

Spider mites (Acariformes, Tetranychidae) of the Massane Nature Reserve (France)

Philippe Auger^a, Joseph Garrigue^b, Amandine Fossoud^c, Alain Migeon^a

^a CBGP, INRAE, CIRAD, Institut Agro, IRD, Univ Montpellier, Montpellier, France.

^b Réserve Naturelle Nationale de la Forêt de la Massane, Laboratoire Arago, 66650 Banyuls-sur-mer, France.

^c CBGP, IRD, CIRAD, INRAE, Institut Agro, Univ Montpellier, Montpellier, France.

Original research

ABSTRACT

We present results of the inventory of the spider mites of the Massane Forest Nature Reserve made during several field samplings from 2013 to 2017. Nineteen species have been recorded, which represents more than one third of the known spider mite fauna in France. Among them, three new species were disclosed and are described: *Bryobia* (*Bryobia*) *alberensis* **sp. nov.** collected on *Phyteuma spicatum* and *Helichrysum stoechas*, *B. (Periplanobia) polymorpha* **sp. nov.** on *Genista pilosa* and *Tetranychus visigothus* **sp. nov.**, on *Eryngium campestre*, respectively. In addition, three spider mite species, *Bryobia* (*Periplanobia*) *serifiotica*, *Eotetranychus aurantii* and *Eotetranychus fagi* are recorded from France for the first time and three plant species are recorded as new host plants for tetranychid mites. The species delineation of *B. (P.) polymorpha* **sp. nov.**, that presented large variation in dorsal setae length and shape, was investigated using a combination of morphological and molecular data. This approach allowed us to conclude that, despite such variations in a morphological key character, all the specimens observed belong to the same species.

Keywords alpha taxonomy; biodiversity; faunistic survey; haplotype network; integrative taxonomy; new species; molecular data; species delineation

Zoobank <http://zoobank.org/A1832F38-DDB2-428B-8C7D-B68A196EF936>

Introduction

The Massane Nature Reserve, located in the east end of Albères massif (Pyrénées mountains, southern France, Fig. 1), covers 3.36 km² and extends from Mediterranean forest and matorral at lower altitudes to a relict beech forest at middle altitudes and grasslands above 950 m above sea level (a.s.l.). Protected since 1954 and registered “Nature Reserve” in 1973, the reserve has not been affected by any direct management or large disturbance (Garrigue and Magdalou, 2000; Travé, 2000). As a consequence, the Massane forest is considered as one of the last 40 old forests of the Mediterranean basin (Quézel & Médail, 2003). To date, the inventories of flora and fauna undertaken in this nature reserve revealed more than 8000 species (<http://www.rnnmassane.fr/>). Among mites, Oribatida have been particularly well characterized thanks to the studies by Joseph Travé (1963) and, in a lesser extent Uropodida (Athias-Binche, 1977). In order to assess a little bit more the mite species richness of the Massane Reserve Forest, as no data were available for tetranychid mites, several sampling operations of spider mites were performed between 2013 and 2017.

The aim of the current paper is to present the results of these investigations. We provide the descriptions of two new species belonging to the Bryobiinae subfamily and one new species

Received 27 January 2023

Accepted 01 March 2023

Published 21 March 2023

Corresponding author

Philippe Auger^a:

philippe.auger@inrae.fr

Academic editor

Kreiter, Serge

<https://doi.org/10.24349/v9oe-egsn>

ISSN 0044-586X (print)

ISSN 2107-7207 (electronic)



Auger P. *et al.*

Licensed under

Creative Commons CC-BY 4.0



How to cite this article Auger P. *et al.* (2023), Spider mites (Acariformes, Tetranychidae) of the Massane Nature Reserve (France). *Acarologia* 63(2): 306-345. <https://doi.org/10.24349/v9oe-egsn>

