

Two new species of eriophyid mites (Trombidiformes: Eriophyoidea) associated with Lamiaceae species from semi-arid and arid environment in East Iran

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Abstract

During the field study of eriophyid mites associated with Lamiaceae species in semi-arid and arid environment in East Iran (Birjand, South Khorasan, Iran, summer 2017), two new eriophyid mite species (Trombidiformes: Eriophyidae) were discovered. They are *Aceria pocrii* sp. nov. on *Teucrium polium* L. and *Cecidophyes punctinea* sp. nov. on *Rosmarinus officinalis* L., and are illustrated and described herein. Both new species seemed to be vagrants on leaves and flowers, and they were not associated to any particular symptom.

Key words: Eriophyidae, South Khorasan, *Cecidophyes*, *Aceria*, survey

Introduction

The plant family Lamiaceae or Labiatae (mint or sage family) consists of 245 genera and 7,886 species, which are cosmopolitan and mainly distributed in the Mediterranean regions and Southwest Asia. They are flowering plants and generally herbs, subshrubs, or shrubs (Xu & Chang 2017; The Plant List 2013). Most species in the mint family are aromatic and produce essential oils. They are among the most important medicinal plants, widely used as culinary herbs, cosmetics, food flavoring, perfumer essence and biopesticide (Carovic-Stanko *et al.* 2016; Venkateshappa & Sreenath 2013). *Teucrium* genus consists of approximately 300 perennial plant species distributed in Europe, North Africa, and the temperate parts of Asia, but mostly in the Mediterranean area. *Teucrium polium* L. is a wild perennial and flowering species that has found application for some diseases like abdominal and intestinal pains (Milosevic-Djordjevic *et al.* 2018). It is called ‘Kalpoore’ in Persian and is distributed in steppes, arid and semiarid regions of Iran (Bukhari *et al.* 2014). *Rosmarinus* includes six species (The Plant List 2013). *Rosmarinus officinalis* L., rosemary, is a woody evergreen herb, distributed in the Mediterranean region; its leaves and flowers are used as culinary condiments and are supposed to improve memory, boost the immune system and promote the hair growth (Kompelly 2019).

Until now, approximately 70 species of Eriophyoidea (Trombidiformes) have been reported on Lamiaceae plants throughout the world, of which three species on *Teucrium* spp. and one on *Rosmarinus* spp.; *Aculops thymi* Nalepa (originally described from specimens collected on *Thymus serpyllum* L.), *Anthocptes octocinctus* Nalepa and *Aculus teucrii* Nalepa were reported on *Teucrium chamaedrys* L., whereas *Cecidophyopsis rosmarinusis* Wang & Elhalawany was reported on *R. officinalis*. No eriophyid species have been collected on *T. polium* (Amrine and de Lillo, unpublished databases).

Some studies regarding the autochthonous host plants were done in arid and semi-arid environments of Iran by the authors of this paper. Nevertheless, obviously our knowledge about the Eriophyid-fauna in this environment is fragmentary. In order to promote our knowledge, a survey on Eriophyoids associated with Lamiaceae host plants, was carried out in Birjand, South Khorasan, Iran.

Material and methods

Samples of Lamiaceae plants were collected in the vicinity of Birjand (South Khorasan, East Iran) during the summer of 2017. Leaves and flowers were washed according to the method developed by Monfreda *et al.* (2007) and specimens were recovered also directly from the surface of plant parts under a dissecting stereomicroscope. Specimens were preserved in part in 70% ethanol and in part in Oudemans' solution (Chapter 7 in Krantz & Walter 2009). Eriophyid mites were cleared and mounted in Keifer's media (Keifer 1975). Some kapok fibers were used between slide and coverslip. This procedure avoids mite flattening and allows rotating mites around their longitudinal axis making measurements and drawings easier (de Lillo *et al.* 2010). Generic key of Amrine *et al.* (2003) was used for genera identification. The morphological terminology and setal notations followed Lindquist (1996). Phase contrast microscope Olympus BX50 was used for taking morphological measurements according to Amrine and Manson (1996), as modified by de Lillo *et al.* (2010), and for line drawings with a drawing tube according to de Lillo *et al.* (2010). All measurements are given in micrometers (μm). The holotypes' measurements were followed by the range values of the paratypes in parentheses. Measurements are rounded off to the nearest integer and regard the length of the morphological traits unless otherwise specified. Abbreviations used in the drawings follow Amrine *et al.* (2003). The host plants were identified by Mohammad Reza Joharchi, botanist at the Plant Science Research Institute, Ferdowsi University of Mashhad, Iran.

