer) comb. nov.: A- dorsal view of nymph; B- ventral view of nymph; C- dorsal view of larva. Scale bars: 10 μ m.

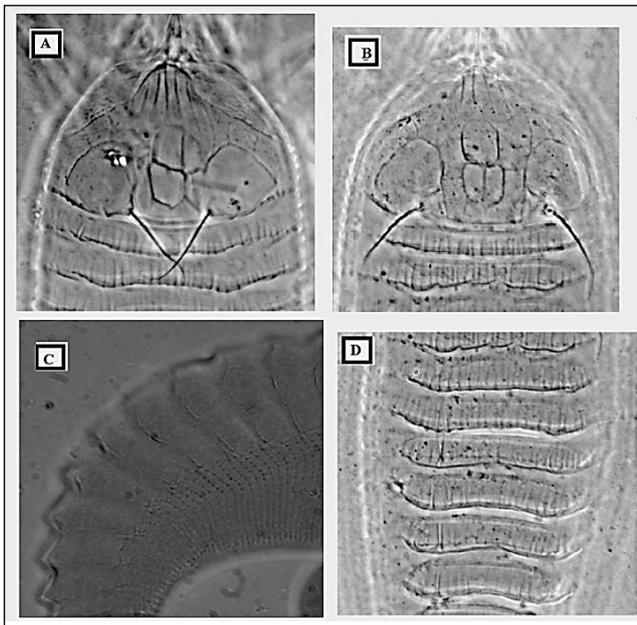


Fig. (4): Phase microphotograph of *Vittacus bougainvilleae* (Keifer) comb. nov.: A and B Dorsal view of mite; C- Coxigenital female; D- Coxigenital male.

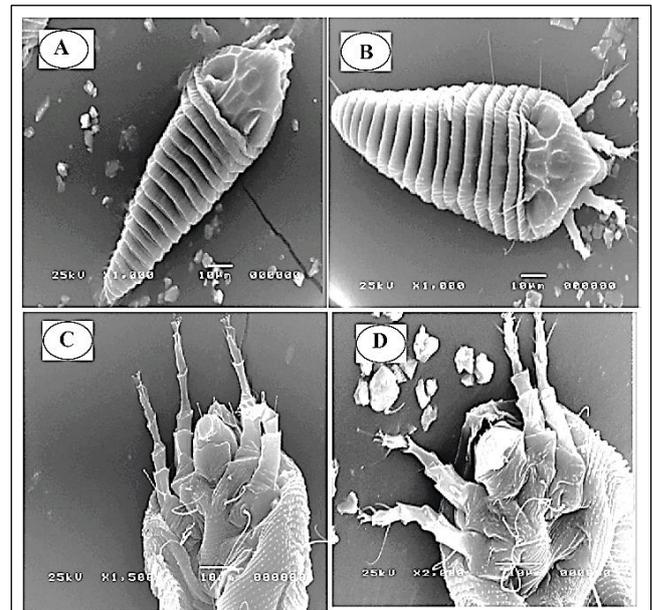


Fig. (5): SEM photograph of *Vittacus bougainvilleae* (Keifer) comb. nov.: A and B Dorsal view of mite; C- Coxigenital female; D- Coxigenital male.

setae (*bv*) 12 (11–13); genu 5 (4–5), antaxial genual setae (*l''*) 7 (7–8); tibiae 6 (6–7); tarsi 6 (6–7); tarsal empodia (*em*) simple 5 (5–6), 3-rayed, tarsal solenidia (ω) slightly knobbed 6 (6–7), setae (*ft'*) 9 (7–10), setae (*ft''*) 23 (21–24), setae (*u'*) absent. **Opisthosoma** 18 (18–19) dorsal annuli, broad dorsal annuli with elongated linear microtubercles; ventral annuli with 64 (62–66) annuli (counted from first annulus after coxae II), microtubercles rounded elongate, placed on posterior ventral annuli, on the last 10 annuli, the ventral microtubercles are linear. Lateral setae (*c2*) 14 (12–15), 54 (54–55) apart, on annulus 13 (11–14) from coxae II; ventral setae I (*d*) 48 (45–52), 36 (35–37) apart, on annulus 23 (22–26); ventral setae II (*e*) 17 (15–17), 21 (20–21) apart, on annulus 37 (37–40); ventral setae III (*f*) 25 (24–27), 14 (14–15) apart, on annulus 58 (58–62) or 5th annulus from rear. Setae (*h2*) 55 (50–60), 8 (8–9) apart; setae (*h1*) absent. **External genitalia** 16 (16–17), 20 (20–21) wide, coverflap with 12 (11–12) longitudinal ridges in a single row, proximal setae on coxisternum III (*3a*), 32 (27–32), 17 (16–17) apart.

