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A NEW ERIOPHYID, *ACERIA MADHUCAE* N. SP. (ACARI: ERIOPHYIDAE) FROM INDIA

Sushila JOSHI[1], Pratibha MENON[2,*] and V.V. RAMAMURTHY[3]

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Network Project on Insect Biosystematics, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India-110012.
[1] sushilaaa2003@yahoo.co.in; [2] pratibharish@gmail.com ([*]corresponding author); [3] vvr3@vsnl.com

ABSTRACT — A new species of Eriophyidae (Acari: Prostigmata: Eriophyoidea), *Aceria madhucae* **n. sp.**, collected from the lower surface of leaves of *Madhuca longifolia* (J. Konig) J.F. Macbr. (*Sapotaceae*), is described from India. *Aceria madhucae* is distinguished by its 4-rayed empodium, shield with median line present from rear to almost middle of shield, admedian lines, two pair of submedian lines and a pair of short lateral lines present, all parallel to median line and slightly diverging laterally, opisthosomal seta *h1* absent, pedipalp genual seta *d* present.

KEYWORDS — Taxonomy; new species; mites; Eriophyidae; *Aceria; Madhuca longifolia*; India

INTRODUCTION

Aceria madhucae **n. sp.**, was collected from the lower surface of leaves of Madhuka tree (Honey tree), *Madhuca longifolia* (J. Konig) J.F. Macbr (Sapotaceae). It is a medium to large sized tree, which grows in abundance throughout India and is used for timber, flowers, fruit and for its medicinal properties. So far, seventeen species of eriophyid mites are known on Sapotaceae worldwide and are listed in Table 1, along with their synonyms, type-hosts, type-localities and symptomology. Five of these are recorded from India on different plant hosts.

MATERIALS AND METHODS

Leaves of *Madhuca longifolia* were collected and examined for the presence of mites using a Leica MZ6 stereozoom microscope. Mites were mounted in a drop of Hoyer's medium and subsequently dried at 45 – 55°C for 10 – 12 hours (Krantz, 1970). The cleared and dried slide mounted specimens were studied under a Leica DM1000 phase contrast compound microscope fitted with a drawing tube. All illustrations are provided with their relevant scale of magnification.

The classification and terminology are after Amrine *et al.* (2003). The holotype measurement is followed by mean, standard deviation, and range of paratypes in parentheses. All measurements are in micrometers (μm) and, unless specified, refer to the length of the structure. Body length is measured from the apical tip of the gnathosoma to the posterior opisthosomal apex and leg length is from the base of the trochanter to the apical tip of the tarsus, not including the tarsal appendages (solenidion and empodium). Ventral opisthosomal annuli were counted from the first anterior incomplete annulus, which ends at the lateral margin of coxa II.

TABLE 1: List of eriophyid mites known on Sapotaceae.