Three paratypes of each new species are deposited at the Entomological and Zoological Section, Department of Soil, Plant and Food Sciences (DiSSPA), University of Bari Aldo Moro, Italy (UNIBA). The rest of the paratype specimens and the holotypes are deposited in the collection of the Acarology Laboratory, Department of Plant Protection, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran (FUM).

Results

Aceria pocrii sp. nov. (Fig. 1)

Description

FEMALE: (n = 10) Body vermiform, 200 (170–210, including gnathosoma), 50 (50–51) wide, 50 (47–51) thick. **Gnathosoma** 22 (21–23) projecting obliquely downwards, pedipalp coxal setae *ep* 2 (no range), dorsal pedipalp genual setae *d* 6 (6–7), unbranched, palp tarsus setae *v* 1(1–2), cheliceral stylets 22 (20–23). **Prodorsal shield** subtriangular 30 (30–31), including frontal lobe, 30 (29–31) wide; with rounded frontal lobe 5 (4–5) over gnathosomal base. Median and admedian lines complete; admedian lines with very short and pronounced arches (like commas) close to the rear margin of the shield. One pair of inner submedian lines on the anterior half of shield, divergent and posteriorly connected to the outer submedian lines. One pair of outer submedian lines on the anterior half of shield, convergent and reaching the anterior and lateral side of the shield. A further short and arched pair of outer submedian lines and some dashes on the lateral and posterior half of the shield, ahead the tubercles of *sc* setae; very small microtubercles between the lateral sides of shield and base

of coxae. Tubercles of scapular setae *sc* on rear shield margin, 19 (18–20) apart, scapular setae *sc* 55 (55–58), directed backward. **Leg I** 31 (31–32), femur 9 (9–10), genu 4 (no range), tibia 6 (no range), tarsus 8 (7–8), solenidion ω 10 (9–10), curved down, distally slightly enlarged, empodium 5 (no range), simple, 6-rayed; femoral setae *bv* 13 (12–13), genual setae *l''* 27 (26–28), tibial setae *l'* 8 (7–8), tarsal setae *ft'* 14 (13–15), setae *ft''* 26 (25–26). **Leg II** 26 (25–26), femur 8 (8–9), genu 4 (no range), tibia 5 (no range), tarsus 7 (6–7), solenidion ω 11 (10–11), curved down, distally slightly enlarged, empodium 5 (no range), simple, 6-rayed; femoral setae *bv* 14 (13–15), genual setae *l''* 15 (13–15), tarsal setae *ft'* 6 (5–6), setae *ft''* 31 (29–31). **Coxae** ornamented with several granules; setae *lb* 13 (13–14), tubercles *lb* 10 (9–10) apart, setae *la* 25 (24–26), tubercles *la* 9 (9–10) apart, setae *2a* 45 (45–48), tubercles *2a* 19 (18–20) apart, prosternal apodeme 5 (no range). **Opisthosoma** dorsally arched with 72 (68–72) dorsal semiannuli, with elliptical microtubercles on rear margin, and 75 (69–76) ventral semiannuli, with elliptical microtubercles on rear part; 5 (5–6) semiannuli with fine microtubercles between coxae and genital coverflap; last 7 (no range) ventral and dorsal semiannuli of the opisthosoma with elongated microtubercles. Setae *c2* 36 (34–36), on ventral semiannulus 11 (10–12); setae *d* 65 (65–69), on ventral semiannulus 23 (23–25); setae *e* 16 (16–17), on ventral semiannulus 44 (42–45); setae *f* 24 (23–25), on ventral semiannulus 65 (63–69), 6 (no range) annuli after setae *f*. Setae *h2* 95 (90–108), setae *hl* 6 (no range). **Genital coverflap** 10 (10–11), 20 (20–21) wide, coverflap with 14 (no range) longitudinal striae, setae *3a* 24 (22–24), 14 (14–15) apart; with two transversal rows of strong granulated lines at the genital coverflap base.

