



<http://dx.doi.org/10.11646/zootaxa.3760.4.4>

<http://zoobank.org/urn:lsid:zoobank.org:pub:1289E1D4-B912-4DFE-9D77-729B6FAC1368>

A new species of eriophyoid mite, *Aceria tripuraensis* sp. n. (Acari: Eriophyoidea), on *Hibiscus macrophyllus* from India

PRATIBHA MENON¹, SUSHILA JOSHI & VILAYANOR VENKATARAMAN RAMAMURTHY

Network Project on Insect Biosystematics, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India 110012.

E-mail: sushilajoshi@gmail.com; vvr3@vsnl.com

¹Corresponding author. E-mail: pratibharish@gmail.com

Abstract

A new species of Eriophyidae (Acari: Prostigmata: Eriophyoidea) mite, *Aceria tripuraensis* n. sp., is described from the closed bud galls of *Hibiscus macrophyllus* Roxb. ex Hornem. (Malvaceae) in India. *Aceria tripuraensis* n. sp. is distinguished by having a prodorsal shield with distinct rounded lobes on the postero-lateral margins and two pairs of submedian lines. The tarsal solenidia with unusual transverse sculptures, are 2.5x longer than the empodia. Twenty *Aceria* species are now known to inhabit malvaceous plant hosts and those are listed here along with type localities and host plant details. A key to all known species of *Aceria* recorded from *Hibiscus* spp. is also provided.

Key words: Eriophyoidea, *Aceria*, *Hibiscus macrophyllus*, India, taxonomy, new species

Introduction

Eriophyoid mites are a specialized group of plant feeding arachnids with a high level of host specificity and adaptability (Lindquist & Oldfield 1996; Amrine 1996). Many are vagrant and cause no visible harm to their host plants. However, some eriophyoid species are known to be serious pests while others are recognised for transmitting plant viruses and pathogens. Often their infestation and feeding behaviour leads to plant injury that manifests in the form of russetting, gall formation, bronzing, browning, silvering or curling of leaves and deformed or stunted buds (Keifer *et al.* 1982).

A worldwide count of eriophyoid mites approximates to 4600 known species in about 420 genera, of which the genus *Aceria* contributes about 25%–30% of this biodiversity (Amrine & Stasny 1994; Amrine & de Lillo unpublished databases 2003 & 2010). More than 482 eriophyoids have been described from India with 127 species belonging to the genus *Aceria* (Amrine & de Lillo unpublished database 2010; Huang 2008).

So far, 47 eriophyoid species have been reported from India on malvaceous plant hosts, of which, 19 species belong to the genus *Aceria* and eight of those are reported from *Hibiscus* spp. (Amrine & Stasny 1994; Amrine & de Lillo unpublished database 2010).

The present paper describes a new species, *Aceria tripuraensis* n. sp., and provides a list of *Aceria* spp. previously recorded on Malvaceae along with damage symptoms, type hosts and locality information (Table 1). A key to *Aceria* species known from *Hibiscus* spp. is also included.

Material and methods

During exploration surveys in the Tripura state of northeast India, a new species of eriophyoid mite belonging to the genus *Aceria* was collected from inside closed bud galls of *Hibiscus macrophyllus* Roxb. ex Hornem. (Malvaceae). The galls were found on the abaxial surface of leaves with their corresponding adaxial surface appearing to be bronzed.

TABLE 1. List of *Aceria* species recorded on Malvaceae plant hosts along with their damage symptoms, type host and locality.

No.	Species name	Damage symptoms	Type host	Type locality
1	<i>Aceria abutilonae</i> Mohanasundaram, 1990	Causing erineum on stems and leaves.	<i>Abutilon hirtum</i> (Lam.) Sweet	Coimbatore; TNAU Campus, Tamil Nadu, India.
2	<i>Aceria egmirae</i> Denizhan, Monfreda, Cobanoglu & de Lillo, 2006	Small populations on leaves; no host injury observed.	<i>Alcea rosea</i> L.	Egmir Lake, Ankara, Turkey
3	<i>Aceria elacanthi</i> Keifer, 1970	Inhabiting leaf hairs but causing no visible damage.	<i>Malva parviflora</i> L.	California, USA
4	<i>Aceria esculenti</i> Keifer, 1966	Causing irregular erineum pockets and resulting in deformed leaves.	<i>Abelmoschus esculentus</i> (L.) Moench. (host originally listed by its junior synonym: <i>Hibiscus esculentus</i> L.)	Rural University of Brazil, 47 km from Rio Sao Paulo, State of Rio de Janeiro, Brazil.
5	<i>Aceria flockii</i> Keifer, 1965	Vagrant among leaf and bud hairs causing no visible damage.	<i>Malvella leprosa</i> (Ortega) Krapov	Seeley, California, USA.
6	<i>Aceria geranii</i> (Canestrini, 1891)	Causing shoot tip deformation, rolling of leaves and shortening of internodes.	<i>Geranium sanguineum</i> L.	Italy
7	<i>Aceria gymnoprocta</i> (Nalepa, 1902)	Causing bud and leaf deformation.	<i>Malva moschata</i> L.	Botanical Garden, Vienna, Austria.
8	<i>Aceria hastatum</i> Ueckermann, 1990	Causing globular, hairy galls.	<i>Hibiscus calyphyllus</i> Cav.	Letsitele, Transvaal, South Africa.
9	<i>Aceria hibisci</i> (Nalepa, 1906)	Causing erineum, misshapen leaves.	<i>Hibiscus rosa-sinensis</i> L.	Suva, Fiji Islands
10	<i>Aceria hibiscitilea</i> (Nalepa, 1909)	Causing leaf galls, epiphyllous or hypophyllos, rugose, pustuloid, pale yellow, unilocular pouch gall; ostiole minute.	<i>Hibiscus tiliaceus</i> (host originally listed by its junior synonym: <i>Talipariti tiliaceum</i> (L.) Fryxell L.)	Beach near Mulinuu, Upolu Island, Samoa.

