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Eriophyoid Mites (Acariformes: Eriophyoidea) Collected from *Phyllostachys* spp. in Hungary

G. RIPKA[1]*, E. KISS[2], J. KONTSCHÁN[3], A. NEMÉNYI[4] and Á. SZABÓ[5]

[1]National Food Chain Safety Office, Directorate of Plant Protection, Soil Conservation and Agri-environment, H-1118 Budapest, Budaörsi út 141–145, Hungary
[2]Plant Protection Institute, Szent István University, H-2100 Gödöllő, Páter Károly u. 1, Hungary
[3]Plant Protection Institute, Centre for Agricultural Research, H-1525 Budapest, P.O. Box 102, Hungary
[4]Faculty of Agricultural and Environmental Sciences, Institute of Horticulture, Szent István University, H-2100 Gödöllő, Páter Károly u. 1, Hungary
[5]Department of Entomology, Faculty of Horticultural Science, Szent István University, H-1118 Budapest, Villányi út 29–43, Hungary

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Aceria bambusae ChannaBasavanna, 1966 is reported from Hungary for the first time. The species was collected from the leaf sheaths of the introduced bamboo species, *Phyllostachys rubromarginata* McClure and *Phyllostachys tianmuensis* Z.P. Wang et N.X. Ma (both Poaceae) in Hungary. Morphological differences distinguishing this species from other bambusoid inhabiting congeners are discussed. In addition, new date-locality-host records for 3 eriophyoid species collected from 7 bamboo species are given.

Keywords: Eriophyidae, *Aceria*, *Phyllostachys*, ornamental bamboos, new hosts, Hungary.

The subfamily Bambusoideae (fam. Poaceae) is represented by 1,575 species belonging to 115 genera (Ohrnberger, 2002). On bamboo species (*Bambusa* spp., *Phyllostachys* spp., *Sasa* spp., *Yushania* spp.) (Poaceae) 39 eriophyoid mite species have been found (Amrine and Stasny, 1994; Davis et al., 1982; Huang, 2001; Lin et al., 2000; Sukhareva, 1994; Xue et al., 2006). In Hungary three further species were recently described: from greenwax golden bamboo (*Phyllostachys viridiglaucescens* A. Rivière et C. Rivière) *Abacarus korosicsomai* Ripka, 2011 and *Adventacarus turulae* Ripka, 2011, from cock bamboo (*Phyllostachys iridescens* C.Y. Yao et S.Y. Chen) *Mucotergum nigrum* Ripka et al., 2015 (Ripka, 2011; Ripka et al., 2015). No eriophyoid species have previously been recorded from *Phyllostachys angusta*, *Ph. aureosulcata*, *Ph. edulis*, *Ph. fimbriligula*, *Ph. meyeri*, *Ph. rubromarginata* and *Ph. tianmuensis* (Amrine and Stasny, 1994; Davis et al., 1982).

The genus *Aceria* Keifer, like many eriophyoid mites, is well-known for being host specific. However some feed on multiple species within the same plant genus, and some species live on related plant genera (Oldfield, 1996). Majority of the *Aceria* spp. inhabits dicotyledonous hosts. Currently four bamboo-dwelling *Aceria* species are known from

*Corresponding author; e-mail: RipkaG@nebih.gov.hu

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the different parts of the world (Amrine and Stasny, 1994; Baker et al., 1996; Davis et al., 1982; Wang and Huang, 2011; Xue et al., 2006).

Herein we report on our discovery of a species of the genus *Aceria* found on *Phyllostachys rubromarginata* McClure and *Phyllostachys tianmuensis* Z.P. Wang et N.X. Ma (both Poaceae), which are introduced species from China. We provide evidence that this species is different from *Aceria gilloglii* Keifer, 1963, *Aceria havenensis* (Keifer, 1979) (sensu Keifer) and *Aceria niitakayamensis* Wang et Huang, 2011 in consideration of the Asian origin of the hosts.

Materials and Methods

The eriophyoid mite fauna of Asian bamboo collections, among other bamboo species of Asian origin, was studied on *Phyllostachys angusta* McClure, *Phyllostachys aureosulcata* McClure, *Phyllostachys edulis* (Carrière) J. Houzeau, *Phyllostachys fimbriligula* T. H. Wen, *Phyllostachys meyeri* McClure, *Phyllostachys nigra* var. *henonis* (Mitford) Stapf ex Rendle, *Phyllostachys rubromarginata* and *Phyllostachys tianmuensis* taken from plant samples collected in the Botanical Garden of Szent István University, Gödöllő (Pest county, Central Hungary), Szada (Pest county, Central Hungary), Debrecen (Hajdú-Bihar county, East Hungary) and Egerág (Baranya county, South Hungary) in the years of 2016, 2017 and 2019. The eriophyoid mites were cleared in lactic acid then mounted in Keifer's F-medium with sorbitol and Hoyer's medium on microscope slides (Keifer, 1975). Specimens were examined with the aid of a research phase contrast compound microscope (Nikon Eclipse E600) equipped with a drawing tube (Nikon Y-IDT). A Zeiss Axio Imager A2 microscope was used for making digital microscopic images on slide mounted specimens.

