

A NEW GENUS AND SPECIES *MANGALAUUS BKAPUS* (ACARI: ERIOPHYIDAE) FROM INDIA

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ABSTRACT – *Mangalauus bkapus* n. gen., n. sp. (Acari: Prostigmata: Eriophyidae: Eriophyinae: Aceriini), collected from erineum on the underside of leaves of *Cordia dichotoma* G. Forster (Boraginaceae), is described and illustrated from specimens collected at the Indian Agricultural Research Institute (IARI) in New Delhi, India.

Key words – Systematics, *Mangalauus bkapus*, new genus, new species, *Cordia dichotoma*, erineum, Eriophyidae, Aceriini, India.

INTRODUCTION

Cordia dichotoma G. Forster (Boraginaceae), commonly known as Indian cherry or fragrant manjack, is a small to medium-sized deciduous tree found in tropical and subtropical regions of Asia. *Mangalauus bkapus* n. gen., n. sp. (Prostigmata: Eriophyidae: Eriophyinae: Aceriini) from erineum on *C. dichotoma* is described here. The mites were seen in the whitish erineum having no particular shape, formed primarily on the undersurface of leaf, which gradually becomes brownish as it ages (Figs. 11 and 11a). Sometimes, on tender leaves, the erineum spreads across the entire leaf as a soft white hairy layer. Twenty eriophyid spp. have been recorded so far on *Cordia* spp. and these are listed in Table 1.

MATERIALS AND METHODS

Leaves of *Cordia dichotoma* with erineum were collected and screened in the laboratory, using Leica MZ6 stereozoom microscope. The mites were mounted in a drop of Hoyer's medium and heated at 45–55°C for

10–12 hours. The cleared and dried specimen-slides were examined using a Leica DM1000 phase contrast compound microscope fitted with a drawing tube. Classification and terminology of Amrine *et al.* (2003) and Lindquist (1996) are used. The measurement of the holotype is followed by the mean, standard deviation, and range of 10 specimens, in parentheses. Body length was measured from the apical tip of the palpi to the posterior opisthosomal apex. Leg length was measured from the base of the trochanter to the apical tip of the tarsus, not including the tarsal appendages (solenidion and empodium). The number of ventral opisthosomal annuli was counted from the first anterior incomplete annulus ending at the lateral margin of coxa II, at level of setae 2a.

Low-temperature scanning electron microscopy – Some mite specimens were studied with Low-Temperature Scanning Electron Microscopy (LT-SEM) at the United States Department of Agriculture (USDA), Agricultural Research Service (ARS), Electron and Confocal Microscopy Unit (Beltsville, Maryland, USA) essentially as in Wergin *et al.* (2000) with the following exceptions: a S-4700 field emission scanning

Table 1. Eriophyids associated with *Cordia* spp.

Name	Author/year/type locality	Host	Symptoms	Remarks
<i>Aceria boraginiae</i>	Mohanasundaram, 1982, India	<i>Cordia</i> sp.	Erineum on lower side of the leaf with protuberances on the upper side	
<i>A. cordiae</i>	(Cook, 1909), Java, Indonesia	<i>Cordia</i> sp.	Fleshy erineum on small papillae on leaf underside	No type specimen
<i>A. cordiae</i>	(Nalepa, 1914), Java, Indonesia	<i>C. dichotoma</i>	Small irregular erineum on the upper leaf surface	Possible junior homonym
<i>A. dichotomae</i>	Mohanasundaram, 1982, India	<i>C. dichotoma</i>	Causing tightly rolled edges of the leaves	
<i>A. gallae</i>	Huang, 1996, Taiwan	<i>C. dichotoma</i>	Conical or cylindrical galls on both sides of the leaves, cylindrical galls on upper surface with opening on lower surface	
<i>A. mixacordiae</i>	(Nalepa, 1929), Java, Indonesia	<i>C. myxa</i>	Erineum	
<i>A. neocordiae</i>	Wilson, 1970, Mexico	<i>Cordia</i> sp.	Galls	
<i>A. obliquae</i>	Mohanasundaram, 1990, India	<i>C. obliqua</i>	Erineum, both leaf surface	
<i>A. pobuzii</i>	Huang, 1996, Taiwan	<i>C. dichotoma</i>	Same symptoms as galls formed by <i>A. gallae</i>	
<i>Caloptirimerus cordiae</i>	Chakrabarti and Das, 1982, India	<i>C. myxa</i>	Vagrant on ventral surface of leaf causing brown patches, discoloration	
<i>Cosetacus sharadi</i>	Menon, Joshi and Ramamurthy, 2009, India	<i>C. dichotoma</i>	Whitish erineum mostly on the leaf under surface, gradually becoming brown as it matures	
<i>Eriophyes cordiae</i>	(Channabasavanna, 1966), India	<i>C. myxa</i>	Whitish warty patches on the leaf under surface	Chakrabarti <i>et al.</i> (1981) suggested new combination for <i>Aceria cordiae</i> Channabasavanna 1966, and revised the description with respect to body length and genital setae
<i>Floracarus claviger</i>	Flechtmann, 1996, Brazil	<i>Cordia</i> sp.	Leaf vagrants, no apparent symptom of damage	
<i>Neodichopelmus cordiae</i>	Chakrabarti and Pandit, 1997, India	<i>C. myxa</i>	Occur on lower leaf surface under thin white web with no apparent damage to plant	
<i>Notaceria tetrandrae</i>	Mohanasundaram and Muniappan, 1990, Guyana	<i>C. tetrandra</i>	Occur on undersurface of tender leaf as vagrants	
<i>Paraphytoptella arnaudi</i>	Keifer, 1959, Mexico	<i>C. parviflora</i>	Galls	
<i>P. secunda</i>	Flechtmann and Etienne, 2001, Guadeloupe	<i>C. polycephala</i>	Erineum patches on both sides of leaf	
<i>Shevchenkella cardiavagrans</i>	Mohanasundaram, 1982, India	<i>Cordia</i> sp.	Undersurface leaf vagrant	
<i>Tegolophus cordis</i>	Das and Chakrabarti, 1982, India	<i>C. myxa</i>	Vagrant on leaf undersurface, no damage	
<i>Mangalaua bkapus</i> n. gen., n. sp.	Menon, P., present study, India	<i>C. dichotoma</i>	Whitish erineum mostly on the leaf under surface, gradually becoming brown as it matures	

electron microscope (Hitachi High Technologies America, Inc., Pleasanton, California) equipped with a Polaron Polar Prep 2000 (Energy Bean Sciences, East Grandby, Connecticut) cryotransfer system was used. Samples of mites or mites on leaves were excised and placed on flat specimen holders consisting of 16 × 30 mm copper plates that contained a thin layer of Tissue Tek[®] (Optimal Cutting Temperature Compound, Ted Pella, Inc., Redding, California), which acted as the cryo-adhesive upon freezing. The samples were frozen conductively, in a styrofoam box, by placing the plates on the surface of a pre-cooled (−96°C) brass bar, the lower half of which was submerged in liquid nitrogen (LN₂). After 20–30 sec, the holders containing the frozen samples were transferred to a LN₂ Dewar for future use or cyrotransferred under vacuum to the cold stage in the pre-chamber of the cryotransfer system. Removal of surface contamination (condensed water vapor) took place in the cryotransfer system by etching the frozen specimens for 10–15 min by raising the temperature of the stage to −90°C. Following etching, the temperature was lowered below −130°C, and a magnetron sputter head equipped with a platinum target was used to coat the specimens with a very fine layer of platinum. The specimens were transferred to a pre-cooled (−140°C) cryostage in the SEM for observation. An accelerating voltage of 10 kV was used to view the specimens. Images were captured at 2560 × 1920 resolution with a resulting 4.8 Megapixel image. Images were sized and placed together to produce the figures using Adobe[®] Photoshop 7.0.