.....continued on the next page

TABLE 1. (Continued)

No.	Species name	Damage symptoms	Type host	Type locality
11	<i>Aceria hirsutivagrans</i> (Mohanasundaram, 1984)	Under-surface leaf vagrant, found among leaf hairs causing no visible damage.	<i>Hibiscus</i> sp.	Palampur, Himachal Pradesh, India.
12	<i>Aceria liuzhouensis</i> Qin, Wei & Chen, 2003	Not stated.	<i>Hibiscus mutabilis</i> L.	Liuzhou City, Guangxi Zhuang Autonomous Region, China.
13	<i>Aceria malvacearum</i> Boczek & Davis, 1984	Vagrant on leaf undersurfaces.	<i>Malva sylvestris</i> L.	Lazienki, Warsaw, Poland.
14	<i>Aceria malvae</i> (Canestrini, 1891)	Causing shoot tip deformation, rolling of leaves and shortening of internodes.	<i>Malva alcea</i> L.	Italy.
15	<i>Aceria meconycha</i> Ueckermann, 1990	Associated with <i>Acutus</i> sp. in blister-like leaf galls.	<i>Pavonia burchelli</i> (DC.) Dyer	Lynnwood, Pretoria, Transvaal, South Africa.
16	<i>Aceria plagianthi</i> Manson, 1984	Found in deformed inflorescence in association with <i>Eriophyes plaginus</i> .	<i>Plagianthus regius</i> (Poit.) Hochr.	Price's Valley, Banks Peninsula, New Zealand.
17	<i>Aceria punctulata</i> (Nalepa, 1914)	Causing bud galls, erineum.	<i>Hibiscus macrophyllus</i> Roxb. ex Hornem.	Java, Indonesia.
18	<i>Aceria puttarudriahi</i> ChannaBasavanna, 1966	Causing erineum on shoots and leaves.	<i>Gossypium herbaceum</i> L.	Chitradurga, Mysore, Karnataka, India.
19	<i>Aceria tripuraensis</i> n. sp.	Found inside galls on abaxial leaf surface with corresponding axial surface showing a bronzing effect.	<i>Hibiscus</i> Roxb. ex Hornem.	Ishaan Chandranagar, Agartala, Tripura, India.
20	<i>Aceria vitifoliae</i> Mohanasundaram, 1990	Causing leaf undersurface erineum with upper surface crinkling.	<i>Hibiscus vitifolius</i> L.	Gobichettipalayam, Tamil Nadu, India.

Leaves of *Hibiscus macrophyllus* were collected and examined for the presence of mites using a Leica MZ6 stereozoom microscope. Specimens were mounted directly onto microscope slides in a droplet of Hoyer's medium and subsequently dried on a hot plate at 45–55°C for 10–12 hours (Krantz 1970). The cleared slide mounted specimens were studied under a Leica DM1000 phase contrast compound microscope fitted with a drawing tube. All illustrations are indicated with their relevant scale of magnification. The classification and terminology follows Amrine *et al.* (2003). The holotype measurement is followed by the mean, standard deviation and range of paratypes in parentheses. All measurements are in micrometres (μm) and, unless specified, refer to the length of the structure. The body length has been measured from the apical tip of the gnathosoma to the posterior end of the opisthosoma while the length measurement of the legs is from the base of the trochanter to the apical tip of the tarsus, excluding the tarsal appendages (solenidion and empodium). The ventral opisthosomal annuli were counted from the first annulus from the lateral margin of coxa II.

Scanning Electron Microscopy (SEM) study was undertaken with the aid of a Zeiss EVOMA10 scanning electron microscope at 20 KV/EHT and 10 Pa between 2.15 \times to 23.7 \times after 24 nm palladium coating. Photographs were taken using a Canon Powershot S50 digital camera.

Type material has been deposited in the National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, (NPC, IARI), New Delhi 110012, India and the Insect and Mite National Collection, National Museum of Natural History (NMNH), Smithsonian Institution, USDA, ARS, SEL, Beltsville, Maryland, USA.

Results

Taxonomy

Family: Eriophyidae Nalepa, 1898

Subfamily: Eriophyinae Nalepa, 1898

Tribe: Aceriini Amrine & Stasny, 1994

Genus: *Aceria* Keifer, 1944

Type species: *Eriophyes tulipae* Keifer, 1938:185

***Aceria tripuraensis* n. sp.**

(Figs. 1–13)

Diagnosis. Prodorsal shield with rounded lobes on postero-lateral margins and shield design comprised of one median, two admedian and four submedian lines. Solenidia on tarsus I and II, stout with transverse sculptures, at least 2.5 \times longer than respective empodia; empodia 4-rayed. Coxisternal plates microtuberculated. Female genital cover flap with longitudinal ridges. Opisthosomal setae (*d*) long, almost 3.5 \times the length of setae (*c*2), 2.9 \times the length of setae (*f*) and 12 \times the length of the shortest setae (*e*); setae (*h*2) nearly 13.3 \times the length of setae (*h*1). Live mites are transparent to white in colour.

