

# New French tiny spider mites (Prostigmata, Tetranychidae) on a tiny broom

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## Original research

### ABSTRACT

Two new spider mite species collected in southern France on the tiny broom *Genista pulchella* are described. The new species, *Bryobia* (*Lyobia*) *baroni* sp. n. and *Tenuipalpoides genistearum* sp. n. are among the smallest known species belonging to the genera *Bryobia* (*Lyobia*) and *Tenuipalpoides*, respectively. In addition, pictures, corrections on body size measurements and additional morphological data of *Tenuipalpoides zizyphus* are provided.

**Keywords** faunistic survey; biodiversity; alpha taxonomy

**Zoobank** <http://zoobank.org/918203DC-09E4-45AC-8F77-26F6BC0AA8D6>

## Introduction

According to the number of recorded species, Europe has the greatest specific diversity for the genus *Bryobia* with about 45% of the recorded species (Migeon and Dorkeld, 2006-2021) and of 70% of the species from the Palearctic region. This trend is confirmed by the location of the newly described species belonging to this genus in the last ten years. During this period, of the seven newly described species worldwide, six were from the palearctic region: two from Syria (Barbar and Auger, 2020; Barbar *et al.*, 2022) and four from Europe, in France (Auger and Migeon, 2014; Auger *et al.*, 2015). As a result, the genus *Bryobia* is very diversified in Europe with 54 recorded species (see Migeon and Dorkeld, 2006-2021).

The work by Eyndhoven and Vacante (1985) on the *Bryobia* species belonging to the *berlesei*-group and some more recent works (Auger and Migeon, 2014; Auger *et al.*, 2015, Barbar *et al.* 2022) have shown that the plants of the family Fabaceae, from the tribe Genisteae, belonging to the genera *Cytisus* (including *Calicotome*), *Genista* (including *Teline* and *Retama*), and *Ulex*, are favourable to many *Bryobia* species. In France, these plant genera are quite well represented with 53 species recorded (Coulot and Rabaute, 2016) and several of them remain unsampled for spider mite detection.

Therefore, when the last author remembered that during his studies, the French botanist Dr Yves Baron showed him the tiny broom *Genista pulchella* Vis. [French name: “genêt joli” meaning “pretty broom”, (Fig. 1)] in a location quite close to our laboratory, we wanted to know if, despite its very reduced size, some *Bryobia* mites could inhabit this plant.


The sampling events of *G. pulchella* we undertook in several locations in southern France disclosed two unknown spider mite species: one belonging to the genus *Bryobia* but also one belonging to the genus *Tenuipalpoides*. The aim of the present work is to provide the descriptions of these two new species. In addition, the observation of type specimens of *Tenuipalpoides zizyphus* Reck and Bagdasarian, 1948 for comparison with the new *Tenuipalpoides* species allowed us to provide updated body measurements (those given in

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**Figure 1** *Genista pulchella* Vis., host plant of *Bryobia* (*Lyobia*) *baroni* sp. n. and *Tenuipalpoides genisteaeae* sp. n. [top of Mont Tauch, Tuchan (Aude), France]. Scale bar = about 5 cm.

the original description were smaller than in reality) and some additional morphological data that were missing or inaccurate in the original description.

## Material and methods

Mites were extracted from broom using the washing method (Boller, 1984), by filtering the solution on three stacked sieves (smallest mesh size 400), and picking out mites using a camel hair brush. They were preserved in 70% ethyl alcohol. Following clearing in lactic acid (50%) for 24 hours, mites were mounted in Hoyer's medium. The specimens were examined using a Leica® DM LB2 phase contrast microscope. Drawings were made with a Wacom Intuos Pro L pen tablet using stacks of photographs acquired from the AmScope® MU1803 camera and imported to Adobe Illustrator® CS5. Line drawings were vectorised, edited and placed into figures using Adobe Illustrator® CS5. Measurements were taken with live images using the software AmScope® suite (v. 3.7.7934) coupled with the above mentioned camera.

The setal nomenclature used in the description follows Lindquist (1985). Leg setal counts

are given according to the sequence coxa-trochanter-femur-genu-tibia-tarsus. Numbers of setae refer to tactile setae, solenidia are given in parentheses. The most frequent number of setae in a leg segment is provided first and alternative counts are given in brackets. All measurements are presented in micrometres ( $\mu\text{m}$ ) and correspond to the holotype followed (in parentheses) by minimum and maximum values from paratypes. Body length measurement represents the distance between the tip of gnathosoma (when including gnathosoma) or the tip of inner prodorsal lobes (when excluding gnathosoma) to the caudal end of idiosoma and width represents the widest transversal part of the hysterosoma. Distance between  $sc_2$  setae members and between  $v_2$  and  $h_1$  setae are also given (Saito *et al.*, 1999). Setae were measured from the centre of their setal bases to their tips. The distance between two setae was measured as the distance from the centre of one setal base to the other. In bryobiine mites, the inner lobe height was measured as the orthogonal distance from the bottom of outer incisions to the tip of the inner lobes (excluding setae  $v_1$ ). Prodorsal lobes basal width was measured as the distance between the external margin of the bases of the external lobes. The following abbreviations are used for institutions: CBGP = Centre de Biologie pour la Gestion des Populations; INRAE = Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement. All the mite specimens are deposited in the Centre de Biologie pour la Gestion des Population. 2018. CBGP - Continental Arthropod Collection. <https://doi.org/10.15454/D6XAKL>

## Results and discussion

### Family Tetranychidae Donnadieu, 1875

#### Subfamily Bryobiinae Berlese, 1913

#### Tribe Bryobiini Reck, 1952

#### Genus *Bryobia* Koch, 1836

*Bryobia* Koch, 1836 :8-9 Type-species: *Bryobia praetiosa* Koch.

#### *Bryobia* (*Lyobia*) *baroni* sp. n.

Zoobank: 33013FE0-200F-4C9A-8181-0267155785A2

(Figures 2-5)

#### Type material

**Holotype (female)** — 11 female, 8 deutonymph, 1 protonymph paratypes on 21 microscopic preparations from *Genista pulchella* Vis. (Fabaceae), Top of Mont Tauch (42.9096°N 2.6794°E, 840 m a.s.l.), Tuchan (Aude), France, 18-IX-2014, leg. A. Migeon and P. Auger; 10 female, 2 protonymph, 7 larva paratypes on 17 microscopic preparations from *G. pulchella*, Le Jouquet, forêt domaniale de Partlages (43.7746°N 3.4394°E, 770 m a.s.l.), Saint-Pierre-de-la-Fage (Hérault), France, 26-VII-2012, leg. A. Migeon and P. Auger. Collection Auger-Migeon N° 1864 for holotype, 1865–1901 for paratypes.

**Additional material** — 5 females, one nymph on 6 preparations from *Genista pulchella* Vis. (Fabaceae), Top of Mont Tauch (42.9097°N 2.6794°E, 840 m a.s.l.), Tuchan (Aude), France, 25-VI-2012, leg. A. Migeon and P. Auger; 1 nymph, 1 larva on 2 microscopic preparations from *G. pulchella*, La Crémade on D94 (44.2563°N 3.0669°E, 889 m a.s.l.), Sévérac-le-Château (Aveyron), France, 19-VII-2012, leg. A. Migeon and P. Auger; 11 females, 4 nymphs on 15 microscopic preparations from *G. pulchella*, Piste des Indochinois (44.0128°N 5.2981°E, 779 m a.s.l.), Méthamis (Vaucluse), France, 25-IX-2014, leg. A. Migeon and P. Auger; 12 females, one nymph on 11 preparations from *Genista pulchella* Vis. (Fabaceae), Peyrafic – Route des Cèdres, Parc Naturel du Luberon (43.8049°N 5.2871°E, 635 m a.s.l.), Bonnieux (Vaucluse), France, 25-IX-2014, leg. A. Migeon and P. Auger.



## Diagnosis

This species belongs to the subgenus *Lyobia* having prodorsal lobes well developed, no duplex setae on tarsus IV (Livshits and Mitrofanov, 1971) and to the *berlesei*-group (all living on Genisteae) due to a femoral interior dorsal row of leg I bearing four long setae (Eyndhoven and Vacante, 1985). Females with body small, legs shorter than body length; anterior dorsal prodorsal projections over gnathosoma well developed, outer prodorsal lobes conical, inner lobes triangularly shaped well separated by “u” or v-shaped incision, outer incisions wider; dorsal body setae spatulate, serrate, short, subequal in length, inserted on small bulge-like structures becoming obvious tubercles caudally; among dorsocentral setae,  $c_1$  the largest,  $d_1$  and  $e_1$  the shortest; palptarsus far longer than bidentate tibial claw; spermatheca sacculus oval; empodia I with a pair of tenent hairs, others with two rows of tenent hairs; tarsus IV with 14 setae and one solenidion, femur IV with 5 setae.

