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Description of a new eriophyid species from Hungary (Acari: Acariformes: Eriophyidae)

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Abstract – A new species of eriophyid mites, *Aceria bassicola* sp. n. (Acari: Acariformes: Eriophyoidea: Eriophyidae), collected from *Bassia prostrata* (L.) Beck (Amaranthaceae), is described from Hungary based on females, males and nymphs.

Key words – *Aceria*, Eriophyoidea, forage kochia, Amaranthaceae

INTRODUCTION

The family Amaranthaceae currently contains 178 genera with 2052 accepted species (The Plant List 2013). The family (in a broad sense, including the former Chenopodiaceae) is well represented in the Hungarian flora (consisting of 2721 species) as well, with 266 species (Király 2009).

Out of more than 1000 *Aceria* Keifer, 1944 species (Dr. J. W. Amrine personal communication 2021) 23 have been collected on plants of Amaranthaceae (Elhalawany *et al*. 2018, Lewandowski *et al*. 2021). Most of these are vagrant species (e.g. *Aceria aervae* Mohanasundaram, 1990, *Aceria desertorum* Roivainen, 1953, *Aceria vanensis* Denizhan et Kiedrowicz, 2016), others induce galls (*Aceria atriplicis* Wilson et Oldfield, 1966, *Aceria brevipes* (Nalepa, 1899), *Aceria zumetae* Boczek et Petanović, 1994), cause stunting (*Aceria salsolae* de Lillo et Sobhian, 1996, *Aceria lividus* Elhalawany, 2018), flower deformation and erineum (*Aceria heimi* (Nalepa, 1899)) or witches' broom (*Aceria salicorniae* (Nalepa, 1902)) (Amrine & Stasny 1994, de Lillo & Sobhian 1996, Elhalawany *et al*. 2018, Kiedrowicz *et al*. 2016, Nalepa 1899*a*, *b*, Lewandowski *et al*.

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2021). The vagrant species *Aceria chenopodia* Xue, Sadeghi et Hong, 2009 was recently described from *Chenopodium album* L. in Iran (Xue *et al*. 2009). Besides acting as economically important pests, some species of *Aceria* and related genera were reported as potential agents for biological weed control, albeit of moderate success, viz., *Aceria acroptiloni* Kovalev et Shevchenko, 1974, *Aceria chondrillae* (Canestrini, 1891), *Aceria drabae* (Nalepa, 1890), *Aceria genistae* (Nalepa, 1892), *Aceria malherbae* Nuzzaci, 1985, *Aculus hyperici* (Liro, 1943) and *Phyllocoptes fructiphilus* Keifer, 1940 (Boczek & Petanović 1996, Rosenthal 1996, Xue *et al*. 2015, Marini *et al*. 2021). *Aceria salsolae* was reported to be a suitable agent for biological control of the invasive amarathaceous weeds, *Salsola* spp. (Amaranthaceae) in the USA (Smith 2005).

The eriophyoid fauna of Amaranthaceae has remained scantly known in Hungary. Out of the 388 currently known eriophyoid species, 128 belong to the genus *Aceria*, but only one of them, *Aceria heimi* has been recorded from an amaranthaceous host, namely *Atriplex halimus* L. (Farkas 1966, Ripka 2007, 2008, Ripka *et al*. 2020). Several further species are known to occur but await study. No eriophyoid mite species has hitherto been described or reported from *Bassia prostrata* (L.) Beck (Amaranthaceae).

The goal of this paper, forming part of a series of publications on the eriophyoid mites of Hungary, is to describe *Aceria bassicola* sp. n. collected from a new dicotyledonous host in Hungary.

MATERIAL AND METHODS

This study is part of a larger investigation program on plant-inhabiting mites in Hungary. In the frame of this project the mite fauna of different herbaceous and woody plant species was studied from occasional plant samples collected in Budapest and different sites in the country between 2019 and 2021. Plant materials (including leaves, petioles, stems, buds, flowers and fruits) were collected and placed in plastic bags by the authors, then taken to the laboratory. Live eriophyoid mites were collected from plant samples by direct examination under a dissecting stereomicroscope (Zeiss Stemi 2000-C, Germany) and placed directly into 88% lactic acid with the aid of a bent minuten pin. After having been cleared in lactic acid at room temperature specimens were slide-mounted in Keifer's F-medium with sorbitol, without adding additional fibres (Keifer 1975). Slide preparations were dried, then sealed with commercial nail varnish (Upton 1991). Specimens were examined with the aid of a research phase contrast compound microscope (Nikon Eclipse E600, Japan) equipped with a drawing tube (Nikon Y-IDT, Japan).

