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A new species of *Eustigmaeus* Berlese (Acari: Stigmaeidae) from Brazil

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Original research

ABSTRACT

A new species of Stigmaeidae (Acari: Trombidiformes), namely *Eustigmaeus crassifolius* Bizarro & Johann **n. sp.**, is described and illustrated based on females collected on *Byrsonima crassifolia* (L.) Kunth (Malpighiaceae) in Belém city (1°26′09.2″ S 48°26′28.6″ W), Pará state, Brazil. A dichotomous key of Brazilian species of *Eustigmaeus* genus is provided.

Keywords *Byrsonima crassifolia*; murici; Raphignathoidea; Embrapa
Zoobank http://zoobank.org/CED8BACF-97B2-4280-BF32-35A181428A3E

Introduction

The predaceous stigmaeid mites (Acari: Stigmaeidae) are cosmopolitan, worldwide distributed and with a huge morphologic diversity (Krantz and Walter, 2009). Stigmaeidae is the largest group belonging to the superfamily Raphignathoidea and includes 608 species of 33 valid genera, among them, the genus *Eustigmaeus* Berlese comprises of 131 species to date (Fan *et al.* 2016; 2019; Akyol, 2019).

The genus *Eustigmaeus* is the second-largest within Stigmaeidae, characterized by a dorsoventrally globate body with dorsal shields strongly ornamented with dimples. They are found in soil, mosses and litter habitats (Krantz & Walter, 2009). Four species of *Eustigmaeus* genus are described for Brazil: *E. bryonemus* Flechtmann, 1985 from moss, *E. microsegnis* (Chaudhri, 1965) from leaf debris, mosses, soil, *Pinus* spp. and rocks, *E. oliveirai* Paktinat-Saeij & Bagheri, 2016 from humus on unidentified tree and *E. piracicabensis* Paktinat-Saeij & Bagheri, 2016 from soil and humus under rubber trees (*Hevea brasiliensis* L., Euphorbiaceae) Fan *et al.* (2016; 2019). This paper describes *Eustigmaeus crassifolius* **n. sp.** found on *Byrsonima crassifolia* (L.) Kunth. (Malpighiaceae) and a dichotomous key of Brazilian species of *Eustigmaeus* is provided.

Material and methods

Study area

Leaf collections were carried out in crop clones of *Byrsonima crassifolia* located in experimental area of Embrapa Amazônia Oriental, where no chemical management was applied. The sampled area was located in the municipality of Belém (1°26′09.2″ S 48°26′28.6″ W), Pará state, Brazil. A total of 200 leaves were collected per month between V/23/2012 and XI/03/2014 and kept in plastic bags in a refrigerated box for transportation.

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Laboratory activities

The abaxial and adaxial surfaces of the leaves were examined and mites were collected under a stereomicroscope (Leica S6E), mounted in Hoyer's medium and identified under phases contrast microscope (Zeiss Imager.Z2) based on Fan *et al.* (2016) and Paktinat-Saeij *et al.* (2016). The species was illustrated using a lucid camera and processed in Corel-DRAW X8®. All measurements are shown in micrometers and were taken with Zeiss Zen Imaging Software. For each structure, measurement of the holotype is presented, followed by the ranges for the paratypes (in brackets). Body length measurements represent the distance between base of gnathosoma and posterior end of idiosoma; width was measured at the broadest level; gnathosoma including palp. Setae were measured from the insertion base to the tip of the seta; distances between setae were measured between setal insertions. Leg measurements are from the coxa base to tip of tarsal claw. The terminology and nomenclature follows Kethley (1990).

Systematic

Family Stigmaeidae Oudemans 1931

Genus *Eustigmaeus* Berlese, 1910

Type species *Eustigmaeus kermesinus* (Koch, 1841)

Eustigmaeus crassifolius Bizarro & Johann n. sp.