MALE (n = 1). Body vermiform, 180 (including gnathosoma), 40 wide, 43 thick. **Gnathosoma** 20 projecting obliquely downwards, chelicerae 20, palp coxal setae *ep* 1, palp genual setae *d* 6, unbranched, palp tarsus setae *v* 1. **Prodorsal shield** 28, including frontal lobe, 25 wide, frontal lobe 4. Shield pattern similar to that of female. Tubercles of scapular setae *sc* on rear shield margin, 17 apart, setae *sc* 43. **Leg I** 28, femur 9, genu 4, tibia 6, tarsus 6, solenidion ω 9, curved down, distally slightly enlarged, empodium 5, simple, 6-rayed; femoral setae *bv* 12, genual setae *l''* 25, tibial setae *l'* 8, tarsal setae *ft'* 13, setae *ft''* 26. **Leg II** 25, femur 9, genu 4, tibia 4, tarsus 6, solenidion ω 10, curved down, distally slightly enlarged, empodium 5, simple, 6-rayed; femoral setae *bv* 13, genual setae *l''* 13, tarsal setae *ft'* 5, setae *ft''* 26. **Coxae** similar to those of female; setae *lb* 11, tubercles *lb* 8 apart, setae *la* 20, tubercles *la* 6 apart, setae *2a* 40, tubercles *2a* 17 apart. Prosternal apodeme 5. **Opisthosoma** dorsally arched with 60 dorsal semiannuli; 64 ventral semiannuli; 5 semiannuli between coxae and genital region. Setae *c2* 26 on ventral semiannulus 10, setae *d* 50 on ventral semiannulus 20; setae *e* 13 on ventral semiannulus 35; setae *f* 21 on ventral semiannulus 58, 5 annuli after setae *f*. Setae *h2* 85; setae *hl* 5; setae *3a* 17, 10 apart.

Type host plant

Teucrium polium L., felty germander.

Relation to the host plant

Vagrant on stems and leaves. No symptom was observed on the infested plants.

Type locality

Razg village, Birjand, Iran, 32°47'56.152"N, 59°15'36.911"E, 1867 m above sea level; 10 June 2017, coll. Arash Honarmand.

Type material

Holotype: single female on a microscope slide (slide code: AH96-21-1); paratypes: 11 females (slide code: AH96-21-2 to AH96-21-12) (two females were not measured) and one male (slide code: AH96-21-20) mounted on separate microscope slides.