Morphology of *Aceria bassicola* sp. n. was also investigated with the aid of scanning electron microscopy (SEM) (Zeiss EVO 40 XVP) at the Research Centre for Natural Sciences, Hungarian Academy of Sciences, Budapest. Live mites

were collected individually with a fine entomological needle from fresh plant parts under a stereomicroscope and placed directly on the SEM holder without fixation, dehydration and coating.

Generic classification follows Amrine *et al*. (2003), but comparisons were made with genera described since that publication as well. The terminology of external morphology and setal notation adopted for the morphological description follows mainly Lindquist (1996). The number of measured specimens (n) is given within parentheses in the description. All measurements were made according to Amrine & Manson (1996) using an ocular micrometre eyepiece and are given in micrometres (μm). Measurements and means are rounded off to the nearest integer when necessary. All measurements, unless specified otherwise, are lengths. In the description of the female, each measurement of the holotype precedes the corresponding range for the paratypes. Because some measurements of the holotype specimen could not be taken due to the mounting position, mean measurements are reported. Range values are given in parentheses except in cases of constant value. For males and immature instars, only the ranges are given.

The names of the plant taxa are used according to The Plant List (2013).

Drawing abbreviations follow Amrine *et al*. (2003): AD = antero-dorsal view, AL = lateral view of anterior body region, CG = female coxigenital region, em = empodium, CGM = coxigenital region of male, LO = lateral view of annuli, L1 = leg I (foreleg), PM = lateral view of posterior opisthosoma.

Holotype and some paratypes of the new species are deposited in the collection of the Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budapest, Hungary, and additional paratypes in the Hungarian Natural History Museum, Budapest, Hungary (see below).

RESULTS

Taxonomy

Aceria bassicola sp. n.
(Figs 1–3)

Type material – Hungary: Pest county, between cities Érd and Százhalombatta, south-eastern slope of Sánc-hegy [= Sánc-hill], in seminatural habitat, 47.33902°N 18.94586°E, 163 m, 12.VI.2021, from *Bassia prostrata*, leg. G. Ripka. Holotype female among 2 females, 5 males and 3 nymphs (slide #1524a), 2 females, 3 males and 2 nymphs (slide #1524b), 6 females and 4 males (slide #1524c), 4 females, 5 males and 3 nymphs (slide #1524d). Specimens

other than the holotype, mounted on the above slides, are to be considered as paratypes. Deposited in the corresponding author's collection, kept in the Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budapest, Hungary; paratypes on slide #1524b are in the Hungarian Natural History Museum, Budapest, Hungary.

Additional material examined – Borsod-Abaúj-Zemplén county, Tokaj, 48.113433 N, 21.402985 E, 138 m, 26.VI.2021, leg. A. Takács, from *Bassia prostrata*, 7 females, 5 males and 4 nymphs (slide #1529); same locality, 18.IX.2021, leg. A. Takács, from *Bassia prostrata*, 7 females, 3 males and 2 nymphs (slide #1543). Deposited in the corresponding author's collection, kept in the Directorate of Plant Protection, Soil Conservation and Agri-environment, National Food Chain Safety Office, Budapest, Hungary. These specimens are excluded from the type series.

Description – Female (Figs 1–2) (n = 10): Body ivory, yellowish white, ochre, vermiform, 180 (115–214), 47 (45–47) wide, 48 (45–55) thick. Gnathosoma 20 (20–23), projecting obliquely downwards; dorsal palp genual setae *d* 6 (4–7), unbranched; pedipalp coxal setae *ep* 2 (no range); pedipalp tarsal setae *v* 0.5 (no range). Chelicerae 19 (18–20). Prodorsal shield 28 (27–30), 30 (30–32) wide, subtriangular with short, acuminate and triangular frontal lobe 3 (2–4) over gnathosomal base. Shield pattern indistinct, composed of two faint complete, subparallel admedian lines, diverging posteriorly, more widely separate on rear 1/3–1/2, two faint, incomplete submedian lines; median line faint, incomplete on posterior 1/3–1/2. Obliquely 6 (5–7) sparse, small irregular dashes and oval granules between tubercles setae *sc* and lateral shield margin. No dashes and granules present between median and admedian lines. Tubercles of scapular setae *sc* 2 (2–3), subcylindrical, on rear shield margin, 19 (19–23) apart, setae *sc* 45 (45–50), diverging and directed rearwards. Epicoxal area with 1–2 rows of granules and sparse minute granules.