The generic classification was made according to Amrine et al. (2003) together with further updating. The terminology and setal notation used in the morphological descriptions follow Lindquist (1996). The number of measured specimens (n) is given in parentheses following the body length. All measurements of mites were made according to Amrine and Manson (1996) and are given in micrometers. Measurements and means are rounded off to the nearest integer. All measurements, unless specified otherwise, are lengths. For females, the mean and the ranges are given. For males and nymphs, data of five specimens are given.

The scientific name of host plant is used according to The Plant List (2013).

TAXONOMY
Superfamily ERIOPHYOIDEA Nalepa
Family ERIOPHYIDAE Nalepa
Subfamily ERIOPHYINAE Nalepa
Tribe ACERIINI Amrine and Stasny
Genus *Aceria* Keifer

Aceria bambusae ChannaBasavanna, 1966
(Figs 1–10)

Aceria bambusae ChannaBasavanna, 1966: 58–59. Plate XIII-1.
Aceria havenensis (Keifer, 1979) — Amrine and Stasny, 1994: 51, 493.
Aceria bambusae — Sukhareva, 1994: 33–34. Fig. 1.
Aceria bambusae — Elhalawany, 2015: 49–52. Fig. 3.

Re-description. Female – Body whitish, vermiform, 185 (173–202, n = 10), 39 (38–40) wide, 40 (36–45) thick. Gnathosoma 14 (13–16), projecting obliquely downwards; dorsal palp genual setae *d* 3 (3–4), unbranched, pedipalp coxal setae *ep* 3 (2–3). Chelicerae 12 (11–14). Prodorsal shield 28 (26–30), 33 (29–40) wide, oval; shield pattern composed of an incomplete median line on rear ⅓, two broken admedian lines, sinuate and subparallel to each other anteriorly, on each side of median line farther apart posteriorly, broken at rear ⅓; and two incomplete curving and broken submedian lines at anterior ⅔, forking in front of dorsal tubercle, the inner fork curving back toward tubercle, the outer arm extending laterally to lateral line; posteriorly few granules between the submedian line and lateral shield margins. Tubercles of scapular setae *sc* on rear shield margin, 18 (16–23) apart, diverging, scapular setae *sc* 33 (30–39), directed rearwards. Granules situated in lateral rows on epicoxal areas, i.e. laterally between shield margin and dorsal coxae of legs I and II (*sensu* Chetverikov and Craemer, 2015).

Legs with all usual segments and setae present. Leg I (foreleg) 24 (22–25), femur 8 (7–8), basiventral femoral seta *bv* 5 (5–7), genu 4 (3–5), antaxial genual seta *l″* 16 (13–18), tibia 5 (4–5), short paraxial tibial seta *l′* located at ⅖ (⅓–½) from dorsal base, 4 (3–4), very thin, tarsus 5 (4–5), unguinal tarsal seta *u′* 2 (1–2), solenidion ω 5 (5–6), distally rounded or with a minute knob, slightly curved, empodium simple, bilaterally symmetrical, 5 (4–5), 5-rayed, each ray of three basal pairs with additional secondary branches. Leg II (rear leg) 22 (22–23), femur 7 (7–8), basiventral femoral seta *bv* 7 (6–7), genu 3 (no range), antaxial genual seta *l″* 3 (3–5) very thin, tibia 4 (3–4), tarsus 4 (4–5), unguinal tarsal seta *u′* 1 (1–2), solenidion ω 6 (6–7), distally rounded or with a minute knob, slightly curved, empodium simple, bilaterally symmetrical, 5 (5–6), 5-rayed, each ray of three basal pairs with small subdivisions.

Coxigenital area with 5–7 microtuberculate semiannuli. Coxisternae I with many granules, coxisternae II with less granules; anterior seta on coxisternum I, *1b* 6 (5–7), tubercles setae *1b* 11 (10–12) apart, proximal seta on coxisternum I, *1a* 12 (11–14), tubercles setae *1a* 8 (7–9) apart, proximal seta on coxisternum II, *2a* 30 (22–35), tubercles setae *2a* 19 (17–20) apart. Subcapitular plate with granules. In 50% of the examined specimens the prosternal apodeme not well defined, in the others 9 (8–10).

Opisthosoma with 61 (58–65) dorsal, 63 (59–66) microtuberculate ventral semiannuli. Microtubercles oval dorsally and ellipsoid ventrally. Last 4–6 dorsal annuli with