Zoobank: E20A82AA-CDA9-4950-BFFA-C128AE36178F

Description Female (n = 6) — **Dorsum of idiosoma** – (Fig. 1A). Length of idiosoma 257 (245–262); width 213 (202–222); it is covered by two large shields, leaving exposed margin of unsclerotized cuticle around edges; shield ornamentation consists of asymmetrical oval dimples composed by small circles of equal sizes, dimples bearing vacuoles (Fig. 1B and Fig. 3). Prodorsal shield triangular and bearing four pairs of feather-like setae (*vi*, *ve* (Fig. 1D), *sci* and *sce*) and one pair of eyes between setae *ve* and *sci*. Humeral shields with bigger, irregular dimples and *c2* inserted on it; hysterosomal shield with six pairs of feather-like setae (*c1*, *d1*, *d2*, *e1*, *e2* and *f1* (Fig. 1E)); dorsal body setae inserted on tubercles. Length of dorsal setae: *vi* 50 (47–53); *ve* 56 (50–60); *sci* 46 (44–50); *sce* 54 (52–59); *c1* 55 (49–55); *c2* 50 (47–52); *d1* 57 (55–57); *d2* 56 (52–57); *e1* 53 (49–60); *e2* 57 (52–60); *f1* 53 (50–55); *h1* 31 (29–35); *h2* 23 (23–24). Distances between dorsal setae: *vi–vi* 18 (14–19); *ve–ve* 62 (61–65); *vi– ve* 28 (23–31); *ve–sci* 28 (28–29); *sci–sci* 110 (108–113); *sce–sce* 144 (142–148); *sci–sce* 33 (32–36); *c1–c1* 70 (63–76); *c1–d1* 38 (36–40); *c1–c2* 66 (62–75); *c1–d2* 54 (53–58); *c2–c2* 189 (185–247); *d1–d1* 60 (57–67); *d1–d2* 52 (48–53); *d1–e1* 61 (61–67); *d1–e2* 62 (58–64); *d2–d2* 162 (154–162); *d2–e2* 59 (58–60); *e1–e1* 55 (52–56); *e1– e2* 40 (39–44); *e2–e2* 130 (122–131); *e1–f1* 43 (40–47); *f1–f1* 48 (44–51); *h1–h1* 21 (20–21); *h2–h2* 62 (58–66); *h1–h2* 20 (19-21).

Venter of idiosoma – (Fig. 1C). Endopodal plates, smooth, fused, separated by transverse striae between coxae II and III, bearing three pairs of setae (*1a*, *3a* and *4a*).

Anogenital area with unsclerotized smooth shield fused to the suranal shield; genital area with one pair of aggenital (*ag1)* and three pairs of pseudanal (*ps1–ps3*) setae, all slightly serrate to smooth; genital opening surrounded with striae. Suranal area unsclerotized, bearing irregular oval dimples equal to humeral shield situated dorsoventrally and bearing *h1* and *h2* setae. Measurements of setae: *1a* 13 (12–14); *3a* 11 (11–12); *4a* 12 (11–16); *ag1* 12 (11–14); *ps1* 13 (13–15); *ps2* 12 (11–12); *ps3* 11 (10–12).

Gnathosoma – Length 77 (66–84); subcapitulum bearing smooth subcapitular setae *m* 9 (8–10) and *n* 8 (8–9) and adoral setae *or1* 8 (7-8) and *or2* 7 (7-8). Palp 66 (62–74) long (Fig. 2E) five segmented; with thick smooth and serrate setae; palptrochanter without setae; palpfemur with three setae (*d, v* and *l*); palpgenu with two setae (*l* and *d*); palptibia with two setae (*l* and *d*) + one well-developed claw; palptarsus with five tactile setae (l', l'', *v*, *lp* and *va*) + one solenidion (ω) and one distal trifurcate eupathidium ($ul\xi$+$sul\xi$).