Legs with all usual segments and setae present. Leg I 30 (28–30), femur 8 (8–10), basiventral femoral seta *bv* 14 (10–14); genu 5 (no range), antaxial genual seta *l''* 25 (25–27); tibia 8 (7–8), paraxial tibial seta *l'* located at 1/4 (1/4–1/3) from dorsal base, 8 (7–10), very thin; tarsus 7 (6–7), unguinal tarsal setae *u'* 4 (3–4); paraxial fastigial tarsal setae *ft'* 20 (16–20), antaxial fastigial tarsal setae *ft''* 25 (25–27); solenidion *ω* 8 (7–8), slightly tapered, distally rounded, curved; empodium simple, bilaterally symmetrical, 7 (no range), 7-rayed, with additional secondary branches. Leg II 27 (26–27), femur 7 (6–8), basiventral femoral seta *bv* 8 (8–12); genu 5 (4–5), antaxial genual seta *l''* 10 (10–12), very thin; tibia 5 (no range); tarsus 6 (5–6), unguinal tarsal setae *u'* 2 (2–3); paraxial fastigial tarsal setae *ft'* 6 (5–7), antaxial fastigial tarsal setae *ft''* 26 (25–27); solenidion *ω* 7 (no range), slightly tapered, distally rounded, curved; empodium simple, bilaterally symmetrical, 8 (7–8), 7-rayed, with additional secondary branches. Several minute spinules distally on femora, genua and tibiae on both leg pairs.