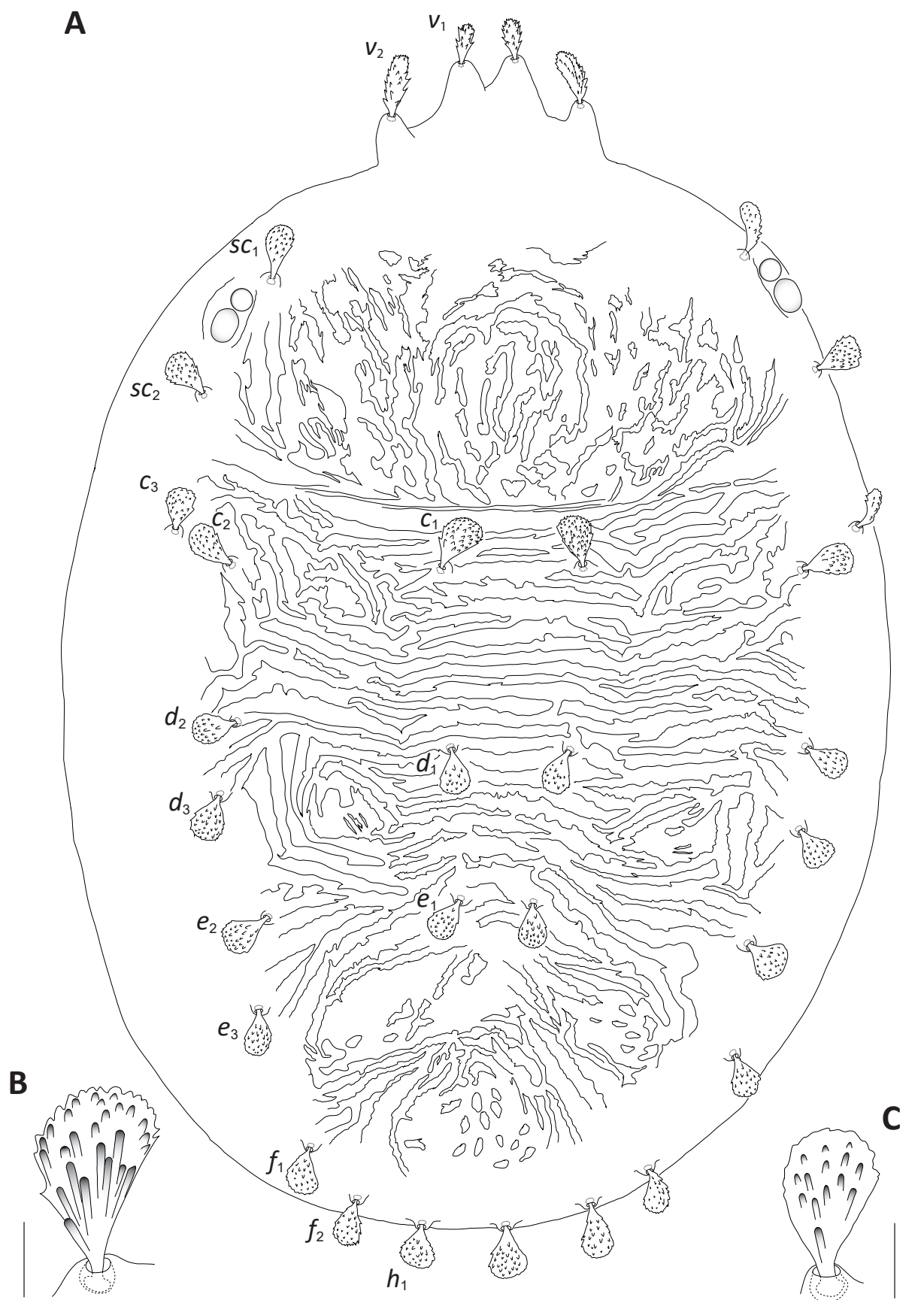
## Description

**Female** — (Figs. 2-5). Holotype 530 long (excluding gnathosoma), 630 (including gnathosoma), distance between setae  $v_2$ - $h_1$  510, width 380, distance between setae  $sc_2$  members 285; 13 paratypes measured, 506-596 long (excluding gnathosoma), 575-675 (including gnathosoma), distance between setae  $v_2$ - $h_1$  470-565, width 345-390, distance between setae  $sc_2$  members 260-297.

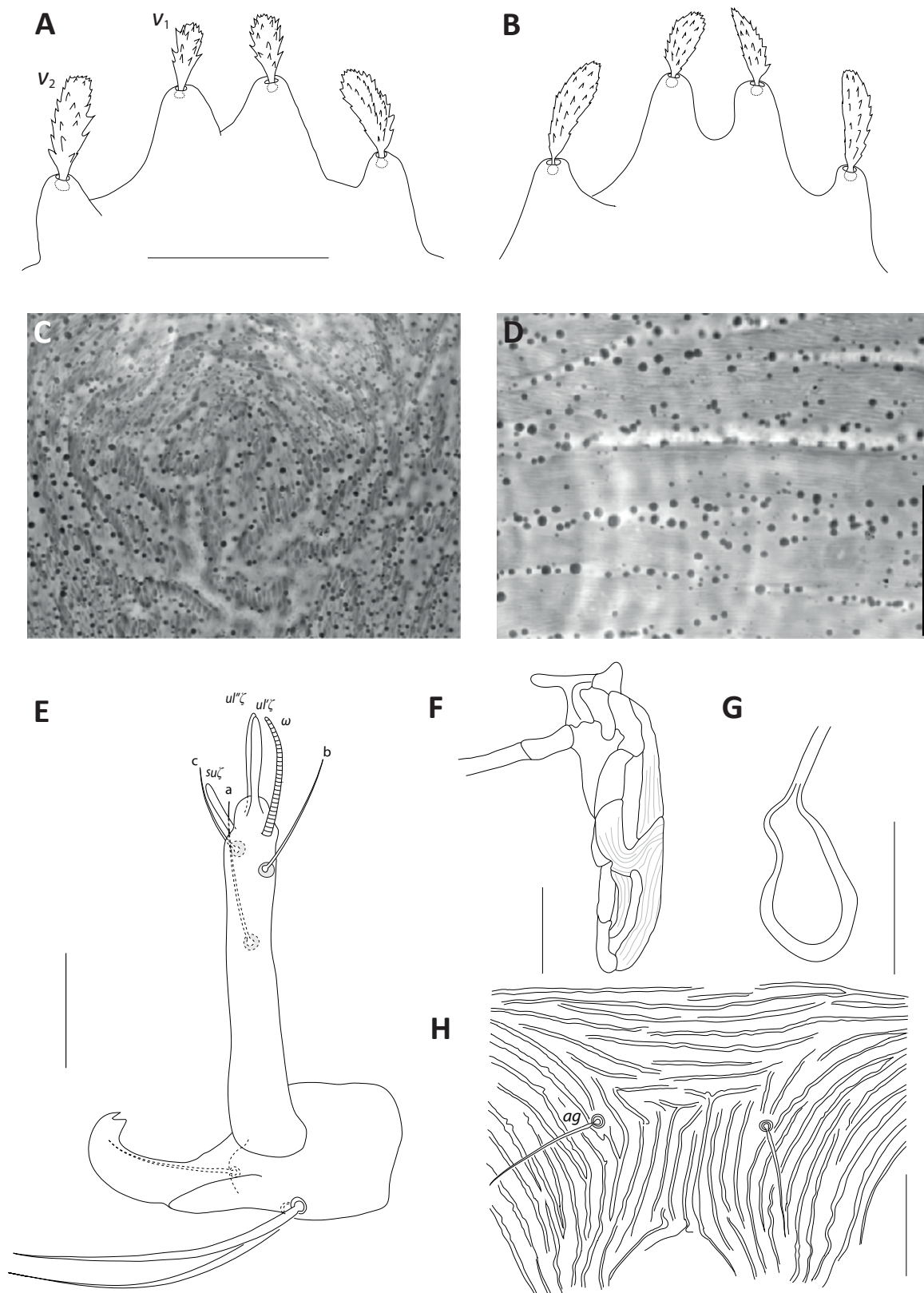
**Dorsum** — Prodorsum with four pairs of setae with well-developed anterior prodorsal lobes (Figs. 2, 3A-B). Prodorsal lobes with basal width about 105 (90-105), outer prodorsal lobes conical, inner lobes triangularly shaped, 32 (31-44) high, usually well separated by bottom U-shaped incision, sometimes varying to V-shaped, 14 (11-20) in depth (Fig. 3A-B). Incisions between median and outer lobes wider, bottom rounded. Propodosomal setae  $v_2$  of outer lobes reaching or slightly extending beyond the base of setae  $v_1$  of inner lobes. Distance between  $v_1$  and  $v_2$  setae insertions 25 (15-30) and 88 (73-89), respectively; setae  $v_1$  and  $v_2$  spatulate elongate,  $v_2$  setae wider: 7 (6-8) and 10 (9-13) in width, respectively. Dorsal body setae spatulate, rounded distally, rough, serrate, subequal in length, inserted on small bulge-like structures becoming obvious tubercles caudally,  $f_1$  and  $f_2$  setae in marginal position not contiguous (Fig. 2A-C). Dorsocentral setae ( $c_1$ ,  $d_1$  and  $e_1$ ) shorter than distances between consecutive setae,  $c_1$  the largest,  $d_1$  and  $e_1$  the shortest (Fig. 2B-C):  $v_1$  20 (17-29);  $v_2$  30 (26-39);  $sc_1$  28 (22-31);  $sc_2$  24 (20-27);  $c_1$  26 (25-29);  $c_2$  26 (22-27);  $c_3$  22 (20-25);  $d_1$  22 (19-24);  $d_2$  21 (20-24);  $d_3$  24 (21-24);  $e_1$  23 (20-24);  $e_2$  24 (21-25);  $e_3$  22 (21-28);  $f_1$  22 (21-29);  $f_2$  26 (22-30);  $h_1$  25 (21-32). Distances between setae:  $c_1$ - $c_1$  61 (63-76),  $d_1$ - $d_1$  57 (45-61),  $e_1$ - $e_1$  35 (26-37),  $c_3$ - $c_3$  313 (286-326),  $c_1$ - $d_1$  83 (70-94),  $d_1$ - $e_1$  70 (57-84),  $v_1$ - $v_1$  25 (15-30),  $v_2$ - $v_2$  88 (73-89),  $sc_2$ - $sc_2$  287 (260-300). Dorsal integument on propodosoma with irregular discontinuous folds forming more or less an oval pattern with longitudinal folds medially becoming oblique laterally (Figs. 2, 3C); prodorsal medial folds integument with irregular stout dashed striation (Fig. 3C). Hysterosomal folds mainly transverse with three pairs of more or less oval-shaped areas with irregular folds present between setae  $c_1$ - $c_2$ ,  $d_1$ - $d_3$ , and  $e_1$ - $e_3$  and one caudally (Fig. 2). Hysterosomal medial folds integument near setae  $c_1$  with irregularly dashed fine striation becoming finely striated near setae  $d_1$  and  $e_1$  (Fig. 3D).

**Gnathosoma** — Stylophore notched longer than wide 120 (115-125) and 75 (70-90), respectively. Palptarsus well-developed 40 (33-39) (including eupathidia), 31 (26-32) (without eupathidia), far longer than bidentate tibial claw, tip of tibial claw do not reach insertion of proximal palptarsal tactile seta  $a$ , palptarsus with three tactile setae, three eupathidia and one solenidion (Fig. 3E): eupathidia  $ul''\zeta$ ,  $ul'''\zeta$  10 (9-10) slightly shorter than solenidion 11 (10-12),  $su\zeta$  shorter 6 (5-7). Peritreme anastomosed distally in a relatively long and slender enlargement, 38 (30-40) long, 8 (7-8.5) wide (Fig. 3F).