Family ERIOPHYIDAE Nalepa, 1898
Subfamily ERIOPHYINAE Nalepa, 1898
Tribe ACERIINI Amrine and Stasny, 1994

***Mangalaus* Menon, n. gen.**

Type species – *Mangalaus bkapus*, n. sp.

Diagnosis – *Mangalaus* n. gen. is characterized by presence of an evenly arched opisthosoma without any furrows, ridges, humps, or crenulations; dorsal annuli semi-circular, with distinct microtubercles; dorsal shield with a well-defined ocellar region; anterolateral seta on coxisternum I (*Ib*) present; paraxial tibial seta of leg I (*I'*) absent; all other tarsal, femoral, and genual setae of legs I and II present and of normal length; solenidion of normal length placed distally on tarsus; all opisthosomal setae present, genitalia in typical position, placed 3–4 annuli behind the coxisternal region.

Description – Body vermiform, annuli subequal dorsoventrally and both surfaces microtuberculate; prodorsal shield subtriangular, without a frontal lobe; scapular tubercles and setae on or very near posterior margin of the shield, usually scapular setae (*sc*)

directed divergently back; empodia entire; legs with the usual segments, tibiae separate from tarsi; fastigial tarsal setae (*ft'*, *ft''*) present; solenidion elongate, slightly curved, rod-like; paraxial tibial setae (*I'*) absent; antaxial genual seta (*I''*) present; basiventral femoral setae (*bv*) present; all coxisternal setae, *Ib*, *Ia* and *2a* present; prosternal apodeme present; opisthosomal setae *h₁* minute; female genitalia not appressed to or separating the coxae; female genital coverflap with one rank of longitudinal ridges; anterior apodeme of the internal female genitalia folded up, appearing as a transverse line under phase contrast microscope in ventral view; opisthosoma evenly arched with all standard setae, dorsal annuli becoming broader towards the rear.

Assignment – Eriophyidae, Eriophyinae, Aceriini

Etymology – The generic name *Mangalaus* is masculine and is derived from the first name of Dr. Mangala Rai, under whose vision and direction, the Indian Council of Agricultural Research (ICAR) funds the Network Project on Insect Biosystematics; it is assigned in his honor and to recognize his interest and commitment towards this basic area of research.

Remarks – The new genus is assigned to the family Eriophyidae, subfamily Eriophyinae and tribe Aceriini, based on the characters as used in the key to genera by Amrine *et al.* (2003). Accordingly, *Mangalaus* can be separated from other genera of Aceriini as follows: from *Acaralox* Keifer, 1966 by the absence of a dorsal furrow on the opisthosoma; from *Distaceria* Flechtmann *et al.*, 1995 by the absence of smooth flat areas with crenulations on the dorsal annuli, although the prodorsal shield of *Mangalaus* has eye-like structures; from *Tetrameracarus* Huang, 2001, *Baileyna* Keifer, 1954 and *Phytoptochetus* Nalepa, 1917 by the lack of any ridges on opisthosoma; from *Acunda* Keifer, 1965b by the absence of mid-dorsal humps or annular thickenings on the opisthosoma; from *Keiferophyes* Mohanasundaram, 1983, *Aceria* Keifer, 1944, *Paraphytoptus* Nalepa, 1896 and *Paraphytoptella* Keifer, 1959 by the absence of paraxial tibial setae (*I'*); from *Acerimina* Keifer, 1957, *Ramaculus* Manson, 1984, *Scoletoptus* Meyer, 1992 and *Cenaca* Keifer, 1972 by the presence of the anterolateral seta on coxisternum I (*Ib*); and from *Acalitus* Keifer, 1965a by the presence of basiventral femoral setae (*bv*). Following this key, the new genus, *Mangalaus* is regarded to be more closely related to the genus *Notaceria* Mohanasundaram and Muniappan, 1990 and *Cymoptus* Keifer, 1946. The genus *Notaceria* is characterized by the presence of a minute basiventral femoral setae (*bv*) and antaxial genual setae (*I''*), lacks paraxial tibial setae (*I'*), has very minute or nearly absent fastigial tarsal setae (*ft'*, *ft''*), tarsal solenidion (ω) near mid-tarsus on leg I and basally on leg II. In contrast, basiventral

femoral setae (*bv*), antaxial genual setae (*l''*) and fastigial tarsal setae (*ft'*, *ft''*) are conspicuous and of normal length in *Mangalaus* and tarsal solenidion (ω) of both legs are placed near tarsal apex. In comparison to *Cymoptus*, *Mangalaus* is similar in the presence of fastigial tarsal setae (*ft'*, *ft''*), cylindrical tarsal solenidion (ω), absence of paraxial tibial setae (*l'*), presence of antaxial genual setae (*l''*) and basiventral femoral setae (*bv*), and all opisthosomal setae; however, differs in the presence of a well-defined ocellar region on prodorsal shield and distinct microtubercles on dorsal annuli.

Interestingly, another eriophyid mite, *Cosetacus sharadi* Menon *et al.*, 2009, of the subfamily Cecidophyinae was observed in the same erineum along with *Mangalaus*. While, the new genus has been placed in the subfamily Eriophyinae broadly based on the external morphological characters as defined in the key to genera by Amrine *et al.* (2003), the occurrence of another cecidophyid mite, in the same erineum is also suggestive of these mites possibly being alternate forms of each other. Considering the fact that both male and female forms of both these eriophyid mites exist and have been described and that they all occur in the same erineum simultaneously and not alternately, the presumption that these could be alternate forms of each other does not hold true. Also, *Mangalaus* distinctly differs from *Cosetacus* in the presence of a well-defined ocellar region on the prodorsal shield, female genital cover flap with longitudinal ridges in a single rank and the shape of the internal female apodeme, thus substantiating its placement in subfamily Eriophyinae. However, in view of the fact that these key characters have known not to hold true for all the genera defined under these subfamilies, a detailed phylogenetic analysis to confirm this placement becomes pertinent.