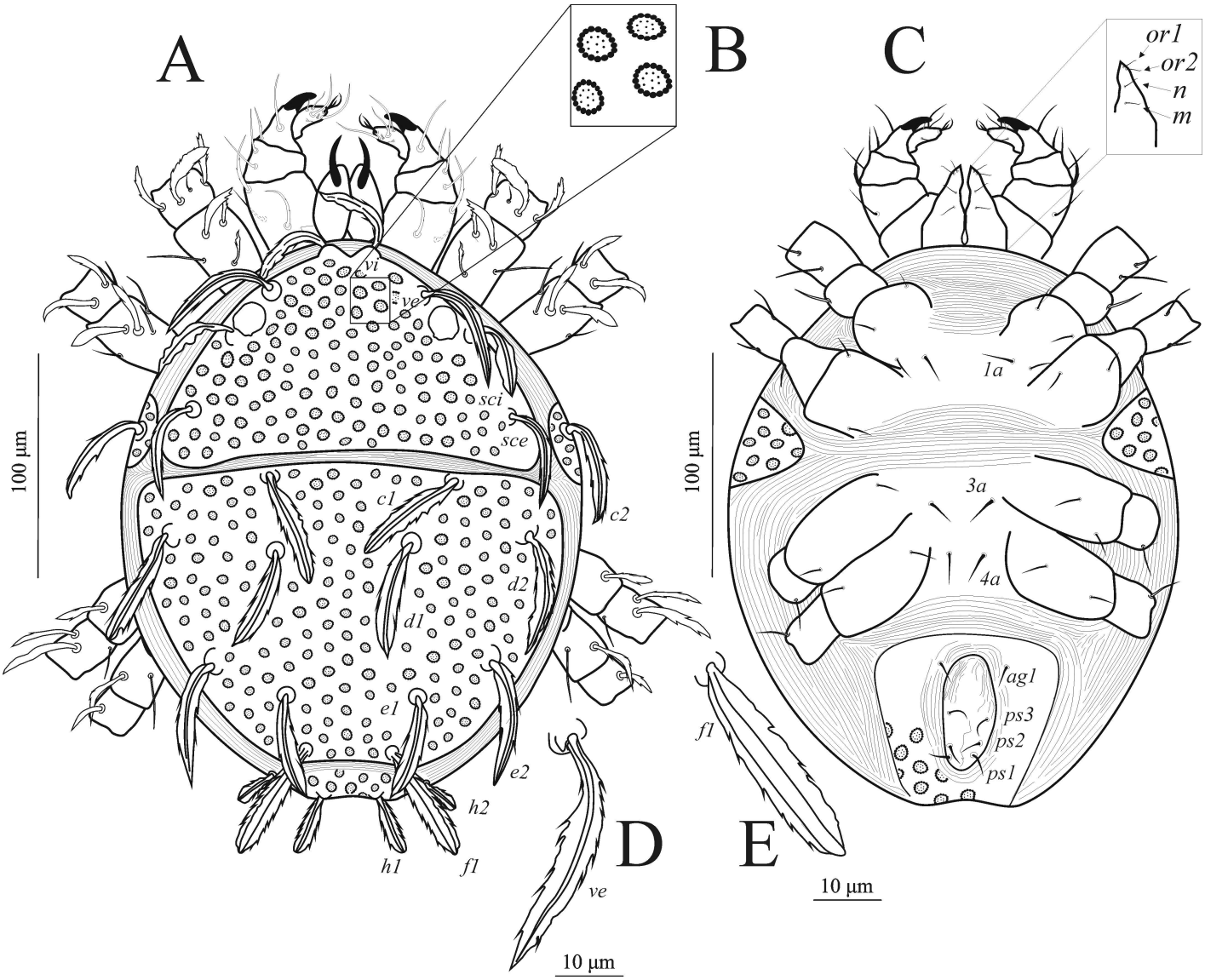


Figure 1 *Eustigmaeus crassifolius* Bizarro & Johann **n. sp.** (female) A – Dorsal view of idiosoma; B – Close up to the dimples; C – Ventral view of idiosoma and subcapitulum; D – *ve* setae; E – *f1* setae.