Sl. No.	Species with synonym names	Type host	Type locality	Symptomology
1	*Aceria bassiae* Ghosh & Chakrabarti, 1988:378	*Madhuca latifolia* Roxb. (Host originally listed as basionym *Bassia latifolia* Roxb.)	Dubrakone Forest, Bankura, West Bengal, India.	Within bud hairs.
2	*Aceria chrysophylli* (Cook, 1906). *Eriophyes chrysophylli* Cook 1906:250; Amrine & Stasny 1994:35	*Chrysophyllum* sp.	Cuba.	Galls.
3	*Aceria madhucae* Joshi, **n. sp.**	*Madhuca longifolia* (J. Konig) J.F. Macbr.	New Delhi, India.	Vagrant on lower leaf surface.
4	*Aceria mimusopae* Mohanasundaram, 1990:51	*Mimusops elengi* L.	Coimbatore, near Anamalai, Tamil Nadu, India.	Buds.
5	*Calacarus citrifolii* Keifer, 1955:126	*Citrus* spp. (Type host, Family Rutaceae), *Mimusops* sp. (other host, Family Sapotaceae)	Rustenburg, South Africa.	Vagrant on lower leaf surface, supposed vector of concentric ring blotch, fruit spotting, rusting of foliage. This mite is recorded as developing on 39 different host plants in 21 families; the most diverse host range of all Eriophyoidea.
6	*Cenaca paula* Flechtmann, 2004:11	*Chrysophyllum gonocarpum* (Mart. & Eichl.) Engl.	Fazenda Capoava, Itu, São Paulo, Brazil.	Vagrant on leaf undersurface; under debris near midrib, near petiole.
7	*Colopodacus palaquius* Huang, 2001:40	*Palaquium formosanum* Hay	Taitung: Lanyu, Taiwan, China.	Vagrant on lower leaf surface. No damage observed.
8	*Eriophyes emphlopei* Meyer & Ueckermann, 1989:339	*Sideroxylon inerme* L.	Xora River Mouth, Transkei, South Africa.	Open cup leaf galls with white to brown erineum.
9	*Eriophyes gallitor* Flechtmann & Etienne, 2005:63	*Sideroxylon obovatum* Lam.	Saint Anne, La Toubana, Guadeloupe.	Causes galls on leaves.
10	*Eriophyes hexandrae* Umapathy & Mohanasundaram, 1999:58	*Manilkara hexandra* (Roxb.) Dubard	Orchard, Coimbatore, Tamil Nadu, India.	Lower leaf surface erineum.
11	*Eriophyes inermae* Meyer & Ueckermann, 1989:337	*Sideroxylon inerme* L.	Gordon's Bay, Cape Province, South Africa.	Open cup leaf galls, with white to brown erineum in domes.
12	*Eriophyes manilkarae* (Keifer 1977) *Phytoptus manilkarae* Keifer, 1977:19; Amrine & Stasny 1994: 202	*Manilkara hexandra* (Roxb.) Dubard. (Host originally listed as *Manilkara hexandra* Dubard, then by its basionym *Mimusops hexandra* (Dubard))	Pattaya, Chonburi Province, Thailand.	Conspicuous erineum pockets on underside of leaves, the pockets projecting out of upper surface.
13	*Eriophyes mimusi* Meyer & Ueckermann, 1989:340	*Mimusops zeyheri* Sond.	Magaliesberg Mountains, near Maanhaarrand, Transvaal, South Africa.	Dome-shaped leaf galls.
14	*Eriophyes planchonellus* Manson, 1984:50	*Planchonella novozelandica* (F. Muell.) Allan	Destruction Gully, Huia, New Zealand.	Distorted flower buds.
15	*Metaculus magalismontani* Meyer, 1990:561	*Englerophytum magalismontanum* (Sond.) T.D.Penn. (Host originally listed as the synonym name *Bequaertiodendron magalismontanum* Sonder Heine & J. H. Hemsley.)	Brummeria Botanical Garden, Pretoria, Transvaal, South Africa.	Among hairs in shoot tips with an *Aceria* sp.
16	*Shevtchenkella birbhumensis* (Das & Chakrabarti, 1985). *Tegonotus birbhumensis* Ghosh & Chakrabarti, 1983:126. (nomen nudum); Amrine & Stasny, 1994:283. *Tegonotus birbhumensis* Das & Chakrabarti, 1985:142; Amrine & Stasny, 1994:283	*Madhuca longifolia* (L.) J. F. Macbr. var. *latifolia* (Roxb.) A. Chev. (Host originally listed as basionym *Bassia latifolia* Roxb.)	Illambazar, Birbhum, West Bengal, India.	Undersurface leaf vagrant.
17	*Tegonotus bassius* Das & Chakrabarti, 1982:300	*Madhuca* sp. (Host originally listed as *Bassia* sp.)	Massanjore, Santhalparagana, Bihar, India.	Vagrant on undersurface of the leaves.

The type material is deposited in the National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, (NPC, IARI), New Delhi 110012, India and paratypes will be deposited in Insect and Mite National Collection, National Museum of Natural History (NMNH), Smithsonian Institution located at USDA, ARS, SEL, Beltsville, Maryland, USA.