***Mangalaus bkapus* Menon n. sp.**
(Figs. 1–31)

Diagnosis – Empodia on tarsae I and II four-rayed; coxisternal plates I and II microtuberculated; coxisternal area with microtuberculated annuli; female genital cover flap with longitudinal ridges, central longitudinal ridges longer than those on sides. Setae *c2* just reaching base of setae *d*, which is 6 times longer than shortest setae *e*; very stout setae *f*; setae *h2* nearly 12 times as long as setae *h1*. Prodorsal shield with median line present, some specimens with anterior half of median line weak. Admedian lines outwardly concave, almost encasing median line, sometimes with forked terminal apices, and extending posteriorly and meeting median line in posterior region. First submedian line

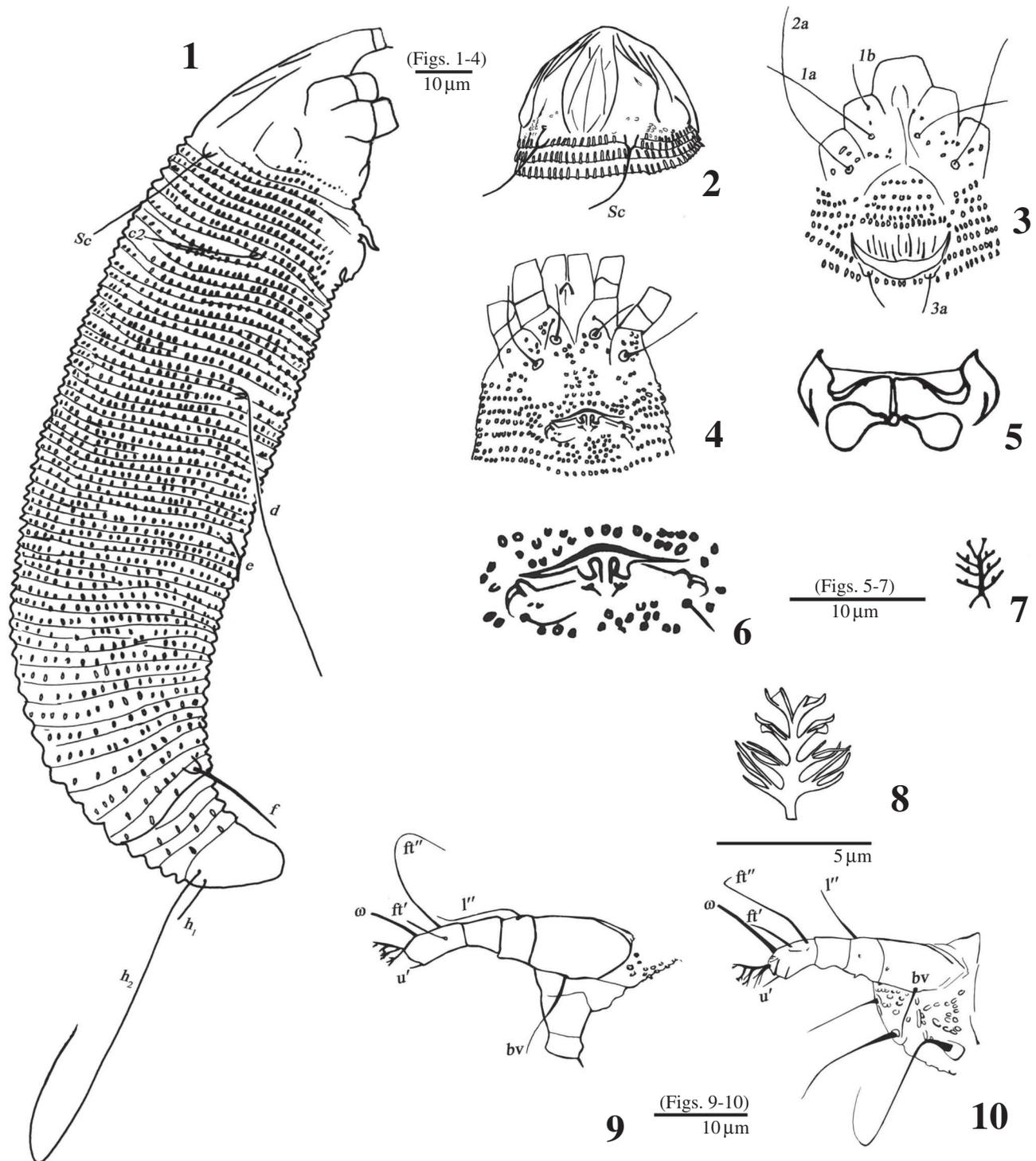
usually reaching tip of shield anteriorly and posteriorly; second submedian divided anteriorly and extending into the shield, submedian lines 3–5 present at anterior half of the shield. Ocellar structures present on the prodorsal shield (Figs. 15 and 17). Live mites are transparent to white.

FEMALE ($n = 10$) – Body vermiform, 191 (189.3 \pm 23.5; 161–245) long, 36 (41.1 \pm 1.5; 38–43) wide (Figs. 1, 13 and 14).

Gnathosoma – Projecting downward; dorsal pedipalp genual seta (*d*) present 3 (3.5 \pm 0.5; 3–4); chelicerae 12 (12.6 \pm 1.3; 10–15); gnathosoma 14 (11.7 \pm 1.1; 10–14) (Figs. 15 and 24).

Prodorsal shield – Subtriangular; 21 (23.8 \pm 1.2; 22–25) long, 32 (34.8 \pm 2.4; 32–38) wide; shield design with median line prominent from middle to posterior margin of shield, admedian lines concave outwardly, vase-like, bifurcate anteriorly and nearly meeting posteriorly, first submedian lines slightly curved, subscribing both median and admedian lines and converging to shield margin anteriorly and posteriorly, submedians (*sm*) 2–5 arising from the anterior shield margin: *sm2* forked at the anterior end, *sm3* extending diagonally into the shield outlining the inner edges of the ocellar structure, joined by *sm4* midway, *sm5* running laterally ending a little ahead of the ocellar region. Ocellar structures present on the lateral margins of shield (Figs. 2, 15–17). Scapular tubercles present near posterior margin of shield 15 (15.6 \pm 0.8; 14–17) apart, scapular setae (*sc*) directed posteriorly and divergent, *sc* 20 (21.6 \pm 0.9; 20–23), spanning 10 (11 \pm 1.2; 10–13) annuli behind the shield.