MALE. (n=4). Similar to female. Body fusiform, 160–173 long, 52–55 wide, 44–48 thick; light yellow. **Gnathosoma** 21–22, projecting obliquely downwards, chelicerae 15–16, setae (*ep*) absent, setae (*d*) 3–5. **Prodorsal shield** 37–38 long including frontal lobe, 42–45 wide; prodorsal shield frontal lobe over gnathosoma, rounded, acuminate, 5–6 long; scapular tubercles near the rear shield margin, 20–21 apart, setae (*sc*) 20–21, projecting up and diverging. **Coxigenital area** with short curved lines, prosternal apodeme present 5–6; setae (*1b*) 5–6, 10–11 apart; setae (*1a*) 13–15, 6–7 apart; setae (*2a*) 25–30, 19–20 apart. **Leg I** 28–30, femora 7–8, setae (*bv*) 10–12; genua 4–5, setae (*l''*) 19–22; tibiae 7–8, setae (*l'*) 4–5; tarsi 5–7; tarsal empodia (*em*) simple 4–5, 3-rayed, tarsal solenidia (ω) distally slight knobbed 6–7, setae (*ft'*) 11–13, antaxial, fastigial, tarsal setae (*ft''*) 18–22, tarsal setae (*u'*) absent.

Leg II 26–28, femur 6–8, (*bv*) 10–12; genua 3–4, (*l''*) 6–8; tibiae 5–6; tarsi 5–6; empodia (*em*) simple 4–5, 3-rayed, (ω) distally slight knobbed 6–7, (*ft'*) 8–10, (*ft''*) 19–21, (*u'*) absent. **Opisthosoma** with 18–19 broad dorsal annuli, ventral annuli 58–60. Microtubercles same as female. Lateral setae (*c2*) 11–16, 52–55 apart, on annulus 11–13 from coxae II; ventral setae I (*d*) 44–49, 33–35 apart, on annulus 22–25; ventral setae II (*e*) 15–18, 19–21 apart, on annulus 37–39; ventral setae III (*f*) 24–28, 13–15 apart, on annulus 54–56 or 5th annulus from rear. Setae (*h2*) 50–55, 7–8 apart; setae (*h1*) absent. **External genitalia** 12–13, 16–18 wide, proximal setae on coxisternum III (*3a*) 22–24, 14–15 apart.

NYMPH (n= 4). Body spindleform, 152–170; width 41–43. **Gnathosoma.** 16–17, curved downward,

d 3–5, cheliceral stylets 12–13. **Prodorsal shield.** sub-circular, 32–34, 36–38 wide, with pattern of faint lines, median line at 1/2 from rear, complete admedian line connected at 1/4, 1/2 and 2/3 by transverse lines forming cells. Tubercles *sc* ahead of rear shield margin, 16–18 apart; *sc* 15–16 divergently out. **Coxisternal plates.** With granules, *1b* 3–5, 8–9 apart; *1a* 10–11, 6–7 apart; *2a* 18–21, 19–20 apart; *3a* 19–21, 8–9 apart. **Legs.** All usual segments and setae present. Leg I 19–21; femur 7, *bv* 4–5; genu 3–3.5, *l''* 13–15; tibia 4–5, *l'* 3–4; tarsus 4–5, *ft'* 8–9, *ft''* 10–13; ω 4–5; *em* 3–4, simple, 3-rayed. Leg II 17–18; femur 6–7, *bv* 5–6; genu 3, *l''* 7–10; tibia 3–4; tarsus 3–4, *ft'* 6–7, *ft''* 11–13; solenidion ω 4–5; *em* 3–4, simple, 3-rayed. **Opisthosoma.** With 38–41 dorsal annuli, with linear elongate microtubercles set on rear margin of annuli, 46–48 ventral annuli with oval microtubercles, elongated on the posterior annuli, 6–8 coxigenital annuli. Seta *c2* 6–7, 38–40 apart, on 7–8th ventral annulus; *d* 26–28, 26–27 apart, on 16–18th ventral annulus; *e* 8–10, 14–15 apart, on 26–27th ventral annulus; *f* 14–15, 13–15 apart, on 5th annulus from rear. Seta *h1* absent; *h2* 15–19.