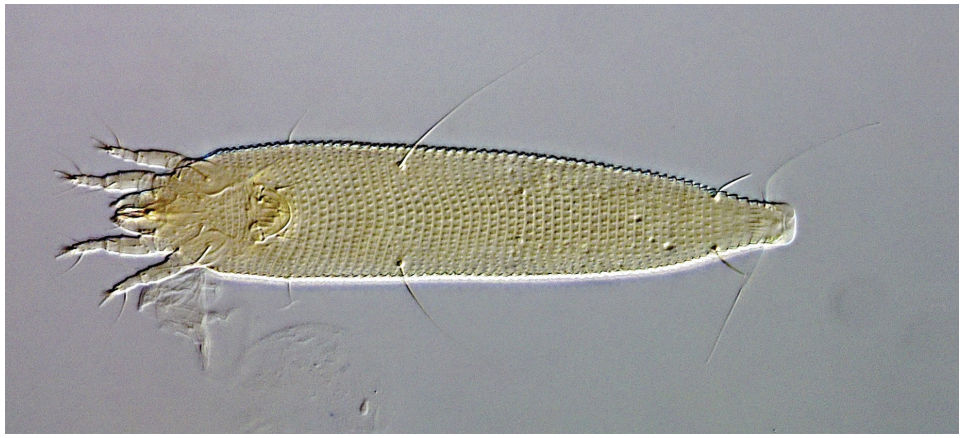

Fig. 1. Digital micrograph of *Aceria bambusae*, female in ventral view. (Photo: Árpád Szabó)

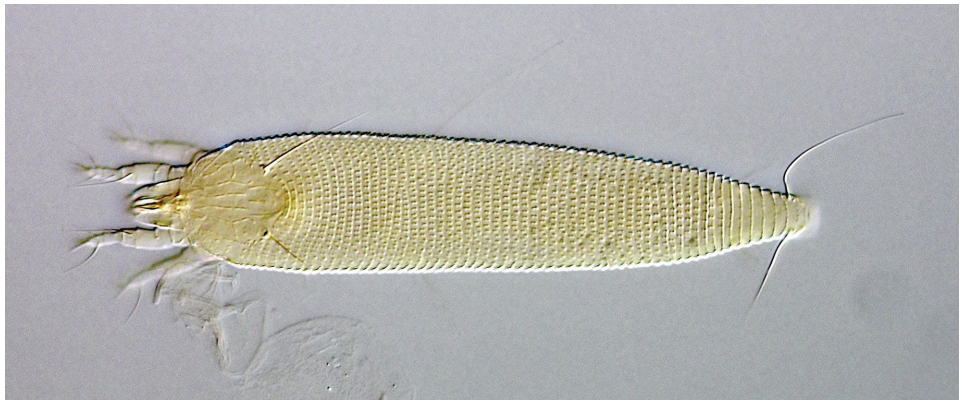

Fig. 2. Digital micrograph of *Aceria bambusae*, female in dorsal view. (Photo: Árpád Szabó)

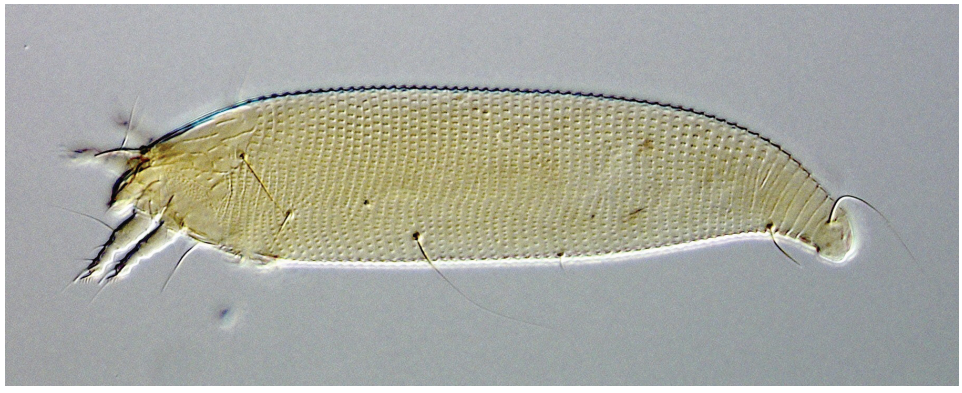

Fig. 3. Digital micrograph of *Aceria bambusae*, female in lateral view. (Photo: Árpád Szabó)