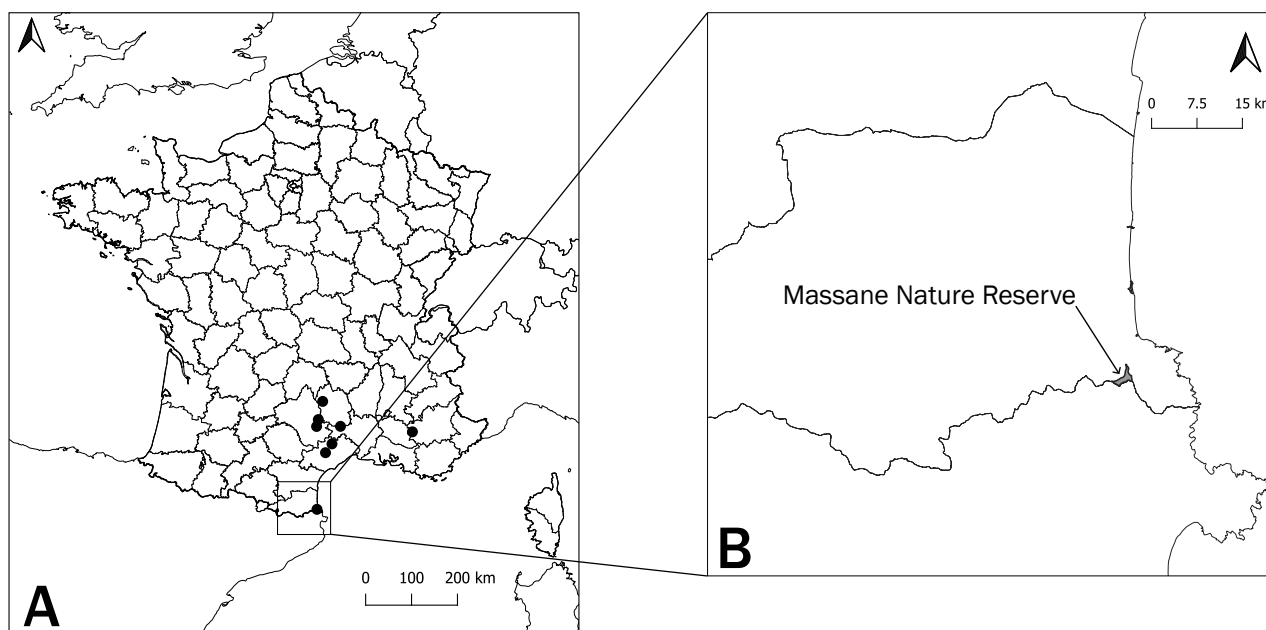


Figure 1 Locations of the Massane Nature Reserve and the samples collected. **A** – general map showing locations of the *Bryobia* (*Periplanobia*) *polymorpha* **sp. nov.** samples (black circles); **B** – enlargement of the Pyrénées-Orientales and Massane Nature Reserve location.

belonging to the subfamily Tetranychinae. We report new spider mite records for France and we also extend the list of potential host plants for several species of spider mites. Because of unusual large variations in size and shape of the dorsohysterosomal setae found in *Bryobia* (*Periplanobia*) *polymorpha* **sp. nov.** we also provide the results of a combined approach using both morphological traits and molecular data to investigate its species delimitation emphasizing the interest of integrated taxonomy.

Material and methods

Morphology based identification

Mites were collected directly from field samples in 70% ethanol. Following clearing in lactic acid (50%) for 24 hours they were mounted in Hoyer's medium. The specimens were examined using a Leica® DM LB 2 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 or a live capture from the AmScope® MU1803 transferred through VLC media player (v.0.9.8a) as a background in the Inkscape graphic suite (Sidorchuk and Vorontsov, 2014). 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 and alternative counts are given in brackets. The most frequent number of setae in a leg segment is provided first and alternative counts are given in brackets. All measurements are given in micrometres and correspond to the holotype followed (in parentheses) by minimum and maximum values from paratypes. For specimens that do not belong to types series, only minimum and maximum values are provided. Body length measurement represents the distance between the tip of gnathosoma to the 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/h_2 setae are also given (Saito *et al.*, 1999). Body length *sensu* Mathys (1962), corresponding to the distance from the base of the prodorsal lobes to the hysterosomal posterior margin, is provided to allow comparisons among species belonging to the subgenus *Bryobia* and described by Mathys (1962). Setae were measured from the centre of their setal base to their tips. The distance between two setae was measured as the distance from the centre of one setal base to the other. *Bryobia* 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). Propodosomal 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, 34988 Montferrier-sur-Lez, France; 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 Populations. 2018. CBGP – Continental Arthropod Collection. <https://doi.org/10.15454/D6XAKL>.

DNA extraction, amplification and sequencing

A fragment of 867 pb of Cytochrome oxidase subunit I mtDNA was used to characterize specimens. This marker was chosen because of its variability at intraspecific level (Gotoh *et al.*, 2009, Boubou *et al.*, 2011). For molecular analysis, mites were collected directly from field samples in 100% ethanol. DNA extraction was carried out on single females. After DNA extraction, when it was possible, the mite bodies were retrieved, mounted and considered as vouchers. DNA extraction was made using the DNeasy tissue Kit (Qiagen, USA), following the protocol described in Boubou *et al.*, (2011). All the sequences were deposited into Genbank (OQ064092– OQ064101).