LARVA (n= 3). Body vermiform, 125–148; width 37–40. **Gnathosoma.** 15–16, curved downward, *d* 3–4, cheliceral stylets 10–11. **Prodorsal shield.** sub-circular, 28–30, 30–33 wide, with pattern of faint lines, median line at 1/2 from rear, admedian line at 2/3 connected at 1/4 by transverse line forming two cells. Tubercles *sc* ahead of rear shield margin, 15–16 apart; *sc* 13–15 divergently out. **Coxisternal plates.** With granules, *1b* 3–4, 8–9 apart; *1a* 9–11, 6–7 apart; *2a* 18–20, 18–19 apart; *3a* 16–18, 8–9 apart. **Legs.** All usual segments and setae present. Leg I 18–20; femur 6–7, *bv* 4–5; genu 3–3.5, *l''* 13–14; tibia 4–5, *l'* 3 (no range); tarsus 3–4, *ft'* 8–9, *ft''* 10–11; ω 4–5; *em* 3–4, simple, 3-rayed. Leg II 16–18; femur 6–7, *bv* 4–6; genu 3, *l''* 7–9; tibia 3; tarsus 3–4, *ft'* 6–7, *ft''* 10–12; solenidion ω 4–5; *em* 3–4, simple, 3-rayed. **Opisthosoma.** With 36–38 dorsal annuli, with linear elongate microtubercles set on rear margin of annuli, 43–46 ventral annuli with oval microtubercles, elongated on the posterior annuli, 6–7 coxigenital annuli. Seta *c2* 6–7, 36–38 apart, on 6–7th ventral annulus; *d* 24–26, 25–26 apart, on 15–16th ventral annulus; *e* 6–7, 13–14 apart, on 25–26th ventral annulus; *f* 13–14, 13–14 apart, on 5th annulus from rear. Seta *h1* absent; *h2* 10–15.

Type data: *Bougainvillea spectabilis* Willd. (Nyctaginaceae).

Host plant from Egypt: *Bougainvillea glabra* Choisy and *Bougainvillea luteoalba* H. & K. (Nyctaginaceae).

Relation to the host plant: Leaf edge rolling from the underside (Keifer, 1959). In Egypt it causes leaf edge rolling from the underside and wrinkle flowers.

Geographic distribution: (Sao Paulo) Brazil; Kenya; (California, Florida) USA.

Material examined

Ten slides (no. NJAUAcariEriEgypt17) from *Bougainvillea glabra* Choisy (Nyctaginaceae) Egypt, Qalyubia, 30°17'38.14N, 31°14'51.56"E, 15 August 2012. Coll. A. Elhalawany; deposited as slide mounted specimens in the Arthropod/Mite Collection of the Department of Entomology, Nanjing Agricultural University, Jiangsu Province, China. Two slides, with the same data deposited at Department of Soil, Plant and Food Sciences (Di.S.S.P.A.), section of Entomology and Zoology, University of Bari Aldo Moro, Bari, Italy. Two slides, with the same data deposited at Department of Zoology and Nematology, Faculty of Agricultural, Cairo University, Egypt. Five females and 3 males on 6 slides, with the same data (no. EGPErio36.1–36.6), 1 June 2015, deposited at Fruit Trees Mites Dept., Plant Protection Research Institute Dokki Egypt. Two slides at Plant Protection Research Institute collection.