Description. FEMALE (n=10). Body worm-like 180, 156 \pm 20 (130–180), 41, 36 \pm 5 (30–43) wide; white in colour. **Gnathosoma** 12, 12 \pm 2 (9–15) projecting downwards, pedipalp genual setae (*d*) 2.5 \pm 0.5 (2–3), cheliceral stylets 15, 14 \pm 1 (12–15). **Prodorsal shield** broad at base, 19, 20 \pm 2 (17–23), 35, 30 \pm 3 (26–35) wide; frontal lobe partially buried into flexible cuticle of basal pedipalp; prodorsal shield (based on SEM images, Figs. 6–9) with median line, prominently visible on anterior half of shield; admedian lines complete, extending outwards and bifurcating in middle of prodorsal shield; short lines present below bifurcation of admedian lines; first submedian lines complete, meeting posteriorly to form a vase-like structure, enclosing median and admedian lines completely and sometimes bifurcating near base of prodorsal shield; second submedian lines present only on anterior 1/3 of shield; third submedian lines complete, running obliquely and extending to base of prodorsal shield; fourth pair of submedian lines extending up to lobe structures as present laterally on prodorsal shield. Prodorsal shield (as

examined under phase contrast; Fig. 1 DA) characterized by many lines: straight, admedian line, vase-shaped; submedian lines enclosing various lines in middle and postero-lateral rounded lobes, prominently visible. Posterior margin of prodorsal shield with sulcus (furrow) at level of scapular setae. Scapular tubercles subcylindrical, arising from under posterior margin of prodorsal shield with two annuli lateral to each tubercle, 11, 13 ± 1 (11–14) apart, directing scapular seta (*sc*) divergently backwards; (*sc*) 22, 23 ± 1 (21–25), spanning 9, 11 ± 2 (9–15) annuli. **Legs.** **Leg I** 27, 27 ± 1 (26–28); trochanter 4, 4 ± 1 (3–4), femur 10, 9 ± 1 (8–10), basiventral femoral seta (*bv*) 7, 6 ± 1 (5–7); genu 4, 4 ± 1 (4–5), antaxial genual seta (*l''*) 14, 13 ± 1 (12–15); tibia 5, 5 ± 1 (4–6), paraxial tibial seta (*l'*) 2, 2 ± 0 (2); tarsus 7, 6 ± 1 (5–7), tarsal solenidion (*o*) 12, 13 ± 1 (12–14), rod-like, without knob, but with very faint transverse sculpturing over entire length, empodium 6, 5 ± 1 (5–6), simple, 4-rayed, paraxial fastigial seta (*fi'*) 3, 4 ± 1 (4–5), antaxial fastigial seta (*fi''*) 4, 5 ± 1 (4–6), unguinal seta (*u'*) 3, 2 ± 1 (2–3). **Leg II** 24, 24 ± 1 (23–25); trochanter 3, 3 ± 1 (3–4); femur 9, 9 ± 1 (8–10); basiventral femoral seta (*bv*) 6, 7 ± 1 (6–9); genu 4, 4 ± 1 (3–4), antaxial genual seta (*l''*) 8, 7 ± 1 (5–9); tibia 5, 4 ± 1 (3–5); tarsus 6, 5 ± 1 (6–7), tarsal solenidion (*o*) 15, 16 ± 1 (15–17), rod-like, without knob, but with very faint transverse sculpturing over entire length (visible in SEM micrographs; Figs. 10 & 13), tarsal empodium 5, 5 ± 1 (4–6), simple, 4 rayed, paraxial fastigial seta (*fi'*) 3, 3 ± 1 (3–4), antaxial fastigial seta (*fi''*) 4, 4 ± 1 (3–5), unguinal seta (*u'*) 3, 2 ± 1 (2–3). Coxal area granular, sternal line present, anterolateral setae on coxisternum I (*lb*) 5, 5 ± 1 (4–5), 7, 7 ± 1 (6–8) apart; proximal setae on coxisternum I (*la*) 25, 22 ± 3 (20–26), 8, 7 ± 1 (6–8) apart; proximal setae on coxisternum II (*2a*) 37, 35 ± 2 (30–36), 16, 16 ± 1 (16–17) apart. Coxisternal area with 4–5 microtuberculated annuli. **Genitalia** 10, 7 ± 1 (5–9) long, 16, 16 ± 1 (15–16) wide; epigynium with 10–12 longitudinal ridges; central ridge longer than lateral ridges; internal female genitalia with foreshortened anterior apodeme; proximal seta on coxisternum III (*3a*) 5, 6 ± 1 (4–7). **Opisthosoma** with annuli subequal dorsoventrally. Opisthosomal seta (*c2*) 14, 14 ± 1 (13–15), on ventral annulus 9–10; opisthosomal seta (*d*) 48, 49 ± 2 (46–53), 31, 30 ± 1 (30–31) apart, on ventral annulus 17, 18 ± 1 (16–19); opisthosomal seta (*e*) 4, 4 ± 1 (4–5), 16, 16 ± 1 (14–17) apart, on annulus 32, 33 ± 2 (31–35); opisthosomal seta (*f*) 17, 17 ± 1 (15–18), 14, 13 ± 1 (12–14) apart, on annulus 54 (5th annulus from rear), 56 ± 2 (53–60). Number of dorsal annuli 65, 65 ± 1 (63–68) with oval/elongated microtubercles; 2 annuli present laterally to each scapular tubercle; first annulus posterior to prodorsal shield broadened with elongated microtubercles; widely spaced microtubercles present on posterior 5–8 annuli, becoming reduced in size; last 5 to 8 annuli smooth dorsally in some females. Number of ventral annuli 59, 61 ± 2 (58–65) also with oval microtubercles, becoming narrower, rib-like and closely spaced posterior to seta (*f*). Opisthosomal seta (*h2*) 74, 75 ± 4 (70–81); opisthosomal seta (*h1*) 6, 6 ± 1 (4–7).

