

A New Species and Record of *Aceria* (Acari: Prostigmata: Eriophyoidea) on Weeds from Egypt

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ABSTRACT

Eriophyoids are of great economic importance as pests of weeds, particularly in causing sometimes deformities such as bud galls, stunting, rusting, bronzing, leaf rolling, erineum, blisters, galls, coating, damaged seeds and mosaic virus disease. During the survey of eriophyoid mite fauna from Qalyubia, Cairo and Gharbia governorates in Egypt from 2014 to 2018. One new species and one new record of the genus *Aceria* from weeds are described and illustrated. *Aceria lividus* sp. nov., was collected from *Amaranthus lividus* L. (Amaranthaceae), vagrant on buds and flowers causing stunt and deformation. This species is the first record of eriophyoid mite from the family Amaranthaceae from Egypt. A supplementary description of the first record of *Aceria malherbae* Nuzzaci, 1985 infested *Convolvulus arvensis* L. (Convolvulaceae) in Egypt based on females, males and immature. This mite found on upper leaf surface alongside the midrib, causes leaf folding, deformation of flowers and plants and prevent plant reproduction. The two *Aceria* species indicate that is a promising candidate for the biological control of *C. lividus* and *C. arvensis*.

Key words: *Eriophyidae*, *Aceria*, *Amaranthus lividus*, *Convolvulus arvensis*, weeds, taxonomy.

INTRODUCTION

Eriophyoidea are an economically important group because the direct damage they can cause to their hosts, their ability to transmit serious plant diseases, and also due to the possibility of using them as biological agents for weed control (Lindquist *et al.*, 1996). Nearly 80% have been reported on a single host species, 95% on one host genus and 99% on one host family (Skoracka *et al.*, 2010).

Amaranthus is a cosmopolitan genus compresses almost 65 species, distributed in the tropical, subtropical and warm region of the world (Boulos, 1999). It is a serious problem weed in several field crops as well as in vegetables and orchards. It is an annual spreading by seeds which have a long viability and are dispersed principally by wind and water, but also by machinery (Zaki, 2000).

Along with the current new records, more than 28 named eriophyoid species have been collected and described from plants of the family Amaranthaceae, 20 of them belong to genus *Aceria* and none of them has been found in Egypt. Only two *Aceria* species collected up to now from *Amaranthus*: *Aceria amaranthi* Abou-Awad & El-Banhawy, 1992 collected from numerous galls on both leaf surfaces, causing malformation of the leaves of *Amaranthus* sp. from Tanzania and *Aceria vanensis* Denizhan & Kiedrowicz, 2016 vagrant on leaves of *Amaranthus retroflexus* L. in Turkey (Zaher 1984; Abou-Awad & El-Banhawy, 1992; Elhalawany 2012; Denizhan *et al.*, 2016 & Amrine and de Lillo personal communication) Table 1.

Field bindweed, *Convolvulus arvensis* L. (Convolvulaceae) is an aggressive perennial weed of

Mediterranean and Middle East origin, found throughout temperate regions of the world. It is distributed from 44 countries and in 2 different crops, and it's ranked as the 12th most important weed in the world (Holm *et al.*, 1977). Field bindweed's long lived seeds and extensive root system make it extremely difficult to control by chemical and mechanical means (Rosenthal, 1983).

Aceria malherbae Nuzzaci, 1985 was recorded on *Convolvulus arvensis* L. from Italy, on leaf feeding starts on the upper surface alongside the midrib, usually towards the distal end of the leaf. Galled leaves become yellow-green or red. When mites attack the bud they also prevent natural stem growth and elongation (Rosenthal, 1996). *A. malherbae* was release against *C. arvensis* in the USA during 1987 (Rosenthal & Platta, 1990), and in South Africa in 1995 (Creamer, 1995) and established in Texas, but the effect on the weeds is not yet known (Boldt & Sobhian, 1993).

The knowledge on eriophyoid mite fauna of Egypt is limited. Reviewing literature showed that up to 2012 only 65 eriophyoid species have been discovered and described from Egypt. Since then more eriophyoids have been recorded and described by several authors (e.g., Zaher 1984, Elhalawany, 2012, 2014a, 2014b, 2015, 2017). As a result of these studies, the list of eriophyoid mites recorded in Egypt has reached up to 101 species belonging to 32 genera. More than 1,000 named species have been assigned to the genus *Aceria* Keifer, 1944 and about 38 of them have been found in Egypt up to now (Elhalawany & Ueckermann 2015 & 2018).

The current contribution is aimed to description of a new eriophyoid mite species, namely *Aceria lividus*

Table 1. Eriophyoid mite species collected from Amaranthaceae plants worldwide and their type host, habits and, type locality.