Remarks

This is the first record of occurrence of females and males of *V. bougainvilleae* in Egypt. The holotype female was described by Keifer, 1959 from Brazil. The morphometry of the female appears to match the original description by Keifer, 1959. The principal differences between this species and the descriptions given by Keifer are the size of the specimens now examined is shorter (45–50) long; scapular seta *sc* short 16 long and seta *3a* short 25 long; seta *f* 17 long; the Egyptian specimens are slightly longer than those in Keifer's description; while the lateral seta *c2* 23 long from Keifer is longer than Egyptian specimens. After careful study by Prof. Amrine specimens from Egypt (sent by the author) were compared to paratypes of Keifer's material, prepared several different ways. Fresh material, cleared in modified Berlese medium at about 95° C for 3–4 hours always resulted in specimens with characters that matched *P. bougainvilleae* Keifer, 1959; overheated slides produced specimens with the characters of *V. bougainvilleae*. But, reconsideration of the characters of this mite places it in *Vittacus*, not in *Phyllocoptes*; it thus becomes a senior homonym for *V. bougainvilleae*, same name but a later date for the description. Comparison of descriptions indicate that they are different species. If proven to be separate species, *Vittacus bougainvilleae* Abou-Awad & El-Banhawy, 1991 needs a new name (Amrine personal communication). But when mounting many slides from different locality from Egypt and using scanning electron microscope found no differences between the two species, and both names may be conspecific. DNA typing is needed to prove speciation.

Tegolophus guavae (Boczek, 1960) (Figs 6–8)

Synonyms

Tegonotus guavae Boczek, 1960: 11–14.
Aculops guavae (Boczek, 1960): Craemer C. 1993.
Tegolophus guavae (Boczek, 1960); Amrine & Stasny, 1996: 300.
Tegolophus guavae (Boczek, 1960); Elhalawany, 2012:207–209.
Aculops Guajavae Abou-Awad, Al-Azzazy & Afia, 2016: 108–108.

Redescription.

FEMALE: (n=20) body fusiform, 165 (155–200) long without gnathosoma, 60 (55–62) wide, 52 (47–60) thick; light yellow. **Gnathosoma** 25 (25–27) long, projecting obliquely downwards, basal setae (*ep*) 3 (2–3), antapical setae (*d*) 4 (4–5), chelicerae 16 (16–18) long. **Prodorsal shield** 42 (40–43) long including broad rounded frontal lobe 6(6–8), 47 (44–50) wide; subtriangular; prodorsal shield ornamentation with faint incomplete median line, split near center of shield into two lines which do not reach anterior margin forming U shape, surface of shield punctuated. Scapular tubercles on rear shield margin, 33 (31–35) apart, setae (*sc*) 15 (13–16), projecting posteriorly. **Coxigenital area** with granules, with 9 (8–9) annuli between coxae and genitalia, prosternal apodeme present 6 (5–7); anterolateral setae on coxisternum I (*Ib*) 5 (5–6), 10 (10–11) apart; proximal setae on coxisternum I (*Ia*) 13 (11–15), 7 (7–8) apart; proximal setae on coxisternum II (*2a*) 27 (25–30), 20 (19–22) apart. **Leg I** 32 (30–33), femur 10 (9–11), basiventral femoral setae (*bv*) 7 (7–9); genua 4 (4–5), antaxial genual setae (*l'*) 25 (22–27); tibiae 6 (6–7), paraxial tibial setae (*l*) 4 (4–5), setae located 1/4 from dorsal base; tarsi 4 (4–5); empodia (*em*) simple 4 (4–5), 4-rayed, tarsi solenidia (ω) slightly knobbed, 6 (5–6), paraxial fastigial tarsal setae (*ft'*) 15 (12–15), antaxial fastigial tarsal setae (*ft''*) 22 (18–21). **Leg II** 29 (28–30), femur 8(7–9), setae (*bv*) 8 (7–9); genua 5 (4–5), setae (*l''*) 7 (7–8); tibiae 5 (5–6); tarsi 5 (5–6); tarsal (*em*) simple 4 (3–5), 4-rayed, (ω) slightly knobbed 5 (5–6), setae (*ft'*) 8 (7–10), setae (*ft''*) 18 (17–20). **Opisthosoma** 30 (29–32) dorsal annuli broad, with faint longitudinal lines, with three longitudinal ridges, middorsal ridge stronger than lateral ridges, fading caudally. Ventral annuli with 65 (64–67) annuli (counted from first annulus after coxae II), microtubercles rounded, placed on posterior ventral annuli, the last 10th ventral microtubercles liner. Lateral setae (*c2*) 17 (15–20), 47 (46–50) apart, on annulus 11 (11–12) from coxae II; ventral setae I (*d*) 35 (33–38), 31 (30–33) apart, on annulus 25 (24–27); ventral setae II (*e*) 14 (12–15), 15 (15–17) apart, on annulus 40 (39–42); ventral setae III (*f*) 25 (23–26), 20 (19–21) apart, on annulus 61 (60–62) or 6th annulus from rear. Setae (*h2*) 60 (55–67), 9 (8–9) apart; setae (*h1*) absent. **External**

genitalia 16 (15–17), 23 (22–25) wide, coverflap with 12–14 longitudinal ridges in a single row, proximal setae on coxisternum III (3a), 10 (9–12), 13 (12–14) apart.