MALE (n=2). Similar to female, 137.5 ± 10 (130–145), 47.5 ± 0.7 (47–48) wide. **Gnathosoma** projecting downwards; pedipalp genual setae (*d*) 2.5 ± 0.5 (2–3); chelicerae 13 ± 1.4 (12–14); rostrum 11 ± 1.4 (10–12). **Prodorsal shield** 20.5 ± 0.7 (20–21) long, 27 ± 1.4 (26–28) wide; dorsal tubercles near rear shield margin 15.5 ± 0.7 (15–16) apart, directing scapular seta (*sc*) divergently backwards; (*sc*) 18.5 ± 0.7 (18–19), spanning 11–12 annuli. **Legs.** **Leg I** 25; femur 9.5 ± 0.7 (9–10), basiventral femoral seta (*bv*) 7 ± 1.4 (6–8); genu 3.5 ± 0.7 (3–4), antaxial genual seta (*l''*) 13; tibia 4.5 ± 0.7 (4–5), paraxial tibial seta (*l'*) 2; tarsus 5.5 ± 0.7 (5–6), tarsal solenidion (*o*) 13 ± 2.8 (11–15), rod-like, without knob, but with very faint transverse sculpturing along entire length, empodium 5.5 ± 0.7 (5–6), 4 rayed, paraxial fastigial seta (*fi'*) 4, antaxial fastigial seta (*fi''*) 5, unguinal seta (*u'*) 2. **Leg II** 23; femur 9.5 ± 0.7 (9–10); basiventral femoral seta (*bv*) 5.5 ± 0.7 (5–6); genu 3, antaxial genual seta (*l''*) 9.5 ± 0.7 (9–10); tibia 4, tarsus 4.5 ± 0.7 , tarsal solenidion (*o*) 15, not knobbed, rod-like, but with very faint transverse sculpturing along entire length, empodium 5, 4-rayed, paraxial fastigial seta (*fi'*) 3, antaxial fastigial seta (*fi''*) 5, unguinal seta (*u'*) 2. Anterolateral setae on coxisternum I (*lb*) 4 ± 1.4 (3–5), 8 ± 1.4 (7–9) apart; proximal setae on coxisternum I (*la*) 16.5 ± 2.1 (15–18), 8.5 ± 0.7 (8–9) apart and proximal setae on coxisternum II (*2a*) 29 ± 1.4 (28–30), 17 ± 2.8 (15–19) apart. **Genitalia** 17 wide, 9.5 ± 0.7 (9–10), genital seta (*3a*) 10 ± 1.1 (9–12). **Opisthosoma.** Opisthosomal seta (*c2*) 14 ± 1.4 (13–15) on annulus 9–10; opisthosomal seta (*d*) 42.5 ± 3.5 (40–45), 34 ± 2.8 (32–36) apart on annulus 21.5 ± 0.7 (21–22); opisthosomal seta (*e*) 3.5 ± 0.7 (3–4), 21 apart, on annulus 36.5 ± 0.7 (36–37); opisthosomal seta (*f*) 15.5 ± 2.1 (14–17), 13.5 ± 0.7 (13–14) apart, on annulus 61.5 ± 0.7 (61–62). Number of dorsal annuli 66.5 ± 0.7 (66–67), microtuberculated; number of ventral annuli 68 ± 2.8 (66–70), microtuberculated. Opisthosomal seta (*h2*) 49 ± 1.4 (48–50); opisthosomal seta (*h1*) 5 ± 1.4 (4–6).

NYMPH. Not found.

LARVA (n=5). Body 100 (in all specimens measured), 36.6 ± 4.7 (30–40) wide. **Gnathosoma** projecting downwards; chelicerae 12.2 ± 0.8 (11–13); gnathosoma 11.2 ± 1.3 (10–13). **Prodorsal shield** 20.4 ± 3.2 (15–23) long, 20 wide; dorsal tubercles near rear shield margin directing scapular seta (*sc*) divergently backwards; (*sc*) 4.4 ± 0.5 (4–5), spanning 5–6 annuli. **Legs.** **Leg I** 13; femur 5, basiventral femoral seta (*bv*) 2.6 ± 0.5 (2–3); genu 2, antaxial