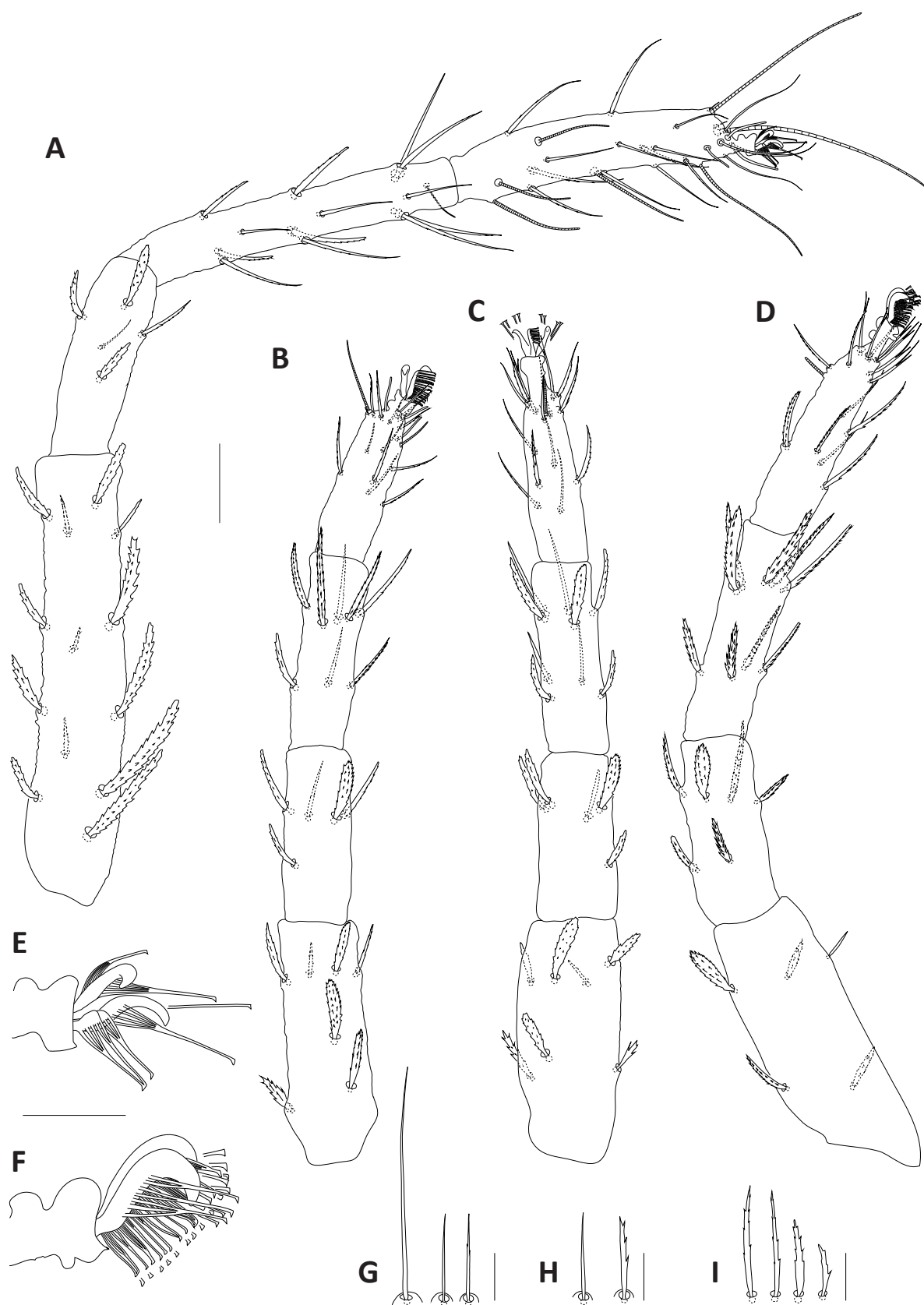
**Venter** — Striation transverse between 1<sup>st</sup> pair of setae ( $1a$ ) and second pair ( $3a$ ), almost smooth between setae  $3a$  and  $4a$ , transverse posteriorly to setae  $4a$  becoming longitudinal from aggenital ( $ag$ ); area immediately anterior to genital opening with irregular longitudinal striation



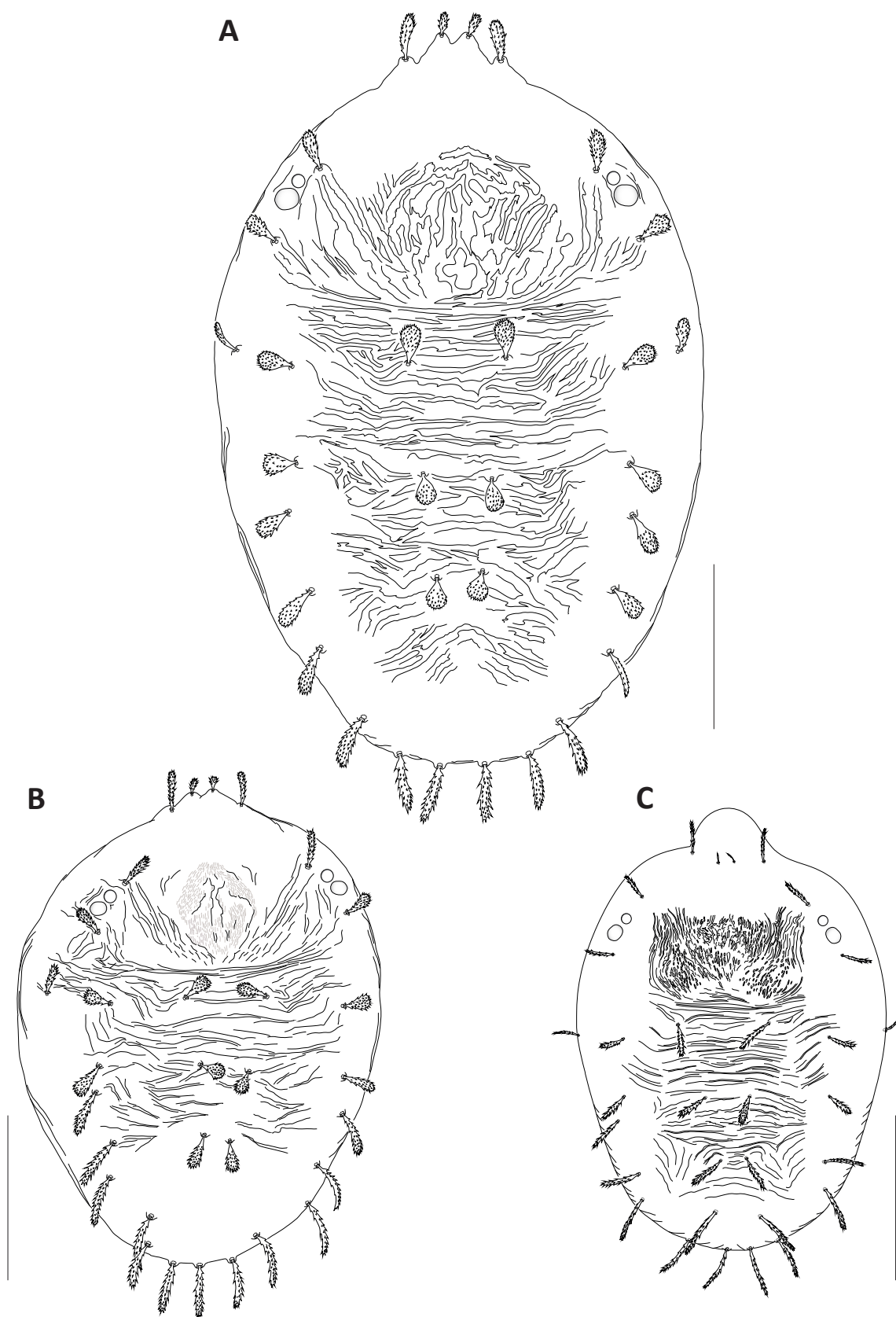
**Figure 2** *Bryobia (Lyobia) baroni* sp. n., female. A – dorsal aspect; B – dorsal seta  $c_1$ ; C – dorsal seta  $d_1$ . Scale bars = 100  $\mu$ m (A), 10  $\mu$ m (B-C).



**Figure 3** *Bryobia (Lyobia) baroni* sp. n., female. A – prodorsal lobes with V-shaped incision between inner lobes (holotype and some paratypes); B – prodorsal lobes with U-shaped incision between inner lobes (paratypes); C – medial prodorsal striation (detail); D – medial hysterosomal striation on folds (detail); E – palpal tibia and tarsus; F – peritremal distal anastomosis; G – spermatheca (paratype); H – anterogential striation. Scale bars = 50  $\mu$ m (A-B), 25  $\mu$ m (C-D, H), 10  $\mu$ m (E-G).



**Figure 4** *Bryobia (Lyobia) baroni* sp. n., female. A – leg I; B – leg II; C – leg III; D – leg IV; E – claws and empodia I; F – claws and empodia II-IV; G – coxisternal setae 1b (left) and 1c (middle and right); H – coxisternal seta 2b (left and right side); I – setae v' on trochanters I, II, III and IV (from left to right). Scale bars = 25  $\mu$ m (A-D), 10  $\mu$ m (E-I).



**Figure 5** *Bryobia (Lyobia) baroni* sp. n. A – deutonymph, dorsal aspect; B – protonymph, dorsal aspect; C – larva, dorsal aspect. Scale bars = 100  $\mu$ m.



(Fig. 3H). Two pairs of ventrocaudal ( $h_{2,3}$ ) setae and three pairs of pseudanal setae ( $ps_{1-3}$ ) present. Spermatheca oval in shape 11 (10-11) long, 7 (6.5-7) wide (Fig. 3G).

**Legs** – Legs shorter than body length. Leg I 420 (385-425) long (measured from femur to tarsus) about  $\frac{3}{4}$  body length, longer than leg II 240 (210-240), leg III 240 (215-245) and leg IV 280 (240-280). Length of segments of leg I as follows: trochanter 50 (40-50), femur 150 (130-155), genu 65 (65-75), tibia 105 (95-105), tarsus 100 (90-105). Tibia I and tarsus I about  $\frac{2}{3}$  length of femur I. Leg setal counts as follows (Fig. 4A-D):

I 2 – 1 – 12 [11-14] – 7 [5-8] – 13 + (1) – 19 + (5) + 2 duplexes;

II 1 – 1 – 9 [7-8] – 5 – 9 [7-8] – 15 + (2) + 1 duplex;

III 1 – 1 – 6 [7] – 6 [5-7] – 9 – 13 + 1 duplex;

IV 1 – 1 – 5 [4] – 6 – 9 – 14 + (1).

Femur I usually bearing 4 (sometimes 3, rarely 2, on one of the two femora I) large serrate elongate setae (subproximal seta  $bl$  and 3 setae  $l$ ) in the internal femoral upper row, the longest about 40 (37-44). Empodium I with one pair of tenent hairs, other empodial pads each provided with two rows (Fig. 4E-F). True claws uncinat each with one pair of tenent hairs on leg I, other claws usually with two/three pairs but sometimes four pairs present (Fig. 4E-F). Coxisternal seta  $lb$  slender smooth 49 (40-50), coxisternal seta  $lc$  shorter 18 (17-30), smooth to finely serrate (Fig. 4G). Solenidion on tibia I 15 (12-17). Tarsus III associated setae approximate with solenidion forming duplex, tactile member (17-21) slightly serrate dorsally, proximal, slightly longer than solenidion (13-18) (Fig. 4C); tarsus IV with solenidion 10 (8-10) well-separated from tactile 20 (18-20), proximal, about half the length of tactile (Fig. 4D). Tectal setae ( $tc'$ - $tc''$ ) smooth, elongated, slender on tarsus I, slightly serrate and furcate distally on other tarsi.

**Deutonymph** — (4 paratypes measured) (Fig. 5A). Body 430-470 long (excluding gnathosoma), 520-540 long (including gnathosoma), distance between setae  $v_2$  –  $h_1$  430-450, width 290-315, distance between  $sc_2$  members 220-240.

**Dorsum** – Prodorsal lobes developed, outer small more or less triangularly shaped, inner lobes more developed, triangular, 20-24 high, well separated by v-shaped incision 7-10 in depth. Prodorsal setae  $v_2$  of outer lobes reach about  $\frac{2}{3}$  of setae  $v_1$ ,  $v_2$  about 1.5 times the length of  $v_1$ . Dorsal setae inserted on small tubercles (except setae  $v_1$  and  $v_2$ ), more obvious on hysterosoma and stronger caudally. Prodorsal setae serrate, spatulate, hysterosomal setae serrate, setae  $c_1$  to  $e_2$  spatulate, setae  $e_2$  narrower and longer, setae  $e_3$  subspatulate, other caudal setae  $f_1$ ,  $f_2$  and  $h_1$ , serrate, subspatulate to elongate wide, more or less rounded distally (Fig. 5A).

Dorsocentral setae the shortest,  $f_1$ ,  $f_2$  and  $h_1$  the longest:  $v_1$  15-18;  $v_2$  26-29;  $sc_1$  25-29;  $sc_2$  18-23;  $c_1$  22-24;  $c_2$  18-22;  $c_3$  19-23;  $d_1$  19-21;  $d_2$  20-23;  $d_3$  22-27;  $e_1$  19-20;  $e_2$  20-28;  $e_3$  25-34;  $f_1$  29-44;  $f_2$  32-38;  $h_1$  22-37. Distances between setae:  $c_1$ - $c_1$  58-60,  $d_1$ - $d_1$  40-45,  $e_1$ - $e_1$  27-32,  $c_1$ - $d_1$  75-84,  $d_1$ - $e_1$  60-72,  $v_1$ - $v_1$  16-17,  $v_2$ - $v_2$  57-65.