MALE. (n=5). Similar to female. Body fusiform, 140–165 including gnathosoma, 47–53 wide, 44–48 thick; light yellow. **Gnathosoma** 22–24, chelicerae 13–15, setae (ep) 3–4, setae (d) 3–5. **Prodorsal shield** 32–34 long including frontal lobe, (42–45) wide; Scapular tubercles near the rear shield margin, 20 (18–21) apart, setae (sc) 19 (18–20), projecting diagonal posteriorly. **Coxigenital area** with granules, prosternal apodeme present 5 (5–6); setae (1b) 5 (5–6), 8(8–9) apart; setae (1a) 13 (13–15), 7 (7–8) apart; setae (2a) 25 (25–27), 17 (16–18) apart. **Leg I** 25–27, femora 7–8, setae (bv) 6–7; genu 4–5, setae (l'') 17–19; tibiae 6–7, setae (l') 4–5; tarsi 5–6; tarsal empodia (em) simple 4–5, 4-rayed, tarsal solenidia (ω) distally slight knobbed 5–6, setae (ft') 11–13, setae (ft'') 17–20. **Leg II** 24–26, femora 6–7, setae (bv) 6–7; genu 3–4, setae (l'') 17–19; tibiae 5–6; tarsi 5–6; tarsal empodia (em) simple 4–5, 4-rayed, tarsal solenidia (ω) distally slight knobbed 5–6, setae (ft') 5–7, setae (ft'') 16–19. **Opisthosoma** with 28–30 broad dorsal annuli, ventral annuli 52–56. Microtubercles same as female. Lateral setae (c2) 13–16, 38–40 apart, on annulus 7–8 from coxae II; ventral setae (d) 38–43, 24–26 apart, on annulus 18–20; setae (e) 8–10, 13–14 apart, on annulus

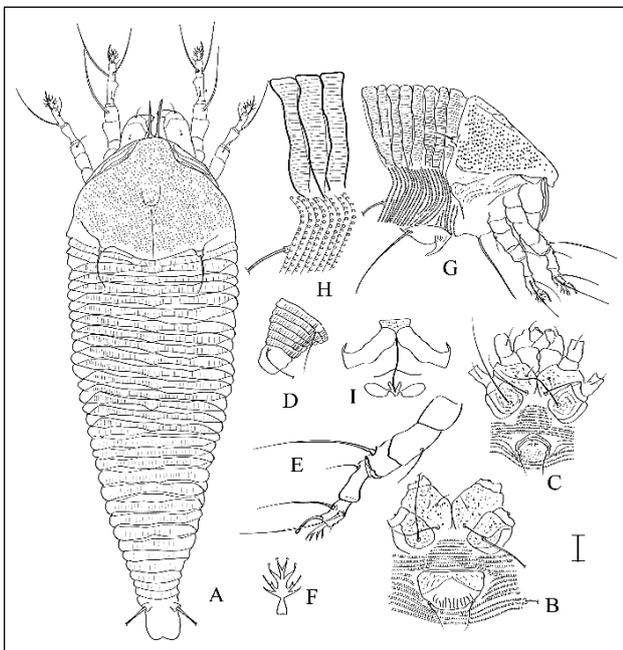


Fig. (6): Line drawings of *Tegolophus guavae* (Boczek): A– dorsal view of female; B– female coxigenital region; C– male coxigenital region; D– lateral view of posterior opisthosoma; E– Leg I; F– empodium; G– anterior lateral view of mite; H– lateral view of annuli; I– internal genitalia. Scale bars: 10 μ m for A, B, C, D, G, H; 5 μ m for E, I; 2.5 μ m for F.