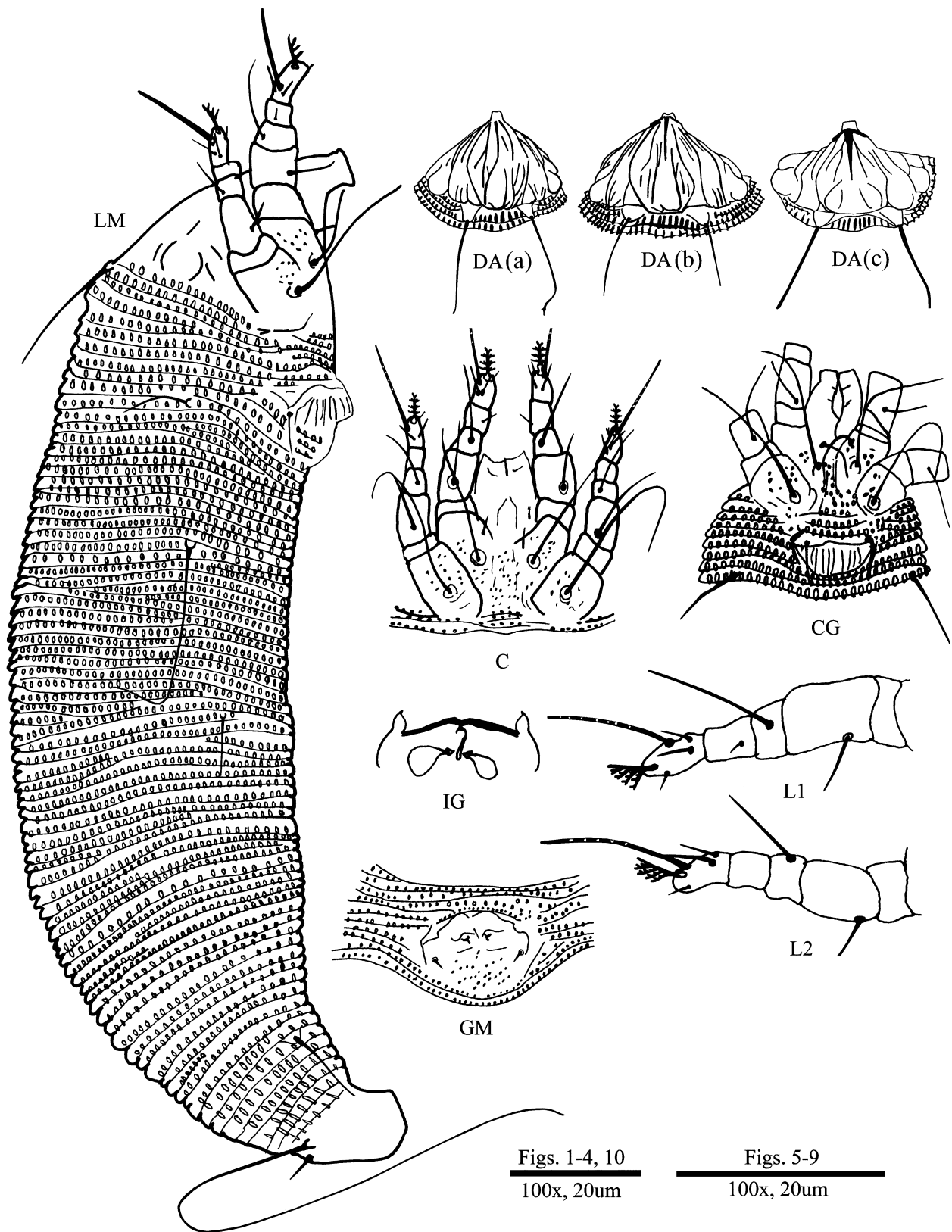
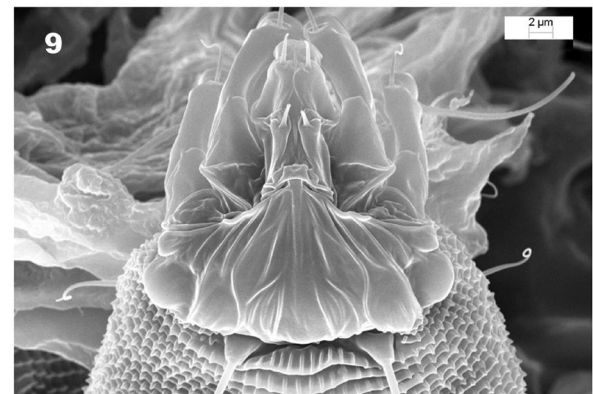
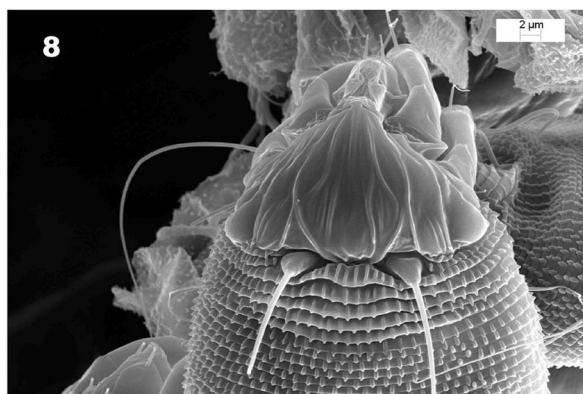
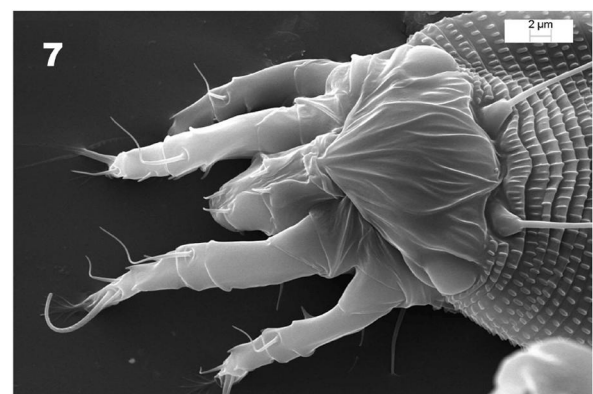
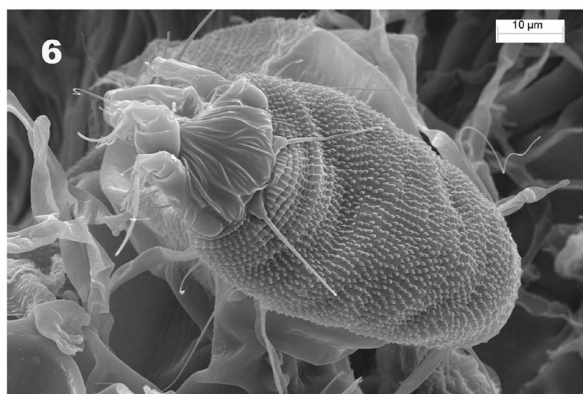
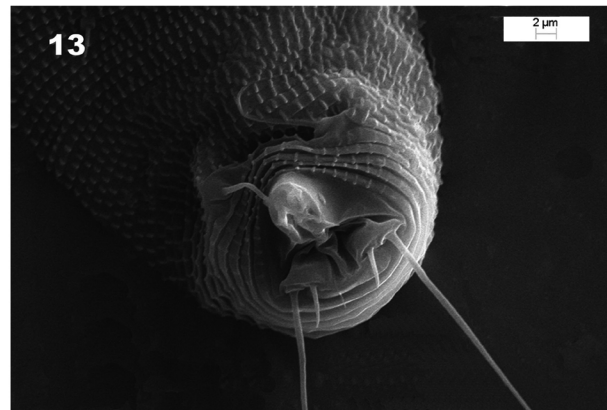
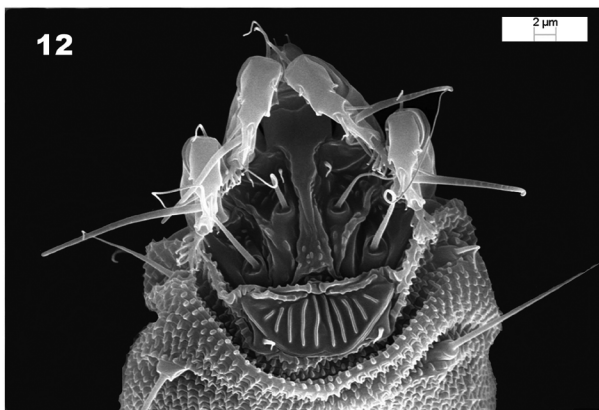
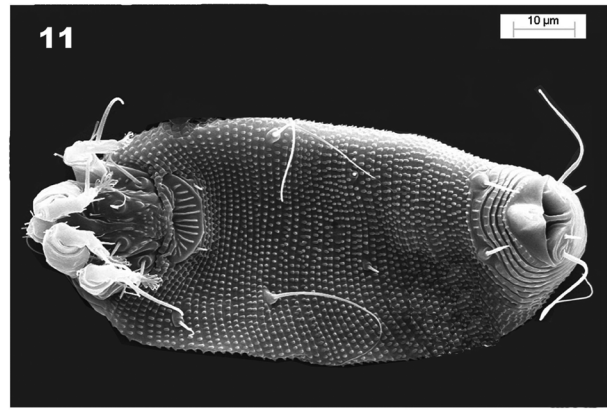
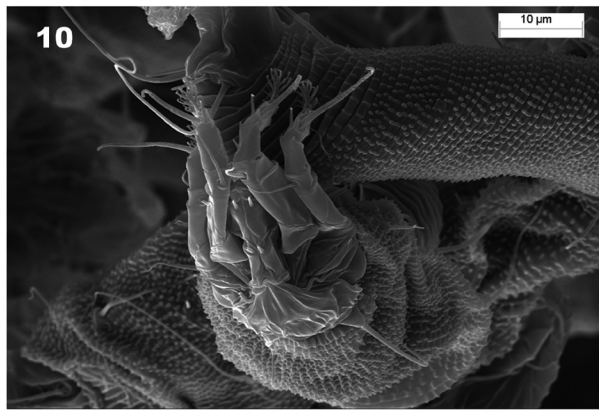


