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Correct identification and biosecurity decision-making: Two species instead of one in *Aceria genistae* complex (Acari: Eriophyidae) in New Zealand

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Abstract

In this paper, *Aceria genistae* (Nalepa) on scotch broom (*Cytisus scoparius*) from Mandagout, France is redescribed and a neotype is designated. A gall mite on *Ulex europaeus* L. (Fabaceae) in New Zealand, previously mis-identified by David Manson as *A. genistae* is here redescribed as a new species, *Aceria davidmansoni* sp. nov. Taxonomic and nomenclatural history of *A. genistae* is reviewed.

Key words: eriophyoid mites, new species, taxonomy, Scotch broom, gorse

Introduction

Biosecurity is becoming an important issue for many countries in the world as movements of organisms across countries and regions are increasing. One of the foremost tasks of biosecurity workers is to minimize the risk of potential damage that may be caused by the accidental or intentional movement of exotic species across borders. Taxonomic knowledge of the species concerned is essential for determining if the species being moved is already present in the home country or if it is an exotic species. Incorrect identification can result in wrong decision-making. Such is the case for a tiny eriophyoid mite *Aceria genistae* (Nalepa 1892).

The Eriophyoidea is a large mite superfamily with over 4,000 described species (Zhang *et al*. 2011). The genus *Aceria* was established by Keifer (1944) based on the type species of *Eriophyes tulipae* Keifer, 1938. It is a member of the family Eriophyidae. *Aceria* is the biggest genus in the Eriophyoidea and included over 900 species world-wide up to 2003 (Amrine *et al*. 2003). Most species of *Aceria* are extremely host-specific and restricted to a single species of host plant, some species are known to feed on multiple species within the same plant genus, and exceptionally some species attack related plant genera (Lindquist *et al*. 1996a).

Aceria genistae has become an important species of *Aceria* because of its potential as a biological control agent against the Scotch broom (*Cytisus scoparius*) in Australia and New Zealand (Syrett *et al*. 1999). The world catalogue (Amrine & Stasny 1994) lists this species from three species of *Cytisus*, five species of *Genista* and two species of *Ulex* —all members of the tribe Genisteae— an unusual wide range of host species and genera for *Aceria* species. This has been followed by many others, including biocontrol workers (e.g. Chan & Turner 1998). Syrett *et al*. (1999) suspected that the gall-forming mite "*Aceria genistae*" is probably a complex of sibling species, each restricted to

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a single species of host plant. Castagnoli (1978) showed in Italy that mites infesting the Spanish broom (*Spartium junceum*) are a separate species, *Aceria spartii* (Canestrini 1893), from those on Scotch broom. Likewise, mites identified as "*A. genistae*" from gorse in New Zealand (Manson 1989), caused galls on gorse (*Ulex europaeus*) but not on Scotch broom (Manson 1989), and tests with *A. genistae* collected from Scotch broom in France produced no galls on gorse (Sagliocco *et al.* 2013). Chan & Turner (1998) reported *A. genistae* from both gorse and French broom (*G. monspessulana*) in California, USA, but also discussed the possibility of a species complex (we will report on our results from studies of US specimens in a forthcoming paper). The problem of taxonomic identities of the mite species on different host plant species requires further studies.

This paper was initiated in 2008 by an identification request to Zhang from Quentin Paynter (Landcare Research, Auckland) who introduced *A. genistae* from France to New Zealand for the biological control of scotch broom in New Zealand. An examination of the mite specimens from the Scotch broom in France and the voucher specimens from New Zealand gorse of Manson (1989) by Zhang revealed that they are different species—the mites from gorse being a new species, rather than "*A. genistae*" as reported by Manson (1989). Xue visited Landcare Research in 2008 and prepared the descriptions and illustrations of two species. During the preparation of a manuscript on these two species, Zhang and Xue did a survey of literature on *A. genistae* and noted numerous errors in previously published records on this species and related species. To clarify the taxonomic problems of "*Aceria genistae"*, Zhang loaned presumed type material of *A. genistae* from the Natural History Museum Vienna. In 2009, Zhang also loaned specimens of *A. genistae* studied by Castagnoli (1978) in Italy. This work was completed during visits by Xiao Han to Landcare Research in 2012 and 2014. The purpose of this paper is to describe the new species of *Aceria* from gorse in New Zealand, revise the concept of *A. genistae* and clarify the taxonomic problems within this species complex.

Historical and taxonomical review of "*Aceria genistae*"

Date of publication

Aceria genistae was listed as published in either 1891 (see Nalepa 1898; Castagnoli 1978; Manson 1989) or 1892 (see Roivainen 1953; Amrine & Stasny 1994; Baker *et al*. 1996). Although this name was first mentioned in Nalepa (1891: 162), Nalepa did not describe the species in this paper—he merely listed it as a new species; hence it was first proposed by Nalepa (1891) as a nude name, not available to science, as correctly interpreted by Newkirk (1984). Nalepa (1892: 532) provided the first description of *A. genistae* (under *Phytoptus*) with two illustrations (ventral view of the body and dorsal view of the prodorsum). Roivainen (1953: 13) correctly attributed the date of publication to 1892.

Authority

There is no doubt that the author of *A. genistae* is Nalepa (1892: 532). Farkas (1965: 42), however, attributed the authority of the "*Aceria genistae*" that he identified to Canestrini without giving any reference to the publication. Canestrini (1893: 153) described *Phyllocoptes genistae* from deformed flowers of *Genista tinctoria* in Italy. This is the only other species of the Eriophyoidea with the specific designation "*genistae*" based on a search of the Zoological Record and all references that we have. Canestrini (1894: 789) repeated the same description of *P. genistae* in 1893, only adding a figure of the infested plant and also indicating the collector (A. Fiori). Both papers contain no illustrations of the species and the descriptions he provided lack the necessary details to allow even a proper generic placement based on the current classification of the family. In his monograph on Eriophyidae, Nalepa (1898) recognized both species, placing his own *genistae* Nalepa, 1892 in

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Eriophyes (now = *Aceria*) and *genistae* Canestrini in *Phyllocoptes*. Davis *et al*. (1982) considered the generic assignment of *genistae* Canestrini 1893 to be *Phyllocoptes* on page 26, but listed the species in *Eriophyes* (now *Aceria*) on page 127—*genistae* Nalepa listed as species 0905 and *genistae* Canestrini listed as species 0906. In their world catalogue of Eriophyoidea, Amrine and Stasny (1994) listed *P. genistae* Canestrini, 1893 with a question mark, not sure about its current status.