DNA sequence alignment and analysis

Thirty specimens (Table 1) were used for molecular characterisation. However, we could only retrieve 15 of them which were mounted and measured as voucher specimens. Sequences were edited using Codon Aligner v.4.1.1 (CodonCode Corporation) and aligned using the default parameters. All the sequences were verified for stop codons and for insertions/deletions. Pairwise nucleotide distances of sequences were computed Kimura 2-parameter (K2P, Kimura, 1980) model using MEGA version X (Kumar *et al.*, 2018). Haplotype network was constructed using PopART software (Leigh and Bryant, 2005) with TCS network method (Clement *et al.*, 2002).

Systematics

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 (*Bryobia*) *alberensis* sp. nov. Auger & Migeon

Zoobank: 99D2DC06-9694-4CA8-9128-59EE367B411E

Figures 2–7

Type material

Holotype (female), 4 female and 1 protonymph paratypes on 6 microscopic preparations from *Phyteuma spicatum* L. (Campanulaceae), Refuge of the riverine forest (42.4897°N 3.0288°E, alt. 661m a.s.l.), Massane Nature Reserve (MNR), Argelès-sur-Mer (Pyrénées-Orientales), France, 24-VI-2015, leg. A. Migeon & P. Auger; 2 female, 1 deutonymph and 3 protonymph paratypes on 6 microscopic preparations, same host plant, riverine forest (42.4918°N 3.0304°E, alt. 633m a.s.l.) MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 6-VI-2013, leg. A. Migeon & P. Auger; 2 deutonymph paratypes on 2 microscopic preparations, same host plant, riverine forest (42.4918°N 3.0304°E, alt. 633m a.s.l.) MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 6-VI-2013, leg. A. Migeon & P. Auger. All material deposited in the collection of the CBGP, coll. Auger-Migeon slides 2062 for holotype and 2063–2075 for paratypes.

Additional material

Two females from *Helichrysum stoechas* (L.) Moench (Asteraceae), MNR, Coll del Camp d'en Selva (42.5125°N 3.0340°E, alt. 371 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), 04-VI-2013, France, leg. A. Migeon & P. Auger; 3 nymphs and 1 larva, same data, 05-VI-2013; 1 nymph and 1 larva, from *Helianthemum nummularium* Mill. (Cistaceae), Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 03-VI-2013, leg. A. Migeon & P. Auger, coll. Auger-Migeon.

Diagnosis

Anterior dorsal propodosomal projections over gnathosoma well developed, inner lobes conical, outers triangular, incision between inner vertical setae (v_1) v-shaped, about half the length of inner lobes, outer incisions wider. One duplex setae present on tarsi II, III and IV, empodia I with a pair of tenent hairs, others with two rows of tenent hairs. Body and leg I large, leg I longer than body, tibia I large with 24 setae at least twice the length of tarsus I, the latter with 28 setae, femur I with 23–27 setae. Small triangularly rounded growths “shoulders” present on prodorsal margins. Dorsal body setae short, spatulate, serrate, subequal in length on hysterosoma, sc_1 the shortest, most of them inserted on small bulges, becoming obvious small tubercles caudally, f_1 and f_2 setae in marginal position not contiguous.

Description

Female — (Figs. 2–5). Holotype 807 long (including gnathosoma), 680 *sensu* Mathys (1962), distance between setae v_2 – h_1 730, width 517, distance between setae sc_2 members 368; 6 paratypes measured, 805–942 long, 680–790 *sensu* Mathys (1962), distance between setae v_2 – h_1 730–878, width 508–640, distance between setae sc_2 members 370–380.