Legs – Lacking paraxial tibial setae (*l'*). Leg I 22 (24.5 \pm 1.9; 22–29); femur 6 (7.2 \pm 0.6; 6–8), basiventral femoral seta (*bv*) 6 (6 \pm 1.8; 5–10); genu 3 (3.3 \pm 0.6; 3–5), antaxial genual seta (*l''*) 12 (14.5 \pm 1.9; 12–18); tibia 4 (4.3 \pm 0.4; 4–5), paraxial tibial seta (*l'*) absent; tarsus 5 (5.5 \pm 0.8; 4–7), solenidion (ω) 6 (6.9 \pm 0.7; 6–8), slightly curved, without knob; empodium 4 (3.8 \pm 0.4; 3–4), four-rayed, each ray further branched- third and fourth ray with three branches each and first and second ray with two branches each, of which one has a spatula-like distal end (Figs. 7, 8, 18, 19 and 21), paraxial fastigial tarsal seta (*ft'*) 4 (4.5 \pm 1.1; 3–7), antaxial fastigial tarsal seta (*ft''*) 14 (15.7 \pm 2.5; 10–18), paraxial unguinal seta (*u'*) 3 (2.5 \pm 0.5; 2–3) (Figs. 9, 18–21). Leg II 21 (21.8 \pm 1.6; 19–25); femur 6 (6.6 \pm 1.0; 5–8); basiventral femoral setae (*bv*) 6 (5.9 \pm 0.6; 5–7); genu 3 (3.1 \pm 0.3; 3–4), antaxial genual seta (*l''*) 5 (6.3 \pm 1.4; 5–10); tibia 3 (3.6 \pm 0.3; 3–4); tarsus 5 (5.1 \pm 0.5; 4–6), solenidion (ω) 9 (9 \pm 1.1; 9–10), slightly curved, without knob, empodium 4 (3.6 \pm 0.6; 3–5), four-rayed, paraxial fastigial tarsal seta (*ft'*) 4 (4.5 \pm 0.5; 4–5), antaxial fastigial



Figs. 1–10. *Mangalauis bkapus* n. gen. n. sp. – 1. lateral view, ♀; 2. dorsal shield design; 3. coxisternal area and genitalia, ♀; 4. coxisternal area and genitalia, ♂; 5. genital apodeme, ♀; 6. close up of genitalia, ♂; 7. empodium (as seen in light microscope); 8. empodium (as seen in SEM photos); 9. leg I; 10. leg II. Scale. All figures are 10 μm except for Fig. 8 scale = 5 μm.

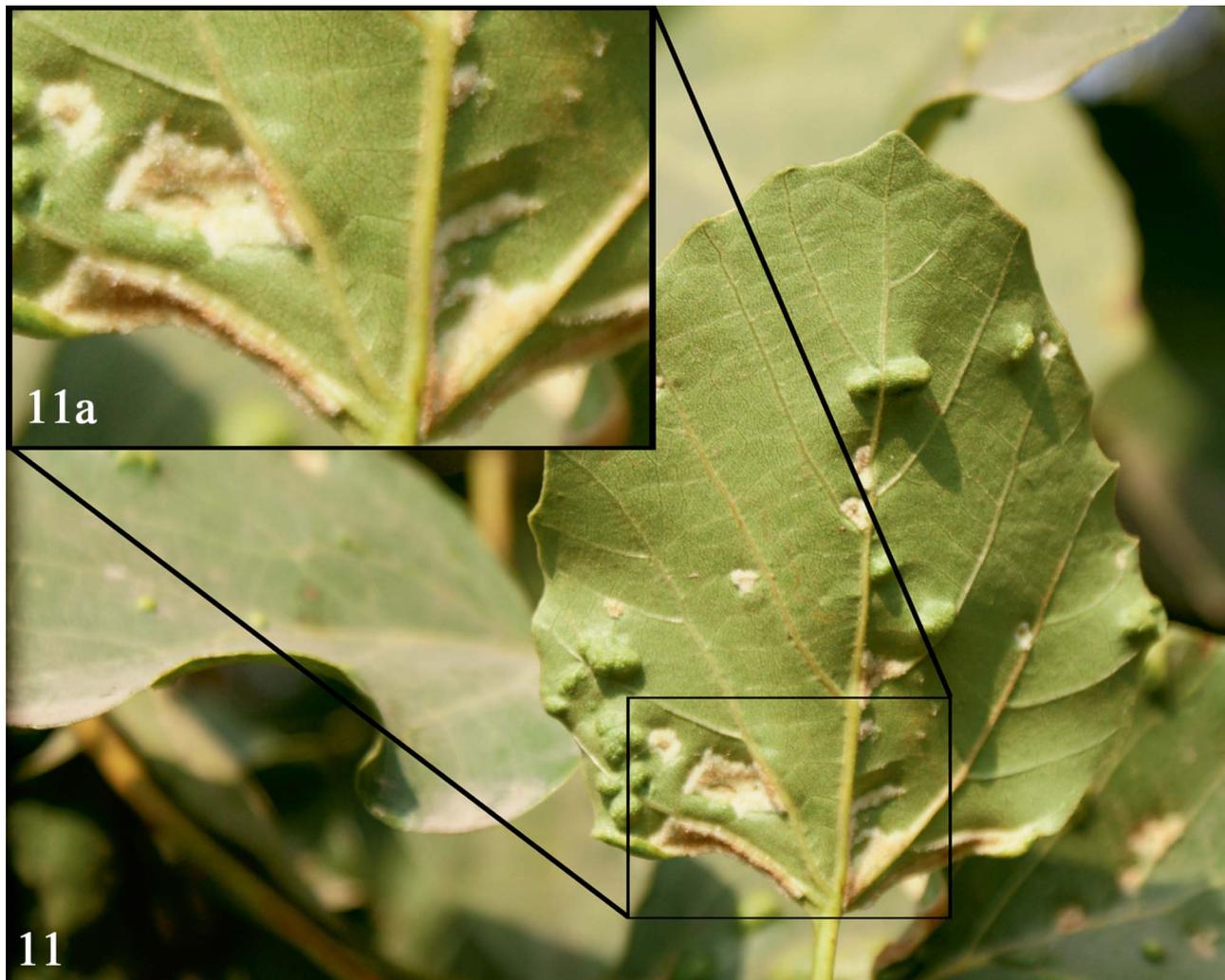
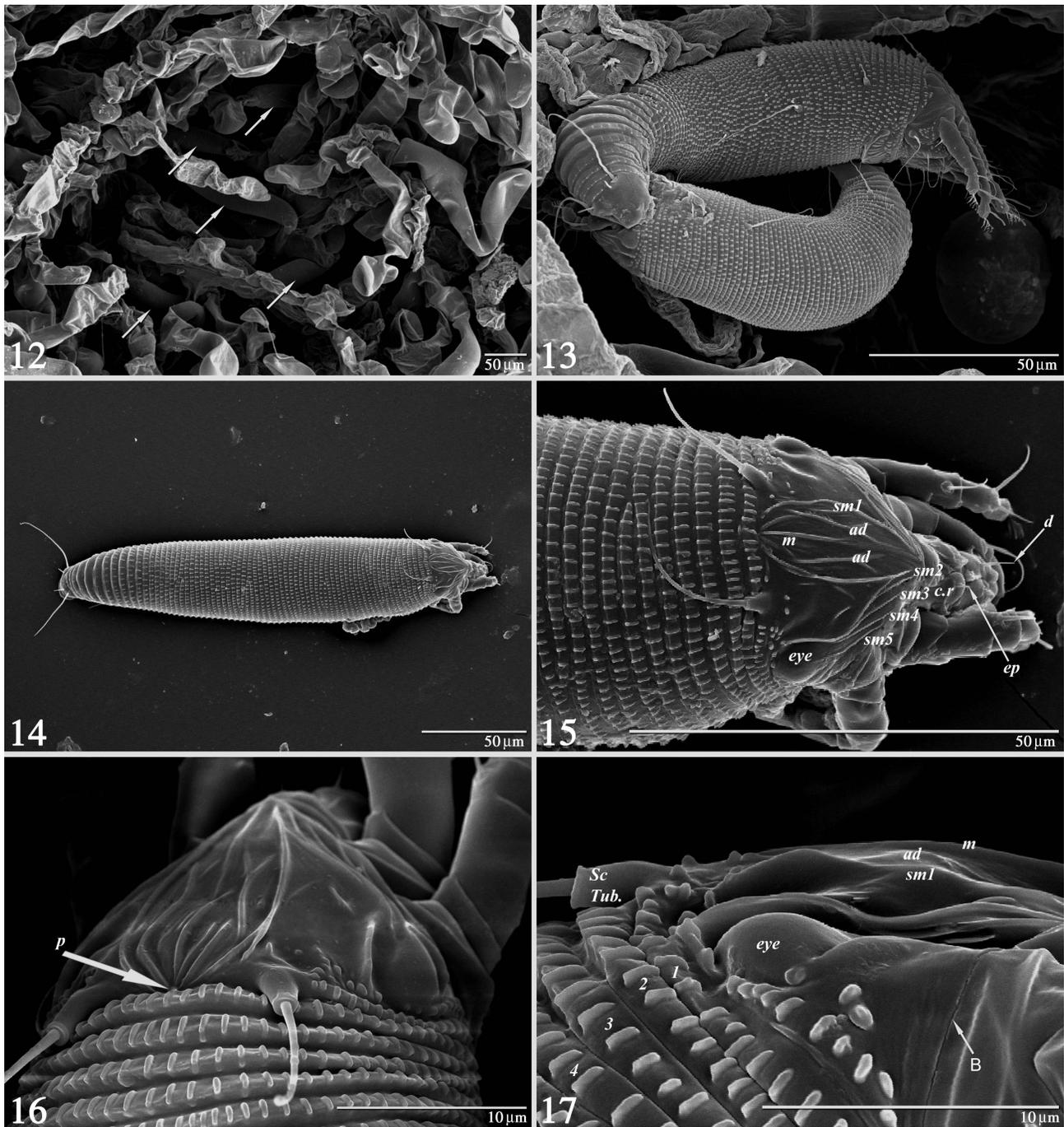