Although the original descriptions of *Phyllocoptes genistae* Canestrini are not detailed enough by modern standards to allow a proper generic placement, it does show at least the following two points: (1) *Phyllocoptes genistae* Canestrini is not a member of the genus *Aceria* because Canestrini (1893) described that the dorsal setae *sc* "avvicinate alla linea mediana"—not posteriorly directed as in *Aceria*; (2) *Phyllocoptes genistae* Canestrini is certainly not *A. genistae* Nalepa because Canestrini (1893) described that this species has "semiannali dorsali 27, lisci"—significantly different from 70 dorsal annuli with microtubercles in *A. genistae* Nalepa, 1892. Farkas (1965: 42) described that his "*Aceria genistae*" has 70 dorsal annuli with fine microtubercles and the feather-claw 7-rayed; thus his "*Aceria genistae* Canestrini" is not *Phyllocoptes genistae* Canestrini, 1893 but *Aceria genistae* Nalepa, 1892. We conclude that Farkas (1965: 42) wrongly attributed the author of his "*Aceria genistae*" to Canestrini and mis-identified his specimens from *Genista*.

Type locality and host plants

Nalepa (1891) only listed the species name *Phytoptus genistae*, recording it from *Genista pilosa*—no locality was mentioned and no descriptions/figures were provided. Nalepa (1892: 532) described and illustrated it from *G. pilosa* and *C. scoparius* (then placed in *Sarothamnus*), but no locality was mentioned, nor type specimens designated. It is unfortunate that Nalepa (1892) did not indicate if his description was based on specimens from *G. pilosa* or *C. scoparius* or both. The first mention of the distribution/locality of *A. genistae* is by Kieffer (1892: 142–143) who described the galls of this mite on *C. scoparius* in Lorraine, France. This publication was hypothetically attributed to Nalepa by Newkirk (1984: 21), which is a mistake. Newkirk (1984: 21): "The Abbé J. J. Kieffer indicated that that the descriptions in this article …… were by Nalepa". It seems rather strange why Newkirk would think that the title Abbé for J. J. Kieffer should indicate that the descriptions in his paper should be someone else. J. J. Kieffer is a priest but also a taxonomist mainly specializing on gall-forming Diptera and Hymenoptera. In "Les acarocecidies de Lorraine (Suite)", Kieffer (1892: 141–147) described galls, not mites and the paragraph on "*Phytoptus genistae*" (pp. 142–143) consisted mostly a quote from Réaumur (1737, Mem. III, p. 432). There is no description of *Phytoptus genistae*. This paper was published in March 1892 (according to Newkirk) before Nalepa (1892), which was published in July. Thus, Kieffer (1892) read Nalepa (1891) which has no descriptions of the morphology of *A. genistae*.

Amrine and Stasny (1994: 49) probably followed Newkirk (1984) as they listed Lorraine as the type locality and *C. scoparius* as the host plant of *A. genistae* (other plant species listed as alternative hosts). There is no doubt that "Les acarocecidies de Lorraine (Suite)" is authored by Kieffer (1892) and mentioning of *A. genistae* forming galls on *C. scoparius* in that paper cannot be interpreted as evidence that the type locality of *A. genistae* is Lorraine. In his monograph on the Eriophyidae, Nalepa (1898: 30) referred to his two earlier papers on this species (Nalepa, 1891, 1892) and provided for the first time the distribution of this species: middle Europe. It is obvious that the original description of *A. genistae* is in Nalepa (1892) with mention of the type locality of this species.

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Material and methods

Specimens of eriophyoid mites were collected from France and New Zealand, with details presented in the material examined section for each species. The morphological terminology used here follows Lindquist (1996b) and the generic classification is made according to Amrine *et al.* (2003). In 2008, specimens were examined with a Leica DM4500B (Germany) research microscope with phase contrast and semi-schematic drawings were made; photos were taken with Nikon (Japan) research microscope with differential interference contrast. In 2012–2013, additional specimens were examined with the aid of a Zeiss A2 (Germany) research microscope equipped with phase contrast (A-plan phase objectives: ×10/0.25, ×20/0.45; EC plan-NEOFLUAR phase objectives: ×40/0.75; ×100/1.3 oil immersion) and schematic drawings were made. Images were taken with the same microscope (under 100× oil immersion with 10× eyepieces) with an Axio Cam MRc (Carl Zeiss) system, connected to a computer and using Axiovision image analysis software. Specimens were measured according to de Lillo *et al.* (2010). For each species, the neotype and holotype female measurement precedes the corresponding range for paratypes (given in parentheses). All measurements are in micrometers (μm), and are lengths when not otherwise specified. All type specimens are deposited as slide mounted specimens in the New Zealand Arthropod Collection (NZAC), Landcare Research, Auckland.

Species descriptions

Aceria genistae (Nalepa, 1892) (Figures 1–2, 5A–B)

Phytoptus genistae Nalepa, 1891: 162 (nom. nud.).
Phytoptus genistae Nalepa, 1892: 532.
Aceria genistae (Nalepa); Roivainen, 1953: 13–14.
Eriophyes genistae (Nalepa); Castagnoli, 1978: 540–542.
Aceria genistae (Nalepa); Amrine & Stasny, 1994: 48–49.
Aceria genistae (Nalepa); Baker *et al*., 1996: 320–322.
Aceria genistae (Nalepa); Syrett *et al*., 1999: 19, 26, 28, 29.