Species	Type host	Habits	type locality
<i>Aceria heimi</i> (Nalepa, 1899a)	<i>Atriplex halimus</i> L.	flower deformation and erineum, halophytic	France
<i>Aceria brevipes</i> (Nalepa, 1899c)	<i>Atriplex halimus</i> L.	hemispherical indentations in the leaf surface	Italy
<i>Aceria caulobia</i> (Nalepa, 1900)	<i>Suaeda vera</i> J. F. Gmelin in L.	galls	Italy
<i>Aceria salicorniae</i> (Nalepa, 1902)	<i>Arthrocnemum fruticosum</i> (L.) Moq.	witches' broom	Cyprus
<i>Aceria obiones</i> (Molliard, 1904)	<i>Atriplex pedunculata</i> L.	flower stalk galls	France
<i>Aceria allenrolfeae</i> Keifer, 1952	<i>Allenrolfea occidentalis</i> (Wats.) Kuntze.	the mites inhabit joints and flowers heads	USA
<i>Aceria rubifaciens</i> Lamb, 1953	<i>Salicornia australis</i> Sol. ex Forst. f.	galls on shoot	New Zealand
<i>Aceria desertorum</i> Roivainen, 1953	<i>Suaeda vera</i> J. F. Gmelin in L.	vagrant	Spain
<i>Aceria sarcobati</i> Keifer, 1962	<i>Sarcobatus vermiculatus</i> (Hook.) Torr.	produce blister-like leaf swellings	USA
<i>Aceria atriplicis</i> Wilson & Oldfield, 1966	<i>Atriplex polycarpa</i> (Torr.) S. Watson	leaf bead galls	USA
<i>Aceria beniciae</i> Keifer, 1966	<i>Salicornia virginica</i> L.	the mites live between stem joints	USA
<i>Aceria achyranthi</i> Mohanasundaram, 1990	<i>Achyranthes aspera</i> L.	undersurface leaf vagrant, slight rusting.	India
<i>Aceria aervae</i> Mohanasundaram, 1990	<i>Aerva lanata</i> (L.) Juss. ex Schult.	vagrant	India
<i>Aceria amaranthi</i> Abou-Awad & El-Banhawy, 1992	<i>Amaranthus</i> sp.	numerous galls on both leaf surface, causing malformation of the leaves	Tanzania
<i>Aceria zumetae</i> Boczek & Petanovic, 1994	<i>Krascheninnikovia ceratoides</i> (L.)	causing small galls on leaves	Spain
<i>Aceria salsolae</i> de Lillo, 1996	<i>Salsola kali</i> L.	infested plants remain stunted and less spiny; seed production is dramatically reduced	Turkey
<i>Aceria chenopodia</i> Xue, Sadeghi & Hong, 2009	<i>Chenopodium lividus</i> L.	vagrant on flowering parts	Iran
<i>Aceria vanensis</i> Denizhan & Kiedrowicz, 2016	<i>Amaranthus retroflexus</i> L.	vagrant	Turkey
<i>Aceria halocnemi</i> Lotfollahi & Tajaddod, 2018	<i>Halocnemum strobilaceum</i> (Pall.) M. Bieb.	vagrant	Iran
<i>Aceria lividus</i> Elhalawany sp. nov.	<i>Amaranthus lividus</i> L. (<i>A. blitum</i>)	vagrant on buds and flowers causes stunted, deformed.	Egypt

sp. nov., infested *C. lividus* in Egypt. It also supplementary description and illustration of immature stages of *A. malherbae* infested *C. arvensis* as a new science for the Egyptian fauna.

MATERIALS AND METHODS

During the five year period from 2014–2018, random samplings of weeds showing symptoms of mite infestation were carried out in Quallyubia, Cairo and Gharbia governorates in Egypt. 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 (Carl Ziess Nr, German). Illustrations were made with the use of drawing tube attached to the phase contrast microscope and using the Adobe Illustrator® CS6 program. Identifications 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.

RESULTS AND DISCUSSION

Family Eriophyidae Nalepa, 1898

Subfamily Eriophyinae Nalepa, 1898

Tribe Aceriini Amrine and Stasny, 1994

Aceria lividus Elhalawany **sp. nov.** (Figures 1– 4)

Description

FEMALE: (n=15) Body vermiform, 200 (173–213) long without gnathosoma, 52 (50–62) wide, 51 (46–62) thick; whitish in life. **Gnathosoma** 25 (25–28) long, projecting obliquely downwards, basal setae *ep* 3 (2–3), antapical setae *d* 6 (5–6), chelicerae 17 (16–18) long. **Prodorsal shield** 34 (33–35) long with short frontal lobe acuminate, 45 (42–50) wide; semicircular; prodorsal shield ornamentation with median line complete, broken basal one-third; admedian lines complete, gently diverging to rear, first submedian line from side of admedian at anterior edge ending at 1/2; lateral line from anterior end of submedian soon becoming granular; numerous granules and short dashes in area between median and admedian lines, and lateral sides of prodorsal shield. Scapular tubercles on rear shield margin, 30 (26–30) apart, setae *sc* 26 (24–27), projecting posteriorly. **Coxigenital area** with granules, with 5 (5–6) annuli between coxae and genitalia, prosternal apodeme present 6 (5–7); anterolateral setae on coxisternum