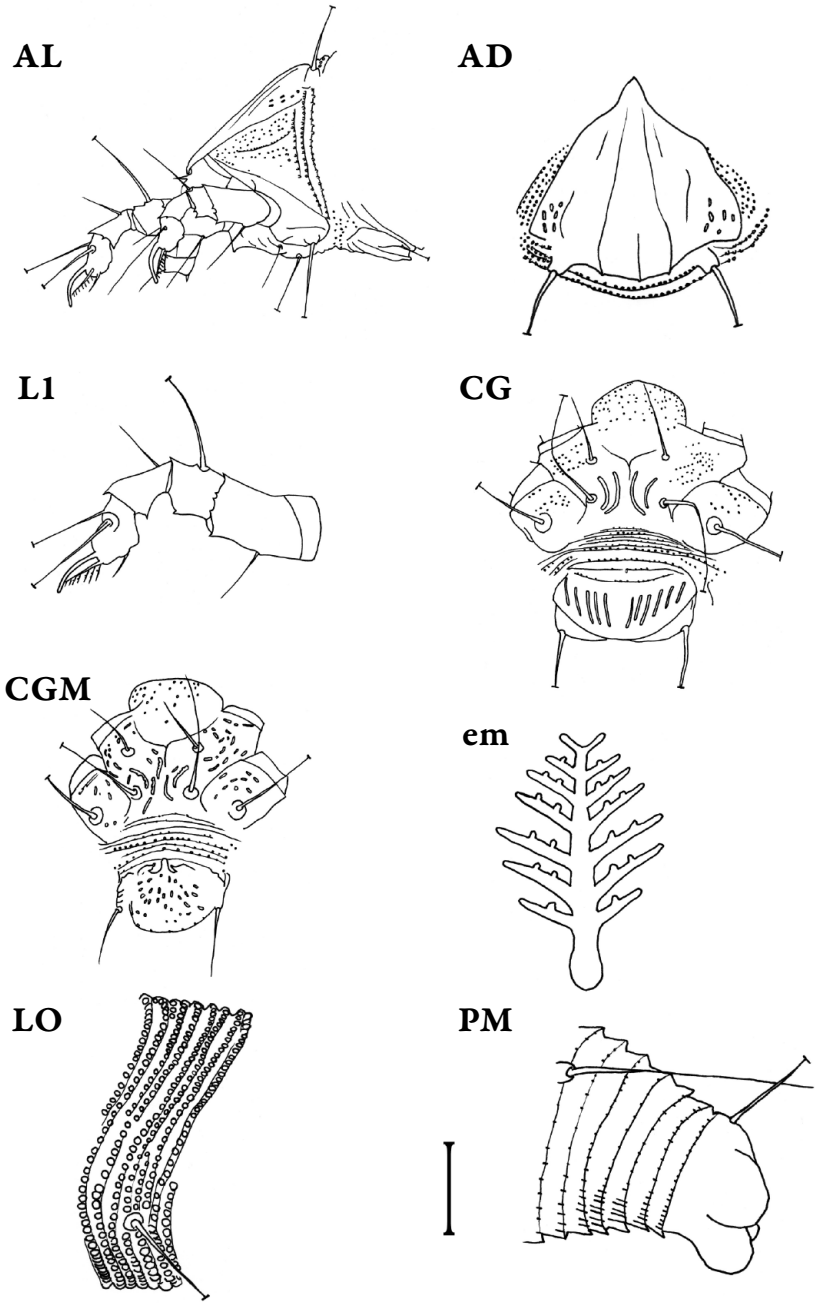

Fig. 1. *Aceria bassicola* sp. n., drawings, scale bar = 15 µm for AL, 12 µm for AD, 12 µm for CG, 16 µm for CGM, 12 µm for LO, 8 µm for L1, 8 µm for PM, 2 µm for em

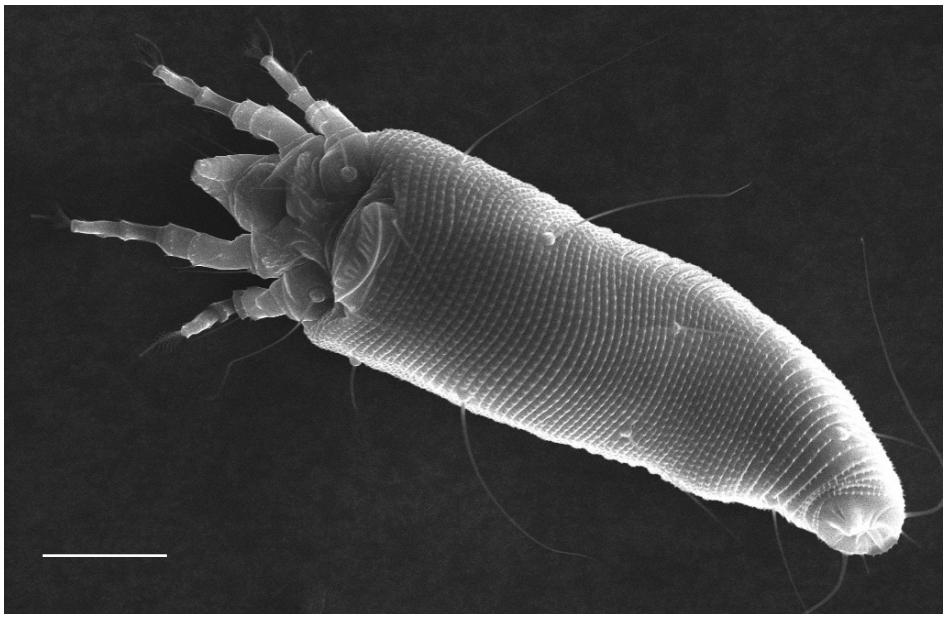

Fig. 2. SEM micrograph of *Aceria bassicola* sp. n., ventral view of female, scale bar = 20 µm (photo by László Szabó)