Redescription

Female: (neotype and 27 specimens) Body vermiform, 254 (180–254), 56 (48–56) wide, 51 (47–51) thick; light yellow. Gnathosoma 17 (16–17), projecting obliquely down, pedipalp coxal setae (*ep*) 3 (3–4), dorsal pedipalp genual setae (*d*) 4 (4–5), cheliceral stylets 15 (14–15). Prodorsal shield semicircular, with granules laterally, 31 (25–31), 35 (30–35) wide; anterior shield lobe 3 (3–4); median line present 1/4 at base, admedian lines convexed at levels of median line but concaved near center, submedian lines branched, basal part continuing with outer branch, strongly concaved and forming a half-circle, inner branch nearly parellel to anterior half of admedian line. Some specimens represent with indistinct "V" shape at the posterior part between the median line and admedian lines. Scapular tubercles on rear margin, 21 (20–21) apart, scapular setae (*sc*) 16 (12–16) projecting posteriorly. Coxal plates with granules; anterolateral setae on coxisternum I (*1b*) 13 (10–13), 10 (8–11) apart, proximal setae on coxisternum I (*1a*) 25 (24–25), 9 (7–10) apart, proximal setae on coxisternum II (*2a*) 32 (30–32), 21 (18–24) apart. Prosternal apodeme present, 5 (5–6), not forked posteriorly. Legs with usual series of setae. Legs I 25 (24–27), femur 9 (9–10), basiventral femoral setae (*bv*) 8 (7–8); genu 5 (4–5), antaxial genual setae (*l″*) 22 (22–23); tibia 5 (5–6), paraxial tibial setae (*l′*) 4 (4–5), setae located 1/3 from proximal tibial margin; tarsus 6 (5–7), seta *ft′* 10 (8–11), seta *ft″* 17 (15–17); tarsal empodium simple 5 (5–6), 5-rayed, tarsal solenidion (*ω*) 8 (8–9), rod-like. Legs II 23 (21–24), femur 7 (6–7), basiventral femoral setae (*bv*) 8 (7–8); genu 5 (4–5), antaxial genual

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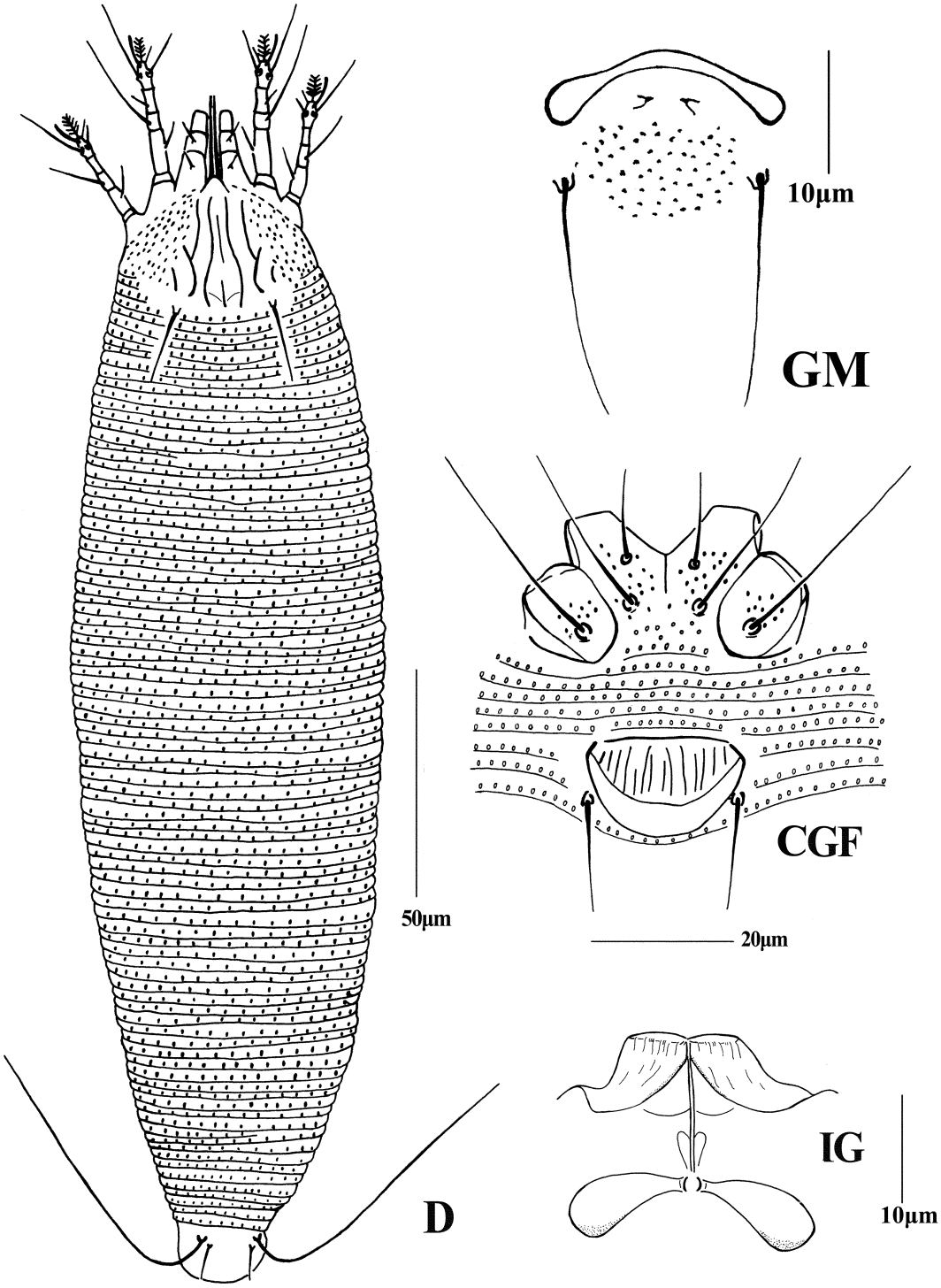


FIGURE 1. *Aceria genistae* (Nalepa). D—dorsal view of female; GM—male genitalia; CGF—coxae and female genitalia; IG—internal genitalia.