I *Ib* 7 (7–9), 14 (14–15) apart; proximal setae on coxisternum I *Ia* 23 (22–25), 12 (12–13) apart; proximal setae on coxisternum II *2a* 27 (25–33), 28 (27–30) apart. **Leg I** 33 (30–35), femur 10 (10–11), basiventral femoral setae *bv* 10 (10–12); genua 5 (5–6), antaxial genual setae *l''* 25 (24–27); tibiae 8 (7–9), paraxial tibial setae *l'* 6 (6–7), setae located 1/4 from dorsal base; tarsi 7 (6–7); empodia *em* simple 5 (4–5), 6-rayed, tarsi solenidia ω slightly tapered, 8 (7–9), paraxial fastigial tarsal setae *ft'* 15 (14–17), antaxial fastigial tarsal setae *ft''* 25 (24–27), tarsal setae *u' 2–3*. **Leg II** 29 (28–32), femur 10 (10–11), setae *bv* 11 (10–12); genua 5 (4–5), setae *l''* 10 (10–12); tibiae 7 (6–8); tarsi 6 (6–7); tarsal *em* simple 5 (4–5), 6-rayed, ω slightly tapered 8 (7–9), setae *ft'* 8 (7–10), setae *ft''* 22 (20–25), tarsal setae *u' 2–3*. **Opisthosoma** with 65 (63–68) dorsoventrally annuli subequal, with elliptical microtubercles on rear annular margins; ventrally with round microtubercles on rear annular margins, the last 10th ventral microtubercles liner. Lateral setae *c2* 25 (25–27), 48 (47–50) apart, on annulus 9 (9–10) from coxae II; ventral setae I *d* 55 (53–60), 41 (30–43) apart, on annulus 21 (20–22); ventral setae II *e* 11 (9–12), 21 (20–22) apart, on annulus 34 (33–35); ventral setae III *f* 25 (24–30), 23 (22–23) apart, on 7th annulus from rear. Setae *h2* 65 (64–70); setae *h1* 3 (3–4). **External genitalia** 16 (15–18), 23 (22–25) wide, coverflap with 12–14 longitudinal ridges in a single row, proximal setae on coxisternum III *3a*, 17 (15–18), 18 (18–19) apart.

MALE. (n=10). Similar to female. Body vermiform, 150–165 including gnathosoma, 46–53 wide, 45–48 thick; whitish in life. **Gnathosoma** 22–25, chelicerae 15–17, setae *ep* 3–4, setae *d* 5–6. **Prodorsal shield** shape and patterns similar to those of the female, 28–30 long including frontal lobe, 42–45 wide; Scapular tubercles near the rear shield margin, 24–26 apart, setae *sc* 16–19, projecting diagonal posteriorly. **Coxigenital area** with granules, prosternal apodeme present 5–6; setae *Ib* 5–6, 11–12 apart; setae *Ia* 12–14, 10–11 apart; setae *2a* 24–27, 20–21 apart. **Leg I** 26–29, femora 8–9, setae *bv* 9–11; genu 5–6, setae *l''* 17–19; tibiae 6–7, setae *l'* 4–5; tarsi 7–8; tarsal empodia *em* simple 5–6, 6-rayed, tarsal solenidia ω distally slight tapered 6–8, setae *ft'* 11–13, setae *ft''* 17–20, setae *u' 2–3*. **Leg II** 24–27, femora 7–8, setae *bv* 9–10; genu 4–5, setae *l''* 7–9; tibiae 5–6; tarsi 6–7; tarsal empodia *em* simple 5–6, 6-rayed, tarsal solenidia ω distally slight tapered 5–6, setae *ft'* 5–7, setae *ft''* 17–22, setae *u' 2–3*. **Opisthosoma** with 55–60 dorsoventrally annuli subequal, microtubercles shape same that of the female. Lateral setae *c2* 17–22, 48–50 apart, on annulus 9 from coxae II; ventral setae *d* 38–40,

[33–37 apart, on annulus 18–20; setae *e* 8–10, 18–19 apart, on annulus 30–32; setae *f* 20–24, 18–20 apart, on 7th annulus from rear. Setae *h2* 44–55; setae *h1* 3–4. **External genitalia** 12–13 long, 19–20 wide, with granules, setae *3a* 12–15, 16–17 apart.

Nymph (n=6). Body vermiform, 150–167; width 40–43. **Gnathosoma** 20–23, curved downward, setae *d* 4–5, *ep* 2–3, chelicerae 16–18. **Prodorsal shield** sub-circular, 39–42, including frontal lobe 4–6 over the gnathosomal base 40–42 wide, with pattern similar to that of female. Tubercles *sc* on rear shield margin, 20–21 apart; *sc* 14–17. **Coxisternal plates** With granules, *Ib* 5–6, 11–12 apart; *Ia* 13–15, 8–9 apart; *2a* 22–25, 25–26 apart; *3a* 9–10, 9–10 apart. **Leg I** 24–26; femur 7–8, *bv* 8–10; genu 4–5, *l''* 12–15; tibia 5–6, *l'* 4–5; tarsus 4–5, *ft'* 11–13, *ft''* 15–17, setae *u' 2*; solenidion ω 5–6; *em* 4, simple, 5-rayed. **Leg II** 22–24; femur 6–7, *bv* 8–10; genu 3–4, *l''* 5–8; tibia 4–5; tarsus 4–5, *ft'* 7–8, *ft''* 12–14, setae *u' 2*; ω 5–6; *em* 4–5, simple, 5-rayed. **Opisthosoma** With 52–56 dorsal annuli, with elliptical microtubercles situated on rear margin of each semiannulus, 46–50 ventral annuli with minute round microtubercles, situated on rear margin of each semiannulus; elongated on the posterior annuli. Setae *c2* 21–23, 40–42 apart, on 8–9 ventral semiannulus; setae *d* 30–35, 28–30 apart, on 18–19 ventral semiannulus; setae *e* 12–14, 17–18 apart, on 27–28 ventral semiannulus; setae *f* 20–23, 19–20 apart, on 6th semiannulus from rear. Setae *h1* 2–3; *h2* 30–44.