FAMILY ERIOPHYIDAE NALEPA, 1898

Subfamily Eriophyinae Nalepa, 1898

Tribe Aceriini Amrine and Stasny, 1994

Genus *Aceria* Keifer, 1944

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

Aceria madhucae n. sp. Joshi

Female — (n=10, Figure 1: a–h) — Body worm like, 175, 189±19.1, (175 – 210) long, 50, 55±5 (49 – 60) wide.

Gnathosoma projecting downwards; pedipalp genual setae *d* 5, 3±3 (0-5); chelicerae 17, 18±2 (16 – 20); gnathosoma 18, 19±2 (18 – 22).

Prodorsal shield broad at base, forming a small semicircle at the anterior end, 26, 27.8±2 (26 – 30) long, 40, 44.4±4.3 (40 – 50) wide; median line present from rear end to almost middle of shield; admedian lines not touching the anterior and posterior margin of the shield, running parallel from anterior end, gently diverging and curving out towards the rear shield margin; two pairs of short submedian lines running parallel to admedians, gently diverging and ending a little ahead of dorsal tubercles, sometimes broken at middle; lateral line short and diverging longitudinally to the sides of the shield; dorsal tubercles subcylindrical, situated at rear shield margin, 19, 20.4±1.6 (19 – 23) apart, directing scapular seta (*sc*) divergently backwards; *sc* 20, 22±1.5 (20 – 24), spanning 9, 6±3 annuli.

Leg I 24, 24.8±1 (24 – 26); femur 7, 7.6±0.8 (7 – 9), basiventral femoral seta (*bv*) 9, 9.8±1.3 (9 – 12); genu 3, 3.6±0.5 (3 – 4), antaxial genual seta (*l″*) 18, 19.4±1.6 (18 – 22); tibia 4, 4 (4), paraxial tibial seta (*l′*) 6, 6.4±0.5 (6 – 7); tarsus 6, 5.8±0.4 (5 – 6); solenidion (*ω*) 5, 5.6±0.5 (5 – 6), rod-like, without knob, empodium 5, 5 (5), simple, 4-rayed, paraxial fastigial seta (*ft′*) 7, 6.4±0.8 (5 – 7), antaxial fastigial seta (*ft″*) 17, 16.4±1.1 (15 – 18), unguinal seta (*u′*) 5, 4.8±0.4 (4 – 5). Leg II 20, 22±1.4 (20 – 24); femur 6, 7.2±0.8 (6 – 8); basiventral femoral seta (*bv*) 8, 9.2±1 (8 – 10); genu 4, 3.4±0.5 (3 – 4), antaxial genual seta (*l″*) 9, 8.8±1.3 (7 – 10); tibia 4, 3.6±0.5 (3 – 4); tarsus 5, 5 (5), solenidion (*ω*) 7, 7±0.7 (6 – 8), rod like, without knob, empodium 5, 4.8±0.4 (4 – 5), simple, 4-rayed, paraxial fastigial seta (*ft′*) 6, 6.2±0.5 (6 – 7), antaxial fastigial seta (*ft″*) 17, 18.4±2.4 (15 – 21), unguinal seta (*u′*) 4, 0.8±1.7 (0 – 4).

Coxal area smooth, sternal line absent, anterolateral seta on coxisternum I (*1b*) 7, 7.6±0.8 (7 – 9), 9, 8.6±1.1 (7 – 10) apart; proximal seta on coxisternum I (*1a*) 15, 13.8±7.8 (15 – 19), 10, 10.6±1.9 (8 – 13) apart; proximal seta on coxisternum II (*2a*) 35, 32.2±3.8 (28 – 35), 20, 20.4±2.6 (18 – 24) apart. Coxisternal area with 2-3 microtuberculate annuli.

Genitalia 12, 13.6±1.5 (12 – 15) long, 19, 19.4±0.5 (19 – 20) wide; epigynium with 10 – 12 longitudinal ridges; proximal seta on coxisternum III (*3a*) 6, 7.4±1.6 (6 – 10).