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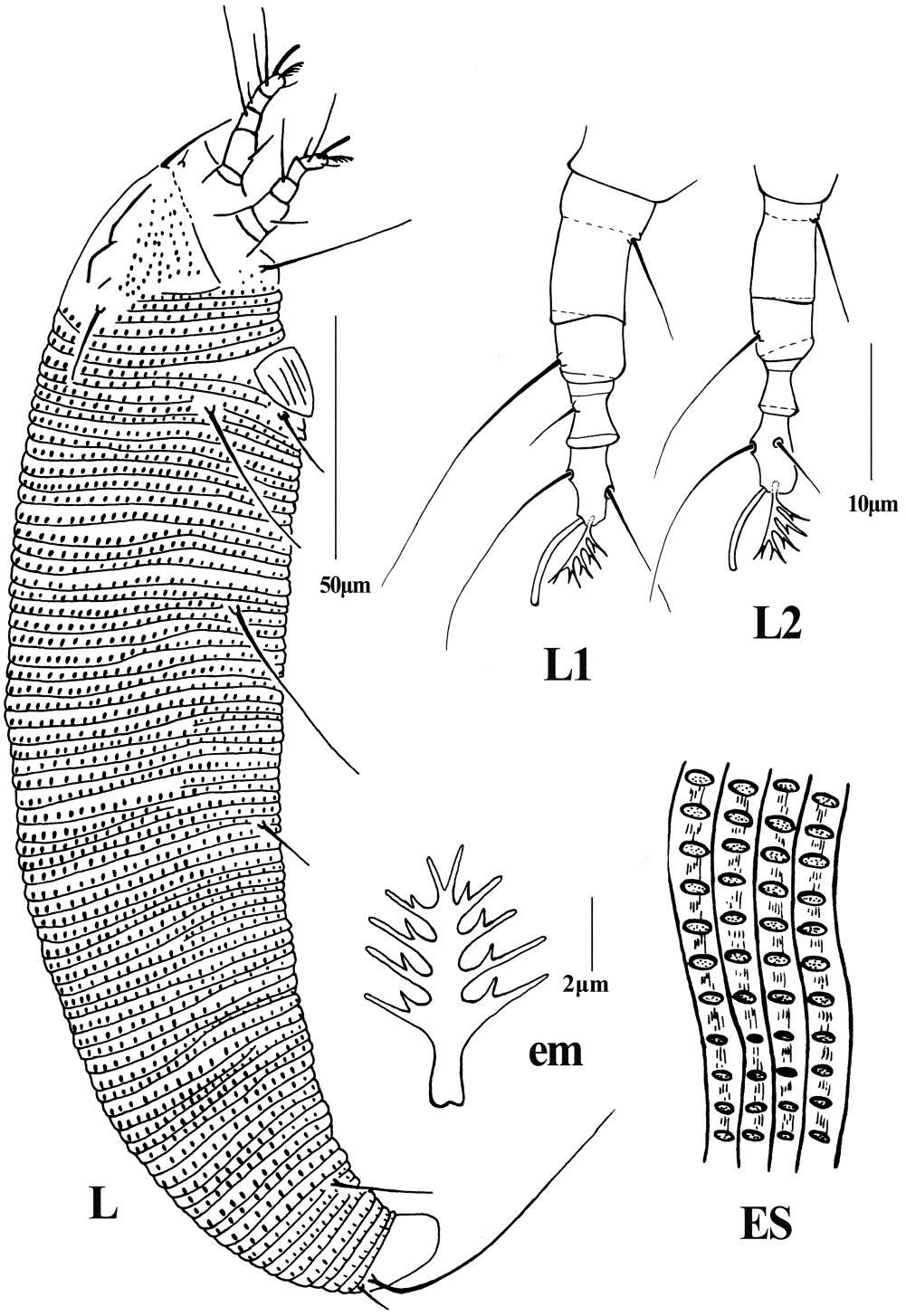


FIGURE 2. *Aceria genistae* (Nalepa). L—lateral view of female; L1—leg I; L2—leg II; em—empodium; ES—enlarged microtubercles.

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setae (*l''*) 13 (10–13); tibia 4 (4–5); tarsus 6 (5–6), seta *ft'* 5 (5–6), seta *ft''* 16 (15–17); tarsal empodium simple 5 (5–6), 5-rayed, tarsal solenidion (*ω*) 8 (8–9), rod-like. Opisthosoma: opisthosoma dorsally with 85 (78–89) annuli, with oval microtubercles, ventrally with 77 (75–83) annuli, with oval microtubercles. Setae c_2 35 (33–40) on ventral annulus 9 (9–10), 51 (43–51) apart; setae *d* 43 (38–43) on ventral annulus 25 (25–26), 40 (37–40) apart; setae *e* 12 (8–12) on ventral annulus 43 (41–43), 27 (19–27) apart, setae *f* 20 (18–23) on 8th ventral annulus from rear, 21 (17–21) apart. Setae h_1 7 (6–7), h_2 65 (65–70). Female genitalia 13 (12–13), 22 (20–22) wide, coverflap with 12 to 14 longitudinal ridges, proximal setae on coxisternum III (*3a*) 16 (13–16), 20 (15–20) apart.

Male: (four specimens) Body vermiform, 175–185, 40–45 wide; light yellow. Gnathosoma 17–18, projecting obliquely down, pedipalp coxal seta (*ep*) 2–3, dorsal pedipalp genual seta (*d*) 4–5, cheliceral stylets 14–15. Prodorsal shield semicircular, 25–27, 30–32 wide, shape and pattern similar to that of female; anterior shield lobe 3–4. Scapular tubercles on rear margin, 20–21 apart, scapular seta (*sc*) 12–15 projecting posteriorly. Coxal plates with granules; anterolateral setae on coxisternum I (*1b*) 6–7, 9–10 apart, proximal setae on coxisternum I (*1a*) 20–21, 7–8 apart, proximal setae on coxisternum II (*2a*) 30–32, 19–20 apart. Prosternal apodeme present, 5–6. Legs with usual series of setae. Legs I 25–27, femur 7–8, basiventral femoral seta (*bv*) 4–5; genu 4–5, antaxial genual seta (*l''*) 16–18; tibia 5–6, paraxial tibial seta (*l'*) 4–5, seta located 1/3 from proximal tibial margin; tarsus 5–6, seta *ft'* 10–12, seta *ft''* 20–21; tarsal empodium simple 5 (5–6), 5-rayed, tarsal solenidion (*ω*) 8 (8–9), rod-like. Legs II 23–25, femur 7–8, basiventral femoral seta (*bv*) 4–5; genu 3–4, antaxial genual seta (*l''*) 6–7; tibia 4–5; tarsus 4–5, seta *ft'* 4–5, seta *ft''* 18–20; tarsal empodium simple, 5-rayed, tarsal solenidion rod-like. Opisthosoma: dorsally with 74–81 annuli, with oval microtubercles, ventrally with 68–69 annuli, with oval microtubercles. Seta c_2 27–28 on ventral annulus 10–11, 42–45 apart; seta *d* 30–32 on ventral annulus 22–23, 33–35 apart; seta *e* 7–10 on ventral annulus 35–36, 18–20 apart, seta *f* 17–19 on 9th ventral annulus from rear, 18–19 apart. Seta h_1 5–6, h_2 50–60. Male genitalia 18–19 wide, with dense granules below eugenital setae; proximal setae on coxisternum III (*3a*) 13–16, 13–16 apart.