LARVA (n=4). Body vermiform, 142–155; width 38–40. **Gnathosoma** 20–22 curved downward, setae *d* 3–4, *ep* 1–2, cheliceral stylets 15–16. Prodorsal shield sub-circular, 24–26, including frontal lobe 2–3 over the gnathosomal base 24–27 wide; median and sub-median complete; broken, admedian lines from anterior 1/2, subparallel; granules present on lateral sides of prodorsal shield. Tubercles *sc* on rear shield margin, 18–20 apart; setae *sc* 14–17. **Coxisternal plates** With granules setae *Ib* 5–6, 9–10 apart; *Ia* 11–13, 7–8 apart; *2a* 17–20, 19–21 apart. setae *3a* 4–5, 6–7 apart. **Leg I** 23–25; femur 5–6, *bv* 5–6; genu 3–4, *l''* 13–15; tibia 3–4, seta *l'* 3–4; tarsus 5–6, *ft'* 9–10, *ft''* 14–15; ω 5–6; *em* 3–4, simple, 4-rayed. **Leg II** 18–20; femur 5–6, *bv* 5–6; genu 3, *l''* 5–7; tibia 3–3.5; tarsus 4–5, *ft'* 4–5, *ft''* 14–17; ω 5–6; *em* 3–4, 4-rayed. **Opisthosoma** With subequal annuli, 30–36 annuli, with minute round microtubercles situated on rear margin of each semiannulus. Seta *c2* 17–20, 35–37 apart, on 9 ventral semiannulus; setae *d* 19–23, 19–20 apart, on 14 ventral semiannulus; setae *e* 7–8, 12–13 apart, on 20 ventral semiannulus; setae *f* 16–17, 14–15 apart, on 6th semiannulus from rear; *h1* 1–2; *h2* 17–22.

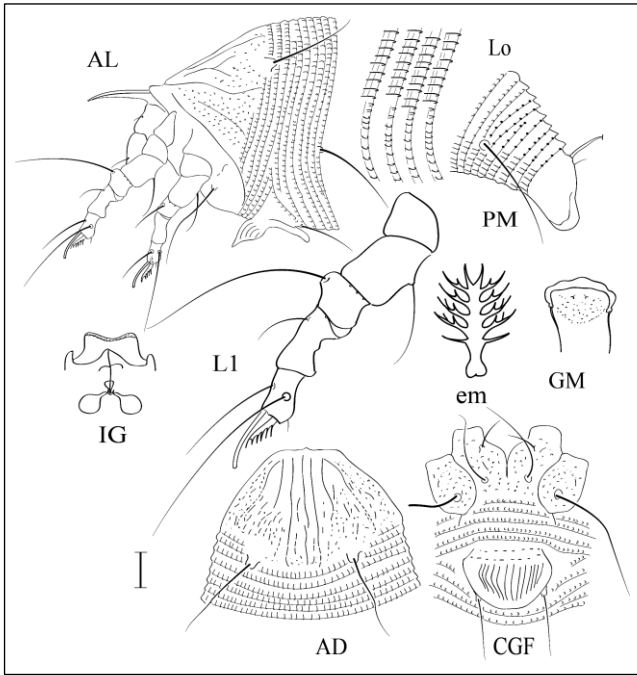


Fig. (1): Line drawings of *Aceria lividus* sp. nov.: AD– prodorsal shield of female; CGF– female coxigenital region; GM– male genitalia; IG– internal female genitalia; em– empodium; L1– Leg I; AL– antero–lateral view of mite; Lo– lateral view of annuli; PM– posterior lateral view of mite. Scale bars: 10µm for AD, CGF, GM, IG, Al, PM; 5µm for L1; 2.5µm for em.

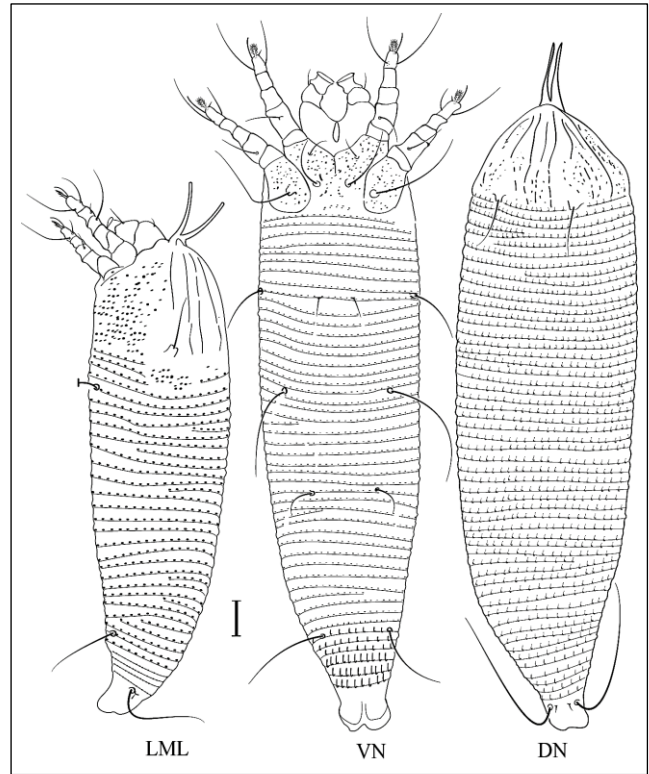


Fig. (2): Line drawings of *Aceria lividus* sp. nov.: DN– dorsal view of nymph; VN– ventral view of nymph; LML– lateral view of larva. Scale bars: 10µm.