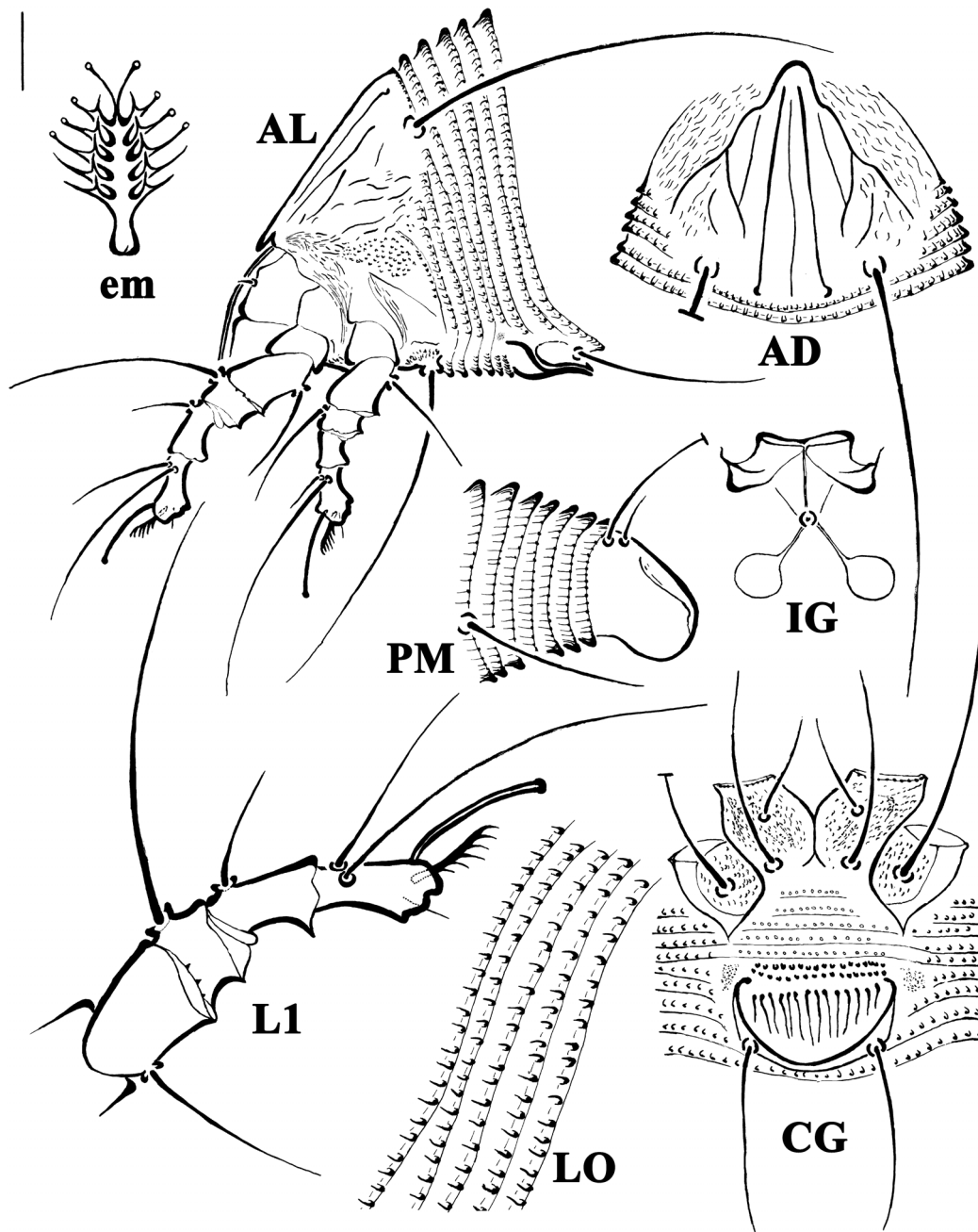


FIGURE 1. Line drawings of *Aceria pocrii* sp. nov.: AD. Prodorsal shield; AL. Lateral view of anterior body region; CG. Female coxigenital region; em. Empodium; IG. Internal female genitalia; LO. Lateral view of annuli; L1. Leg I; PM. Lateral view of posterior opisthosoma. Scale bar: 10 μ m for AD, AL, CG, IG, PM; 5 μ m for LO, L1; 2.5 μ m for em.

Other material

Mites were preserved in part in 70% ethanol and in part in Oudemans' solution extracted from the same sample as the type specimens.

Etymology

The specific epithet, *pocrii*, is a combination of the genus and species names of the host plant in the singular genitive case.

Differential diagnosis

Aceria pocrii **sp. nov.** is not close to any *Aceria* species found on Lamiaceae whereas it appears to be very close to *Aceria portalis* Keifer which was found on *Artemisia tridentata* Nutt (Compositae) from the USA (Keifer 1965). *Aceria pocrii* **sp. nov.** and *A. portalis* have similar median, admedian, inner and outer submedian lines, but they differ by one very short pair of lines located between admedian and inner submedian lines present only in *A. portalis*. The admedian lines of *A. pocrii* **sp. nov.** are provided posteriorly with a very short and strongly arched end, which is absent in *A. portalis*; admedian lines are straight in *A. pocrii* **sp. nov.** and sinuate in *A. portalis*. Other similarities regard the 6-rayed empodium, number of longitudinal striae on the coverflap, length of *d* and *f* setae, and number of semiannuli in the coxigenital region. The new species can be differentiated by the length of scapular setae *sc* (55–58 in *A. pocrii* **sp. nov.** versus 50 in *A. portalis*), dorsal semiannulus number (68–72 in *A. pocrii* **sp. nov.** versus 60 in *A. portalis*), genital setae *3a* length (22–24 in *A. pocrii* **sp. nov.** versus 14 in *A. portalis*), setae *c2* length (34–36 in *A. pocrii* **sp. nov.** versus 24 in *A. portalis*), setae *e* length (16–17 in *A. pocrii* **sp. nov.** versus 20 in *A. portalis*), and the ornamentation of coxae which are provided with several small granules in *A. pocrii* **sp. nov.** and some strong dashes in *A. portalis*.