Type material

Nalepa (1892) did not designate any type specimens. The label data of voucher material loaned from the Nalepa collection in the Natural History Museum Vienna matched the description in Nalepa (1891, 1892)—see Fig. 6. However, the plant material completely disintegrated into fine dusts and no mites were recovered. Amrine and Stasny (1994) presumed that the type locality is in France (Lorraine). Therefore, a neotype female—from *Cytisus scoparius* (L.) Link (Fabaceae), Mandagout, France (44°01'18"N, 3°37'34"E), April 30, 2007, coll. Q. Paynter—is designated.

Additional material examined

Seven females, with same data as the neotype. 19 females and 4 males, from *Cytisus scoparius*, October 10, 2014, coll. H. Gourlay, Christchurch, New Zealand; 1 female, from *C. scoparius*, August 26, 1976, coll. Castagnoli, Vallombrosa near Florence, Italy (43°43'57"N, 11°33'24"E), elevation 990 m.

Relation to host

Gall-making. Mite feeding causes the buds to develop into deformed lumps of various sizes (often diameters of 5 to 30 mm, see Fig. 7).

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Distribution

United States of America (accidentally introduced and widespread, Smith *et al*. 2010), New Zealand (introduced and established, Sagliocco *et al*. 2013), Australia (introduced and established, Sagliocco *et al*. 2013), Italy (Castagnoli 1978), France (Nalepa 1892 and this study), Hungary (Ripka 2008), United Kingdom (Keesing 1981, Welch 1994), Spain (Roivainen 1953), Portugal (Carmona 1980).

Aceria davidmansoni sp. nov. (Figures 3–4, 5C–D)

Aceria genistae (Nalepa); Manson, 1989: 39–40. [ex gorse—incorrect identification].

Description

Female: (holotype and 19 paratypes) Body vermiform, 245 (165–245), 60 (60–62) wide, 62 (60–63) thick; light yellow. Gnathosoma 18 (18–19), projecting obliquely down, pedipalp coxal setae (*ep*) 3 (3–4), dorsal pedipalp genual setae (*d*) 5 (5–6), cheliceral stylets 15 (15–16). Prodorsal shield semicircular, 26 (25–27), 30 (30–33) wide; anterior shield lobe 3 (3–4); median line present and discontinuous, indistinct anteriorly, admedian lines complete, submedian lines concaved in posterior half, forming a pair of discontinuous circles, each with several elongated granules distributed in a circular pattern; prodorsal shield with several elongated granules between admedian and submedian lines at basal 1/3, and also numerous granules lateral to submedian lines. Some specimens represent with indistinct "V" shape at the posterior part between the median line and admedian lines. Scapular tubercles on rear margin, 25 (20–25) apart, scapular setae (*sc*) 20 (20–21) projecting posteriorly. Coxigenital region with 8 (8–9) microtuberculated annuli. Coxal plates with granules; anterolateral setae on coxisternum I (*1b*) 12 (12–13), 13 (10–13) apart, proximal setae on coxisternum I (*1a*) 23 (23–25), 10 (8–10) apart, proximal setae on coxisternum II (*2a*) 38 (33–38), 25 (20–25) apart. Prosternal apodeme present, 5 (5–6). Legs with usual series of setae. Legs I 30 (28–31), femur 10 (9–10), basiventral femoral seta (*bv*) 7 (6–7); genu 5 (4–5), antaxial genual seta (*l''*) 22 (18–22); tibia 5 (5–6), paraxial tibial seta (*l'*) 4 (4–5), setae located 1/3 from proximal tibial margin; tarsus 6 (5–6), set *ft'* 13 (11–13), seta *ft''* 23 (22–24); tarsal empodium simple 5 (5–6), 6-rayed, tarsal solenidion (ω) 9 (8–9), little knobbed. Legs II 25 (23–26), femur 8 (7–8), basiventral femoral seta (*bv*) 7 (7–8); genu 4 (4–5), antaxial genual seta (*l''*) 13 (12–13); tibia 4 (4–5); tarsus 5 (5–6), seta *ft'* 6 (6–8), seta *ft''* 23 (22–24); tarsal empodium simple 5 (5–6), 6-rayed, tarsal solenidion (ω) 8 (8–9), little knobbed. Opisthosoma: dorsally with 101 (95–101) annuli, with oval microtubercles, ventrally with 90 (85–92) annuli, with oval microtubercles. Setae c_2 25 (22–25) on ventral annulus 11 (11–12), 58 (50–58) apart; seta *d* 52 (48–52) on ventral annulus 29 (29–30), 50 (50–51) apart; seta *e* 6 (5–6) on ventral annulus 45 (45–49), 26 (25–26) apart, seta *f* 20 (19–22) on 8th ventral annulus from rear, 23 (20–23) apart. Seta h_1 5 (5–6), h_2 81 (81–88). Female genitalia 13 (12–13), 24 (19–24) wide, coverflap with 14 to 16 longitudinal ridges, proximal setae on coxisternum III (*3a*) 12 (11–12), 16 (16–19) apart.

Male: (three paratypes) Body vermiform, 147–160, 45–50 wide; light yellow. Gnathosoma 16–17, projecting obliquely down, pedipalp coxal seta (*ep*) 1–2, dorsal pedipalp genual seta (*d*) 4–5, cheliceral stylets 14–15. Prodorsal shield semicircular, 25–27, 30–33 wide, shape and pattern similar to that of female; anterior shield lobe 3–4. Scapular tubercles on rear margin, 20–22 apart, scapular seta (*sc*) 15–17 projecting posteriorly. Coxal plates with granules; anterolateral setae on coxisternum I (*1b*) 6–7, 8–9 apart, proximal setae on coxisternum I (*1a*) 13–15, 7–8 apart, proximal setae on coxisternum II (*2a*) 27–30, 19–20 apart. Prosternal apodeme present, 5–6. Legs with usual series of setae. Legs I 28–30, femur 7–8, basiventral femoral seta (*bv*) 6–7; genu 4–5, antaxial genual seta (*l''*) 18–20; tibia 5–6, paraxial tibial seta (*l'*) 3–4, seta located 1/3 from proximal tibial margin; tarsus 5–