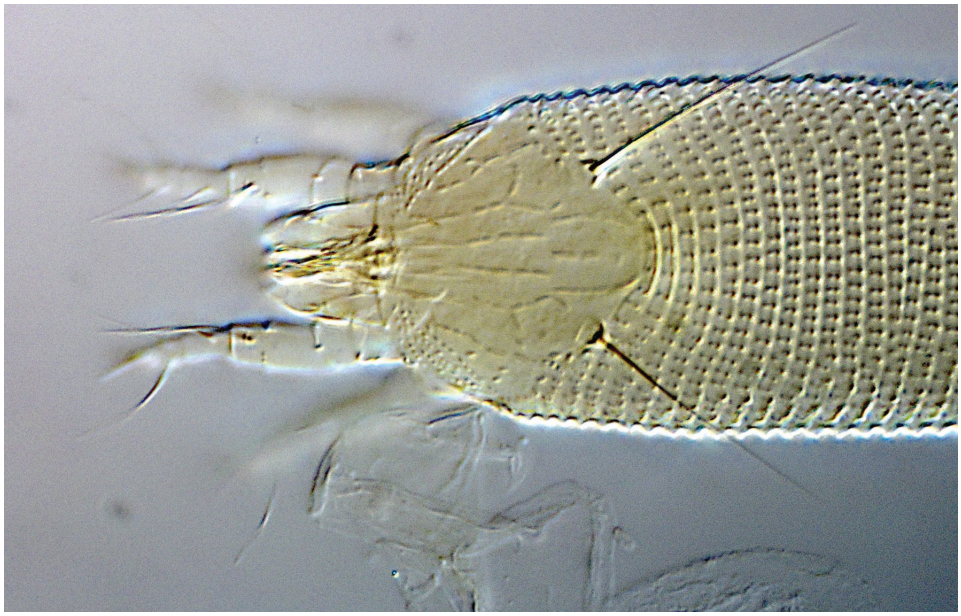

Fig. 4. Digital micrograph of *Aceria bambusae*, prodorsal shield and anterior opisthosoma of female. (Photo: Árpád Szabó)

Fig. 5. Digital micrograph of *Aceria bambusae*, anterior part of female, in lateral view. (Photo: Árpád Szabó)

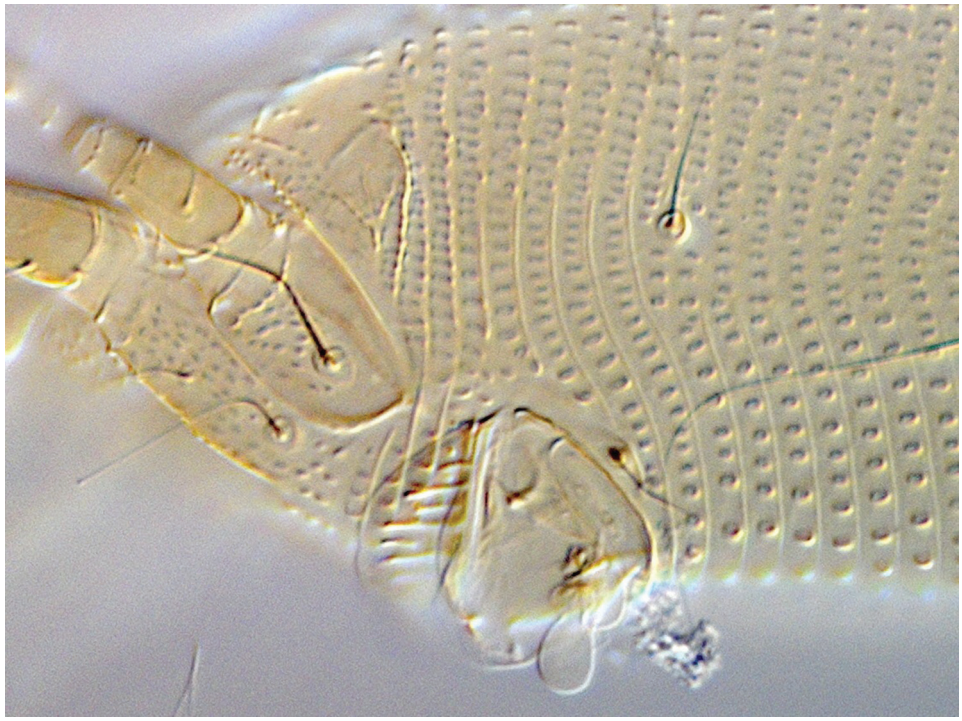

Fig. 6. Digital micrograph of *Aceria bambusae*, coxi-genital region and genitalia of female, in lateral view. (Photo: Árpád Szabó)

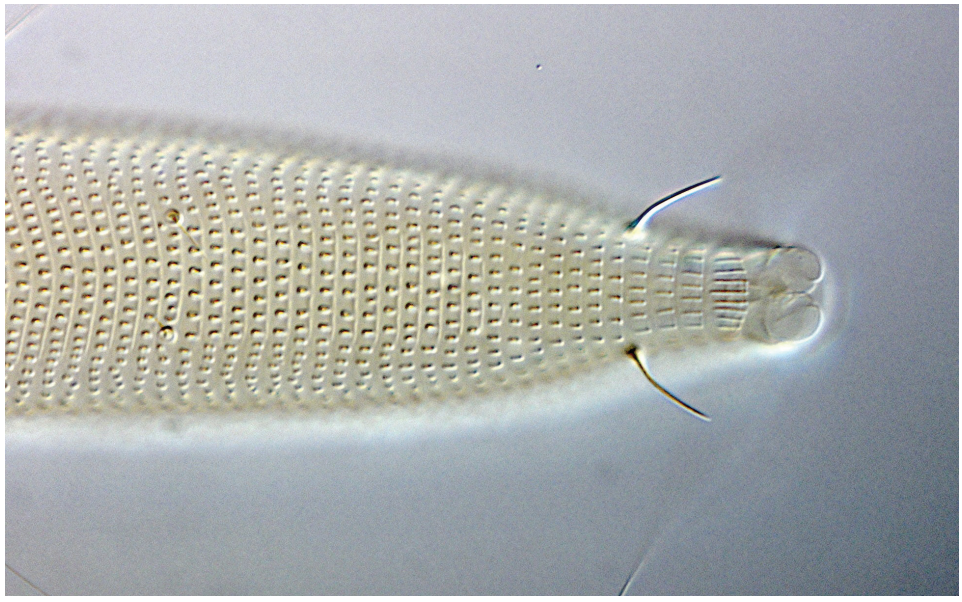

Fig. 7. Digital micrograph of *Aceria bambusae*, posterior opisthosoma of female, in ventral view. (Photo: Árpád Szabó)