Legs – (Fig. 2A-D) Length of legs I–IV: 176 (165–176); 161 (142–161); 125 (119–135); 174 (151–174); with smooth to slightly serrate and thick leaf-like setae. Leg chaetotaxy as follows: coxae (excluding *1a*, *3a* and *4a*) 3-2-2-2, trochanters 2-1-2-1, femora 5-5-2-2, genua 3(1κ)-3-1-1, tibiae 5(1φ)-4-4-4, tarsi 12(1ω)-7(1ω)-6(1ω)-6. Length of solenidion: ωI 19 (18–22), φ 10 (9-11); ωII 18 (20–23); ωIII 13 (12–14).

Immature stages and male — Unknown.

Remarks — The new species resembles *Eustigmaeus floridensis* Maake, Ueckermann & Childers 2016 by having recurved, acute and feather-like dorsal setae, dorsal ornamentation with oval dimples, same number of aggenital and pseudoanal setae and suranal shield smooth with rounded ornamentation bearing *h1* and *h2*. The new species differs from *E. floridensis* by having less setae in tarsi I 13(1) in *E. floridensis vs* 12(1) in *E. crassifolius* **n. sp.**; larger outlined dimples associated with *sce*, *d2* and *e1* setae present in *E. floridensis* but absent in *E. crassifolius* **n. sp.**; pseudoanal and aggenital setae thick and strongly serrated in *E. floridensis* but slightly serrated to smooth in *E. crassifolius* **n. sp.**; palptibia in *E. floridensis* with small spine-like