Fig. 11 and 11a. 11. Dome galls and erineum on underside of *Cordia dichotoma* leaf; 11a. close up of erineum on underside of *C. dichotoma* leaf from Fig. 11.

tarsal seta (*ff''*) 13 (15.5 ± 1.9 ; 12–18), paraxial unguinal seta (*u'*) 3 (3 ± 1 ; 2–4) (Figs. 10, 18–20). Legs I and II: Short spur-like structures are present on the ventral side of the distal area of the tarsus (I, II) (Figs. 19 and 21). Femora and genua with 3–5 short spines, while tibiae with 2–4 short spines (Figs. 18–21); these structures visible only in the LT-SEM micrographs. Coxisternal apodeme present; coxal area microtuberculated with very few short lines; anterolateral seta on coxisternum I (*lb*) 7 (7.5 ± 1.2 ; 5–9), 7 (6.7 ± 1.1 ; 5–9) apart; proximal seta on coxisternum I (*la*) 21 (20.9 ± 2.4 ; 18–26), 8 (7.8 ± 0.4 ; 7–8) apart; proximal seta on coxisternum II (*2a*) 30 (32.6 ± 2.8 ; 29–36), 18 (17.2 ± 1.1 ; 16–20) apart (Figs. 3 and 18). Coxisternal area with five to six annuli separating coxae from genital coverflap (Figs. 3, 18, 22 and 23).

Genitalia – Coverflap 12 (10.2 ± 2.7 ; 8–17), 16 (17 ± 1.3 ; 15–18) wide, with a transverse irregular row of large microtubercle-like nodules forming a pseudo-annulus at coverflap base, distal coverflap with 10–12 longitudinal ridges in a single rank; proximal seta on coxisternum III (*3a*) 6 (5.2 ± 1 ; 3–6) (Figs. 3, 18, 22 and 23). Genital apodeme transverse (Fig. 5).