minute microtubercles on rear annular margin. Last 4–5 ventral annuli with linear microtubercles. Opisthosomal setae *c2* 12 (10–15), on annulus 9 (9–10), 36 (33–38) apart; opisthosomal setae *d* 53 (48–59), on annulus 22 (20–23), 28 (26–29) apart; opisthosomal setae *e* 7 (5–10), on annulus 34 (31–36), 14 (12–15) apart; opisthosomal setae *f* 14 (13–15), on annulus 58 (54–61), or 5 (4–5) from the rear, 13 (10–14) apart. Opisthosomal setae *h2* 48 (43–55), very thin at apex, 9 (9–10) apart; opisthosomal setae *h1* 1 (1–2), 6 (5–7) apart. Anal lobes normal.

Genital plate 12 (10–12), 17 (16–18) wide. Female genital coverflap with 8 (7–9) longitudinal ridges; coxisternal III setae *3a* 14 (13–15) apart, 7 (6–9), very thin (Figs 1–7).

MALE – Similar to female, white, 140–153 (n= 5), 35 wide, 35–38 thick. Gnathosoma 13–15, projecting obliquely downwards; dorsal palp genual setae *d* 2–3, unbranched; pedipalp coxal setae *ep* 1–2. Prodorsal shield 25–28, 28–30 wide, oval, ornamentation similar to female. Tubercles of scapular setae *sc* on rear shield margin, 17–19 apart, diverging, scapular setae *sc* 20–22, directed to the rear. Legs with all usual segments and setae present. Leg I 20–22, femur 7–8, basiventral femoral setae *bv* 4–5, very fine, genu 3 (no range), antaxial genual setae *l″* 14–20, tibia 3–4, paraxial tibial setae *l'* located at ⅓–⅔ from dorsal base, 3–4, very fine, tarsus 4–5, unguinal tarsal seta *u′* 2–3, solenidion ω 5 (no range), slightly curved, distally rounded or with a minute knob, empodium simple, bilaterally symmetrical, 4 (no range), 5-rayed. Leg II 17–18, femur 6–7, basiventral femoral setae *bv* 6–7, very fine, genu 2–3, antaxial genual setae *l″* 5–6, very fine, tibia 2–3, tarsus 4–5, unguinal tarsal seta *u′* 1–2, solenidion ω 5–7, slightly curved, distally rounded or with a minute knob, empodium simple, bilaterally symmetrical, 4–5, 5-rayed. Coxisternae I and II with granules; setae *1b* 5 (no range), 9–10 apart, setae *1a* 10–11, 7–8 apart, setae *2a* 26–27, 14–15 apart, all very fine. Subcapitular plate with granules. In 60% of the examined specimens prosternal apodeme not well defined, in the others 9 (8–10). Coxigenital area with 3–4 microtuberculate semiannuli. Opisthosoma with 55–61 dorsal, 56–58 ventral annuli. Microtuberculate dorsal and ventral annuli. Posterior 4 dorsal annuli with only a few indistinct microtubercles dorsally, almost smooth. Ellipsoid microtubercles on rear annular margin, except for 4–5 ventral annuli of anal lobes, which are elongate and linear. Caudal lobe normal in size and shape. Setae *c2* 14–20, on ventral annulus 9–10, 31–32 apart; setae *d* 34–39, on ventral annulus 18–21, 18–26 apart; setae *e* 3–5, on ventral annulus 29–35, 12–14 apart; setae *f* 10–13, on ventral annulus 52–58, or 4–5 from rear, 11–12 apart. Setae *h2* 33–40, 9–10 apart; setae *h1* 2 (no range), 5–7 apart. Genitalia 11–14, 15–16 wide, posterior ¼ with minute granules, setae *3a* 5–6, 13–15 apart (Fig. 8).

NYMPH – White, vermiform, 135–157 (n = 5), 37 wide, 35–38 thick. Gnathosoma 14–16; dorsal palp genual setae *d* 3 (2–3), unbranched; chelicerae 13–14. Prodorsal shield 24–26, 31 wide, circular. Setae *sc* 25–27, 17 apart, pointing rear. Leg I 18–21, femur 5–7, basiventral femoral seta *bv* 2 (no range), genu 2–3, antaxial genual setae *l″* 13–15, tibia 2–3, paraxial tibial setae *l′* located at ⅓–⅔ from dorsal base, 2–3, very fine, tarsus 3–4, solenidion ω 4–5, slightly curved, distally blunt, empodium simple, bilaterally symmetrical, 3–4, with 5 paired rays. Leg II 14–16, femur 5–6, basiventral femoral setae *bv* 3–5, very fine, genu 2–3, antaxial genual setae *l″* 4–5, very fine, tibia 1–2, tarsus 3–4, solenidion ω 5–6, slightly curved, distally blunt, empodium simple, bilaterally symmetrical, 3–4, with 5 paired rays. Setae *1b* 3–4, 10 apart, setae *1a* 6–7, 7 apart, setae *2a* 13–16, 17 apart. Prosternal apodeme absent. Opisthosoma with 53–58 dorsal, 55–57 ventral semiannuli. Dorsal and ventral semiannuli with minute microtubercles. Setae *c2* 5–10, on annulus 10–