Opisthosomal annuli continuous dorsoventrally. Opisthosomal seta (*c2*) 20, 21.2±1.0 (20 – 22), on annulus 9, 8.6±0.5 (8 – 9); opisthosomal seta (*d*) 40, 44.4±4.3 (40 – 50), 33, 21.8±20.0 (33 – 40) apart, on annulus 20, 19.6±0.5 (19 – 20); opisthosomal seta (*e*) 6, 6.4±0.5 (6 – 7), 18, 16.2±9.4 (17 – 24) apart, on annulus 31, 29.8±1.6 (27 – 31); opisthosomal seta (*f*) 15, 17±1.5 (15 – 19), 17, 15±8.4 (17 – 20) apart, on annulus 48, 48.8±2.4 (45 – 51). Dorsal annuli with oval microtubercles, thorn-like, those on posterior 8 annuli appear as dots, total number of dorsal annuli 53, 53.8±2.6 (51 – 58); ventral annuli with small and slightly oval microtubercles, also thorn-like, becoming more narrow, rib-like and closely spaced posterior to seta (*f*), total number of ventral annuli 53, 54±2.5 (50 – 56). Opisthosomal seta (*h2*) 32, 33.8±1.7 (32 – 36); opisthosomal seta (*h1*) absent.

Male — (n=5) – Similar to female, 146±2.8 (144 – 148) long, 45.5±3.5 (43 – 48) wide.

Gnathosoma projecting downwards; dorsal pedipalp genual seta 4±0 (4); chelicerae 20±0 (20);