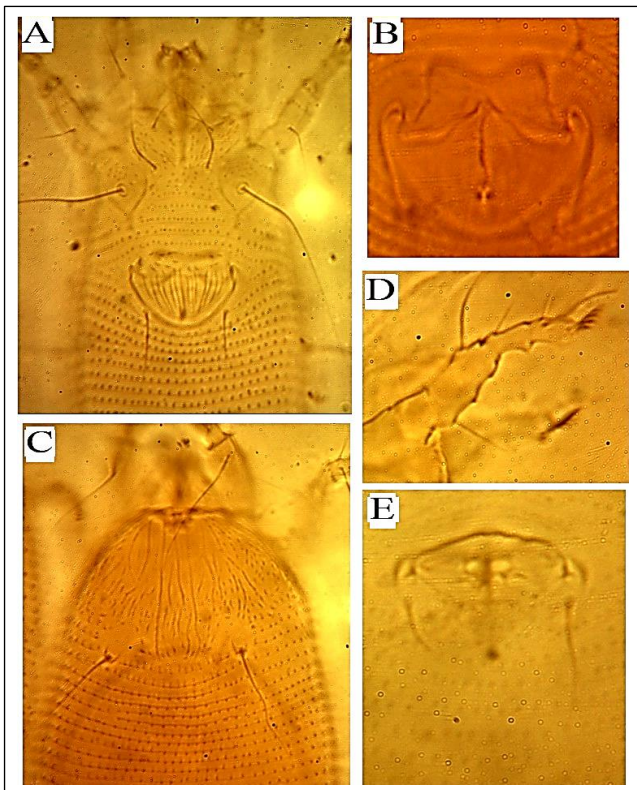


Fig. (3): Phase microphotograph of *Aceria lividus* sp. nov.: A– female coxigenital region; B– internal female genitalia; C– prodorsal shield of female; D– Leg I; E– male genitalia.

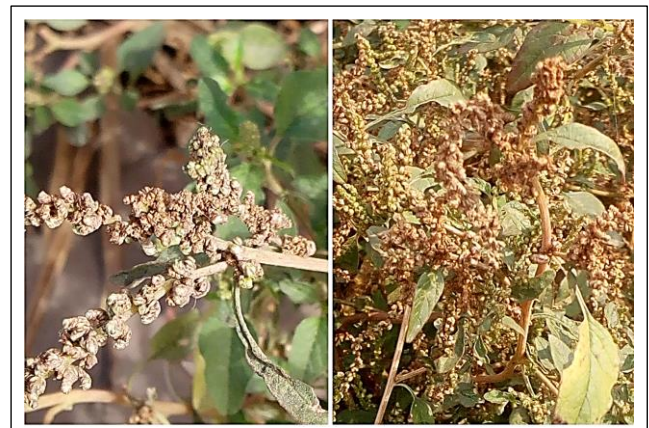


Fig. (4): Plant damage caused by eriophyoid mite *Aceria lividus* sp. nov.

Host plant. *Amaranthus lividus* L. = (*Amaranthus blitum* L.) (Amaranthaceae).

Relation to the host plant. Vagrant on buds and flowers causes stunted, deformed (Figure 4).

Type Locality. El-Sad village, Qalyubia governorate, Egypt, 30°15'50.46"N, 31°14'51.85"E, 15 October 2015 and 17 September 2018 coll. Ashraf S. Elhalawany. New Cairo, 20 October 2018 coll Karam M. El-Sayed. Kafr Ibri, Gharbia governorate, 30°41'56.00"E, 31°10'49.07"N, 10 September 2018 coll. Ahmad Amer.

Type material. Holotype, single female on a microscope slide (slide no. EGPERio62.1), deposited in Fruit Trees Mites Dept., Collection, Plant Protection Research Institute (PPRI), Dokki, Egypt. Paratypes: 25 females and 10 males 6 nymph paratypes and 5 larva paratypes on 10 separate microscope slides deposited in Fruit Trees Mites Dept., Collection, Plant Protection Research Institute (PPRI), Dokki, Egypt. Two slides in Plant Protection Research Institute collection. Two paratype slides are deposited at Plant Protection Research Institute collection. 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.

Etymology. The species name is based on the host plant species name *lividus*.

Differential diagnosis. The new species herein described was compared with all *Aceria* species found on Amaranthaceus plants and no similarities among any of them were observed. *Aceria lividus* sp. nov. is slightly related to *Aceria amaranthi* Abou-Awad & El-Banhawy, 1992 collected from numerous galls on both leaf surfaces, causing malformation of the leaves of *Amaranthus* sp. from Tanzania and *Aceria vanensis* Denizhan & Kiedrowicz, 2016 vagrant on leaves of *Amaranthus retroflexus* L. in Turkey. The new species distinguished from *A. amaranthi* by the length of setae *c2*, *d*, and *f*, shape of dorsal microtubercles, tarsal empodium and ornamentation of prodorsal shield. Females of the newly described species have granules and short dashes in area between median and admedian lines, and lateral sides of prodorsal shield, with elliptical microtubercles on dorsal annuli, tarsal empodium 6-rayed, longest length of *c2*, *d*, and *f* (27–27, 5–60 and 24–0, respectively). In the female of *A. amaranthi* without granules on prodorsal shield, with rounded microtubercles, tarsal empodium 5-rayed, shortest length of *c2*, *d*, and *f* (11, 37 and 16, respectively).

Also, the new species differs from *A. vanensis* by prodorsal shield design, length of *e* and *3a* setae, shape of dorsal microtubercles and number of longitudinal ridges on genitalia, and coxae ornamentation. Prodorsal shield without median line and submedian lines; admedian lines with short lines and without granules in *A. vanensis* (*versus* median, admedian lines complete and short submedian lines and shield with granules and short dashes in the new species); longer *e* setae 45–55 μ and *3a* 21–25 long in *A. vanensis* (*versus* 9–12 and 15–18 in the new species); with rounded microtubercles dorsally in the new species (*versus* elliptical in the new species); genital coverflap smooth in *A. vanensis* (*versus* 12–14 longitudinal ridges in new species), and coxae sooth in *A. vanensis* *versus* with granules and short lines in the new species.