**Gnathosoma** – Stylophore slightly emarginate, longer than wide, 85-95 and 60, respectively. Peritreme anastomosed distally in a relatively long and slender enlargement, 15-20 long, 6-7 wide. Palptarsus 29-30 long (including eupathidia) far longer than bidentate tibial claw, tip of tibial claw do not reach insertion of proximal palptarsal tactile seta  $a$ .

**Legs** – Length inferior to body length, leg I 230-255 long (from femur to tarsus), about 1.5 longer than leg II 160-180, leg III 160-170, leg IV 170-185. Leg setal counts as follows:

I 2 – 1 – 8 – 4 – 9 + (1) – 14 + (1) + 2 duplexes;

II 1 – 1 – 6 – 4 – 5 – 11 [10] + 1 duplex;

III 1 – 1 – 2 – 3 – 5 – 9 + 1 duplex [10+(1)];

IV 1 – 0 – 2 – 3 – 5 – 10.

Duplex on tarsus III sometimes dissociate on one side of the mite. Empodial pads each provided with two rows of tenent hairs. True claws uncinat with one pair of tenent hairs, rarely two pairs on claws II, sometimes two pairs on claws III-IV. On femur I, two serrate macrosetae present, the longest 28-32.

**Protonymph** — (3 paratypes measured) (Fig. 5B). Body 295-325 long (excluding gnathosoma), 345-390 long (including gnathosoma), distance between setae  $v_2 - h_1$  280-310, width 200-210, distance between  $sc_2$  members 155-175.

**Dorsum** — Prodorsal lobes poorly developed, outer very small, inner small triangular, separated by wide weak incision 4 in depth. Prodorsal setae  $v_2$  surpass well tip of setae  $v_1$ ,  $v_2$  about 2.5 times the length of  $v_1$ . Dorsal setae serrate inserted on tiny tubercles caudally. Setae  $c_1$ ,  $c_2$ ,  $d_1$ ,  $d_2$  and  $e_1$  spatulate,  $d_3$  and  $e_2$  subspatulate, other caudal setae elongate, narrower, acute distally (Fig. 5B). On hysterosoma, setae  $c_2$  and  $c_3$  the shortest, setae  $e_2$  to  $h_1$  the longest:  $v_1$  10-11;  $v_2$  24-26;  $sc_1$  22-25;  $sc_2$  18-19;  $c_1$  19-20;  $c_2$  16-19;  $c_3$  16-16;  $d_1$  16-17;  $d_2$  20-22;  $d_3$  24-26;  $e_1$  19-20;  $e_2$  26-31;  $e_3$  31-34;  $f_1$  28-34;  $f_2$  31-33;  $h_1$  29-32. Distances between setae:  $c_1 - c_1$  50-60,  $d_1 - d_1$  35-39,  $e_1 - e_1$  22-25,  $c_1 - d_1$  48-55,  $d_1 - e_1$  36-48,  $v_1 - v_1$  11,  $v_2 - v_2$  45-47.

**Gnathosoma** — Stylophore very slightly emarginate, longer than wide, 75-85 and 60-70, respectively. Peritreme anastomosed distally in slender enlargement, 17-19 long, 4 wide. Palptarsus 19-25 long (including eupathidia) far longer than bidentate tibial claw, tip of tibial claw do not reach insertion of proximal palptarsal tactile seta  $a$ .

**Legs** — Length inferior to body length, leg I 165-185 long (from femur to tarsus), leg II 120-130, leg III 110-130, leg IV 115-130. Leg setal counts as follows:

I 2 - 0 - 3 - 4 - 5 + (1) - 10 + 2 duplexes;

II 1 - 0 - 3 - 4 - 5 - 9 + 1 duplex;

III 1 - 0 - 2 - 2 - 5 - 8;

IV 0 - 0 - 2 - 2 - 5 - 6.

Empodial pads each provided with two rows of tenent hairs. True claws uncinat with one pair of tenent hairs. On femur I, one serrate macrosetae present 23-24 long.

**Larva** — (4 paratypes measured) (Fig. 5C). Body 305-330 long (including gnathosoma), distance between setae  $v_2 - h_1$  230-250, width 185-190, distance between  $sc_2$  members 135-140.

**Dorsum** — Prodorsal lobes absent. Prodorsal setae  $v_2$  surpass well tip of setae  $v_1$ ,  $v_2$  about 3 times the length of  $v_1$ . Dorsal setae elongate serrate acute distally, inserted on tiny bulges posteriorly. Setae  $c_1$ ,  $c_2$ ,  $d_1$ ,  $d_2$  and  $e_1$  slightly wider (Fig. 5C).

On hysterosoma, setae  $c_{2-3}$  and  $d_2$  the shortest, setae  $f_{1-2}$  and  $h_1$  the longest:  $v_1$  6-8;  $v_2$  21-23;  $sc_1$  19-20;  $sc_2$  15-19;  $c_1$  20-24;  $c_2$  16-19;  $c_3$  15-18;  $d_1$  19-23;  $d_2$  16-19;  $d_3$  21-24;  $e_1$  24-25;  $e_2$  22-27;  $e_3$  27-29;  $f_1$  27-33;  $f_2$  28-35;  $h_1$  27-31. Distances between setae:  $c_1 - c_1$  57-64,  $d_1 - d_1$  28-31,  $e_1 - e_1$  16-19,  $c_1 - d_1$  49-55,  $d_1 - e_1$  39-40,  $v_1 - v_1$  10-11,  $v_2 - v_2$  43-45.

**Gnathosoma** — Stylophore very slightly emarginate, longer than wide, 60-70 and 50-55, respectively. Distal end of peritreme not seen. Palptarsus 22-24 long (including eupathidia) far longer than bidentate tibial claw, tip of tibial claw reach insertion of proximal palptarsal tactile seta  $a$ .

**Legs** — Length inferior to body length, leg I 130-140 long (from femur to tarsus), leg II 105-115, leg III 105-110. Leg setal counts as follows:

I 1 - 0 - 3 - 4 - 5 + (1) - 7 + 1 duplex;

II 0 - 0 - 3 - 4 - 5 - 7 + 1 duplex;

III 0 - 0 - 2 - 2 - 5 - 6.

Empodial pads shorts with 2/3 pairs of tenent hairs on leg I, pads longer on legs II-III with 2 rows of tenent hairs. True claws uncinat with one pair of tenent hairs. On femur I, one serrate macrosetae present 15-18 long.

**Male** — Unknown

## Remarks

Among the species belonging to the *berlesei*-group, *B. (L.) baroni* n. sp. is closely related to *B. (L.) provincialis* Van Eynhoven and Vacante, 1985 and more to *B. (L.) dikmenensis* Van Eynhoven and Vacante, 1985 by having short dorsal setae, 4 long and 1 normal setae on femur I, interior lobes more developed than outer ones, empodium I with a pair of tenent hairs. It can be easily separated from *B. (L.) provincialis* by the following characters: 1) it is smaller in size

(in the new species length 506-596 and width 345-390 *versus* 560-740 and 410-600 in *B. (L.) provincialis*); 2) different inner lobes that are triangular and well separated by a “v” or u-shaped incision in the new species *vs.* mammelliform and largely fused in *B. (L.) provincialis*; 3) two small differences in setal count on femur and tarsus IV, 5 and 14+(1) setae, respectively in *B. (L.) baroni* **n. sp.** *vs.* 6 and 13+(1) in *B. (L.) provincialis*; 4) the first pair of dorsocentral setae ( $c_1$ ) is obviously larger than the second and the third pairs ( $d_1$ ,  $e_1$ ) in the new species *vs.* setae  $c_1$ ,  $d_1$  and  $e_1$  of similar size in *B. (L.) provincialis*; 5) a longer palptarsus with the palpal claw not reaching the proximal palpal tactile seta *a* in the new species *vs.* a palpal claw reaching the proximal palpal tactile seta in *B. (L.) provincialis* and 6) a shorter leg I in the new species, 385-425 long *vs.* 446-650 in *B. (L.) provincialis*.

Despite a body length similar, females of *B. (L.) baroni* **n. sp.** differ from *B. (L.) dikmenensis* by: 1) a body less narrow in the new species about 355-390 *vs.* 250-315 in *B. (L.) dikmenensis*; 2) inner lobes triangularly shaped, not inflated, well separated by bottom “v” or u-shaped incision in *B. (L.) baroni* **n. sp.** *vs.* inner lobes mammelliform and largely fused in *B. (L.) dikmenensis*; 3) a larger distal peritremal anastomosis in *B. (L.) baroni* **n. sp.** than in *B. (L.) dikmenensis*, 32-40 and 29-30, respectively; 4) a larger stylophore in *B. (L.) baroni* **n. sp.** than in *B. (L.) dikmenensis*, 115-125 x 70-85 and 100 x 55, respectively; 5) longer legs II, III and IV in *B. (L.) baroni* **n. sp.** than in *B. (L.) dikmenensis*, 225-245, 235-245, 250-280 and 200, 200, 220, respectively and 6) longer large setae on femur I in *B. (L.) baroni* **n. sp.** than in *B. (L.) dikmenensis*, 38-43 and 36, respectively.

### Etymology

The species designation “*baroni*” refers to the French Botanist Dr Yves Baron, recently deceased, who showed to the last author, during his studies, some *Genista pulchella* at the top of the Mont Tauch (Aude, Southern France) (Fig. 1).

## Subfamily Tetranychinae Berlese, 1913

### Tribe Tenuipalpoidini Pritchard and Baker, 1955

### Genus *Tenuipalpoides* Reck and Bagdasarian, 1948

*Tenuipalpoides* Reck and Bagdasarian, 1948: 183-186. Type-species: *Tenuipalpoides zizyphus* Reck and Bagdasarian.