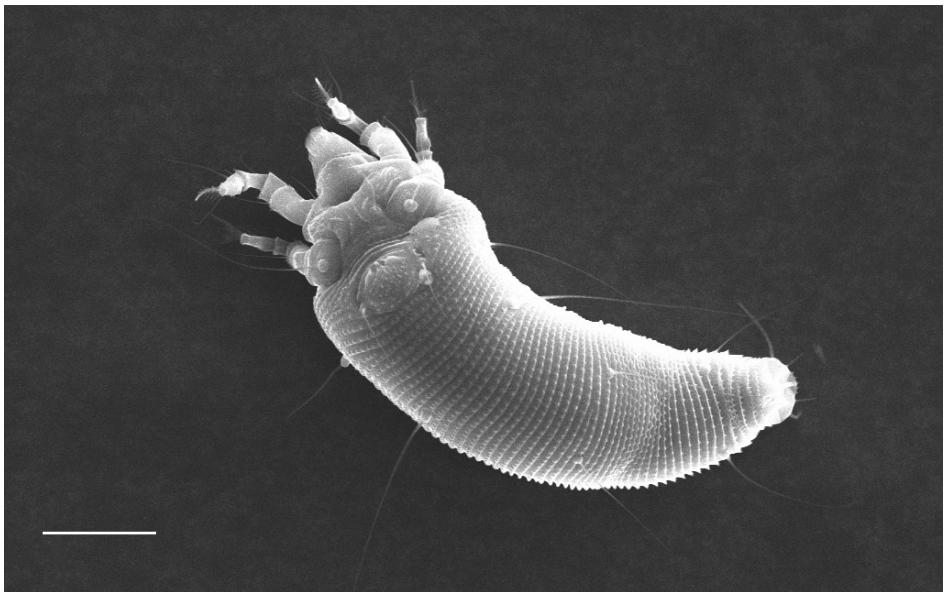

Fig. 3. SEM micrograph of *Aceria bassicola* sp. n., ventral view of male, scale bar = 20 µm (photo by László Szabó)

Coxigenital area with 7 (6–7) finely microtuberculate semiannuli. Coxisternae I with parallel longitudinal lines and dashes, coxisternae II with few, longitudinal lines and dashes; anterior setae on coxisternum I, *1b* 8 (7–9), tubercles setae *1b* 10 (9–10) apart, proximal setae on coxisternum I, *1a* 20 (17–25), tubercles setae *1a* 8 (7–8) apart, proximal setae on coxisternum II, *2a* 45 (40–49), tubercles setae *2a* 23 (23–24) apart. Subcapitular (suboral) plate rounded, with minute granules. Prosternal apodeme 4 (4–5).

Opisthosoma evenly rounded, with 62 (59–64) dorsal and 62 (60–66) ventral annuli. Dorsal annuli with bead-like microtubercles situated on the rear margin of each annulus; ventral annuli with round microtubercles on rear margin of each annulus. Last 5–6 ventral annuli with linear microtubercles (posteriorly opisthosomal seta *f*). Opisthosomal setae *c2* 40 (32–40), on annulus 10 (9–10), 40 (40–42) apart; opisthosomal setae *d* 60 (56–70), on annulus 22 (19–22), 24 (24–25) apart; opisthosomal setae *e* 26 (26–29), on annulus 37 (35–41), 16 (15–16) apart; opisthosomal setae *f* 23 (22–24), on annulus 56 (54–60), or 6 (6–7) from the rear, 12 (11–12) apart. Setae *h2* 87 (72–100), very thin at apex, 10 (9–10) apart; setae *h1* 4 (4–5), 7 (6–7) apart. Anal region bilaterally divided into two caudal lobes.

External genitalia 14 (13–16), 20 (20–21) wide, rounded with ribbon-shaped semicircular genital flange delimiting genital area posteriorly. Base of female genital coverflap with 3 microtuberculate rings, and 12 (11–12) longitudinal ridges; coxisternal III setae *3a* 15 (14–15) apart, 27 (25–28), very thin.