Aceria malherbae Nuzzaci, 1985. **First record** (Figs 5–8).

Aceria malherbae Nuzzaci, 1985: 81–89.

Aceria malherbae; Creamer 1993: 53–95.

Aceria malherbae; Amrine & Stasny, 1994: 62.

Aceria malherbae; Baker *et al.*, 1996: 114.

Aceria malherbae; Xue *et al.*, 2013: 45–47.

Redescription

FEMALE: (n=15) Body vermiform, 200 (180–245) long without gnathosoma, 64 (60–69) wide, 64 (63–67) thick; whitish in life. **Gnathosoma** 25 (24–30) long, projecting obliquely downwards, basal setae *ep* 3 (2–3), antapical setae *d* 6 (6–7), chelicerae 17 (15–18) long. **Prodorsal shield** 44 (41–46) long with short frontal lobe acuminate, 52 (51–53) wide; semicircular; anterior shield lobe somewhat acuminate; median line indistinct on rear of prodorsal shield forming V-shaped marks, admedian lines incomplete and present only on the posterior half to two third of the prodorsal shield, submedian line I faint present on basal 1/2, curved inwards laterally to reach up to the middle of the prodorsal shield; submedian line II present on the posterior 2/3 on lateral side. Scapular tubercles on rear shield margin, 31 (30–34) apart, setae *sc* 25 (21–29), projecting posteriorly. **Coxigenital area** with granules, with 4 annuli between coxae and genitalia, prosternal apodeme present forked; setae *Ib* 8 (7–9), 14 (13–14) apart; setae *Ia* 25 (24–27), 10 (9–12) apart; setae *2a* 32 (29–40), 28 (28–33) apart. **Leg I** 35 (31–35), femur 10 (9–10), setae *bv* 10 (10–12); genua 5 (5–6), setae *l''* 25 (24–27); tibiae 8 (8–9), setae *l'* 8 (6–8), setae located 1/4 from dorsal base; tarsi 7 (6–7); empodia *em* simple 5 (4–5), 6-rayed, tarsi solenidia ω slightly tapered, 8 (7–8), setae *ft'* 17 (17–18), setae *ft''* 21 (21–24), setae *u'* 2–3. **Leg II** 32 (31–33), femur 9 (8–10), setae *bv* 11 (10–12); genua 5 (4–5), setae *l''* 10 (10–12);

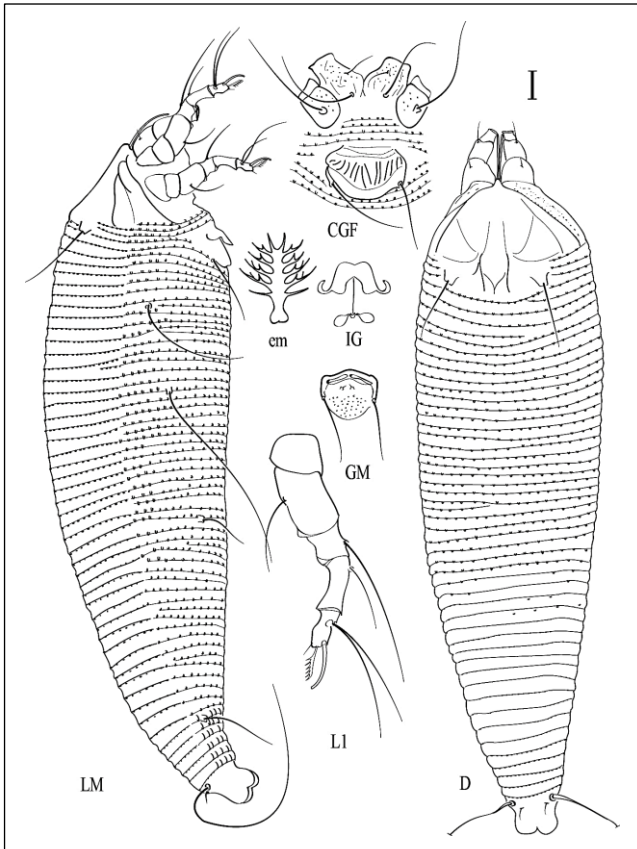


Fig. (5): Line drawings of *Aceria malherbae* Nuzzaci, 1985: D– Dorsal view of female; CGF– female coxigenital region; GM– male genitalia; IG– internal female genitalia; em– empodium; L1– Leg I; LM– lateral view of mite. Scale bars: 10µm for D, CGF, GM, IG, LM; 5µm for L1; 2.5µm for em.