### *Tenuipalpoides genistearum* sp. nov.

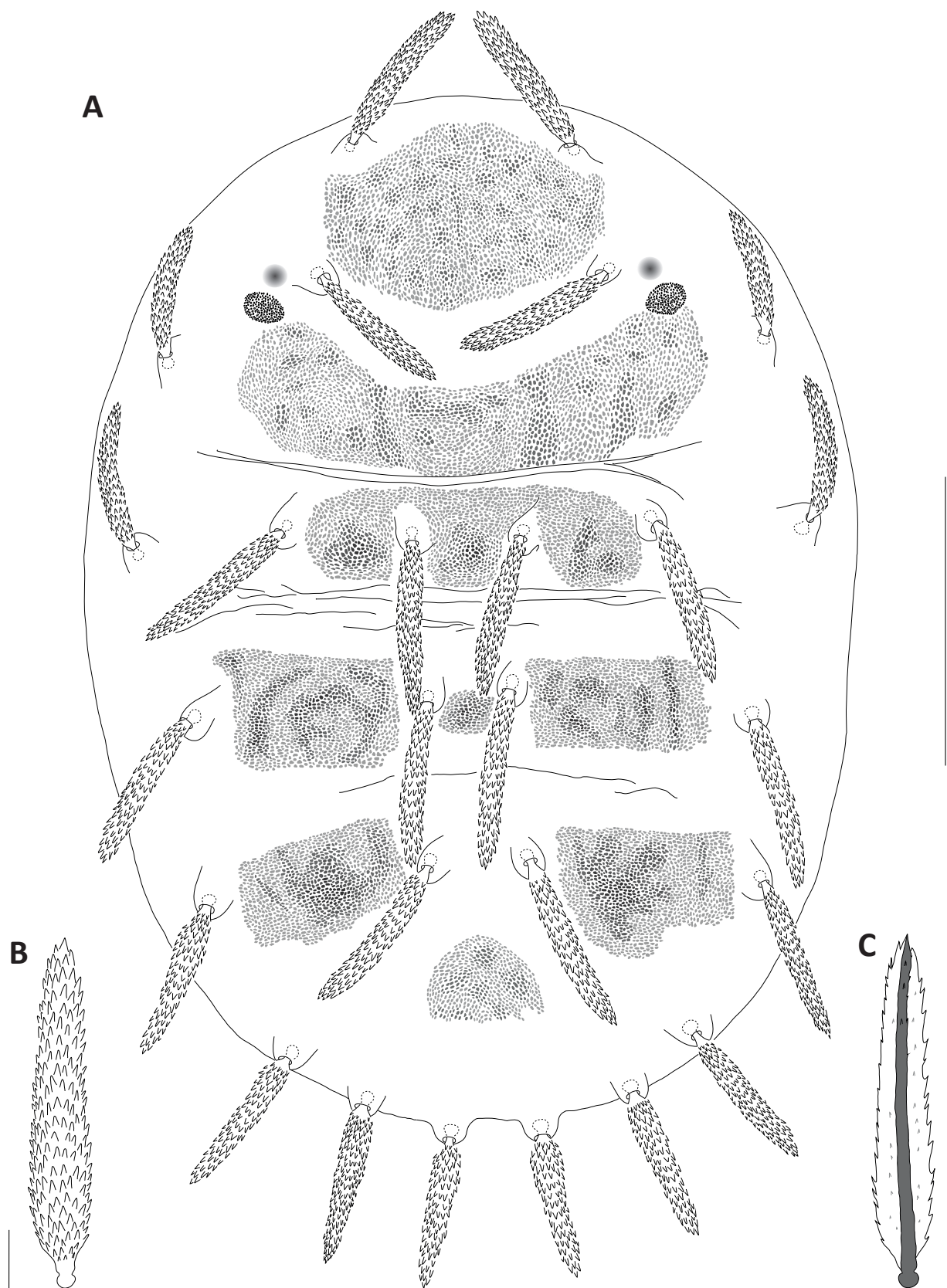
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(Figures 6-12)

### Type-material

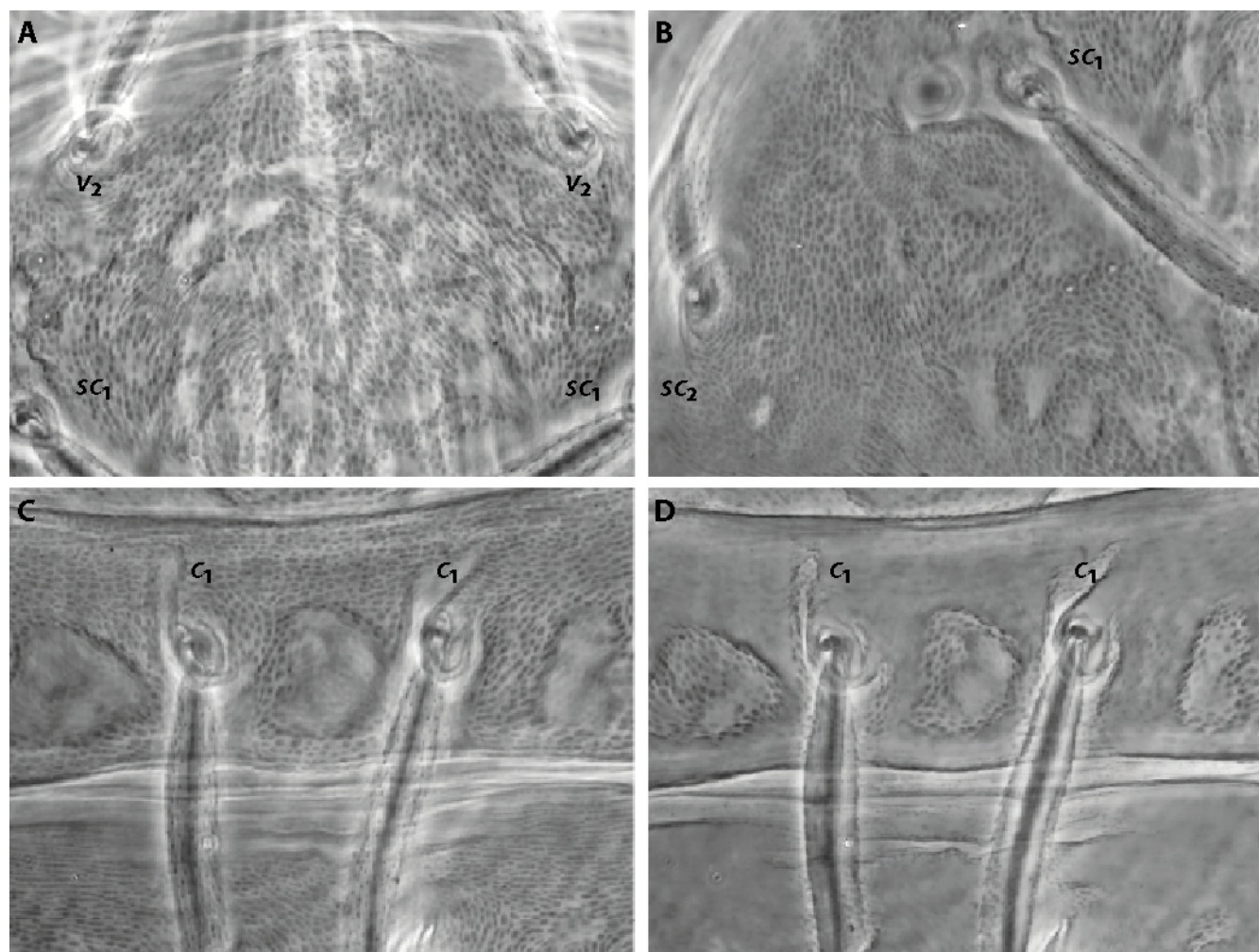
**Holotype (female)** — 10 female, 2 male, 9 nymph, 1 larva paratypes on 20 microscopic preparations from *Genista pulchella* Vis. (Fabaceae), Camp Gourens, Znieff 9010011840 (43.8824°N 3.5566°E, 559 m a.s.l.), Rogues (Gard), France, 26-VII-2012, leg. A. Migeon and P. Auger; 1 male paratype on 1 microscopic preparations from *G. pulchella*, Le Jouquet, forêt domaniale de Notre Dame de Parlatges (43.7746°N 3.4394°E, 770 m a.s.l.), Saint-Pierre-de-la-Fage (Hérault), France, 26-VII-2012, leg. A. Migeon and P. Auger; 8 female, 5 male, 3 nymph paratypes on 16 microscopic preparations from *G. pulchella*, Piste des Indochinois (44.0128°N 5.2981°E, 779 m a.s.l.), Méthamis (Vaucluse), France, 25-IX-2014, leg. A. Migeon and P. Auger. Collection Auger-Migeon N° 1902 for holotype, 1903–1938 for paratypes.

**Additional material** — 4 females, 10 nymphs, 1 larva on 14 microscopic preparations from *G. pulchella*, Col d'Engayresque on D294 (44.2539°N 3.0617°E, 873 m a.s.l.), Verrières (Aveyron), France, 19-VII-2012, leg. A. Migeon and P. Auger; 12 females, 2 nymphs, 1 larva on 15 microscopic preparations from *G. pulchella*, La Crémade on D94 (44.2564°N 3.0669°E, 889



**Figure 6** *Tenuipalpoides genistearum* sp. n., female. A – dorsal aspect; B – dorsal seta  $f_2$  (dorsal view); C – dorsal seta  $f_2$  (ventral view). Scale bars = 100  $\mu\text{m}$  (A), 10  $\mu\text{m}$  (B, C).



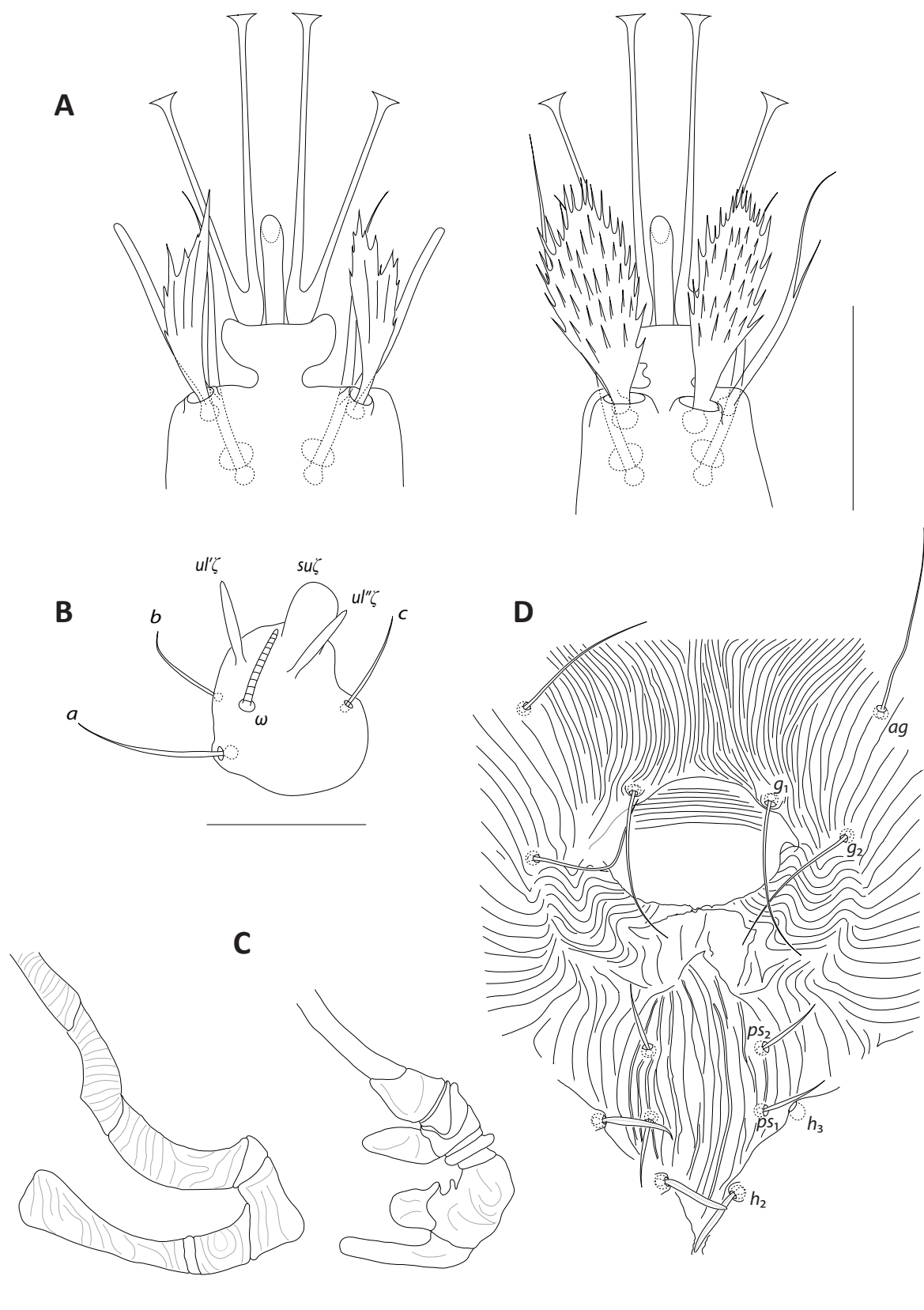


**Figure 7** *Tenuipalpoides genistearum* sp. n., female. A – medial prodorsal integument pattern; B – lateral prodorsal integument pattern; C – dorsal integument aspect around the first pair of dorsohysterosomal setae  $c_1$ ; D – same view as C with a different focus showing the dimples in the dorsal integument. Scale bar = 50  $\mu$ m.