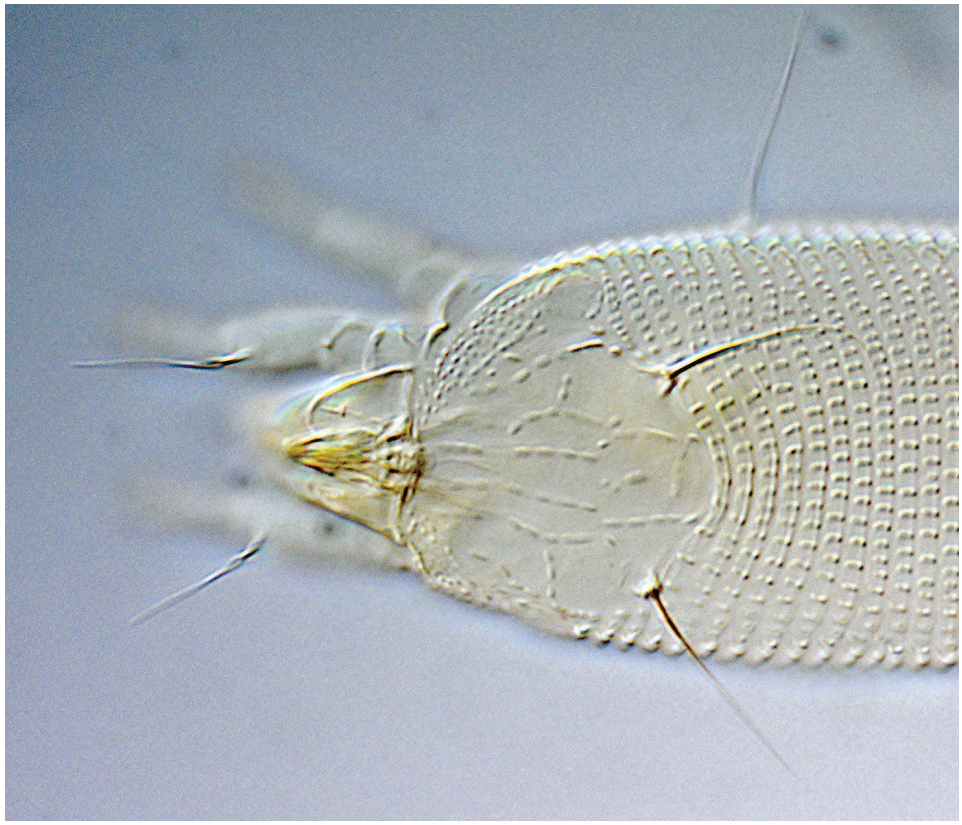

Fig. 8. Digital micrograph of *Aceria bambusae*, prodorsal shield and anterior opisthosoma of male. (Photo: Árpád Szabó)

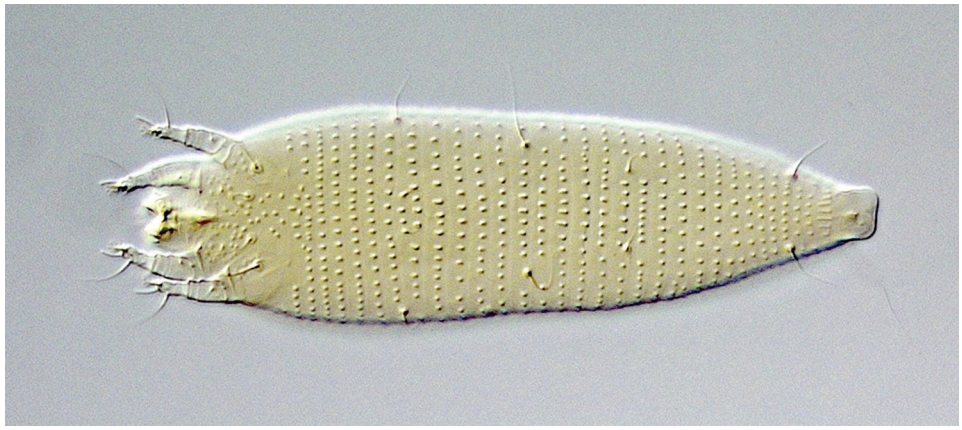

Fig. 9. Digital micrograph of *Aceria bambusae*, nymph in ventral view. (Photo: Árpád Szabó)