Cecidophyes punctinea **sp. nov.** (Fig. 2)

Description

FEMALE (n = 10) Body fusiform, 190 (180–210, including gnathosoma), 49 (48–51) wide, 41 (41–50) thick. **Gnathosoma** 24 (23–25) projecting downwards, pedipalp coxal setae *ep* 2 (no range), dorsal pedipalp genual setae *d* 5 (4–5), unbranched, palp tarsus setae *v* not detectable, cheliceral stylets 25 (24–26). **Prodorsal shield** semicircular in shape, 33 (33–39), including frontal lobe, 43 (40–43) wide; with broad frontal lobe 6 (6–7) over gnathosomal base. Shield pattern composed of granulate lines, denser on the posterior half of the shield: median and admedian lines complete; inner submedian lines on about anterior 1/3 of the shield. Outer submedian lines complete and interrupted on about anterior 1/3 of the shield, arched. All lines joined together by a transverse line on about anterior 1/3 of the shield. Some granules in the submedian areas and on the lateral sides of shield. Dorsal tubercles and setae absent. **Leg I** 26 (25–26), femur 8 (no range), genu 4 (no range), tibia 5 (4–6), tarsus 7 (7–8), solenidion ω 8 (8–9) distally slightly knobbed, empodium simple, 4 (no range), 4-rayed; femoral setae *bv* 12 (11–12), genual setae *l''* 23 (20–24), tibial setae *l'* 10 (9–10), tarsal setae *ft'* 14 (12–14), setae *ft''* 21 (19–21). **Leg II** 25 (24–25), femur 8 (no range), genu 4 (no range), tibia 5 (4–5), tarsus 6 (6–7), solenidion ω 9 (9–10) distally slightly knobbed, empodium simple, 4 (no range), 4-rayed; femoral setae *bv* 12 (11–12), genual setae *l''* 7 (7–10), tarsal setae *ft'* 5 (5–7), setae *ft''* 19 (19–21). **Coxae** smooth and external genitalia appressed to the coxae; setae *1b* 7 (4–7), tubercles *1b* 12 (10–12) apart, setae *1a* 20 (19–21), tubercles *1a* 10 (8–10) apart, setae *2a* 40 (39–41), tubercles *2a* 22 (22–23) apart. Coxae I narrowly connate and sternal line strongly shortened. **Opisthosoma** with 58 (55–60) dorsal semiannuli, with roundish, almost elliptical microtubercles on rear vague annulus margins, and 68 (65–70) ventral semiannuli, with very small almost puncted microtubercles; 3 (2–3) coxigenital semiannuli with fine microtubercles between coxae and genital coverflap; last 5 (no range) ventral and dorsal semiannuli on the opisthosoma with elongated microtubercles, a bit more pointed on the ventral side. Setae *c2* 9 (8–10), on ventral semiannulus 10

(8–10); setae *d* 50 (50–52), on ventral semiannulus 23 (21–26); setae *e* 7 (6–7), on ventral semiannulus 37 (35–38); setae *f* 18 (18–20), on ventral semiannulus 63 (58–65), 5 (no range) annuli after setae *f*. setae *h2* 50 (48–52), setae *h1* absent. **Genital coverflap** appressed to coxae 10 (10–11), 19 (19–21) wide, coverflap with 12 (12–14) longitudinal striae in two ranks, setae *3a* 9 (8–10), 9 (9–12) apart.