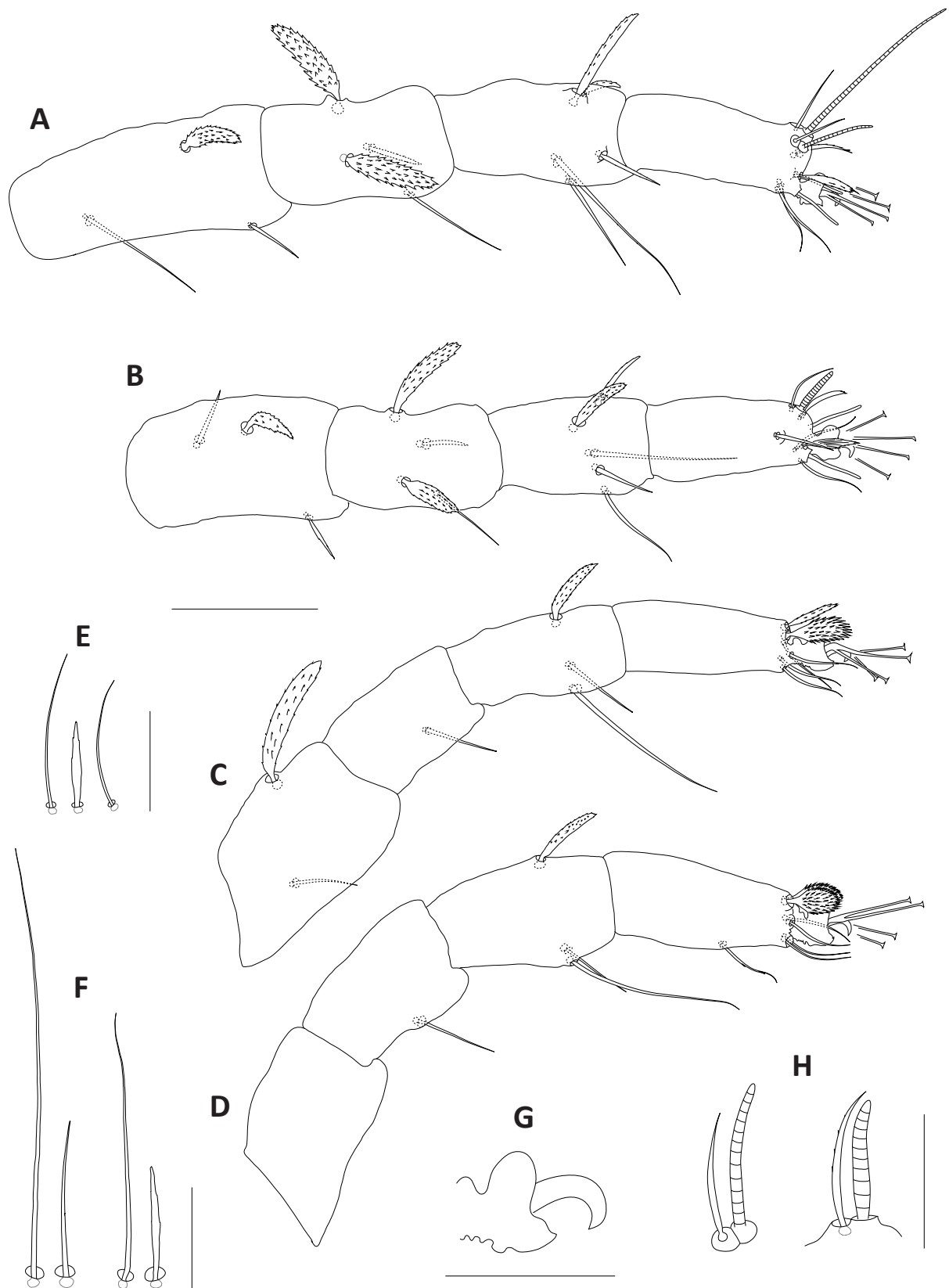
m a.s.l.), Sévérac-le-Château (Aveyron), France, 19-VII-2012, leg. A. Migeon and P. Auger; 8 females, 6 nymphs, 1 larva on 15 microscopic preparations from *G. pulchella*, Le Jouquet, forêt domaniale de Notre-Dame-de-Parlatges (43.7746°N 3.4394°E, 770 m a.s.l.), Saint-Pierre-de-la Fage (Hérault), France, 26-VII-2012, leg. A. Migeon and P. Auger; 10 females, 3 males, 6 nymphs deutonymph on 19 microscopic preparations from *Genista pulchella* Vis. (Fabaceae), Top of Mont Tauch (42.9097°N 2.6794°E, 840 m a.s.l.), Tuchan (Aude), France, 18-IX-2014, leg. A. Migeon and P. Auger.

### Diagnosis

Females with dorsal setae oblong inserted on strong tubercles; dorsal integument finely granulated, covered by tiny dense pimple-like bulges; propodosoma with small irregular shallow dimples forming an irregular not meshlike and blurred alveoli pattern medially; deeper irregularly shaped depressions present on dorsal hysterosomal integument; peritremal distal end a simple hook rarely branched, leg I tarsal setal count very reduced. Male aedeagus bent dorsad near at a right angle, bent part without knob, almost straight, progressively tapering.



**Figure 8** *Tenuipalpoides genistearum* sp. n., female. A – distal part of tarsus I (left) and tarsus IV (right, paratype); B – palptarsus; C – distal end of peritreme (paratypes); D – genito-anal area. Scale bars = 10  $\mu$ m (A-C), 25  $\mu$ m (D).



**Figure 9** *Tenuipalpoides genistearum* sp. n., female. A – leg I; B – leg II; C – leg III; D – leg IV; E – setae v' on trochanters I-II, III and IV (from left to right); F – coxisternal setae 1b, 1c, 2b and 2c (from left to right); G – empodium IV (paratype); H – tarsus I proximal duplex setae (left), tarsus II duplex setae (right, paratype). Scale bars = 25 µm (A-D), 10 µm (E-H).

## Description

**Female** — (Figs. 6-9). Holotype 355 long (excluding gnathosoma) 415 (including gnathosoma), distance between setae  $v_2$ - $h_1$  340, width 260, distance between setae  $sc_2$  members 205; 9 paratypes measured, 325-360 long (excluding gnathosoma) 400-430 (including gnathosoma), distance between setae  $v_2$ - $h_1$  310-340, width 230-280, distance between setae  $sc_2$  members 190-225.

**Dorsum** — All dorsal body setae set on strong tubercles, larger caudally,  $v_2$  tubercles the smallest. Dorsal setae oblong, variable in size and shape according to their dorsal location, serrate with rachis-like stem on the lower surface (Fig. 6A-C). First and second pair of dorsocentral hysterosomal setae ( $c_1$ ,  $d_1$ ) reach insertions of consecutive setae. Dorsal setal lengths:  $v_2$  56 (54-61);  $sc_1$  55 (55-65);  $sc_2$  48 (41-53);  $c_1$  64 (58-64);  $c_2$  62 (60-69);  $c_3$  55 (43-54);  $d_1$  64 (62-70);  $d_2$  63 (58-67);  $e_1$  66 (63-69);  $e_2$  62 (58-67);  $f_1$  58 (54-65);  $f_2$  59 (54-66);  $h_1$  58 (54-61). Distances between setae:  $c_1$ - $c_1$  39 (38-44),  $d_1$ - $d_1$  30 (30-40),  $e_1$ - $e_1$  34 (27-34),  $c_3$ - $c_3$  230 (210-240),  $c_1$ - $d_1$  57 (55-65),  $d_1$ - $e_1$  58 (56-63). Sacral setae ( $f_1$  and  $f_2$ ) in marginal position, not contiguous. Propodosoma with small irregular shallow dimples, forming irregular alveoli pattern medially (Fig. 7A-B); dorsal body integument uniformly covered by tiny dense pimple-like bulges (Fig. 7A-C); quite large irregular deeper dimples present between  $c_1$  and  $d_1$  members, between  $c_1$ - $c_2$ ,  $d_1$ - $d_2$  and  $e_1$ - $e_2$  setal insertions, small irregular shallow dimples present caudally (Fig. 7C-D).

**Gnathosoma** — Thumbclaw indented, as long as palptarsus. Palptarsus terminal sensillum ( $su\zeta$ ) about 1.5 times as long as broad, 4 (4)  $\mu\text{m}$  long, 2.7 (2.5-3)  $\mu\text{m}$  wide, eupathidia  $ul'\zeta$  4.5 (5-5.5),  $ul''\zeta$  4.5 (5.5-6) about as long as solenidion  $\omega$  5 (6) (Fig. 8B). Peritreme distal end a simple hook, rarely branched (Fig. 8C).

**Venter** — Striation transverse between  $1a$  and  $3a$  pairs of setae, between  $3a$  and  $4a$  transverse becoming irregularly transverse near  $4a$  insertions, transverse immediately posteriorly to  $4a$ , becoming longitudinal between  $ag$  to  $g_1$ . Ventral striae without lobes. Two pairs of ventrocaudal ( $h_{2,3}$ ) setae and two pairs of pseudanal setae ( $ps_{1,2}$ ) present (Fig. 8D).

**Legs** — Legs short, less than half body length. Leg I 155 (150-160) long (measured from femur to tarsus tip), leg II 130 (125-135), leg III 125 (115-125), leg IV 125 (115-130). Length of segments of leg I as follows: femur 53 (50-56), genu 27 (29-34), tibia 37 (33-35), tarsus 37 (36-39). Leg setal counts as follows (Fig. 8A-D):

I 2 - 1 - 3 - 4 - 5 - 6 + 2 duplexes;

II 2 - 1 - 3 - 4 - 5 - 7 + 1 duplex;

III 1 - 1 - 2 - 1 - 3 - 6;

IV 1 - 1 - 0 - 1 - 3 - 7.