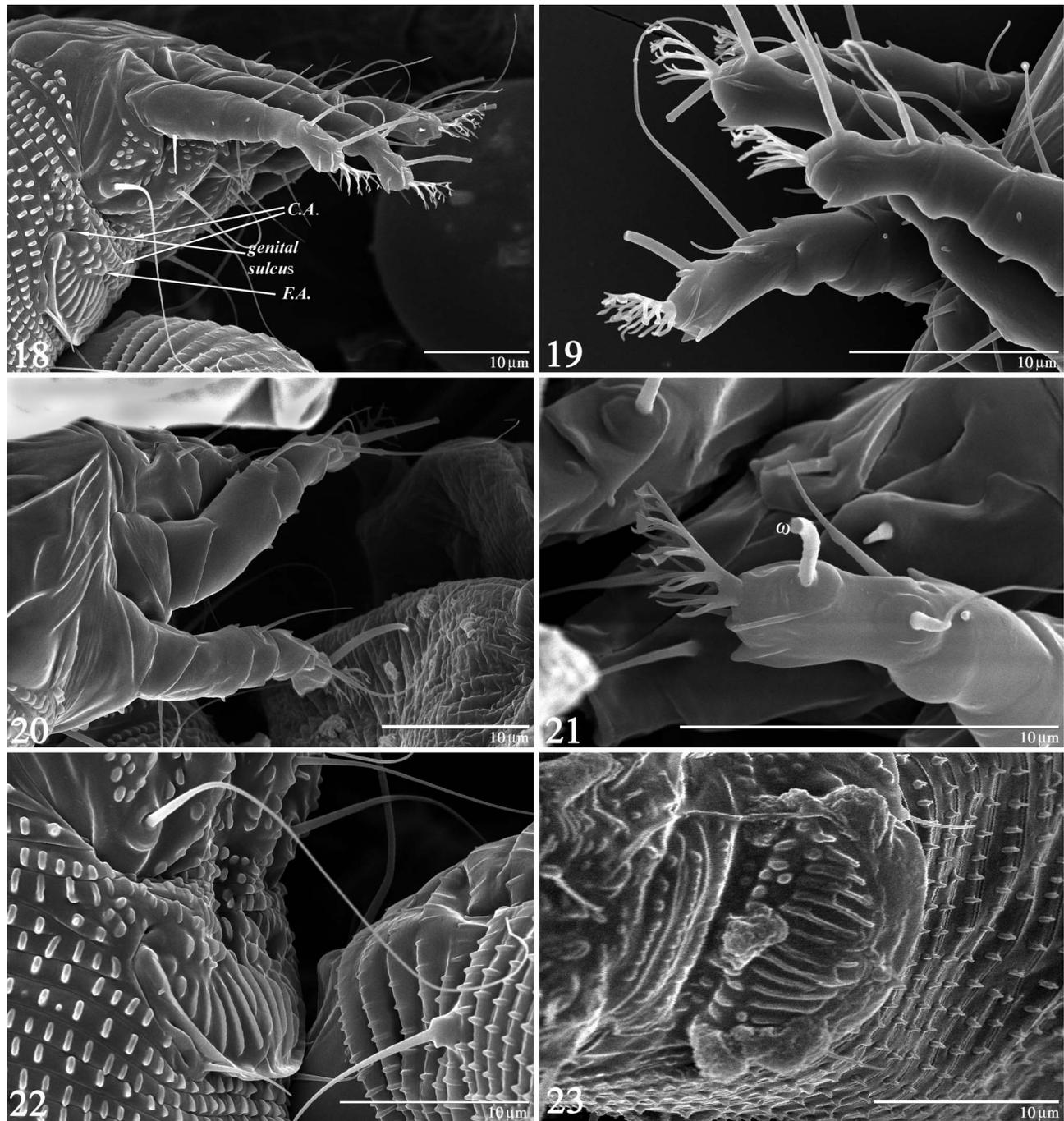
Opisthosoma – Annuli subequal and continuous dorsoventrally (Figs. 1, 13 and 14). Opisthosomal seta (*c2*) 17 (17 ± 0.9 ; 15–18) on annulus 9 (9.2 ± 0.4 ; 9–10) from the first complete ventral ring. Opisthosomal setae (*d*) 45 (48.4 ± 3.3 ; 41–53), 30 (29.5 ± 1.9 ; 26–32) apart, on annulus 21 (21.1 ± 1.5 ; 20–24); opisthosomal setae (*e*) 10 (9.1 ± 0.9 ; 8–10), 18 (17.5 ± 1.1 ; 16–19) apart, on annulus 34 (34.7 ± 2.8 ; 32–40); opisthosomal setae (*f*) 19 (16.3 ± 1.4 ; 16–19), 13 (15 ± 1.7 ; 13–19) apart, on



Figs. 12–17. *Mangalaus bkapus* n. gen. n. sp. – 12. erineum, arrows point to mites; 13. erineum with mite; 14. body, dorsum; 15. shield design, m = median line, ad = admedian line, sm = submedian line, c.r. = cheliceral retainer, ep = pedipalp coxal dorsal seta, d = dorsal pedipalp genual seta; 16. lateral shield with ocellar region, p = pit; 17. ocellar region, lateral view, B = boundary of prodorsal shield, Sc. Tub. = base tubercle of scapular seta.

annulus 56 (55.9 ± 4.6 ; 52–65). Dorsal and ventral annuli semi-circular and subequal. Total ventral annuli 60 (59.2 ± 5.3 ; 54–69), microtuberculate, microtubercles more or less oval; total dorsal annuli

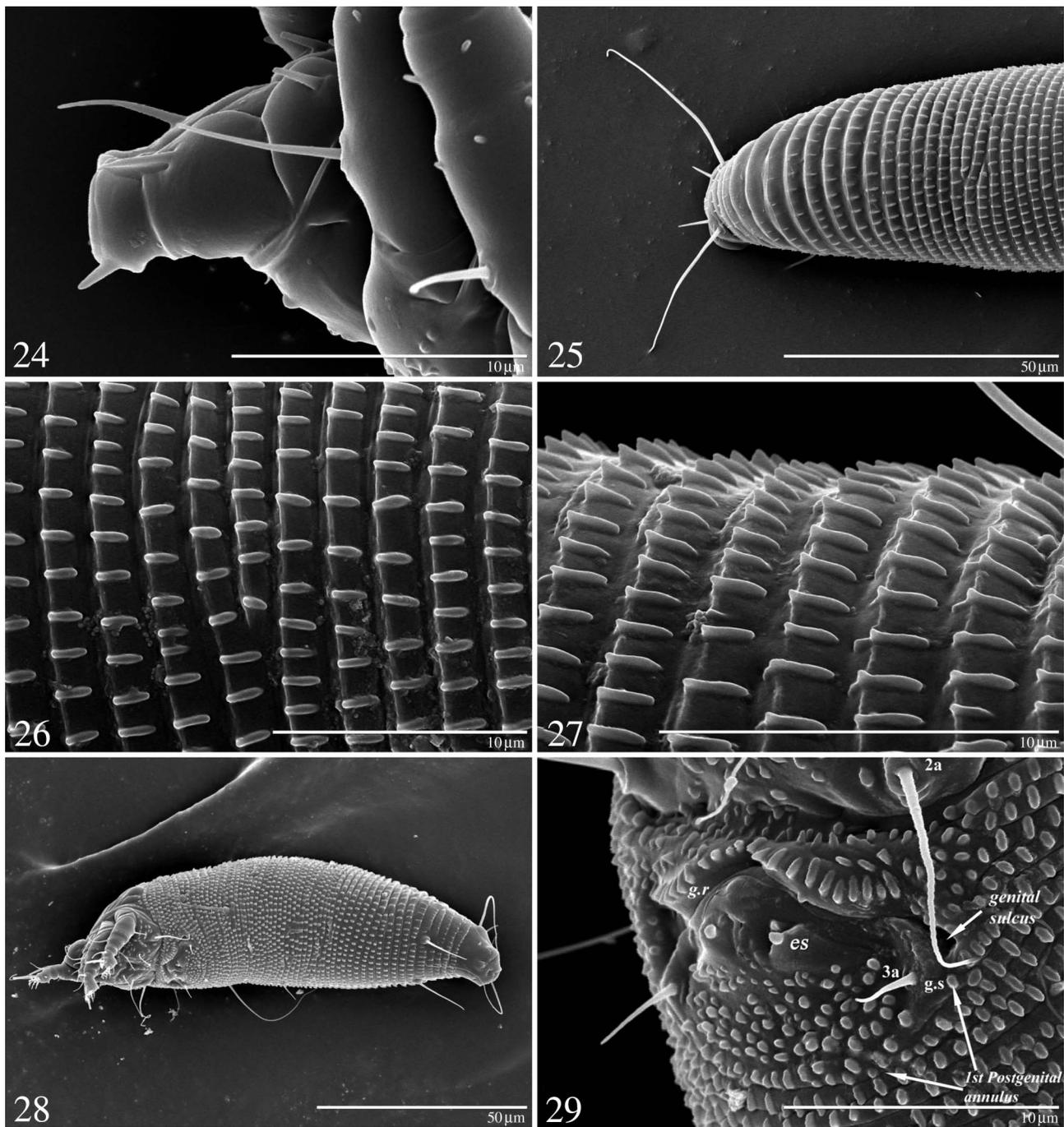
64 (64.2 ± 4.7 ; 59–76), microtuberculate, microtubercles elongate and narrow with distal sharp edge (Figs. 26 and 27). Beyond setae *f* with annuli 52–59 wider, with narrowing microtubercles, widely spaced, fewer in