FIGURE 1. Semi-schematic drawings of *Aceria tripuraensis* n. sp.: C. Coxal region; CG. Coxigenital region of female; DA. Prodorsal shield design showing variation in three different specimens: (a) prodorsal shield design of holotype, (b,c) prodorsal shield design of two paratypes; GM. Genital region of male; IG. Internal genitalia of female; LM. Lateral view of body; L1. Leg I; L2. Leg II. Scale bars as indicated on drawing.



FIGURES 2–9. *Aceria tripuraensis* n. sp. and plant damage symptoms: **2.** Dorsal surface of *Hibiscus macrophyllus* leaf showing damage; **3.** Ventral surface of *Hibiscus macrophyllus* leaf with galls; **4.** *Hibiscus macrophyllus* leaf showing bronzing effect induced by galls; **5.** Scanning electron micrograph (SEM) of *Aceria tripuraensis* n. sp., ventral view; **6.** SEM of *Aceria tripuraensis* n. sp., dorsal view; **7–9.** SEM of *Aceria tripuraensis* n. sp. showing prodorsal shield. Scale bars as indicated on images.



FIGURES 10–13. *Aceria tripuraensis* n. sp.: **10.** Leg I and II; **11.** Ventral view of female; **12.** Coxisternal region and epigynum of female; **13.** Anal region of female. Scale bars as indicated on images.