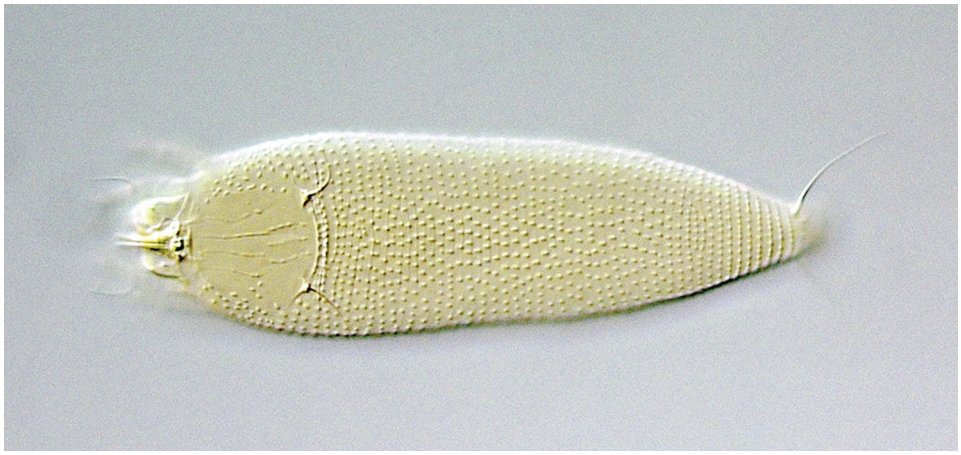

Fig. 10. Digital micrograph of *Aceria bambusae*, nymph in dorsal view. (Photo: Árpád Szabó)

11, 32 apart; setae *d* 28–29, on annulus 20–22, 25 apart; setae *e* 3–6, on annulus 30–33, 15 apart; setae *f* 10–13, on annulus 50–53, or 4–5 from rear, 14 apart. Setae *h2* 31–32, 9 apart; setae *h1* 1–2, 6 apart; setae *3a* 2–4, 6 apart (Figs 9-10).

Host plant – Red-margin bamboo, *Phyllostachys rubromarginata* McClure (Poaceae: subfamily Bambusoideae: tribe Bambuseae). Red-margin bamboo is an ornamental bamboo species, native to temperate Central China, especially in Guangxi, Guangdong, Anhui, Zhejiang, Jiangsu and Henan provinces.

Relationship to the host – This mite was found in high number in the leaf sheaths of the host and caused no discernible symptoms.

Hungarian locality – Gödöllő (Pest county, Central Hungary), in the Botanical Garden of Szent István University, 241 m elev., 47°35’37,99’’ N, 19°21’59,95’’ E.

Material examined – The re-described and illustrated female among 5 females, 4 males and 7 nymphs, and one female of *Abacarus korosicsomai* Ripka on one slide, 2 July 2019, slide # 1465a, coll. Géza Ripka. Other materials: slide # 1465b was prepared from this material containing 8 females, 2 males and 2 nymphs from the leaf sheaths of the host; slide # 1469a from *Phyllostachys tianmuensis* one female, and 5 females and 3 males of *Rhyncaphytoptus longipalpis*, and one female of a *Cecidophyes* species, and one female of *Adventacarus turulae* Ripka, 2 July 2019, coll. Géza Ripka. Slides are in the corresponding author’s collection and deposited in the National Food Chain Safety Office, Directorate of Plant Protection, Soil Conservation and Agri-environment, Budapest, Hungary.

Discussion

Out of 42 known bamboo-inhabiting eriophyoid mite species only four *Aceria* species are known, viz. *Aceria bambusae* ChannaBasavanna, 1966, *Aceria gilloglii* Keifer, 1963, *Aceria havenensis* (Keifer, 1979) and *Aceria niitakayamensis* Wang et Huang, 2011 described from *Bambusa vulgaris* in India, *Sasa pygmaea* in California, USA, *Bambusa vulgaris* in Florida, USA and *Yushania niitakayamensis* in Taiwan, resp. (ChannaBasavanna, 1966; Keifer, 1963, 1979; Elhalawany, 2015; Wang and Huang, 2011). According to Amrine and Stasny (1994) and Sukhareva (1994) *Aceria havenensis* (Keifer) is a junior synonym of *Aceria bambusae* ChannaBasavanna.

The re-described species shows similarities with the four nominal *Aceria* species living on bamboo hosts. The re-described species is close to *Aceria gilloglii* because it shares numerous features, particularly body shape, the number of dorsal and ventral annuli, the ornamentation of prodorsal shield and coxi-genital region, length of several setae, but can be differentiated by having single row of microtubercles on annuli, whereas *A. gilloglii* has double rows of microtubercles on each annulus laterally and dorsally. There are some morphometric differences between the examined Hungarian *Aceria bambusae* specimens and both the holotype of *Aceria bambusae* and the re-described specimens of *A. bambusae* given by Elhalawany (2015). We especially draw attention to the length of setae *sc*: which is 18–20 in holotype of *A. bambusae*, whereas 30–39 in specimens of *A. bambusae* collected in Hungary. There are two other marked differences: in the number of ridges on genital coverflap, which is 4–6 in holotype of *A. bambusae*, whereas 7–8 in the examined *A. bambusae* specimens; and the number of empodial rays, which is 7 in *A. bambusae*, versus 5 in the Hungarian *A. bambusae* specimens (Table 1). Nevertheless the examined specimens belong to *A. bambusae* because the vast majority of the morphometric data for female matches the original description by ChannaBasavanna.