MALE (n = 1) Body fusiform, 150 (including gnathosoma), 47 wide, 48 thick. **Gnathosoma** 24 projecting downwards, chelicerae 24, palp coxal setae *ep* 2, palp genual setae *d* 4, unbranched, palp tarsus setae *v* not detectable. **Prodorsal shield** 36, including frontal lobe, 39 wide, frontal lobe 5. Shield pattern similar to that of female. **Leg I** 26, femur 8, genu 4, tibia 6, tarsus 7, solenidion ω 8, curved down, distally slightly knobbed, empodium 4, simple, 4-rayed; femoral setae *bv* 14, genual setae *l''* 23, tibial setae *l'* 10, tarsal setae *ft'* 10, setae *ft''* 20. **Leg II** 25, femur 8, genu 4, tibia 5, tarsus 6, solenidion ω 9, curved down, distally slightly knobbed, empodium 4, simple, 4-rayed; femoral setae *bv* 14, genual setae *l''* 9, tarsal setae *ft'* 8, setae *ft''* 10. **Coxae** similar to those of female; setae *1b* 5, tubercles *1b* 8 apart, setae *1a* 20, tubercles *1a* 7 apart, setae *2a* 39, tubercles *2a* 24 apart. **Opisthosoma** dorsally arched with 44 semiannuli; 59 ventral semiannuli; 2 semiannuli between coxae and genital region. Setae *c2* 10 on ventral semiannulus 8, setae *d* 40 on ventral semiannulus 18; setae *e* 6 on ventral semiannulus 31; setae *f* 18 on ventral semiannulus 54, 5 annuli after setae *f*. Setae *h2* 47; setae *h1* absent; setae *3a* 9, 10 apart.

Type host plant

Rosmarinus officinalis L., Rosemary.

Relation to the host plant

Vagrant on the leaves. No damage was observed on the infested plants.

Type locality

Tohid park, Birjand, Iran, 32°51'34.625"N 59°12'59.054"E, 2089 m above sea level; 26 Jun. 2017 coll. Arash Honarmand.

Type material

Holotype: single female on a microscope slide (slide code: AH97-6-1); paratypes: 10 females (slide code: AH97-6-2 to AH97-6-11) (one female was not measured) and one male (AH97-6-17) on separate microscope slides.

Other material

Mites preserved in part in 70% ethanol and in part in Oudemans' solution extracted from the same sample as the type specimens.

Etymology

The specific designation comes from the combination of the Latin *punctum*, *-i*, meaning dot, and Latin *linea*, *-ae*, meaning line, and refers to the morphological design of dotted-like lines on prodorsal shield. The specific name is in feminine in the nominative case.

Differential diagnosis

Cecidophyes punctinea **sp. nov.** is the first *Cecidophyes* species reported for a Lamiaceae plant and it appears to be close to *Cecidophyes caliquerci* Keifer, which was found on *Quercus lobata* Née (Fagaceae) from the USA (Keifer 1944). Shield pattern is composed of granulate lines in both species and it shows complete median and admedian lines, but *C. caliquerci* has more submedian

lines than *C. punctinea* sp. nov. on the anterior part of the shield and on the lateral sides. The lateral sides of the shield show sparse granules in *C. punctinea* and many granulate lines in *C. caliquerici*. The new species can be differentiated by the empodium rays number (4 in *C. punctinea* sp. nov. versus 5 in *C. caliquerici*), setae *c2* length (8–10 in *C. punctinea* sp. nov. versus 14 in *C. caliquerici*), setae *e* length (6–7 in *C. punctinea* sp. nov. versus 11 in *C. caliquerici*), setae *f* length (18–20 in *C. punctinea* sp. nov. versus 25 in *C. caliquerici*), genital setae *3a* length (8–10 in *C. punctinea* sp. nov. versus 12 in *C. caliquerici*) and number of coxigenital semiannuli (2–3 in *C. punctinea* sp. nov. versus 5 in *C. caliquerici*).