Figs. 18–23. *Mangalaus bkapus* n. gen. n. sp. – 18. legs, coxisternal region and genitalia, lateral view, ♀, C.A. = coxi-genital annuli, F.A. = false annulus; 19. leg I and II, lateral view; 20. leg I and II, dorsal view; 21. tarsal elements, leg II, ω = tarsal solenidion; 22. genitalia, lateral view, ♀; 23. genitalia, ♀.

number and six rear annuli mostly without microtubercles; opisthosomal seta (*h2*) 85 (85.1 ± 4.9 ; 78–90), opisthosomal seta (*h1*) 6 (6.5 ± 0.8 ; 5–8) (Fig. 25).

MALE ($n = 10$) – Similar to female, except for genitalia. 155 \pm 19.9 (124–158) long, 38.4 \pm 5.1 (31–45) wide (Fig. 28).



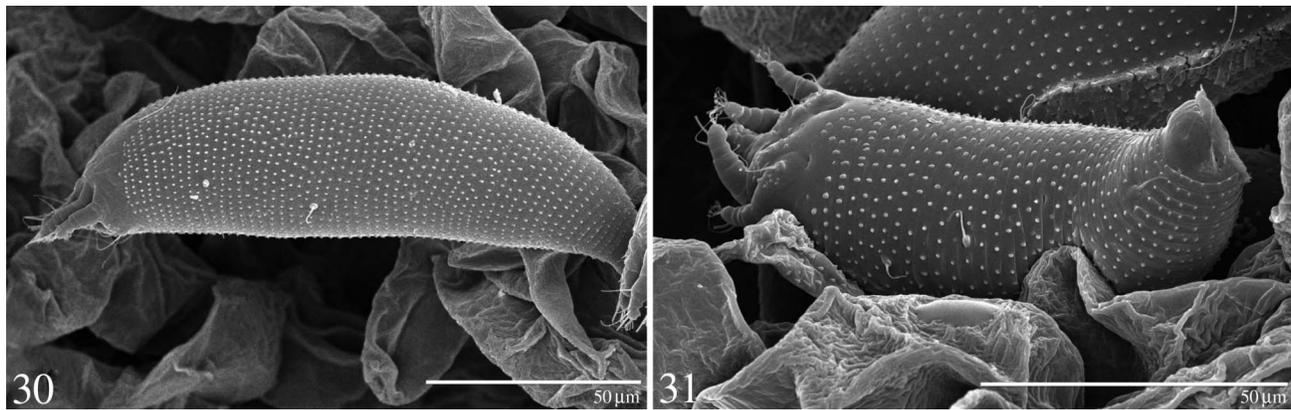
Figs. 24–29. *Mangalaua bkapus* n. gen. n. sp. – 24. palpi, lateral view; 25. opisthosoma, posterior end, ♀; 26. and 27. dorsal microtubercles; 28. ventral body, lateral view, ♂; 29. genitalia, lateral view, ♂, *es* = eugenital seta, *g.r.* = genital ridge, *g.s.* = genital shield, bearing seta *3a*. ♂.

Gnathosoma – Downward projecting; dorsal pedipalp genual seta present; chelicerae 12.2 ± 0.4 (12–13); gnathosoma 11.2 ± 0.7 (10–12).

Prodorsal shield – 20.6 ± 1.3 (19–22), 29.8 ± 4.2 (24–37) wide; scapular tubercles present 15 ± 1.4 (13–17) apart,

scapular seta (*sc*) divergent and posteriorly directed; 17.2 ± 1.9 (15–20), spanning 9.4 ± 0.4 (9–10) annuli. Prodorsal shield with pattern similar to that of female.

Legs – Paraxial tibial seta (*l'*) lacking. Leg I 22.4 ± 1.3 (20–24); femur 5.6 ± 0.8 (4–6), basiventral



Figs. 30–31. *Mangalauus bkapus* n. gen. n. sp. – 30. nymph, lateral view; 31. immature stage (probably larva), ventral view.

femoral seta (*bv*) 4.6 ± 0.4 (4–5); genu 3 ± 0 (3), antaxial genual seta (*l''*) 11.8 ± 1.6 (10–14); tibia 3.8 ± 0.4 (3–5), tarsus 4.4 ± 0.4 (4–5), solenidion (ω) 6.8 ± 0.9 (5–8), slightly curved, without knob, empodium 4 ± 0 (4), four-rayed, paraxial fastigial seta (*ft'*) 3.8 ± 0.7 (3–5), antaxial fastigial seta (*ft''*) 12.6 ± 1.6 (10–15), paraxial unguinal seta (*u'*) 2.2 ± 0.4 (2–3). Leg II 16 ± 0.8 (15–17); femur 5.2 ± 0.4 (5–6); basiventral femoral seta (*bv*) 5 ± 0.8 (4–6); genu 2.2 ± 0.4 (2–3), antaxial genual seta (*l''*) 6.5 ± 3.6 (2–12); tibia 3.2 ± 0.4 (3–4); tarsus 4.2 ± 0.4 (4–5), solenidion (ω) 9.4 ± 0.8 (8–10), slightly curved, without knob, empodium 3.8 ± 0.4 (3–4), four-rayed, paraxial fastigial seta (*ft'*) 2.7 ± 0.4 (2–3), antaxial fastigial seta (*ft''*) 13 ± 1.6 (11–15), paraxial unguinal seta (*u'*) 2 ± 0.7 (1–3). Coxae I apparently fused; anterolateral seta on coxisternum I (*Ib*) 5.2 ± 1.6 (4–8), 7.2 ± 0.8 (6–8) apart; proximal seta on coxisternum I (*Ia*) 12.4 ± 1.9 (10–16), 7.2 ± 0.7 (6–8) apart; proximal seta on coxisternum II (*2a*) 23.8 ± 5.1 (16–30), 15.4 ± 0.08 (14–16) apart (Figs. 4 and 28).