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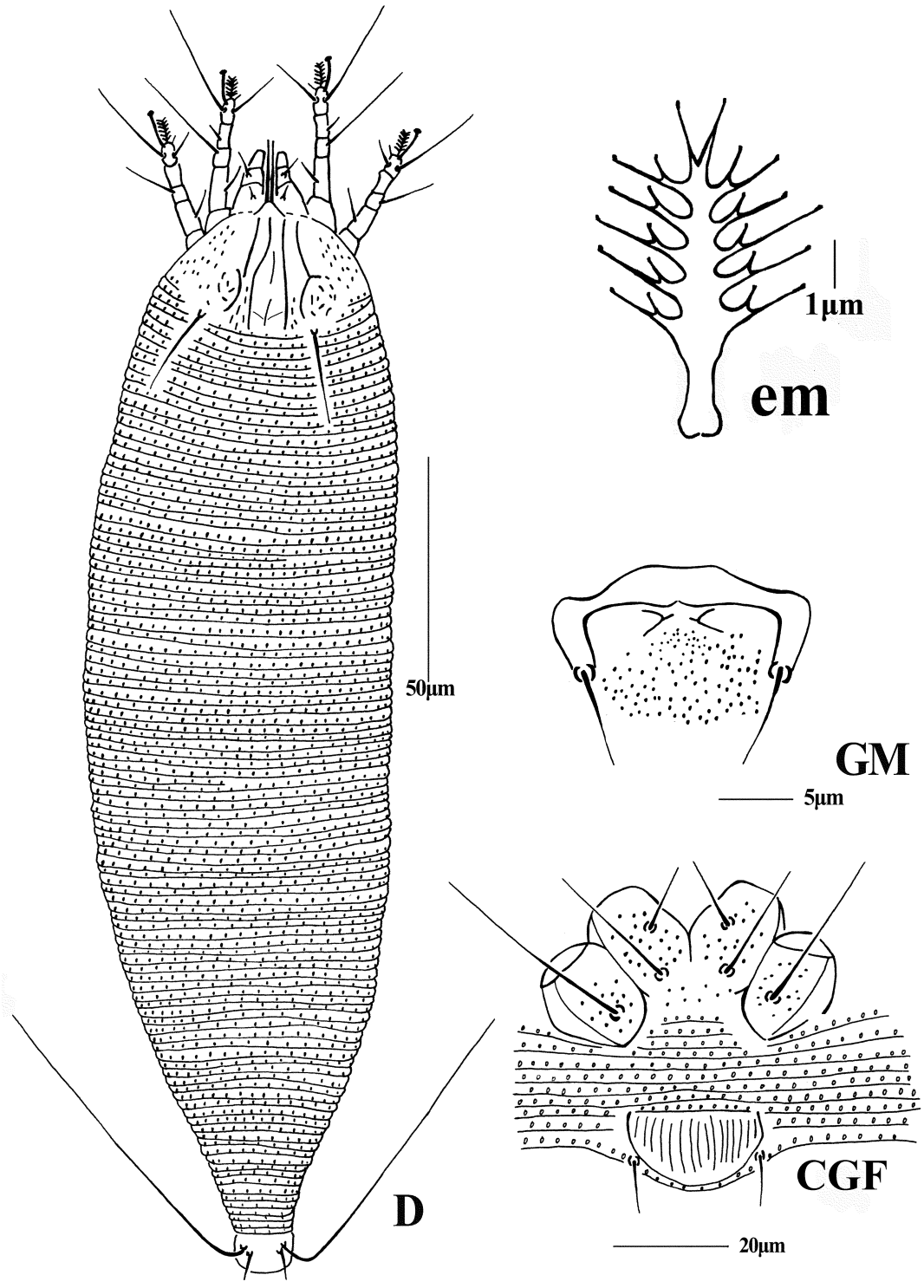


FIGURE 3. *Aceria davidmansoni* sp. nov. D—dorsal view of female; em—empodium; GM—male genitalia; CGF—coxae and female genitalia.

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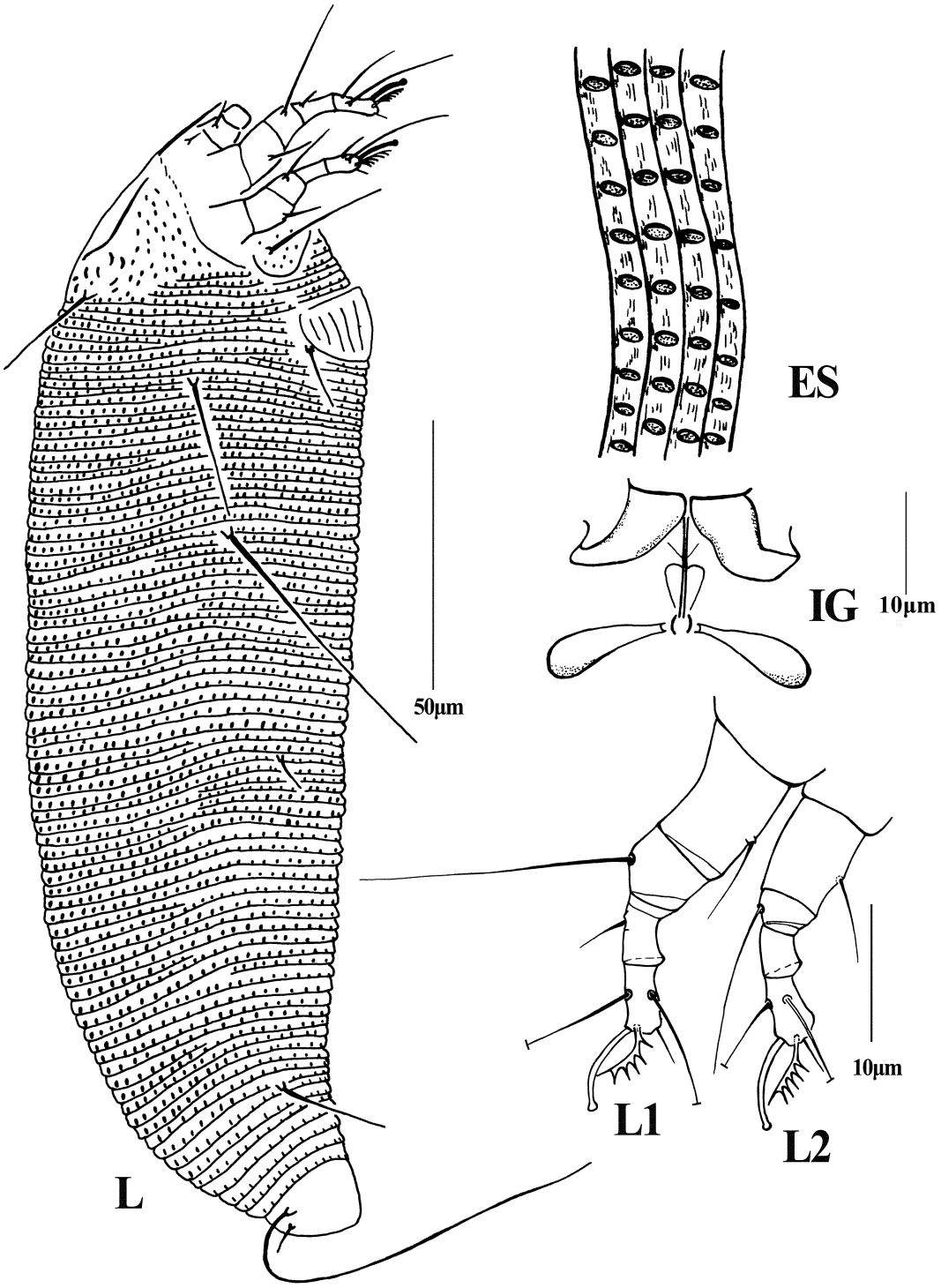