Male (Fig. 3) (n = 6): Smaller than female, 108–172, 43–47 wide, 41–47 thick. Gnathosoma 17–23, projecting obliquely downwards; dorsal palp genual setae *d* 3–5, simple, pedipalp coxal setae *ep* 2; pedipalp tarsal setae *v* 0.5. Chelicerae 17–20. Prodorsal shield 25–27, 26–30 wide, subtriangular with short, triangular frontal lobe 2–3. Ornamentation similar to female, with two faint incomplete, subparallel admedian lines, diverging posteriorly, more widely separate on rear 1/3, a faint incomplete median and two faint incomplete submedian lines. On posterior part of prodorsal shield, between tubercles setae *sc* and lateral margin 4–7 sparse, small irregular dashes and oval granules. No dashes and microtubercles present between the median and admedian lines. Tubercles of scapular setae *sc* 2 on rear shield margin, 22–23 apart, setae *sc* 40–41, diverging, directed rearwards. Minute granules situated sparsely and in 1–2 lateral rows on epicoxal areas. Leg I 25–28, femur 7–9, basiventral femoral setae *bv* 12–14, very fine; genu 4–5, antaxial genual setae *l"* 24–26; tibia 7–8, paraxial tibial setae *l'* located at 1/3 from dorsal base, 6–7, very fine; tarsus 5–6, unguinal tarsal setae *u'* 2–3; paraxial fastigial tarsal setae *ft'* 11–15, antaxial fastigial tarsal setae *ft"* 22–25; solenidion *ω* 6, curved, distally rounded; empodium simple, bilaterally symmetrical, 6, 7-rayed. Leg II 22–25, femur 7–8, basiventral femoral setae *bv* 11–12, very fine; genu 3–4, antaxial genual setae *l"* 10–12, very fine; tibia 4–5, tarsus 5–6; unguinal tarsal setae *u'* 2–3; paraxial fastigial tarsal setae *ft'* 7–8, antaxial fastigial tarsal setae *ft"* 22–24; solenidion *ω* 7, slightly curved, distally

rounded; empodium simple, bilaterally symmetrical, 6, 7-rayed. Minute spinules distally on femora, genua and tibiae on both leg pairs. Coxisternum I with longitudinal dashes and granules, coxisternum II with dashes and granules; setae *1b* 8–12, 10–11 apart; setae *1a* 20–21, 7–8 apart; setae *2a* 41–43, 20 apart, all very fine. Subcapitular (suboral) plate rounded, with minute granules. Coxigenital area with 5–7 microtuberculate semiannuli. Prosternal apodeme 2–3. Opisthosoma with 54–58 microtuberculate dorsal, 54–61 microtuberculate ventral annuli. Elongate and linear microtubercles on 5–6 ventral annuli of anal lobes. Caudal lobes normal in size and shape. Setae *c2* 30–33, on ventral annulus 7–9, 45 apart; setae *d* 57–61, on ventral annulus 17–20, 25–30 apart; setae *e* 20–25, on ventral annulus 30–35, 18–20 apart; setae *f* 20–22, on ventral annulus 48–55, or 6–7 from rear, 15–17 apart. Setae *h2* 76–90, 7 apart; setae *h1* 3–4, 5 apart. Genitalia 12–14, 18–20 wide, setae *3a* 15–22, 15–19 apart, base of external genitalia with 3–4 microtuberculate rings, with distinct medial ridge, posterior ⅞ with minute elongate granules, tiny eugenital setae present.

Nymph (n = 4): White or hyaline, vermiform, 107–145, 45 wide, 40–41 thick. Gnathosoma 16–20; dorsal palp genual setae *d* 4, pedipalp coxal setae *ep* 2, pedipalp tarsal seta *v* non apparent; chelicerae 17–19. Prodorsal shield 22–25, 21–26 wide, subsemicircular, with a frontal lobe 1–2 over gnathosomal base. Ornamentation similar to female. Setae *sc* 37–40, 17–19 apart, directed backwards. Epicoxal area with tiny, round granules. Leg I 20–22. Leg II 17–19. Setae *1b* 7–8; setae *1a* 13–15; setae *2a* 30. Prosternal apodeme 2, indistinct. Opisthosoma with 48–55 dorsal, 49–59 ventral semiannuli. Dorsal and ventral semiannuli with minute, round microtubercles on rear annular margins, on rear 4 annuli elongate ventrally. Setae *c2* 17–25, on annulus 9–10; setae *d* 41–42, on annulus 19–22; setae *e* 14–17 on annulus 30–34; setae *f* 13–17, on annulus 44–54, or 5–6 from rear. Setae *h2* 57–66; setae *h1* 3; setae *3a* 12–15.