Further eriophyoid species were collected from different bamboo species during this survey:

Abacarus korosicsomai Ripka from *Phyllostachys fimbriligula* T. H. Wen (Poaceae), Gödöllő (Pest county, Central Hungary), Botanical Garden of Szent István University, 13 October 2016 and 1 December 2016, coll. Enikő Kiss; from *Phyllostachys rubromarginata* McClure (Poaceae), Gödöllő (Pest county, Central Hungary), Botanical Garden of Szent István University, 24 August 2017, coll. Enikő Kiss; same locality, 2 July 2019, coll. Géza Ripka; from *Phyllostachys angusta* McClure (Poaceae), Debrecen (Hajdú-Bihar county, East Hungary), Diószegi Sámuel Botanical Garden, 19 October 2017, coll. András Neményi; from *Phyllostachys edulis* (Carrière) J. Houzeau (Poaceae), Szada (Pest county, Central Hungary), private garden, 11 September 2017, coll. András Neményi.

Adventacarus turulae Ripka from *Phyllostachys edulis* (Carrière) J. Houzeau (Poaceae), Szada (Pest county, Central Hungary), private garden, 11 September 2017, coll. András Neményi; from *Phyllostachys aureosulcata* McClure (Poaceae), Egerág (Baranya county, South Hungary), private garden, 11 September 2017, coll. András Neményi; from *Phyllostachys nigra* var. *henonis* (Mitford) Stapf ex Rendle (Poaceae), Egerág (Baranya county, South Hungary), private garden, 5 July 2019, coll. Jenő Kontschán.

Mucotergum nigrum Ripka from *Phyllostachys meyeri* McClure (Poaceae), Gödöllő (Pest county, Central Hungary), Botanical Garden of Szent István University, 19 September 2016, coll. Enikő Kiss; from *Phyllostachys rubromarginata*, Gödöllő (Pest county,

Table 1

Distinguishing characters between the females of *A. bambusae*, *A. gilloglii, A. havenensis* and *A. niitakayamensis* (n.d. = no data)

Character	*Aceria bambusae* Hungarian specimens	*Aceria bambusae* holotype India	*Aceria bambusae* re-described Egyptian specimens	*Aceria gilloglii* holotype California, USA	*Aceria havenensis* holotype Florida, USA	*Aceria niitaka-yamensis* holotype Taiwan
Prodorsal shield shape	oval	broadly truncate in front	semicircular, truncate anterior	subsemicircular	anteriorly truncate subsemicircular	n.d.
Length of seta *sc*	30–39	20	18–20	29	11	20.8
Length of gnathosoma	13–16	18	17–20	16	18	n.d.
Length of leg I	22–25	22	24–25	21	23	n.d.
Length of leg II	22–23	20	21–23	19	19	n.d.
Number of empodial rayes	5	7	7	5	6	5
Prosternal apodeme	not well defined	present	absent	distinct	absent	present
Number of coxi-genital annuli	5–7	6	5-6	5	5	6
Number of ridges on genital cover-flap	7–8	4–6	4–6	8–10	5 (3 short and 2 long)	8
Number of opisthosomal annuli	58–66	65–70	57–62	60	57	57
Length of seta *c2*	10–15	5	3–4	14	4	24.7
Length of seta *d*	48–59	55	33–40	51	36	34.7
Length of seta *e*	5–10	7	8–10	4,5	5	9.3
Length of seta *f*	13–15	19	18–21	11	7	20.6
Length of seta *h2*	43–55	45	33–40	n.d.	n.d.	n.d.
Length of seta *3a*	6–9	6	5–6	12	7	10.7
Posterior dorsal opisthosomal and telosomal annuli	distinct elongate oval microtubercles on dorsal annuli, tiny microtubercles on last 4–5 dorsal annuli	obscure dorsally and elongate ventrally	last 10 ventral annuli with linear microtubercles	double rows of microtubercles on most annuli	acuminate microtubercles on rear annular margins	spine microtubercles at posterior $^1/_3$
Microhabitat; damage symptom	lives in the leaf sheaths, no damage	lives between stem and enveloping leaf-sheath on terminal shoots, no damage	lives in the leaves sheath around stem	lives in the petiole bases, causing slight witch's broom	lives in leaf blade sheaths, may cause unthriftiness of the plants	vagrant on leaf underside, no damage

Central Hungary), Botanical Garden of Szent István University, 24 August 2017, coll. Enikő Kiss; from *Phyllostachys tianmuensis* McClure (Poaceae), Gödöllő (Pest county, Central Hungary), Botanical Garden of Szent István University, 24 August 2017, coll. Enikő Kiss.

Abacarus korosicsomai, *Adventacarus turulae* and *Mucotergum nigrum* are vagrant species, living on the underside of the leaves.

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