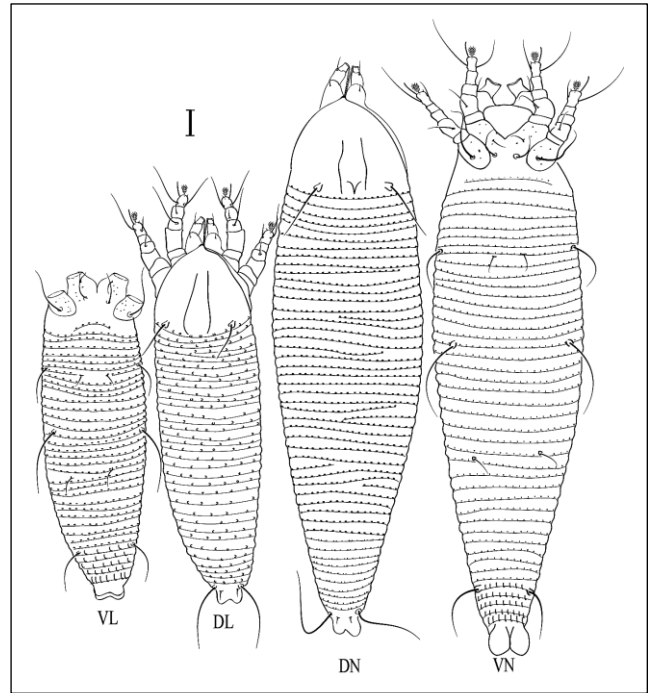


Fig. (6): Line drawings of *Aceria malherbae* Nuzzaci, 1985: DN– dorsal view of nymph; VN– ventral view of nymph; DL– dorsal view of larva; VL– ventral view of larva. Scale bars: 10µm.

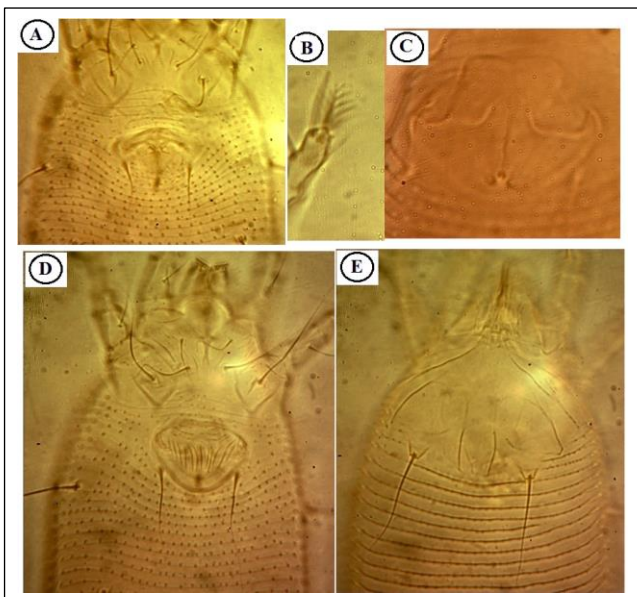


Fig. (7): Phase microphotograph of *Aceria malherbae* Nuzzaci, 1985: A– male coxigenital region; B– empodium; C– internal female genitalia; D– female coxigenital region; E– prodorsal shield of female.



Fig. (8): Plant damage caused by the eriophyoid mite *Aceria malherbae* Nuzzaci, 1985.

tibiae 7 (6–7); tarsi 7 (6–7); tarsal *em* simple 5 (4–5), 6-rayed, ω slightly tapered 8 (7–9), setae *ft'* 8 (7–10), setae *ft''* 21 (20–24), tarsal setae *u'* 2–3. **Opisthosoma** with 46 (45–48) dorsal semiannuli, with small round microtubercles on posterior annular margins, ventrally with 61 (60–63) semiannuli with round microtubercles on rear annular margins, the last 6th ventral microtubercles liner. Lateral setae *c2* 35 (31–38), 63 (61–63) apart, on annulus 10 (9–10) from coxae II; setae *d* 55 (53–56), 53 (50–53) apart, on annulus 20 (19–20); setae *e* 12 (11–15), 28 (28–29) apart, on annulus 34 (33–35); setae *f* 25 (24–26), 29 (29–30) apart, on 6th annulus from rear. Setae *h2* 65 (64–67); setae *h1* 3 (3–4). **External genitalia** 18 (18–20), 28 (23–28) wide, coverflap with 12–14 longitudinal ridges, setae *3a*, 23 (22–25), 24 (24–25) apart.

MALE. (n=10). Similar to female. Body vermiform, 150–160 excluding gnathosoma, 61–63 wide, 60–63 thick; whitish in life. **Gnathosoma** 23–25, chelicerae 16–17, setae *ep* 3–4, setae *d* 5–6. **Prodorsal shield** shape and patterns similar to those of the female, 34–40 long, 45–50 wide; Scapular tubercles near the rear shield margin, 26–29 apart, setae *sc* 21–23, projecting diagonal posteriorly. **Coxigenital area** with granules, prosternal apodeme forked; setae *1b* 7–8, 12–1 apart; setae *1a* 14–16, 9–10 apart; setae *2a* 28–32, 24–25 apart. **Leg I** 29–30, femora 9–10, setae *bv* 9–12; genu 4–5, setae *l''* 15–17; tibiae 6–7, setae *l'* 5–6; tarsi 7–8; tarsal empodia *em* simple 5–6, 6-rayed, tarsal solenidia ω distally slight tapered 7–8, setae *ft'* 10–13, setae *ft''* 18–22, setae *u'* 2–3. **Leg II** 28–30, femora 8–9, setae *bv* 9–11; genu 4–5, setae *l''* 7–10; tibiae 5–6; tarsi 5–6; tarsal empodia *em* simple 5–6, 6-rayed, ω slight tapered 5–6, setae *ft'* 5–8, setae *ft''* 17–22, setae *u'* 2–3. **Opisthosoma** with 44–46 dorsal semiannuli, ventrally with 50–55 semiannuli, microtubercles shape same that of the female. Lateral setae *c2* 28–32, 60–61 apart, on annulus 9–10 from coxae II; setae *d* 48–51, 43–44 apart, on annulus 18–19; setae *e* 11–12, 25–26 apart, on annulus 30–31; setae *f* 19–21, 20–22 apart, on 6th annulus from rear. Setae *h2* 40–47; setae *h1* 2–3. **External genitalia** 17–18 long, 21–22 wide, with granules, setae *3a* 22–23, 17–18 apart.