FIGURE 4. *Aceria davidmansoni* sp. nov. L—lateral view of female; ES—enlarged microtubercles; IG—internal genitalia; L1—leg I; L2—leg II.

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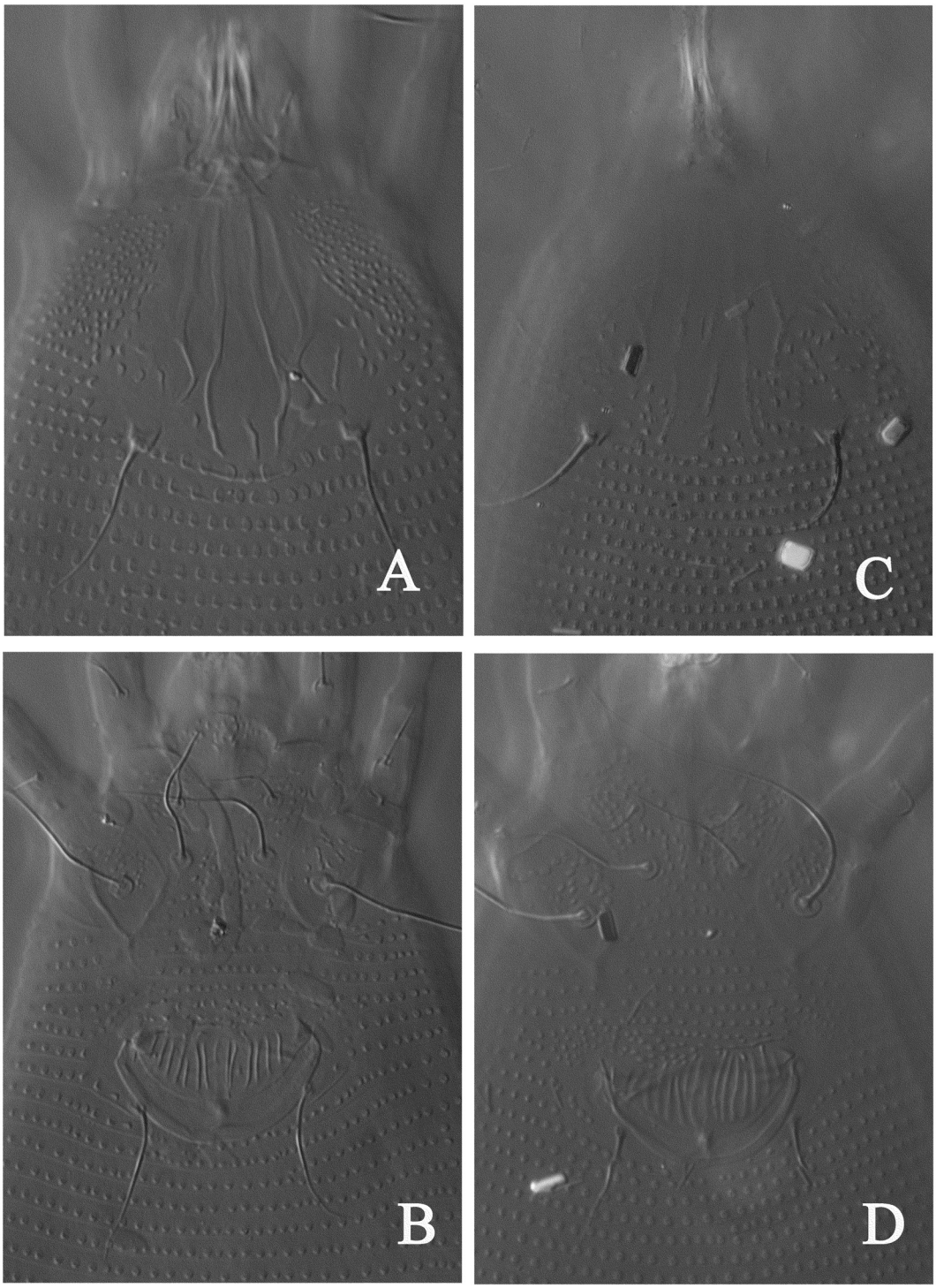


FIGURE 5. A—prodorsal shield of *Aceria genistae* (Nalepa); B—coxae and female genitalia of *Aceria genistae* (Nalepa); C—prodorsal shield of *Aceria davidmansoni* sp. nov.; D—coxae and female genitalia of *Aceria davidmansoni* sp. nov.