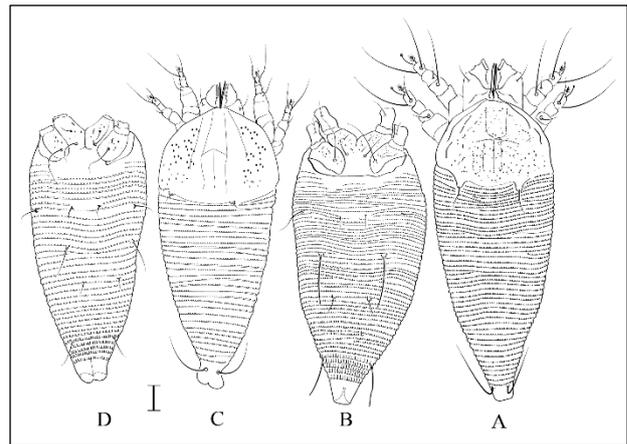


Fig. (7): Line drawings of *Tegolophus guavae* (Boczek): A– dorsal view of nymph; B– ventral view of nymph; C– dorsal view of larva; D– ventral view of larva. Scale bars: 10 μ m.

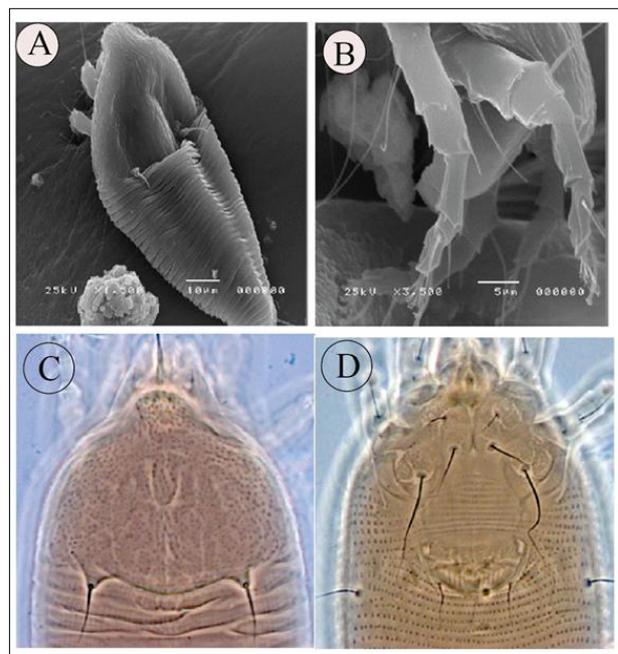


Fig. (8): *Tegolophus guavae* (Boczek) SEM photograph, A- dorsal view of mite; B- Legs and phase microphotograph C- prodorsal shield; D- Coxigenital female.

32–35; setae (f) 16–19, 19–20 apart, on 6th annulus from rear. Setae (h2) 46 (42–55); setae (h1) absent.

External genitalia 11–13 long, 13–14 wide, with granules, setae (3a) 8–10, 9–10 apart.

NYMPH (n= 5). Body spindleform, 105–122; width 40–46. **Gnathosoma.** 15–16, curved downward, setae d 3–4, cheliceral stylets 12–14. **Prodorsal shield.** sub-circular, 30–33, 34–37 wide, with pattern of faint lines and granules, median and admedian lines at 1/2 from rear, transverse line at middle, faint U shape from anterior. Tubercles sc on rear shield margin, 20–22 apart; sc 10–12 directed backward. **Coxisternal plates.** With granules, 1b 3–4, 8–9 apart; 1a 6–8, 6–7 apart; 2a 14–15, 15–16 apart; 3a 3–4, 4–5 apart. **Legs.** All usual segments and setae present.

Leg I 21–23; femur 7, *bv* 4–5; genu 3, *l''* 11–13; tibia 4–5, *l'* 2–3; tarsus 4–5, *ft'* 10–12, *ft''* 11–14; *ω* 4–5; *em* 3–4, simple, 3-rayed. Leg II 19–21; femur 6–7, *bv* 5–6; genu 3, *l''* 7–8; tibia 3–4; tarsus 3–4, *ft'* 6–7, *ft''* 11–13; solenidion *ω* 4–5; *em* 3–4, simple, 3-rayed.

Opisthosoma. With 45–48 dorsal annuli, with pointed oval microtubercles set on rear margin of annuli, 49–53 ventral annuli with pointed oval microtubercles, elongated on the posterior annuli. Seta *c2* 8–10, 38–40 apart, on 8–9th ventral annulus; *d* 27–30, 24–26 apart, on 20–21th ventral annulus; *e* 7–8, 11–12 apart, on 30–32th ventral annulus; *f* 18–19, 16–18 apart, on 5th annulus from rear. Seta *h1* absent; *h2* 13–18.