Dorsum – Prodorsum with four pairs of setae, with well-developed anterior lobes (Figs. 2, 3A). Propodosomal lobes with basal width about 140 (145–157), outer propodosomal lobes more or less triangularly shaped, stout, extending about three quarters of inner lobes; inner lobes conical, taller than wide, 50 (53–65) high, well separated by narrow incision 27 (28–33) in depth, with fused base slightly less than half their length. Incision between median and outer lobes wider, triangularly shaped, deep more or less bottom rounded. Propodosomal setae v_2 of outer lobes extending beyond the base of setae v_1 of inner lobes. Distance between v_1 and v_2 setae insertions 32 (25–32) and 115 (109–124), respectively; v_1 and v_2 setae subequal in length, spatulate, v_2 setae wider: 12 (8.5–14) and 17 (16–20) in width, respectively. Dorsal body setae spatulate, rounded distally, rough, serrate, subequal in length, sc_1 the shortest, inserted on small bulge-like structures becoming obvious tubercles caudally (Fig. 2). Dorsocentral setae (c_1 , d_1 and e_1) shorter than distances between consecutive setae: v_1 27 (27–33); v_2 29 (28–31); sc_1 22 (21–24); sc_2 28 (24–28); c_1 29 (28–32); c_2 29 (25–32); c_3 28 (26–32); d_1 28 (26–29); d_2 31 (28–32); d_3 31 (29–33); e_1 31 (29–33); e_2 31 (28–32); e_3 34 (30–36); f_1 32 (32–37); f_2 32 (30–35); h_1 32 (29–37). Distances between setae: c_1 – c_1 100 (103–119), d_1 – d_1 80 (75–88), e_1 – e_1 68 (63–74), c_3 – c_3 460 (465–624), c_1 – d_1 123 (122–158), d_1 – e_1 98 (97–120),