genual seta (l'') 2.6 ± 0.5 (2–3); tibia 2, paraxial tibial seta (l') 2; tarsus 4, tarsal solenidion (ω) 5, not knobbed, transverse sculpturing not visible, empodium 4, 3-rayed, paraxial fastigial seta (ff') 2, antaxial fastigial seta (ff'') 2, unguinal seta (u') not visible. **Leg II** 13; femur 4.6 ± 0.5 (4–5); basiventral femoral seta (bv) 2.4 ± 0.5 (2–3); genu 2, antaxial genual seta (l'') 2.4 ± 0.5 (2–3); tibia 2; tarsus 3.6 ± 0.5 (3–4), tarsal solenidion (ω) 5.4 ± 0.5 (5–6), not knobbed, transverse sculpturing not visible, empodium 3, 3-rayed, paraxial fastigial seta (ff') 2, antaxial fastigial seta (ff'') 2, unguinal seta (u') not visible. Anterolateral setae on coxisternum I (lb) not seen; proximal setae on coxisternum I ($1a$) 5 ± 1 (4–6), 7 apart and proximal setae on coxisternum II ($2a$) 10 ± 2 (8–12), 15 apart. Genitalia not formed. Opisthosomal seta ($c2$) 3.6 ± 0.8 (3–5) on annulus 7–10; opisthosomal seta (d) 9 ± 1.2 (7–10), 24 apart, on annulus 15–20; opisthosomal seta (e) not seen; opisthosomal seta (f) 9.8 ± 1.4 (8–12), 11 apart, on annulus 36–42. Number of dorsal annuli 61.4 ± 2 (59–64), microtuberculated; number of ventral annuli 41.4 ± 3.7 (36–45), microtuberculated. Caudal seta ($h2$) 17.8 ± 2.2 (15–20); accessory seta ($h1$) 3 ± 1.2 (2–6).

Type material. Holotype female, 20 female paratypes on 20 microscope slides; 2 male paratypes on 2 slides; 5 larva on 3 slides deposited in NPC, India with registration number: 1791–1810/13; 2 female paratypes on 2 microscope slides deposited in NMNH, SEL, USDA with transaction number: 206557. All ex *Hibiscus macrophyllus* Roxb. ex Hornem. (Malvaceae), locality: Ishaan Chandranagar, Agartala, Tripura ($23^{\circ}45'55''\text{N } 91^{\circ}14'33''\text{E}$), collected by V.V. Ramamurthy on 20 August 2011.

Etymology. The specific designation *tripuraensis* is derived from the name of the north-eastern state of India, ‘Tripura’, from where the type host plant was collected.

Host plant. *Hibiscus macrophyllus* Roxb. ex Hornem. (Malvaceae).

Relation to the host plant. This mite causes bud galls with domes on the lower leaf surfaces. The leaves appear bronzed, with reddish coloured pockmarks on the dorsal surface (Figs. 2–4).

Remarks. This new species is distinct among *Aceria* spp. having 4-rayed empodia and reported from India in the presence of prominent lobes on the postero-lateral margins of the prodorsal shield. In addition to this character, the new species is distinct among the species of *Aceria* that are specific to the host plants of the family Malvaceae

in its characteristic prodorsal shield design and legs I and II with very long solenidia with faint transverse sculptures.

Key species of the genus *Aceria* known from *Hibiscus* spp.

1. Prominent lobe-like structures absent on postero-lateral margins of prodorsal shield; coxal granulations may or may not be present on both coxal plates; empodium 4- or 5- rayed; solenidia on Legs I and II, more or less subequal to empodia of legs 2
- Prominent lobe-like structures present on postero-lateral margins of prodorsal shield; coxal granulations present on coxal plate; empodia 4-rayed, solenidia on Legs I and II at least 2.5× length of empodia *Aceria tripuraensis* n.sp. 3
2. Empodia on Legs I and II, 4-rayed 3
- Empodia on Legs I and II, 5 rayed 5
3. Coxal granulations present only on fore-coxae; median line on prodorsal shield appears complete but anterior half is indistinct; admedian and submedian lines form a spear-shaped pattern *Aceria hastatum* Ueckermann, 1990 4
- Shield design not as above; coxal granulations absent or unknown 4
4. Coxal granulations absent; coxal area with few lines; prodorsal shield with median line on basal half, and an arrow pointing posteriorly; admedian lines spaced widely apart with basal arch-like line connecting submedians bordering on either side of the shield *Aceria vitifoliae* Mohanasundaram, 1990 4
- Coxal granulations present or absent, not clearly indicated; median lines on prodorsal shield complete; admedian lines, wavy; submedian lines placed laterally *Aceria hibisci* (Nalepa, 1906) 5
5. Coxal granulations absent; prodorsal shield with complete median line; admedian and submedian lines incomplete 5
- *Aceria liuzhouensis* Qin, Wei & Chen, 2003 6
- Prodorsal shield with complete admedian and submedian lines 6
6. Prodorsal shield with prominent median line visible on posterior two-thirds, fading anteriorly; admedian lines complete; first submedian lines complete, wavy; second submedian lines on anterior half of shield; sides of prodorsal shield, granular; coxal area, lightly granular *Aceria hirsutivagrans* Mohanasundaram, 1984 6
- Prodorsal shield with median line present; admedian, first submedian and second submedian lines all arising from prodorsal shield apex, bending out and joining back while running parallel to median line and meeting at base; coxal granulation not clearly indicated *Aceria punctulata* (Nalepa, 1914) 6

Acknowledgements

The authors are extremely grateful to Prof. E.A. Ueckermann (ARC-Plant Protection Research Institute, Pretoria, South Africa) and Dr Enrico de Lillo (Department of Soil, Plant and Food Sciences, Entomology and Zoology Section, University of Bari Aldo Moro, via Amendola, Bari, Italy) for providing literature support. A special word of thanks is due to Professor Emeritus Dr James Amrine (West Virginia University, USA) for critically reviewing an earlier draft of the paper and providing valuable comments and suggestions. The authors also acknowledge the support of Dr. B.K. Aggarwala (Network Project on Insect Biosystematics, Department of Zoology, Tripura University, Agartala). The authors are grateful to the Indian Council of Agricultural Research (ICAR) for funding the Network Project on Insect Biosystematics (NPIB) which formed part of this study.