LARVA (n= 4). Body spindleform, 70–90; width 30–33. **Gnathosoma.** 12–13, curved downward, setae *d* 3–4, cheliceral stylets 8–10. **Prodorsal shield.** sub-circular, 23–25, 28–31 wide, with pattern of faint lines and granules, median line at 1/2 from rear, complete admedian lines, connected halfway by transverse line, submedian line from anterior half. Tubercles *sc* on rear shield margin, 14–16 apart; *sc* 3–4 directed backward. **Coxisternal plates.** With granules, *1b* 3–4, 9–11 apart; *1a* 6–7, 6–7 apart; *2a* 11–13, 12–13 apart; *3a* 2–3, 4–5 apart. **Legs.** All usual segments and setae present. Leg I 16–18; femur 5–6, *bv* 3–4; genu 3, *l''* 8–10; tibia 3–4, *l'* 2–3; tarsus 3–4, *ft'* 8–10, *ft''* 10–13; *ω* 3–4; *em* 3, 3-rayed. Leg II 14–15; femur 4–5, *bv* 3–4; genu 3, *l''* 8–10; tibia 3–4; tarsus 3–4, *ft'* 5–7, *ft''* 10–13; *ω* 3–4; *em* 3, 3-rayed.

Opisthosoma. With 28–30 dorsal annuli, with pointed oval microtubercles set on rear margin of annuli, 30–33 ventral annuli with pointed oval microtubercles, elongated on the posterior annuli. Seta *c2* 5–6, 22–24 apart, on 7–8th ventral annulus; *d* 8–10, 15–16 apart, on 12–13th ventral annulus; *e* 4–5, 8–9 apart, on 18–19th ventral annulus; *f* 10–12, 10–11 apart, on 5th annulus from rear. Seta *h1* absent; *h2* 10–15.

Host plant: *Psidium guajava* L. (Myrtaceae).

Relation to the host plant: Vagrant on lower and upper surface of leaves causing rust on terminal leaves.

Geographic distribution: Brazil, USA, Egypt.

Material examined: Ten females and 4 males on 10 slides at Qalyubia governorate (30°14'57"N; 31°17'07"E), 6 August 2012, coll. A. Elhalawany. Five females on 3 slides (no. NJAUAcariEriEgypt30) from *Psidium guajava* L. (Myrtaceae) Egypt, Qalyubia, 30°14'57"N; 31°17'07"E, 6 August 2012. Coll. A. Elhalawany; deposited as slide mounted specimens in the Arthropod/Mite Collection of the Department of Entomology, Nanjing Agricultural University, Jiangsu Province, China. Two slides, with the same data deposited at Department of Soil, Plant and Food Sciences (Di.S.S.P.A.), section of Entomology and Zoology, University of Bari Aldo

Moro, Bari, Italy. Two slides, with the same data deposited at Department of Zoology and Nematology, Faculty of Agricultural, Cairo University, Egypt. Ten females and 3 males on 2 slides, with the same data (no. EGPERio11.1–35.2), 8 May 2015, deposited at Fruit Trees Mites Dept., Protection Research Institute Dokki Egypt. Two slides at Plant Protection Research Institute collection.

New material: Five females, 2 males, 5 nymphs and 10 larvae on 2 slides deposited at Plant Protection Research Institute collection, 5 May 2016, Gharbia governorate. Four females and 2 males on 2 slides of each species is deposited in the College of Agriculture and Forestry West Virginia University USA, 10 November 2017, from Behera governorate, coll. K. Elsayed.

Remarks

Finally, after comparing the characters of *Tegolophus guavae* (Boczek, 1960) with *Aculops guajavae* Abou-Awad, Al-Azzazy & Afia, 2016 from *Psidium guajava* L. (Myrtaceae) in Egypt, the author in 2012 recorded *T. guavae* (Boczek, 1960) for the first time in Qalyubia governorate, and found that *A. guajavae* mite belongs in *Tegolophus* not *Aculops*, due to the presence of opisthosoma with 3 ridges on opisthosoma, middorsal ridge stronger than lateral ridges, but fading caudally. While in *Aculops* opisthosoma dorsally arched without ridges. In addition the pattern of the prodorsal shield matched Boczek's description. Thus, *A. guajavae* is identical to *T. guavae* (Boczek, 1960).

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