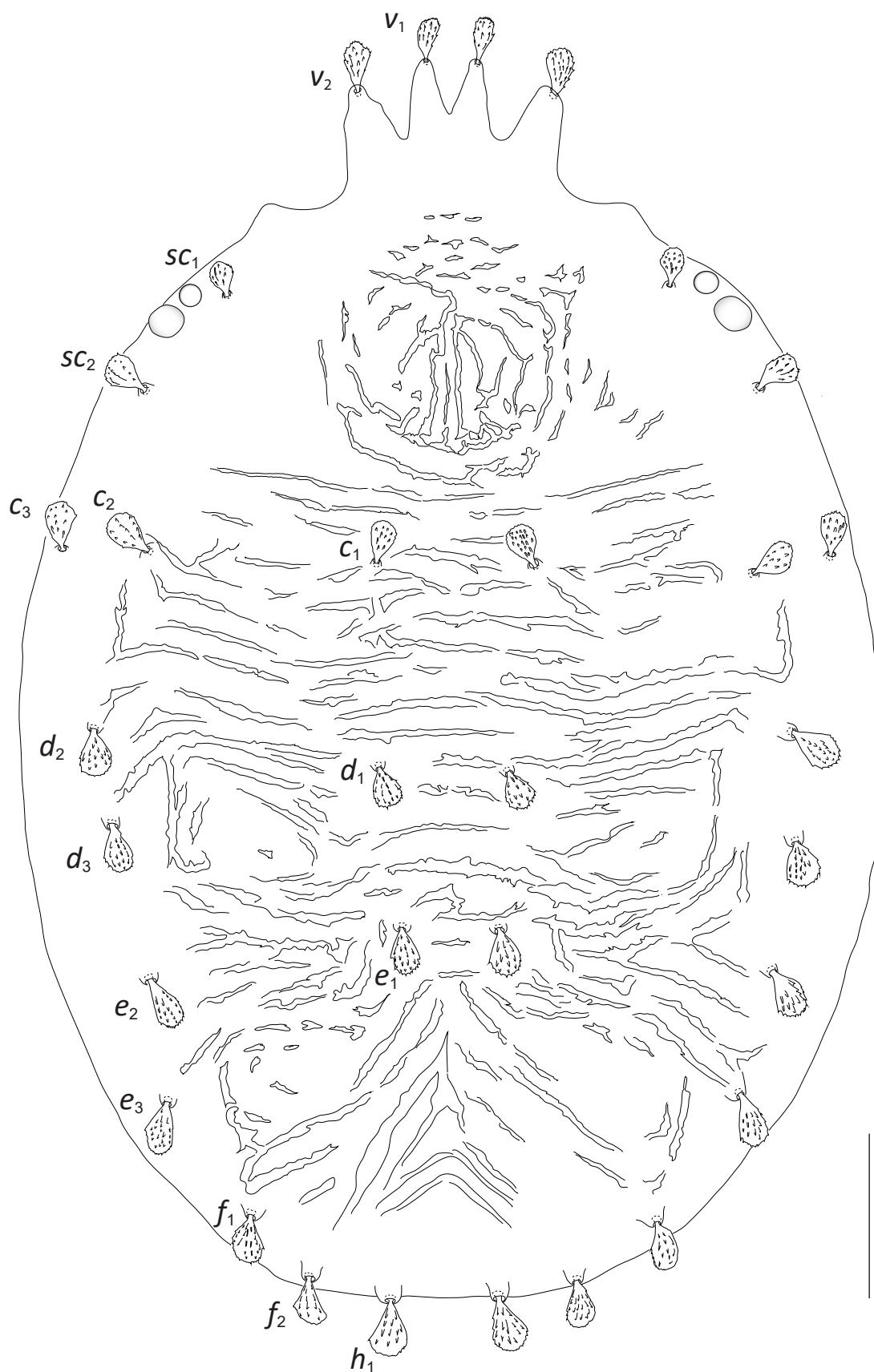


Figure 2 *Bryobia (Bryobia) alberensis* sp. nov. female: dorsal aspect. Scale bar = 100 μ m.