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6, seta *ft′* 10 (10–12), seta *ft″* 20 (20–21); tarsal empodium simple 5 (5–6), 6-rayed, tarsal solenidion (ω) 8 (8–9), rod-like. Legs II 23–25, femur 7–8, basiventral femoral seta (*bv*) 6–7; genu 3–4, antaxial genual seta (*l″*) 8–10; tibia 4–5; tarsus 5–6, seta *ft′* 4–5, seta *ft″* 18–20; tarsal empodium simple 4 (4–5), 6-rayed, tarsal solenidion (ω) 8 (8–9), rod-like. Opisthosoma: dorsally with 75–76 annuli, with oval microtubercles, ventrally with 68–69 annuli, with oval microtubercles. Seta c_2 18–20 on ventral annulus 12–13, 40–42 apart; seta *d* 30–35 on ventral annulus 23–24, 32–33 apart; seta *e* 5–6 on ventral annulus 36–38, 17–20 apart, seta *f* 17 on 6–7th ventral annulus from rear, 17–18 apart. Seta h_1 4–5, h_2 55–60. Male genitalia 16–18 wide, with dense granules below eugenital setae; proximal setae on coxisternum III (*3a*) 9–10, 12–14 apart.

Type material

Holotype female from *Ulex europaeus* L. (Fabaceae), Mahinapua Scenic Reserve, Westland, New Zealand (42°47'34"S, 170°54'09"E), November 11, 1985, coll. R. Hill. Paratypes collected from the same host plant as holotype: 13 females and 3 males with same data as the holotype; 2 females, Bowenvale valley, Christchurch, New Zealand (43°34'52"S, 172°38'52"E), January 21, 1986, coll. R. Hill; 1 female, Dansey's Pass North Otago, New Zealand (44°57'10"S, 170°22'23"E), February 7, 1986, coll. R. Hill; 1 female, Paroa/South Beach, West Coast, New Zealand (42°29'29"S, 171°10'32"E), April 16, 1986, coll. A.H. Gourlay; 1 female, Bruce Bay, West Coast, New Zealand (43°36'25"S, 169°35'32"E), April 16, 1986, coll. A.H. Gourlay; 1 female, Westport, West Coast, New Zealand (41°45'11"S, 171°35'06"E), April 16, 1986, coll. A.H. Gourlay.

Relation to host

Gall-making. Causing growth deformities in gorse shoots.



FIGURE 6. Original containers for plant issues with *Aceria genistae* (Nalepa) from the Nalepa collection. The plant material completely disintegrated into fine dusts.

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Etymology

The specific designation *davidmansoni* is after David C.M. Manson who first described the species under *Aceria genistae*.

Differential diagnosis

This species is similar to *A. genistae* (Nalepa), 1892, but can be differentiated by median line discontinuous, indistinct anterior, submedian lines concaved at posterior and form two discontinuous circle, there are many granules in the circle (median line present 1/4 at base, submedian lines concave at base and form a half-circle, smooth in the half-circle and between the admedian and submedian lines in *A. genistae*), dorsal opisthosoma with 101 (95–101) annuli, ventrally with 90 (85–92) annuli (dorsal opisthosoma with 85 (78–89) annuli, ventrally with 77 (75–83) annuli in *A. genistae*) (Table 1, Fig. 5).

TABLE 1. Main morphological characters discrimination between the females of *Aceria genistae* (Nalepa) and *Aceria davidmansoni* sp. nov.

Characters	*Aceria genistae* (Nalepa)	*Aceria davidmansoni* sp. nov.
prodorsal shield design	Median line distinct anteriorly, admedian lines convexed at levels of median line but concaved near center, submedian lines branched, basal part continuing with outer branch, strongly concaved and forming a half-circle, inner branch nearly parellel to anterior half of admedian lines	median line indistinct anteriorly, admedian lines complete, submedian lines concaved in posterior half, forming a pair of discontinuous circles, each with several elongated granules distributed in a circular pattern; prodorsal shield with several elongated granules between admedian and submedian lines at basal 1/3, and also numerous granules lateral to submedian lines
scapular setae *sc* length	16 (12–20)	20 (20–21)
empodium	5-rayed	6-rayed
number of doral annuli	85 (78–89)	101 (95–101)
number of ventral annuli	77 (75–83)	90 (85–92)
setae *c2* length	35 (33–40)	25 (22–25)
setae *d* length	43 (38–43)	52 (48–52)
setae *e* length	12 (8–12)	6 (5–6)
female genital coverflap	with 12 to 14 longitudinal ridges	with 14 to 16 longitudinal ridges

Discussion

Aceria genistae was regarded as a promising candidate biological control agent for Scotch broom, which can kill young plants and branches (Syrett *et al.* 1999). It was subsequently approved for release in New Zealand for the biological control of Scotch broom in November 2007 (Sagliocco *et al.* 2013). *Aceria genistae* was reported to have a host plant range of 6 plant species. Xue & Zhang (2008) studied Manson's (1989) specimens of "*Aceria genistae*" from gorse in New Zealand and noted it was a misidentification. In this paper, we showed that *A. genistae* from *C. scoparius* caused galls and *Aceria davidmansoni* sp. nov. from *Ulex europaeus* caused deformed shoots; they are two

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species. We focused on material from New Zealand in this paper. In the future, it will be interesting to examine eriophyoid mites from *Cytisus purgans* (L.) Spach., *Genista corsica* L., *G. cinerea* (Vill.) DC., *G. pilosa* L., *G. tinctoria* L., *U. parviflorus* Pourr, to check if these are *A. genistae* or not. It is unknown at this stage if there are more cryptic species in this complex. Skoracka & Kuczyński (2006a, b) showed in cross-host studies that *Abacarus hystrix*, which has commonly been considered as a host generalist, in fact may be a complex species consisting of populations highly specialized among its host plants. Likewise, similar ecological tests of material from different hosts (*Cytisus* spp., *Genista* spp. and *U. parviflorus)* should be conducted to determine if *A. genistae* is specialist or generalist. Material from different hosts should also be collected to support the necessary taxonomic studies. We have studied some specimens from a few hosts in USA and the results, when completed, will be reported in the future.

As eriophyoid species on broom and gorse are so similar in morphology and easy to confuse, in addition to the traditional ecological and morphological methods, molecular methods may provide an effective solution. *Cecidophyopsis ribis* is a severe pest of black currant and also the vector of reversion disease. Fenton *et al.* (1995, 1996, 1997), Kumar *et al.* (1999) and Lemmetty *et al.* (2004) developed protocols to analyse the DNA of eriophyid mites using rDNA ITS1 sequences; it was possible to distinct different *Cecidophyopsis* species on different *Ribes* species. We suggest that more variable DNA markers could be used to differentiate the host species of eriophyoid mites in future studies.



FIGURE 7. *Cytisus scoparius* with *Aceria genistae* galls (enlarged view in inset) in Lincoln, Christchurch, New Zealand (photo by H. Gourlay).

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