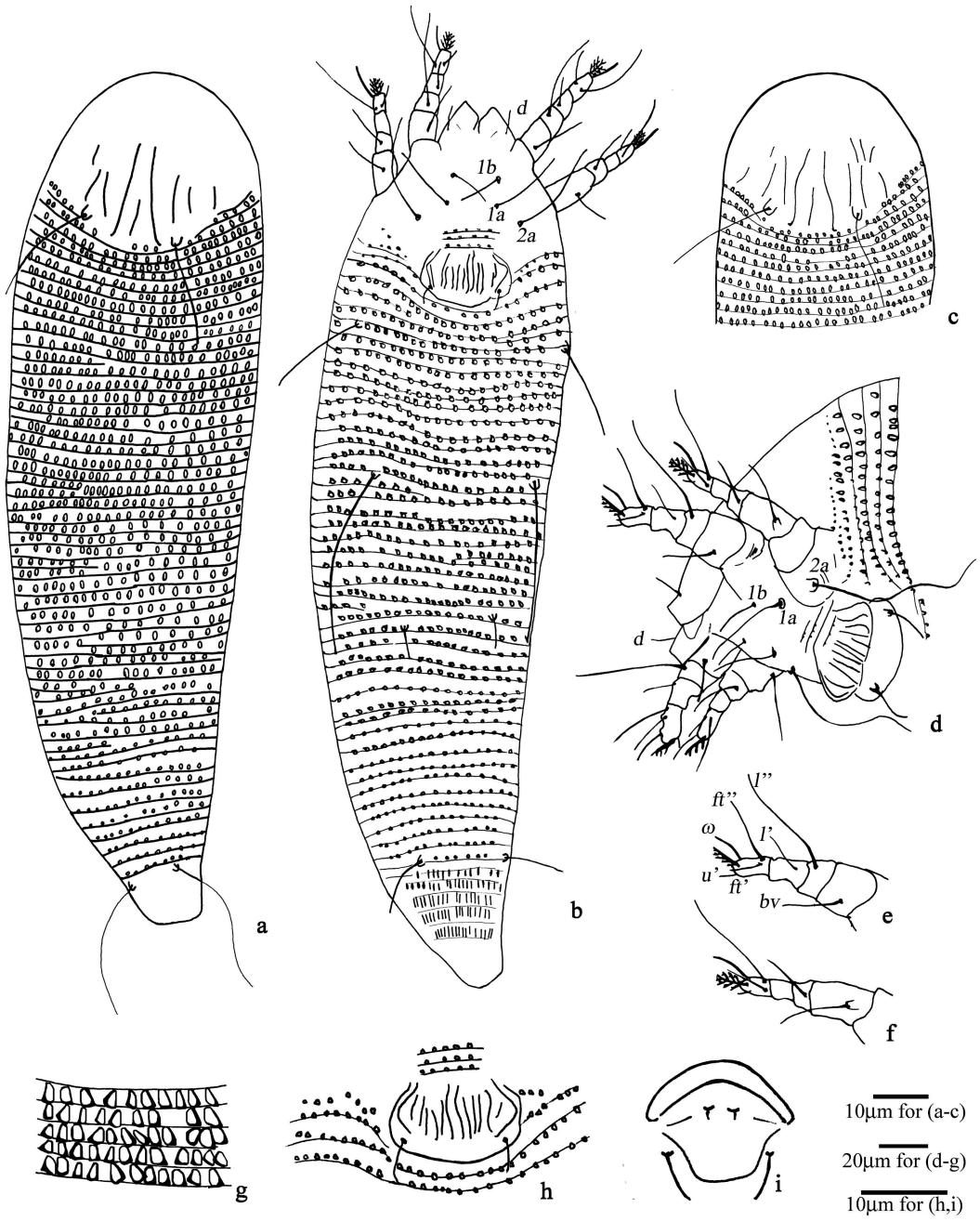

FIGURE 1: *Aceria madhucae* **n. sp.** female: a – dorsal view; b – ventral view; c – shield design of paratype; d – lateral view showing legs I and II, coxisternal area, epigynium of paratype; e – leg I; f – leg II; g – dorsal microtubercles; h – epigynium; i – male external genitalia. Scale as indicated.

gnathosoma 15.5±0.7 (15 – 16).

Prodorsal shield 25±2.8 (23 – 27) long, 42.5±3.5 (40 – 45) wide; dorsal tubercles near rear shield margin 12.5±0.7 (12 – 13) apart, directing scapular seta (*sc)* divergently; *sc* 17±1.4 (16 – 18).

Legs: Leg I 24.5±0.7 (24 – 25); femur 7±0 (7), basiventral femoral seta (*bv*) 7±1.4 (6 – 8); genu 4±0 (4), antaxial genual seta (*l″*) 13±1.4 (12 – 14); tibia 3±0 (3), paraxial tibial seta (*l′*) 6±1.4 (5 – 7); tarsus 6±0 (6), solenidion (*ω*) 5.5±0.7 (5 – 6), without knob, empodium 4.5±0.7 (4 – 5), simple, 4-rayed, paraxial fastigial seta (*ft′*) 6±1.4 (5 – 7), antaxial fastigial seta (*ft″*) 18.5±0.7 (18 – 19), paraxial unguinal seta (*u′*) 3±0 (3). Leg II 22±0 (22); femur 7.5±0.7 (7 – 8); basiventral femoral seta (*bv*) 7.5±0.7 (7 – 8); genu 3±0 (3), antaxial genual seta (*l″*) 10.5±0.7 (10 – 11); tibia 3±0 (3), tarsus 3.5±0.7 (3 – 4), solenidion (*ω*) 8±0 (8), slightly curved, without knob, empodium 4±1.4 (3 – 5), simple, 4-rayed, paraxial fastigial seta (*ft′*) 15±0 (15), antaxial fastigial seta (*ft″*) 4.5±0.7 (4 – 5), paraxial unguinal seta (*u′*) not visible.

Coxisternal area with 2 rows of very faint non-microtuberculate annuli; sternal line absent, anterolateral seta on coxisternum I (*1b*) 8±2.8 (6±10), 8.5±2.1 (7 – 10) apart; proximal seta on coxisternum I (*1a*) 16±4.2 (13 – 19), 10±0 (10) apart; proximal seta on coxisternum II (*2a*) 29±0 (29), 19.5±0.7 (19 – 20) apart.

Genitalia 16.5±2.1 (15 – 18) wide, 11.5±0.7 (11 – 12) long (Figure 1: i); eugenital setae (*es*) present; proximal seta on coxisternum III (*3a*) 6.5±0.7 (6 – 7).