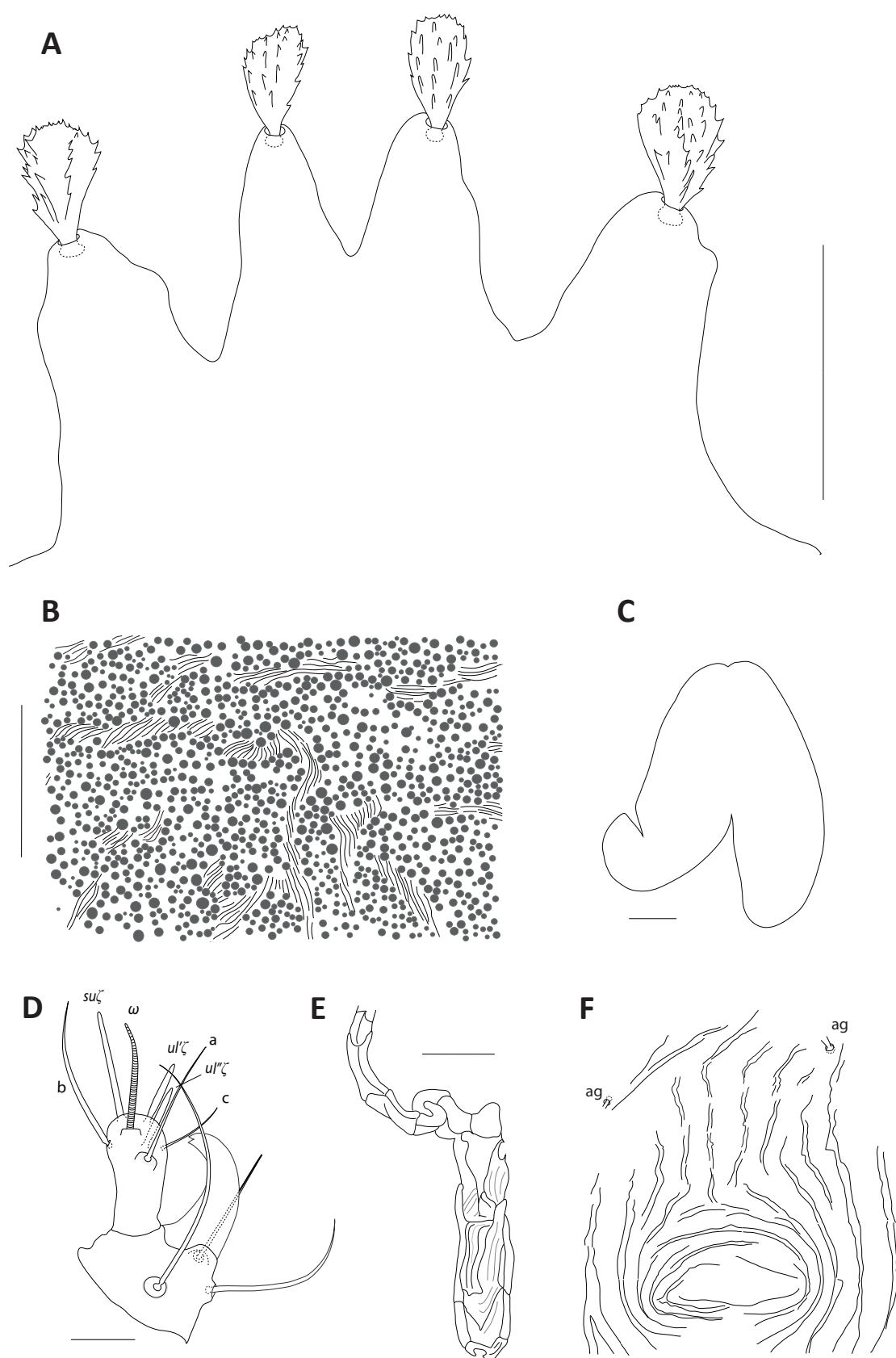


Figure 3 *Bryobia (Bryobia) alberensis* sp. nov. female: **A** – prodorsal lobes; **B** – medial prodorsal folds (detail showing fine striation on folds); **C** – stylophore; **D** – palpal tibia and tarsus; **E** – peritremal distal anastomosis; **F** – anterogential striation. Scale bars = 50 μ m (A), 25 μ m (B–C, F), 10 μ m (D–E).

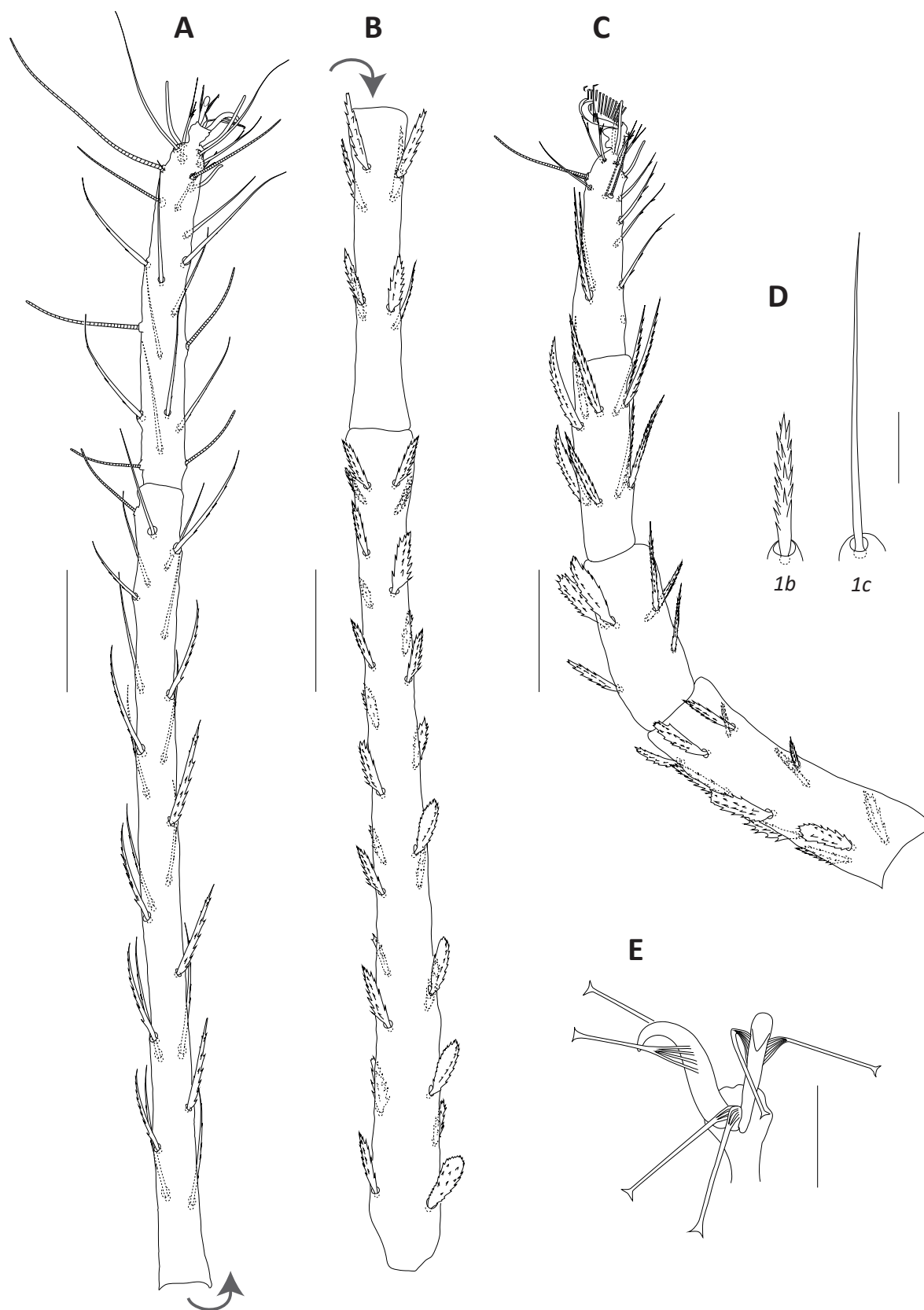


Figure 4 *Bryobia (Bryobia) alberensis* sp. nov., female: **A** – tarsus and tibia I; **B** – genu and femur I; **C** – leg II (tarsus to femur); **D** – coxisternal setae *1b* and *1c*; **E** – claws and empodia I. Scale bars = 50 µm (A–C), 10 µm (D–E).