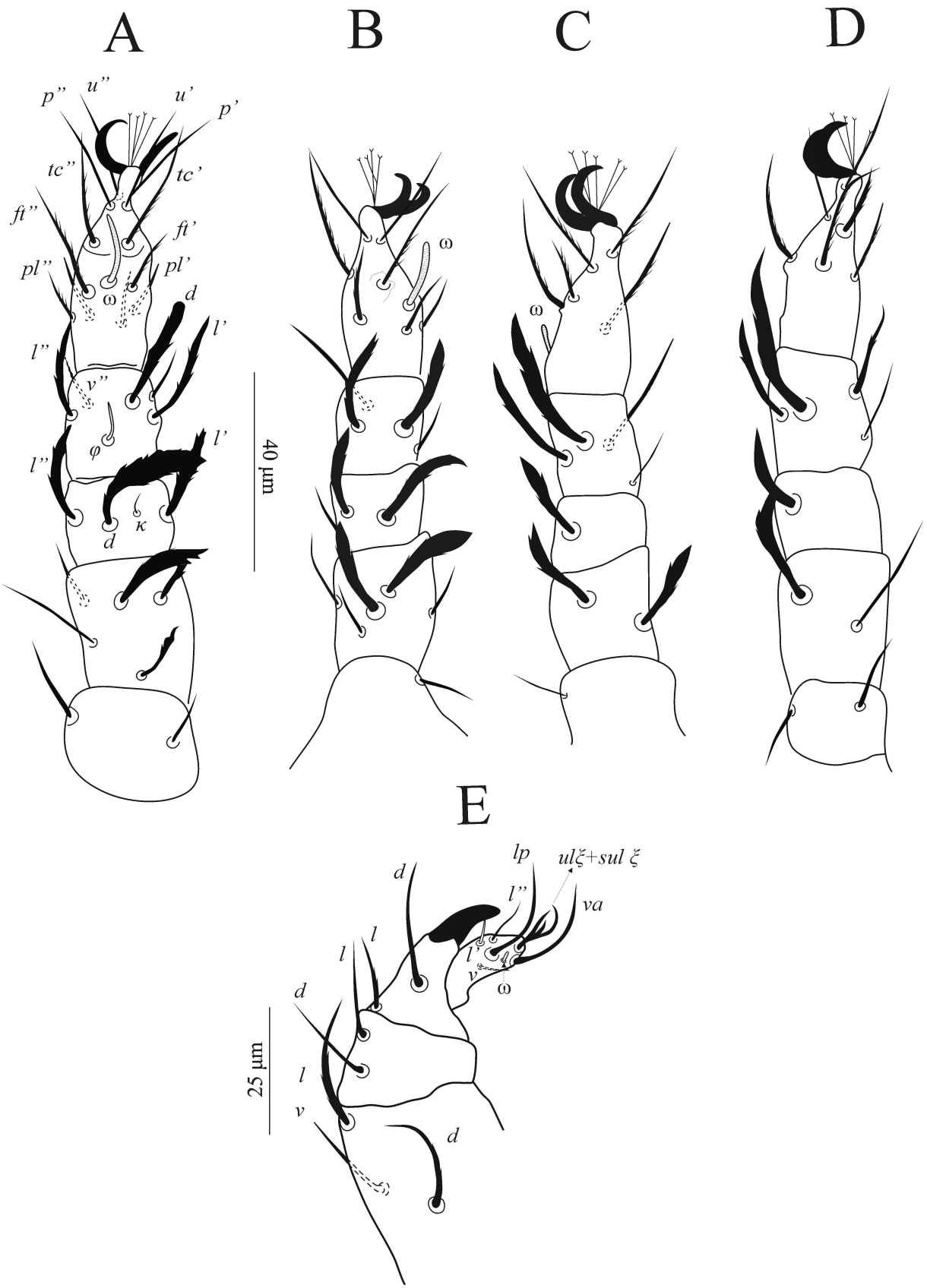


Figure 2 *Eustigmaeus crassifolius* Bizarro & Johann **n. sp.** (female) **A** – Leg I; B – Leg II; C – Leg III; D – Leg IV; E – Dorsal view of palp.

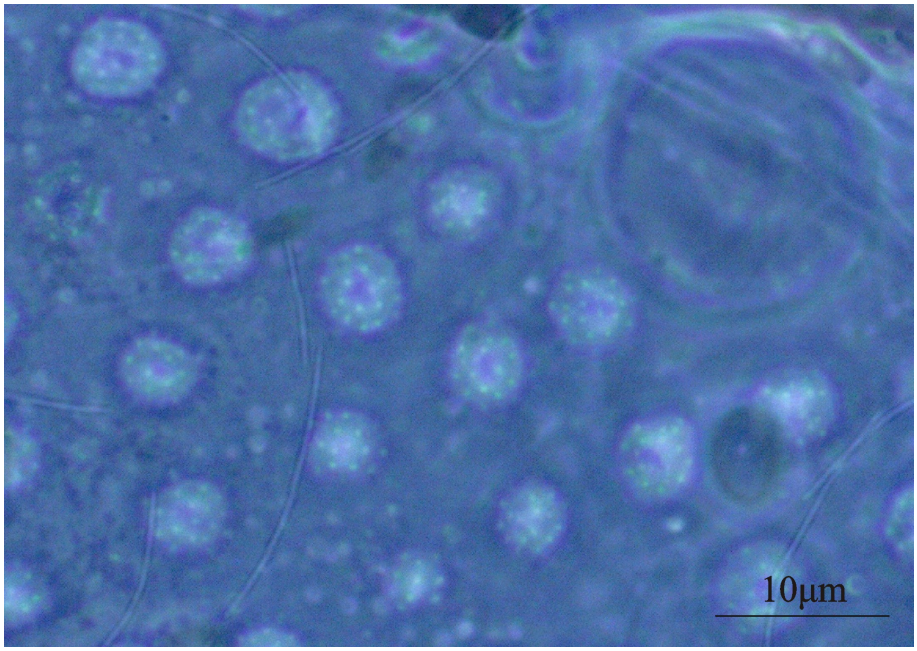


Figure 3 *Eustigmaeus crassifolius* Bizarro & Johann **n. sp.** (female) Dimples with vacuoles evenly spread in it.

claw and one developed claw *vs* small spine-like claw on palptibia absent in *E. crassifolius* **n. sp.**; dimples in *E. floridensis* without vacuoles *vs* vacuoles sieve-like, evenly spread inside the dimples in *E. crassifolius* **n. sp.** The new species also resembles *E. segnis* (Koch, 1836) and *E. microsegnis* but can be easily distinguished by having reticulated endopodal shield and tarsi II with 8(+1) in *E. segnis*; tarsi II with 9(+1) in *E. microsegnis vs* smooth endopodal shield and tarsi II with 7(+1) in *E. crassifolius* **n. sp.**.