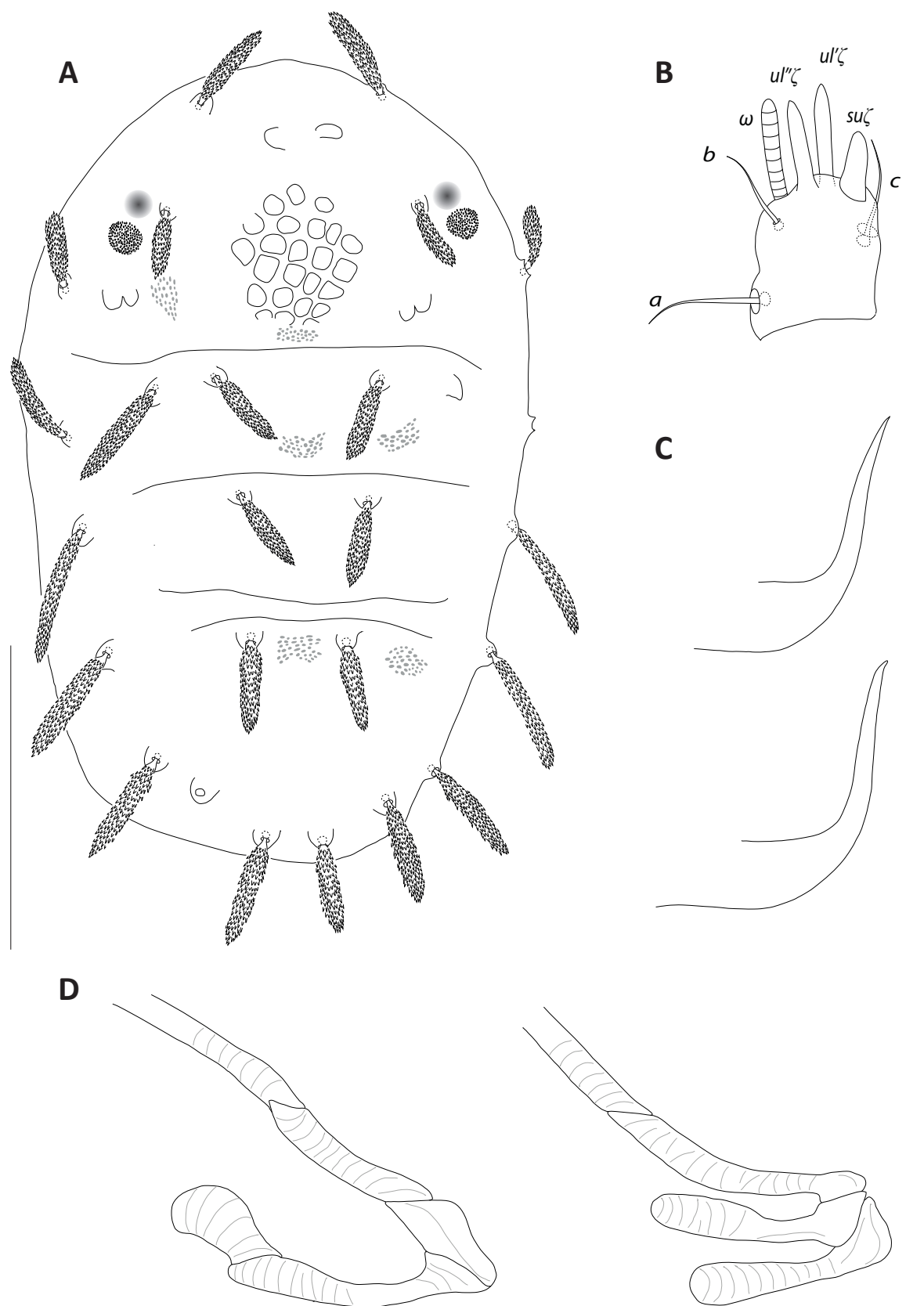
Empodia I-IV simple stout claw, tectals ( $tc'$ - $tc''$ ) spatulate, serrate and denticulate distally, asymmetrical in shape on tarsi I and II, wider and symmetrical in shape on tarsi III and IV (Figs. 8A, 9G).

Tarsus I with only fundamental setae and two pairs of duplex setae (Fig. 9A); solenidion of distal duplex ( $\omega''$ ) 38 (37-42) 3.2 to 4 times longer than solenidion of proximal member ( $\omega'$ ) 12 (10-12.5) (Fig. 9A),  $\omega'$  shorter than distal duplex tactile seta ( $ft''$ ) 13 (12-15), slightly longer than associate tactile ( $ft'$ ) 10 (8-10.5). On tarsus II, tactile member of duplex ( $ft''$ ) 11 (11-15) longer than associate solenidion ( $\omega''$ ), quite stout 9 (9-11) (Fig. 9B-H), the latter about 1/4 the length of distal duplex solenidion on tarsus I ( $\omega''$ ). On leg segments, setae in dorsal position enlarged and serrate, seta  $db$  stout, subspatulate and serrate, setae in ventral position setiform, slender. Coxisternal setae setiform, elongate slender except  $2c$  short, stouter (Fig. 9F); setae on trochanter ( $v'$ ) slender, except on trochanter III, short, slightly enlarged near the middle, acute distally (Fig. 9E).

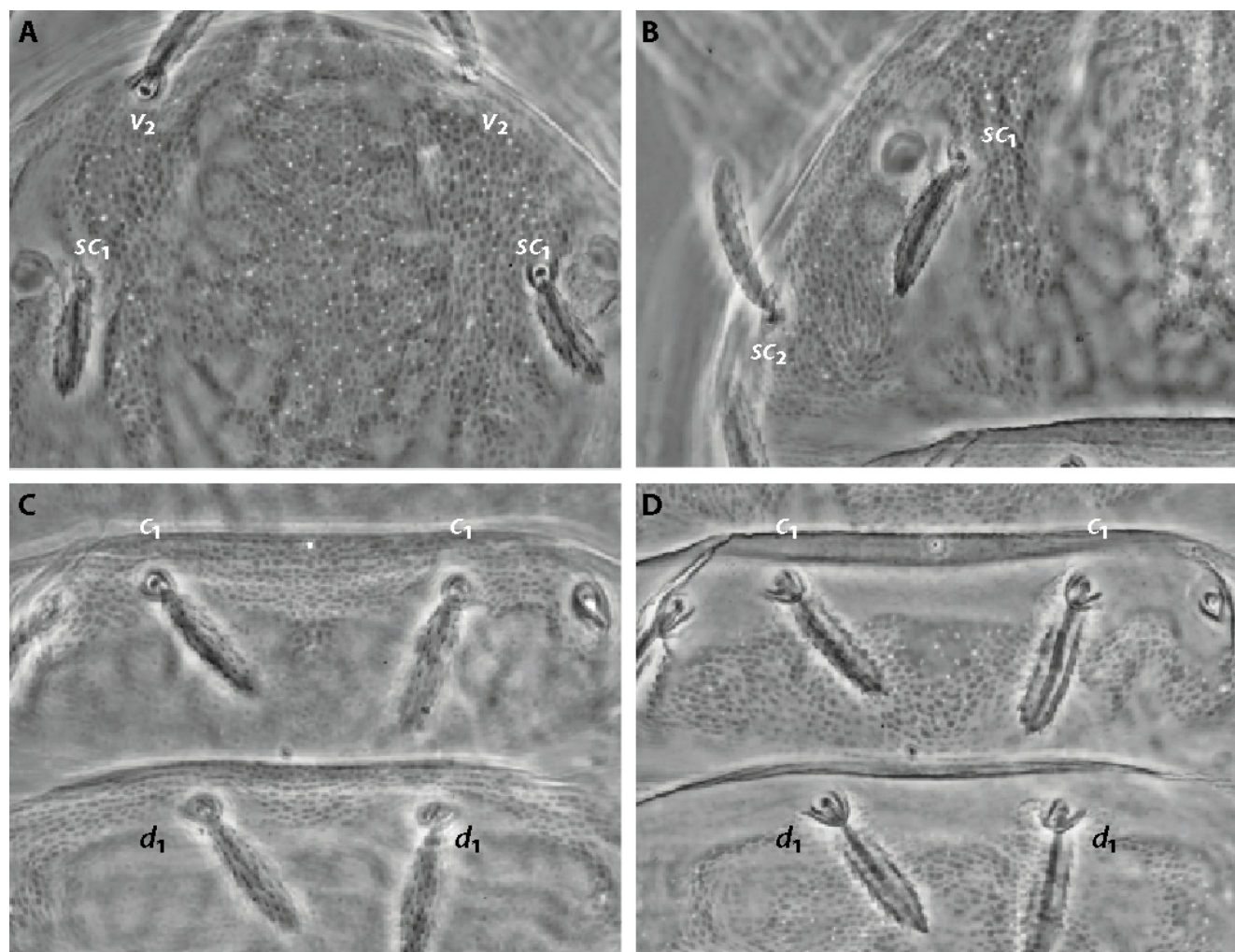
**Male** — (9 paratypes measured) (Figs. 10-12). Body length 320-400 including gnathosoma,  $v_2$  -  $h_1$  215-245, body width 160-170,  $sc_2$ - $sc_2$  130-140.

**Dorsum** — All dorsal body setae set on strong tubercles, larger caudally. Dorsal setae oblong as in female, variable in size and shape according to their dorsal location (Fig. 10A). On





**Figure 10** *Tenuipalpoides genistearum* sp. n., male. A – dorsal aspect; B – palptarsus; C – aedeagi; D – distal end of peritreme. Scale bars = 100  $\mu$ m (A), 10  $\mu$ m (B-D).



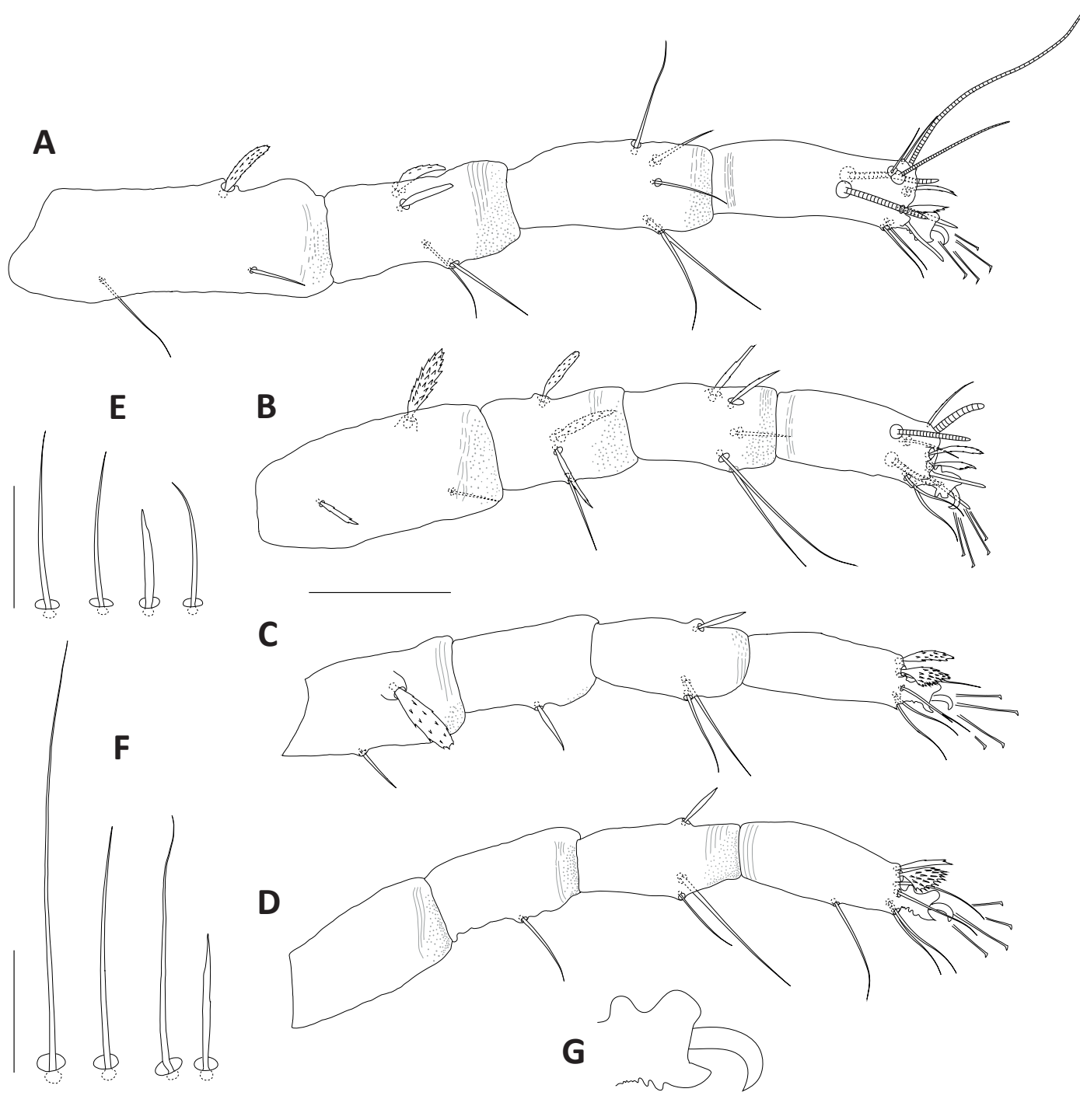
**Figure 11** *Tenuipalpoides genistearum* sp. n., male. A – medial prodorsal integument pattern; B – lateral prodorsal integument pattern; C – dorsal integument aspect around the first pair of dorsohysterosomal setae  $c_1$ ; D – same view as C with a different focus. Scale bar = 50  $\mu$ m.