Genitalia – 15.4 ± 1.3 (6–11) wide, 8.8 ± 1.9 (7–11) long; proximal seta on coxisternum III (*3a*) 3.6 ± 0.8 (3–5). A pair of eugenital setae (*es*) just posterior to the genital ridge within the genital cavity, setae short and rounded apically, set on broad, flexible tubercles; cuticle between bases of setae *3a* sculptured with numerous nodules (ca. 85) resembling microtubercles of annuli; size range is variable (Figs. 4, 6, 28 and 29).

Opisthosoma – Opisthosomal seta (*c2*) 13 ± 2.3 (10–17), on annulus 8.4 ± 1 (7–10) from the first complete ventral annulus. Opisthosomal seta (*d*) 31.8 ± 3.6 (25–35), 30.4 ± 3.6 (25–36) apart, on annulus 17.6 ± 1 (16–19); opisthosomal seta (*e*) 5.2 ± 1.1 (4–7), 18 ± 1.8 (16–21) apart, on annulus 29 ± 1.4 (27–31); opisthosomal seta (*f*) 11 ± 1.5 (10–14), 12.4 ± 1.3 (10–14) apart, on annulus 48.4 ± 1.8 (46–51) (Fig. 28). Total ventral annuli 52.8 ± 2.6 (50–57), microtuberculate; total

dorsal annuli 55 ± 5.2 (48–61), microtuberculate. Opisthosomal seta (*h2*) 51.6 ± 4 (47–57); opisthosomal seta (*h1*) 5 ± 1 (4–7) (Fig. 28).

NYMPH ($n = 5$) – 145 ± 16 (126–165) long, 42 ± 3 (40–46) wide (Fig. 30).

Gnathosoma – Chelicerae 13 ± 1 (12–14); gnathosoma 8.8 ± 1 (8–10).

Prodorsal shield – 20 ± 1 (18–20) long, 30 ± 1 (28–30) wide; scapular tubercles present near posterior margin of shield on nearly 2nd and 3rd annuli, scapular seta (*sc*) divergent and posteriorly directed; *sc* 14 ± 0.5 (14–15). Ocellar structures absent.

Legs – Leg I 15 ± 0.5 (15–16); femur 4.5 ± 0.6 (4–5), basiventral femoral seta (*bv*) 2 ± 0 (2); genu 2 ± 0 (2), antaxial genual seta (*l''*) 9 ± 1.2 (8–10); tibia 2.5 ± 0.6 (2–3), paraxial tibial seta (*l'*) absent; tarsus 3.5 ± 0.6 (3–4), solenidion (ω) 4.8 ± 0.5 (4–5), without knob, empodium 3.8 ± 0.5 (3–4), four-rayed, paraxial fastigial seta (*ft'*) 3.3 ± 0.6 (4–5), antaxial fastigial seta (*ft''*) 8.8 ± 1 (8–10), paraxial unguinal seta (*u'*) not visible. Leg II 15 ± 0.6 (14–15); femur 4.5 ± 0.6 (4–5); basiventral femoral seta (*bv*) 1.8 ± 0.5 (1–2); genu 2.8 ± 0.5 (2–3), antaxial genual seta (*l''*) 3.8 ± 0.5 (3–4); tibia 2.8 ± 0.6 (2–3); tarsus 3 ± 0.8 (2–4), solenidion (ω) 6 ± 0 (6), without knob, empodium 4 ± 0 (4), four-rayed, paraxial fastigial seta (*ft'*) minute, antaxial fastigial seta (*ft''*) 7.5 ± 1 (6–8), paraxial unguinal seta (*u'*) minute, anterolateral seta on coxisternum I (*Ib*) not visible; proximal seta on coxisternum I (*Ia*) 9.3 ± 2.5 (8–13); proximal seta on coxisternum II (*2a*) 18 ± 3.3 (15–22).

Genitalia – Absent.

Opisthosoma – Opisthosomal setae (*c2*) 8.5 ± 2.6 (5–11), on annulus 10 ± 1 (9–11). Opisthosomal setae (*d*) 23 ± 1.9 (20–24), on annulus 21 ± 2 (18–23); opisthosomal setae (*e*) inconspicuous, 1 ± 0 (0.5–1.5), on annulus 30 ± 1 (29–31); opisthosomal setae (*f*)

10 ± 1.3 (9–12), on annulus 50 ± 4 (46–53). Total ventral annuli 53 ± 3.9 (50–58), microtuberculate; total dorsal annuli 61 ± 1 (60–62), microtuberculate. Opisthosomal setae (*h2*) 28 ± 4.8 (25–35); opisthosomal setae (*h1*) 2.3 ± 1 (2–4).

LARVA (*n* = 5) – Similar to nymph, 60–70 long (Fig. 31). Prodorsal shield without ocellar structures. First 2–3 annuli absent dorsally, the area dorsally behind the posterior shield margin of the prodorsum smooth. Microtubercles slightly rounded and less condensed than the nymph.

Type material – Holotype female, 50 female, 15 male paratypes, 5 nymphs and 5 larvae from *Cordia dichotoma* (Boraginaceae), Indian Agricultural Research Institute (IARI), New Delhi, India, coll. Pratibha Menon, 7 March 2008, mounted on 15 microscopic slides deposited in the National Pusa Collection (NPC), IARI. The holotype is marked with a circle on the slide. Additionally, six paratypes on five slides will be deposited in the Insect and Mite National Collection, National Museum of Natural History (NMNH), Smithsonian Institution located at USDA, ARS, SEL, Beltsville, Maryland, USA.

Relation to host – *Mangalauus bkapus* has been observed in large numbers along with *Cosetacus sharadi* in erineum. *Mangalauus bkapus* is considered the principle cause of the production of erineum, however, further study is necessary to prove this conclusively. The erineum first appears in small patches of no particular shape, on both surface of leaf, though more abundant on the ventral surface, expanding progressively in area and depth, with a corresponding bulge on the opposite leaf surface. It is whitish, gradually turning brown as it ages. The mites were observed hidden in the hair-like outgrowth of the erineum (Figs. 11, 11a, 12 and 13).

Etymology – The specific name *bkapus* is masculine and derived from Bhartiya Krishi Anusandhan Parishad (BKAP) also called the Indian Council of Agricultural Research (ICAR), which funds the Network Project on Insect Biosystematics, at the Division of Entomology, IARI, New Delhi, India. The senior author, Pratibha Menon, is the sole authority for the genus and species.

DISCUSSION

Many eriophyid mites are associated with *Cordia* spp., and confusion exists about the distinction of the species. A total of 20 eriophyid species have been described, most of them are associated with some gall-erineum. However, there is a high possibility that many of these species are synonyms, particularly those described in the genus *Aceria* (Table 1).

The key characters which separates *M. bkapus* from all known described species for *Cordia* spp. are the absence of tibial setae on legs I and II and the presence of an ocellar region on the prodorsum shield of the adults. A comprehensive collection of the many eriophyid species which occur on *Cordia* spp. is needed with a detailed study of the morphology of the mites in addition to a careful documentation of the host-plant data.

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