Etymology — The species name refers to the host plant *Byrsonima crassifolia*.

Type material — One holotype collected in July 18, 2013. Two paratypes collected in June 04, 2013 ; One paratype collected in March 25, 2014; Two paratypes collected in September 23, 2014 on *Byrsonima crassifolia* in Belém city (1°26′09.2″ S 48°26′28.6″ W), Pará state, Brazil. Holotype female deposited at Departamento de Entomologia e Acarologia, Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo (ESALQ/USP), Piracicaba, São Paulo State, Brazil. All paratypes are deposited at Museu de Ciências Naturais (ZAUMCN), Universidade do Vale do Taquari - Univates, Lajeado, Rio Grande do Sul, Brazil.

Key to females of *Eustigmaeus* species reported in Brazil

Adapted from (Paktinat-Saeij *et al.*, 2016)

1. Dorsal setae feather-like, slightly to strongly serrated or smooth 2
— Dorsal setae smooth, clavate or cub-like 4

2. Distance between *c1-c1* more than 55 µm. 3
— Distance between *c1-c1* less than 50 µm . . . . . *E. microsegnis* (Chaudhri)

3. Tarsus II with 9(+1) setae; endopodal shield reticulated. . . . . *E. oliverai* Paktinat-Saeij & Bagheri
— Tarsus II with 7(+1) setae; endopodal shield with no reticulation. . . . . *E. crassifolius* **n. sp.**

4. With three pairs of aggenital setae and dorsal shield reticulated with polygonal depressions. . . . . *E. piracicabensis* Paktinat-Saeij & Bagheri
— With two pairs of aggenital setae and dorsal shield ornamented with minute dimples. . . . . *E. bryonemus* Flechtmann

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References

Akyol M. 2019. A new species of the genus *Eustigmaeus* (Berlese) (Acari: Stigmaeidae) from Manisa province, Turkey. Systematic and Applied Acarology, 24: 6, 971-976. doi:10.11158/saa.24.6.2

Chaudhri W.M. 1965. New mites of the genus *Ledermuelleria*. Acarologia 7: 13, 467-486.

Fan Q.H., Flechtmann C.H.W., Moraes G.J. 2016. Annotated catalogue of Stigmaeidae (Acari: Prostigmata), with a pictorial key to genera. Zootaxa, 4176: 1, 1. doi:10.11646/zootaxa.4176.1.1

Fan Q.H., Flechtmann C.H.W., Moraes G.J. 2019. Emendations and updates to "Annotated catalogue of Stigmaeidae (Acari: Prostigmata), with a pictorial key to genera". Zootaxa, 4647: 1, 88-103. doi:10.11646/zootaxa.4647.1.9

Flechtmann C.H.W. 1985. *Eustigmaeus bryonemus*, **sp. n.**, a moss-feeding mite from Brasil (Acari, Prostigmata: Stigmaeidae). Revista Brasileira de Zoologia, 2: 6, 387-391. doi:10.1590/S0101-81751984000200010

Kethley J. 1990. Acarina: Prostigmata (Actinedida). In: Dindal DL, editor. Soil biology guide. New York (NY): John Wiley and Sons; p. 667-756.

Krantz G.W., Walter D.E. 2009. A manual of Acarology. 3rd ed. Lubbock (TX): Texas Tech University Press. pp. 807.

Maake P.A., Ueckermann E.A., Childers C.C. 2016. *Eustigmaeus floridensis* sp. nov., a new mite species of the genus *Eustigmaeus* Berlese, 1910 (Acari: Stigmaeidae) from citrus in Florida Journal of Natural History, 50: 15-16, 975-987. doi:10.1080/00222933.2015.1091105

Paktinat-Saeij S., Bagheri M., Castro T. M.M.G., Moraes G.J. 2016. Two new species of *Eustigmaeus* Berlese (Acari: Trombidiformes: Stigmaeidae) from Brazil, with a key to the American species. Zootaxa, 4066: 5, 571-580. doi:10.11646/zootaxa.4066.5.5