Opisthosomal seta (*c2*) 185±0 (18) on annulus 6.5±0.7 (6 – 7); opisthosomal seta (*d*) 39±1.4 (38 – 40), 32±2.8 (30 – 34) apart, on annulus 14.5±0.7 (14 – 15); opisthosomal seta (*e*) 7±0 (7), 20.5±2.1 (19 – 22) apart, on annulus 24.5±0.7 (24 – 25); opisthosomal seta (*f*) 16.5±2.1 6 (15 – 18), 16±1.4 (15 – 17) apart, on annulus 42±1.4 (41 – 43). Total number of dorsal annuli 47±1 (46 – 47), microtubercles oval shaped and closely set till the first 15 annulus, then a little widely spaced till annulus 30 after which they appear as dots on the annulus; total number of ventral annuli 47±1 (46 – 48), microtuberculate, microtubercles spherical and closely set upto seta (*e*), then widely spaced from seta (*e*) to seta (*f*) and closely set as narrow ribs from seta (*f*) to the last annulus. Opisthosomal seta (*h2*) 31.5±2.1(30 – 33); opisthosomal seta (*h1*) absent.

Holotype — female, INDIA: Greater Kailash (28°34′52.63″ N, 77°14′27.83″ E), New Delhi, 6 July 1988, ex: *Madhuca longifolia* (Sapotaceae), Coll. Sushila Joshi, deposited with NPC, IARI, New Delhi.

Paratypes — Collection data same as above. 8 female and 5 male paratypes on 8 microscopic slides, deposited with NPC, IARI, New Delhi; 1 paratype each in 2 microscopic slide, data same as above, will be deposited in NMNH, Maryland, USA.

Distribution — India: New Delhi.

Relationship with host plant — These mites were found in large numbers, as vagrant, mostly on the lower surface of leaves and no apparent damage was observed.

Etymology — The specific name *madhucae* is after the host plant genus *Madhuca*.

Remarks — The new species is characterized by its 4-rayed empodium, prodorsal shield having median line on the rear quarter to half, complete admedian lines and short submedian lines, coxal area smooth and sternal line absent. It differs from eriophyid mites known on Sapotaceae from India as follows: from *Aceria bassiae* Ghosh and Chakrabarti 1988, ex: *Madhuca latifolia* (Sapotaceae), by virtue of it bearing 6-rayed empodium, complete median, admedian and first submedian lines on prodorsal shield and a granular coxal area. It differs from *Aceria mimusopae* Mohanasundaram 1990, ex: *Mimusops elengi* (Sapotaceae) on account of shield design with a faint median line present only at base, admedian lines parallel, first submedian present at the middle of shield, second submedian converging towards anterior of shield, lateral-shield margins and coxal area granular, 5-rayed empodium, epigynium without ribs and last thanosomal tergite being broad. It is similar to *Aceria trianthemae* Mohanasundaram 1990, ex: *Trianthema decandra* (Aizoaceae), in the presence of 4-rayed empodium, microtubercles spine-like and triangular, getting elongated towards last few annuli but can be differentiated by its shield design comprising of median line present at basal half only, admedian lines complete, slightly wavy, first submedian lines present

at anterior shield, second submedian at mid length of shield, third submedian at border of shield, sides of shield granular, coxal area granular, sternal line present and epigynium with 6 – 8 broken lines. *Aceria madhucae* also resembles *Aceria xeromphisi* Mohanasundaram 1990, ex: *Xeromphis spinosa* (Rubiaceae) in having 4-rayed empodium, shield and coxal area non-granular, sternal line absent and coxal area fused but can be differentiated in the shield design comprising of faintly visible and broken median line, admedian line present on basal $2/3^{rd}$ of shield and faintly visible submedian lines placed obliquely. The new species is near *Aceria jogimatiensis* Mohanasundaram and Jagdish in Mohanasundaram *et al.* 1984, ex: unidentified plant, in its shield design with faint median line (though complete), admedians nearly complete, submedians present as short broken lines, sides of shield clear, coxal area smooth and empodium 4-rayed but can be differentiated from it in presence of sternal line, epigynium bearing 14 – 16 ribs and dorsal annuli with elongate microtubercles.

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