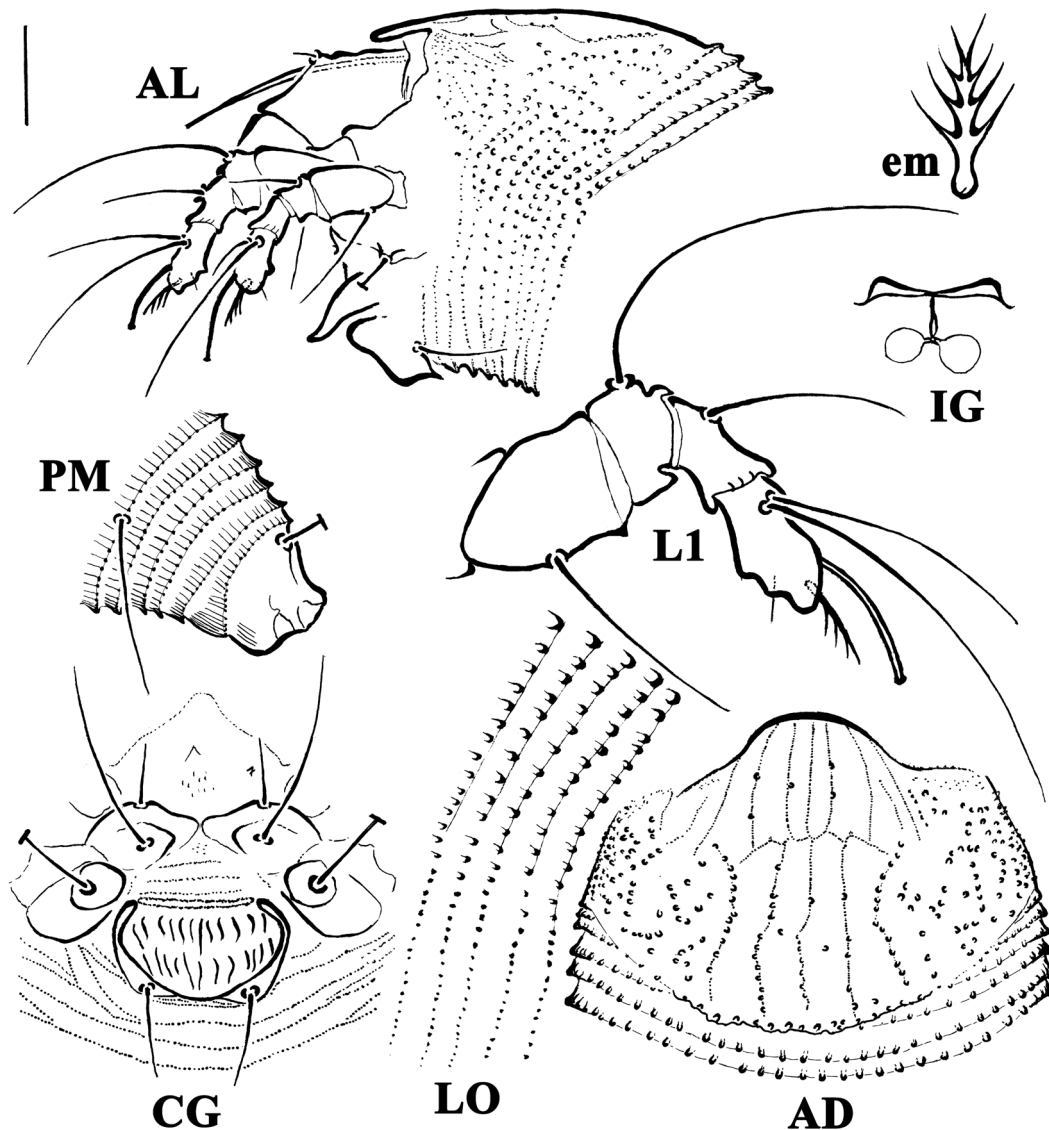


FIGURE 2. Line drawings of *Cecidophyes punctinea* sp. nov.: **AD**. Prodorsal shield; **AL**. Lateral view of anterior body region; **CG**. Female coxigenital region; **em**. Empodium; **IG**. Internal female genitalia; **LO**. Lateral view of annuli; **L1**. Leg I; **PM**. Lateral view of posterior opisthosoma. Scale bar: 10 μ m for **AD**, **AL**, **CG**, **IG**, **PM**; 5 μ m for **LO**, **L1**; 2.5 μ m for **em**.

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