References

Amrine, J.W. (1996) *Keys to the World Genera of the Eriophyoidea (Acari: Prostigmata)*. Indira Publishing House, West Bloomfield, Michigan USA, 186 pp.

Amrine, J.W. Jr. & Stasny, T.A. (1994) *Catalog of the Eriophyoidea (Acarina: Prostigmata) of the World*. Indira Publishing Houses, West Bloomfield, Michigan, 798 pp.

Amrine, J.W. Jr., Stasny, T.A. & Flechtmann, C.H.W. (2003) *Revised Keys to World Genera of Eriophyoidea (Acari: Prostigmata)*. Indira Publishing Houses, West Bloomfield, Michigan, USA, pp 244.

Boczek, J. & Davis, R. (1984) New species of eriophyid mites (Acari: Eriophyoidea). *Florida Entomologist*, 67 (2), 198–213. <http://dx.doi.org/10.2307/3493939>

Canestrini, G. (1891) Intorno a due nuove specie di Phytoptus (4a Serie). *Atti del Reale Istituto Veneto. di Scienze, Lettere ed Arti. Serie VII*, 2, 983–985.

ChannaBasavanna, G.P. (1966) *A Contribution to the Knowledge of Indian Eriophyid Mites (Eriophyoidea: Trombidiformes: Acarina)*. University of Agricultural Sciences, Hebbal, Bangalore, India, 1–154 pp.

Denizhan, E., Monfreda, R., Cobanoglu, S., de Lillo, E. (2006) Three new *Aceria* species (Acari: Eriophyoidea) from Turkey.

- International Journal of Acarology*, 32 (2), 179–184.
<http://dx.doi.org/10.1080/01647950608684458>
- Huang, K.W. (2008) *Aceria* (Acarina: Eriophyoidea) in Taiwan: five new species and plant abnormalities caused by sixteen species. *Zootaxa* 1829, 1–30.
- Keifer, H.H. (1938) Eriophyid Studies I. *Bulletin California Department of Agriculture*, 27, 181–206.
- Keifer, H.H. (1944) Eriophyid Studies XIV. *Bulletin California Department of Agriculture*, 33, 18–38.
- Keifer, H.H. (1965) Eriophyid Studies B–14. *Bureau of Entomology, California Department of Agriculture*, 1–20.
- Keifer, H.H. (1966) Eriophyid Studies B–20. *Bureau of Entomology, California Department of Agriculture*, 1–20.
- Keifer, H.H. (1970) *Eriophyid Studies C–4*. ARS–USDA, 1–24.
- Krantz, G.W. (1970) *A Manual of Acarology*. Oregon State University, Publisher, 335pp.
- Keifer, H.H., Baker, E.W., Kono, T., Delfinado, M. & Styer, W.E. (1982) *An Illustrated Guide to Plant Abnormalities caused by Eriophyid Mites in North America*. USDA, ARS, Agriculture, Handbook No. 573, Washington D.C., USA, 178 pp.
- Lindquist, E.E. & Oldfield, G.N. (1996) Evolution of eriophyoid mites in relation to their host plants. In: Lindquist, E.E., Sabelis, M.W. & Bruin, J. (Eds.), *Eriophyoid Mites: their Biology, Natural Enemies and Control*. Vol. 6. *World Crop Pests*. Elsevier Science Publishers, Amsterdam, The Netherlands, pp. 277–300.
- Manson, D.C.M. (1984) Eriophyinae (Arachnida: Acari: Eriophyoidea). *Fauna of New Zealand*, 5, 1–123.
- Mohanasundaram, M. (1984) New eriophyid mites from India (Acarina: Eriophyoidea). *Oriental Insects*, 18, 251–283.
<http://dx.doi.org/10.1080/00305316.1984.10432206>
- Mohanasundaram, M. (1990) Studies on the genus *Aceria* (Acari: Eriophyidae) from south India. *Indian Journal of Acarology*, 12 (1 & 2), 15–88.
- Nalepa, A. (1898) Zur Kenntniss der Gattung *Trimerus* Nal. *Zoologische Jahrbuecher*, 11 (5), 405–411.
- Nalepa, A. (1902) Neue Gallmilben. (21 Fort.) *Anzeiger der kaiserlichen Akademie der Wissenschaften, Mathematisch–Naturwissenschaftliche Klasse, Wien*, 39 (17), 221–223.
- Nalepa, A. (1906) Über zwei neue Eriophyiden von den Fidschiinseln. *The Journal of Economic Biology, Birmingham*, 1 (4), 147–151 + 10 pls.
- Nalepa, A. (1909) Ch. VI. Eriophyiden. In: Reehinger K., *Botanische und Zoologische Ergebnisse einer wissenschaftlichen Forschungsreise nach den Samoa-inseln, dem Neuguinea-Archipel und den Salomos-inseln, von Maerz bis Dezember 1905. Verhandlungen der kaiserlich-königlichen zoologisch-botanischen Gesellschaft*, 84, 523–536.
- Nalepa, A. (1914) Eriophyiden aus Java. (I. Beitrag) *Marcellia*, 13 (2–3), 51–87.
- Qin, A.Z., Wei, Y.L. & Chen, X.R. (2003) Four new species of the genus *Aceria* (Acari: Eriophyoidea) from China. *Entomotaxonomia*, 25 (4), 307–312.
- Ueckermann, E. (1990) South African *Aceria* (Acari: Eriophyidae): On species associated with plants of the families Acanthaceae and Malvaceae. *Phytophylactica*, 22 (3), 295–301.