Nymph (n=6). Body vermiform, 177–217; width 47–58. **Gnathosoma** 15–18, curved downward, setae *d* 4–5, *ep* 2–3, chelicerae 14–16. **Prodorsal shield** semicircular, 38–42 long, 44–46 wide; median line indistinct on rear of prodorsal shield forming V-shaped marks, admedian lines incomplete and present only on the posterior half to two third of the prodorsal shield, submedian lines absent. Tubercles *sc* on rear shield margin, 28–30 apart; *sc* 22–24.

Coxisternal plates With faint granules, *1b* 5–6, 11–12 apart; *1a* 11–13, 8–9 apart; *2a* 21–23, 25–26 apart; *3a* 6–7, 9–11 apart. **Leg I** 25–27; femur 7–8, *bv* 8–10; genu 4–5, *l''* 12–15; tibia 5–6, *l'* 4–5; tarsus 4–5, *ft'* 11–15, *ft''* 15–20, setae *u'* 2; solenidium ω 5–6; *em* 4, simple, 5-rayed. **Leg II** 23–26; femur 6–8, *bv* 8–10; genu 3–4, *l''* 5–8; tibia 4–5; tarsus 4–5, *ft'* 7–8, *ft''* 15–20, setae *u'* 2; ω 5–6; *em* 4–5, simple, 5-rayed. **Opisthosoma** With 47–49 dorsal semiannuli, with minute round microtubercles situated on rear margin of each semiannulus, 40–43 ventral annuli with minute round microtubercles, situated on rear margin of each semiannulus; elongated on the posterior annuli. Setae *c2* 18–20, 52–54 apart, on 8–9 ventral semiannulus; setae *d* 30–33, 45–47 apart, on 17–18 ventral semiannulus; setae *e* 9–10, 26–27 apart, on 26–27 ventral semiannulus; setae *f* 20–22, 20–22 apart, on 5th semiannulus from rear. Setae *h1* 2–3; *h2* 25–28.

LARVA (n=4). Body vermiform, 115–146; width 41–4. **Gnathosoma** 15–18 curved downward, setae *d* 3–4, *ep* 1–2, chelicerae 12–15. Prodorsal shield semicircular, 35–37 long, 36–38 wide; median and submedian lines absent; admedian lines present on posterior 2/3, subparallel. Tubercles *sc* on rear shield margin, 22–24 apart; setae *sc* 14–17. **Coxisternal plates** With granules setae *1b* 5–6, 11–13 apart; *1a* 11–12, 9–10 apart; *2a* 17–20, 25–28 apart. Setae *3a* 4–5, 10–11 apart. **Leg I** 24–26; femur 6–8, *bv* 5–6; genu 3–4, *l''* 11–15; tibia 4–5, seta *l'* 3–4; tarsus 5–6, *ft'* 11–15, *ft''* 14–17; ω 5–6; *em* 3–4, simple, 4-rayed. **Leg II** 22–24; femur 6–7, *bv* 5–6; genu 3, *l''* 5–7; tibia 3–4; tarsus 5–6, *ft'* 4–5, *ft''* 14–18; ω 5–6; *em* 3–4, 4-rayed. **Opisthosoma** With subequal annuli, 33–36 annuli, with minute round microtubercles situated on rear margin of each semiannulus. Seta *c2* 13–15, 35–37 apart, on 7 ventral semiannulus; setae *d* 25–27, 34–36 apart, on 15–16 ventral semiannulus; setae *e* 7–8, 17–18 apart, on 20 ventral semiannulus; setae *f* 16–18, 22–23 apart, on 5th semiannulus from rear; *h1* 1–2; *h2* 21–52.

Host plant from Egypt: *Convolvulus arvensis* L. (Convolvulaceae).

Relation to host: Leaf folding, deformation of flowers and plants; the mites prevent plant reproduction; they cause bud swelling and injury.

Material examined. Fifty females, 15 males, 6 nymphs and 7 larvae on a microscope slide (slide no. EGPERio122.1–122.20), Kaha, Qalyubia governorate, Egypt, 30°17'21.42" N, 31°12'45.82"E, 15 October 2015 and 15 September 2018 coll. Ashraf S. Elhalawany deposited in Fruit Trees Mites Dept.,

Collection, Plant Protection Research Institute (PPRI), Dokki, Egypt. Two slides in Plant Protection Research Institute collection. Two paratype slides are deposited at Plant Protection Research Institute collection.

Distribution: Canada; Greece; France; Iran; Italy; Mexico; South Africa; Spain; USA, Iran (de Lillo & Amrine, personal communication).

Remarks: This is the first record of occurrence of females, males and immature stages of *A. malherbae* in Egypt. The holotype of female was described by Nuzzaci *et al.* 1985 from Italy; short description of the male and immature stages not found. Comparing the morphological characters of *A. malherbae*, as well as the original description given by Nuzzaci (1985), we did not find any regular differences between them. Morphology is similar, except for the length of the following characters: gnathosoma, body length, length and width of prodorsal shield, lengths of setae *c*₂ and *d*, and the number of genital coverflap. These setae are slightly shorter in mites from Italy than in mites from Egypt. Genital coverflap with 10 longitudinal striae from Italy (versus with 12-14 from Egypt).

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