hysterosoma, first three pairs of dorsocentral setae ( $c_1$ ,  $d_1$ ,  $e_1$ ) the shortest. First and second pair of dorsocentral hysterosomal setae ( $c_1$ ,  $d_1$ ) shorter than distance between consecutive setae. Dorsal setal lengths:  $v_2$  29-34;  $sc_1$  20-29;  $sc_2$  24-29;  $c_1$  25-30;  $c_2$  32-44;  $c_3$  28-35;  $d_1$  26-30;  $d_2$  37-46;  $e_1$  26-31;  $e_2$  38-45;  $f_1$  30-40;  $f_2$  31-38;  $h_1$  29-36. Distances between setae:  $c_1$ - $c_1$  44-48,  $d_1$ - $d_1$  38-42,  $e_1$ - $e_1$  27-32,  $c_1$ - $d_1$  35-41,  $d_1$ - $e_1$  41-47. Sacral setae ( $f_1$  and  $f_2$ ) in marginal position, not contiguous. Propodosoma as in female, with small irregular dimples, forming alveoli pattern medially (Fig. 11A-B); hysterosoma with 2 deep horizontal furrows dividing dorsal surface in three parts (Figs. 10A, 11C-D); dorsal integument uniformly finely granulated (Fig. 11A-D).

**Gnathosoma** – Thumbclaw indented, as long as palptarsus. Palptarsus terminal sensillum  $su\zeta$  twice as long as broad, 2.5-3 long, 1.2-1.4 wide, eupathidia  $ul'\zeta$  4.5-5.5,  $ul''\zeta$  4-4.5 subequal in length to solenidion  $\omega$  4.5-6 (Fig. 10B). Peritreme distal end as in female, a simple hook, sometimes branched (Fig. 10D).

**Venter** – Ventral striae without lobes.

**Legs** – Legs short, less than half body length. Leg I 135-175 long (measured from femur to tarsus tip), leg II 115-140, leg III 110-130, leg IV 110-135. Length of segments of leg I as follows: femur 45-60, genu 25-35, tibia 30-40, tarsus 35-45. Leg setal counts as follows (Fig.



**Figure 12** *Tenuipalpoides genistearum* sp. n., male. A – leg I; B – leg II; C – leg III; D – leg IV; E – setae v' on trochanters I, II, III and IV (from left to right); F – coxisternal setae 1b, 1c, 2b and 2c (from left to right); G – empodium IV. Scale bars = 25  $\mu$ m (A-D), 10  $\mu$ m (E-G).

12A-D):

I 2 – 1 – 3 – 4 – 5 – 6 + (2) + 2 duplexes;

II 2 – 1 – 3 – 4 – 5 – 7 + (2) + 1 duplex;

III 1 – 1 – 2 – 1 – 3 – 6;

IV 1 – 1 – 0 – 1 – 3 – 7.

Empodia I-IV as in female (Fig. 12G); tectals ( $tc'$ –  $tc''$ ) as in female, spatulate, serrate and denticulate distally, asymmetrical in shape on tarsi I and II, wider and symmetrical in shape on tarsi III and IV (Fig. 12A-D).

Tarsus I with only fundamental setae, two solenidia and a pair of duplex setae (Fig. 12A); solenidion of distal duplex ( $\omega''$ ) 37-43 three times longer than associate tactile ( $ft''$ ) 11-15,  $\omega''$  about twice as long as solenidion of proximal member ( $\omega'$ ) 19-26 (Fig. 12A),  $ft'$  11-15 as long as  $ft''$  (Fig. 12A). On tarsus II, tactile member of duplex ( $ft''$ ) 12-15 as long as associate solenidion ( $\omega''$ ) 10-15, (Fig. 12B), the latter about 1/3 the length of distal duplex solenidion on tarsus I ( $\omega''$ ) and about half the length of proximal duplex solenidion ( $\omega'$ ). On tibia I seta  $db$  setiform, slender. Coxisternal setae setiform, elongate, except  $2c$  shorter, slightly enlarged near the middle (Fig. 12F); setae on trochanter ( $v'$ ) slender, except on trochanter III, shorter, stouter, acute distally (Fig. 12E).

*Aedeagus* – Aedeagus bent dorsad near at right angle to dorsal margin of shaft, without distinct knob, bent part almost straight, progressively tapering, with acute tip slightly pointing caudad (Fig. 10C).

### Etymology

The species designation, “*genistearum*”, refers to the host plant tribe name, *Genistae*, that the mite inhabits.

### Remarks

Among the genus *Tenuipalpoides*, *T. genistearum* n. sp. is very similar to *T. zizyphus* Reck and Bagdasarian, 1948 by its body general aspect including oblong dorsal body setae and particularly by having identical leg I and tarsus II setal counts. Thanks to the observation of *T. zizyphus* type specimens we had the confirmation that the leg setal count of *T. genistearum* n. sp. is identical to that of *T. zizyphus*. However, *T. genistearum* n. sp. clearly differs from *T. zizyphus* by 1) its smaller size 400-430 (including gnathosoma) vs. 450-515, in *T. genistearum* n. sp. and *T. zizyphus*, respectively 2) by the dorsal integument almost meshlike in *T. zizyphus* (Fig. 13A) whereas finely granulated in the new species, 3) by the shape of their dorsal body setae being narrower in the new species than in *T. zizyphus* (Fig. 13B), 4) by the relative length of the leg I duplexes solenidia, the distal member being 2.4 longer than the proximal one and the distal member 3.2 to 4 times longer than the proximal one in *T. zizyphus* and *T. genistearum* n. sp., respectively.

### *Tenuipalpoides zizyphus* Reck and Bagdasarian, 1948

Updated body measurements and new data (5 paratypes observed and measured).

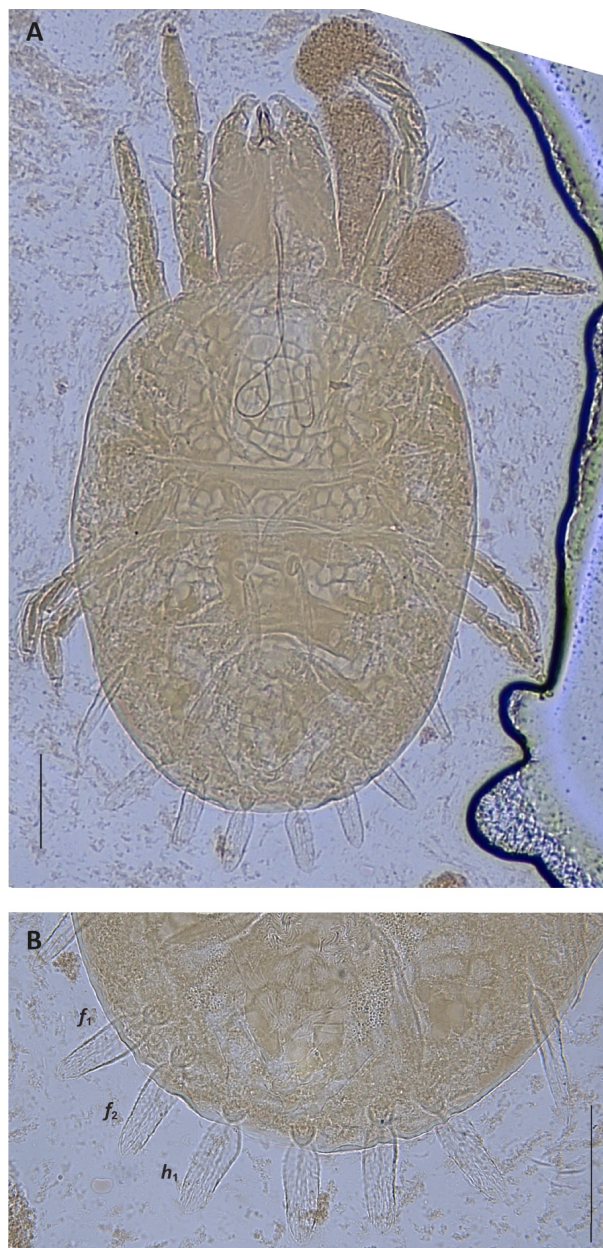
Body length including gnathosoma 450-515, body length excluding gnathosoma 355-400; body width 268-290; distance between  $v_2$ – $h_1$  45-387; distance between  $sc_2$  members 234-245 and distance between  $c_3$  members 240-260.

On tarsus I, solenidion of distal duplex (34) 2.4 longer than solenidion of proximal duplex member (14).

Meshed integument as designated by Reck and Bagdasarian (1948) and aspect of dorsal setae, particularly in the caudal part of the body, are shown in Figures 13A and 13B, respectively.

The anterogenital striation that Reck and Bagdasarian (1948) described as dashed in *T. zizyphus* is entire and similar to that found in the new species (Fig. 9D).





**Figure 13** *Tenuipalpoides zizyphus* Reck and Bagdasarian, 1948, female paratype. A – *in habitus*; B – dorsal caudal part. Scale bars = 62 μm.

## Acknowledgements

We would like to thank Edisher Tschadaia, curator at the Illia State University, Georgia, for allowing us to examine type specimens in the Reck's collection. Thanks are also addressed to Marie Auger, daughter of the senior author, for her assistance in measuring some specimens of *B. (L.) baroni* during the containment period due to COVID-19. Our thanks also go to Carlos Flechtmann and two anonymous reviewers, whose helpful comments improved our manuscript.

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