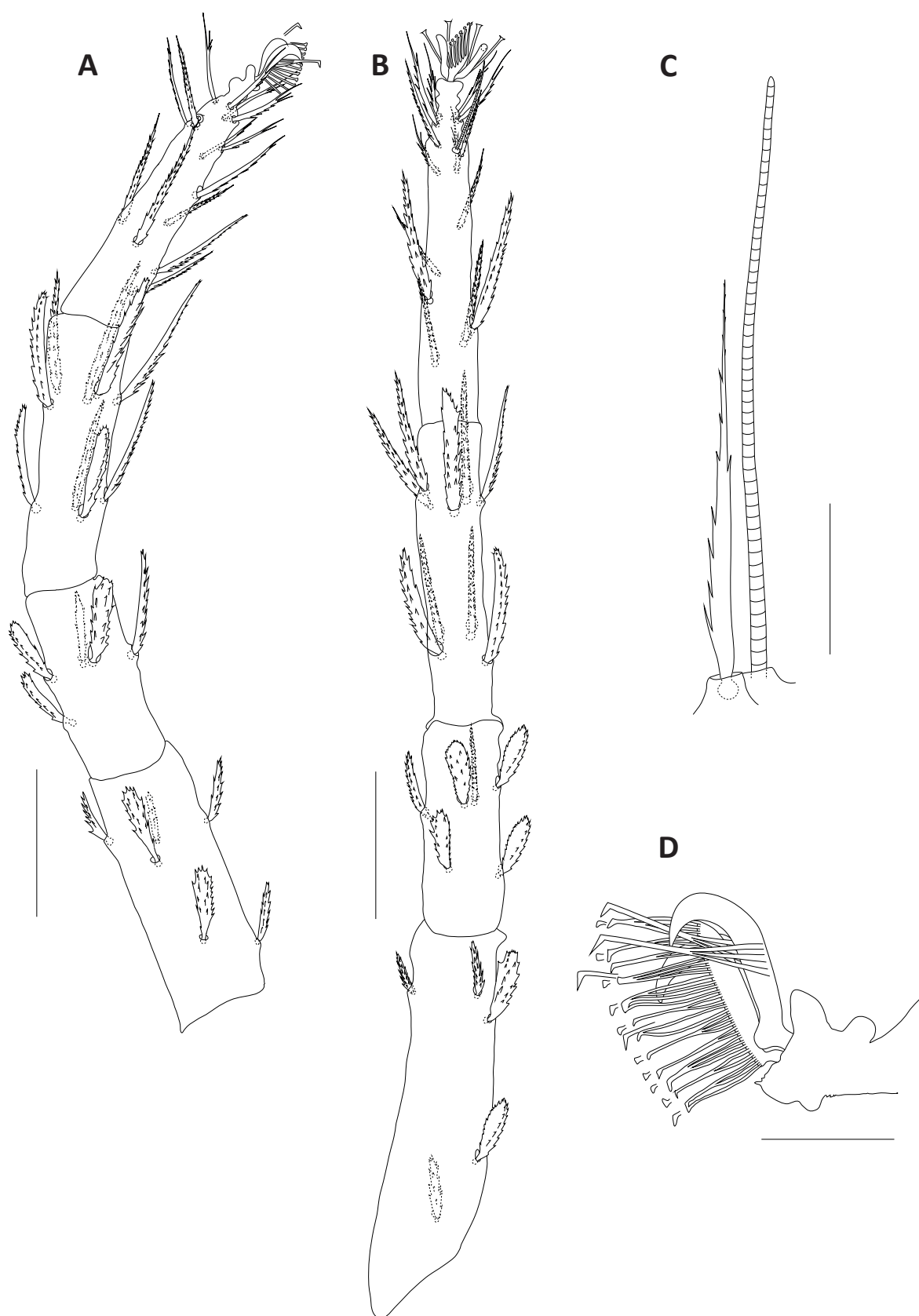


Figure 5 *Bryobia (Bryobia) alberensis* sp. nov., female: **A** – leg III (tarsus to femur); **B** – leg IV (tarsus to femur); **C** – duplex setae on tarsi III and IV (paratype); **D** – claws and empodia II-IV. Scale bars = 50 µm (A–B), 10 µm (C–D).