Host plant – Forage kochia or prostrate summer cypress, *Bassia prostrata* (L.) Beck (syn. *Kochia prostrata* (L.) Schrad.) (Amaranthaceae) is a native suffrutex of Eurasian origin that lives in dry steppes. This perennial and xerophyte subshrub is extremely tolerant to drought, heat and salinity. In Hungary it grows on walls and southern exposures of loess cliffs and hills and in dry alkaline grasslands. In phytosociological and syntaxonomic respects, *Bassia prostrata* builds with association *Agropyro cristati-Kochietum prostratae* Zólyomi (Borhidi 2003, Kállayné Szerényi 2010). This is the first record of eriophyoid mites on this host plant.

Relationship to the host – The mite was collected from inside and surface of buds, pilose stems, clustered, sessile and linear leaves, between sericeous leaves and shoots, and from pilose peduncles and fruits of the host plant. No damage was observed. The ratio of males was considerably high.

Etymology – The specific epithet, *bassicola*, is a combination of the stem *Bassi-* formed from *Bassia*, the generic name of the host plant, and the Latin suffix *-cola* meaning "dwelling in / on", "one that grows on", "inhabitant" or

"dweller", referring to the fact that the new species is an inhabitant of *Bassia*; adjective, ending is the same with no regard to the gender of the generic name it is combined with.

Diagnosis – Considerably detailed descriptions and differential diagnoses of *Aceria* spp. inhabiting amaranthaceous host plants were given by DE LILLO & SOBHIAN (1996), XUE *et al.* (2009) and KIEDROWICZ *et al.* (2016), allowing a comparison of the new species with them. The new species described in this paper is close to *Aceria salsolae*, but the admedian and submedian lines are complete in the latter species (apparently incomplete in *Aceria bassicola* sp. n.), granules and dashes are present on each side of the median and admedian lines (no granules and dashes are present between median and admedian lines in *Aceria bassicola* sp. n.), moreover, the two species differ in the number of empodial rays (5 in *Aceria salsolae*, 6–7 in *Aceria bassicola* sp. n.), the number of ridges on the female genital coverflap (10 in *Aceria salsolae*, 11–12 in *Aceria bassicola* sp. n.), the lengths of opisthosomal setae *e* (33–50 in *Aceria salsolae*, 26–29 in *Aceria bassicola* sp. n.) and setae *f* (30–60 in *Aceria salsolae*, 22–24 in *Aceria bassicola* sp. n.), in length of leg I (31–40 in *Aceria salsolae*, 28–30 in *Aceria bassicola* sp. n.) and in length of leg II (30–33 in *Aceria salsolae*, 26–27 in *Aceria bassicola* sp. n.) (DE LILLO & SOBHIAN 1996).

Aceria chenopodia is also a similar species, but the two species differ in numerous characters, including shield pattern and coxal ornamentation. In *Aceria chenopodia* the admedian and submedian lines are complete, the anterior shield lobe is absent, the prodorsal shield lacks granules, the coxal plates are smooth and the female genital coverflap is provided with 8 ridges, whereas *Aceria bassicola* sp. n. is characterized by having incomplete admedian and submedian lines, a short frontal lobe, its prodorsal shield is provided with granules and dashes, its coxal plates with granules and lines, and 11–12 ridges are present on the female genital coverflap (XUE *et al.* 2009).

Aceria vanensis is another similar species, but based on its three obvious features, i.e., the smooth coxal plates, the smooth suboral plate and the smooth female genital coverflap, its differentiation from the new species is easy (the coxal plates is provided with granules and lines, the suboral plate with minute granules, and the female genital coverflap with 11–12 longitudinal ridges in *Aceria bassicola* sp. n.) (KIEDROWICZ *et al.* 2016).

Aculops bassiae Keifer, 1971 was reported from a chenopodiaceous host plant, *Bassia birchii* (now *Sclerolaena birchii* Domin, fam. Amaranthaceae) in Queensland, Australia (KEIFER 1971). It can be distinguished from the new species by the nearly complete median and admedian lines (apparently incomplete in *Aceria bassicola* sp. n.), the lengths of setae *sc* 18 (whereas 45–50 in *Aceria bassicola* sp. n.), setae *c2* 22 (32–40 in *Aceria bassicola* sp. n.), and setae *e* 46 (while 26–29 in *Aceria bassicola* sp. n.) (KEIFER 1971).

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