v_1-v_1 32 (25–32), v_2-v_2 115 (109–124), sc_2-sc_2 368 (370–380), v_2-h_1 730 (750–878). Sacral setae (f_1 and f_2) in marginal position, not contiguous. A pair of well developed “shoulders” (small triangularly rounded growths) present on prodorsal margins (Fig. 2). Dorsal integument on propodosoma with irregular discontinuous finely striated folds forming a circular pattern becoming longitudinal medially (Figs. 2, 3B). Folds on hysterosoma mostly transverse with irregular fine striation, folds irregularly arched in the caudal part. Two pairs of more or less oval-shaped areas present between d_1-d_3 , and e_1-e_3 setae (Fig. 2).

Gnathosoma – Stylophore emarginated longer than wide 123 (130–149) and 100 (101–122), respectively (Fig. 3C). Tibial claw of palpus bidentate, palptarsus slightly longer than tibial claw, with three tactile setae, three eupathidia and one solenidion (Fig. 3D). Eupathidia $ul''\zeta$, $ul''\zeta$ 11 (10–11) shorter than solenidion 17 (17), solenidion and $su\zeta$ 17 (15–16) subequal in length. Peritreme anastomosed distally in a relatively long and slender enlargement, 40 (40–51) long, 7(8–10) wide (Fig. 3E).

Venter – Ventral striation between 1st pair of setae (la) and aggenital (ag) setae, transverse, difficult to see, not seen in most of specimens, longitudinal posteriorly to members of ag setae, area immediately anterior to genital flap with irregular longitudinal striation (Fig. 3F). Spermatheca not seen. Two pairs of ventrocaudal (h_{2-3}) setae and three pairs of pseudanal setae (ps_{1-3}) present.

Legs – Leg I longer than body length, other legs inferior to body length. Leg I 964 (966–1044) long (measured from femur to tarsus) about 2.5 longer than leg II 378 (377–411), leg III 355 (357–409), leg IV 454 (453–497). Length of segments of leg I as follows: trochanter 48 (45–49), femur 362 (356–400), genu 129 (127–140), tibia 323 (311–356), tarsus 150 (140–163). Tibia I at least twice the length of tarsus I, femur I almost three times longer than genu I. Ratio between tibia I and tarsus I, and between femur I and genu I 2.15 (1.96–2.35) and 2.8 (2.6–3.1), respectively. Leg setal counts as follows (Figs. 4A–D, 5A–B):

I 2 – 1 – 26[23–27] – 8 – 24[21–24] + (1) – 19 + (5) + 2 duplexes;

II 1 – 1 – 11[12] – 6 – 9 – 15 + (2) + 1 duplex;

III 1 – 1 – 6 – 6 – 9 – 13 + 1 duplex;

IV 1 – 1 – 5 – 6 – 9 – 13 + 1 duplex.

True claws uncinat, each claw and empodium I with one pair of tenent hairs (Fig. 4E), other empodial pads each provided with two rows of tenent hairs (Fig. 5D). Coxisternal seta lb slender 49 (48–60), coxisternal seta lc shorter 20 (21–28), serrate, stout (Fig. 4D). Solenidion on tibia I 34 (32–35). On femur I, longest seta 31 (33–35). Tarsi III and IV associated setae serrate and approximate with solenidion forming duplex, tactile member proximal and shorter (about $\frac{3}{4}$ the length of solenidion) (Fig. 5C). Tarsi III and IV tactile and solenidia lengths: 30–33, 38–43 and 33 (30–33), 40 (36–44), respectively. On tarsi I and II ungual setae (u) with smooth shaft furcate distally, on tarsi III and IV with serrate shaft and deeply furcate distally. Tectal setae (tc' – tc'') smooth, elongated, slender on tarsus I, with smooth shaft furcate distally on tarsi II and III (may be serrate on tarsus III), serrate and furcate distally on tarsus IV.

Male – Unknown.

Deutonymph – (Figs. 6A–F). 3 paratypes measured 633–665 long (including gnathosoma), distance between setae v_2-h_1 555–595, width 395–440, distance between sc_2 members 287–300.

Dorsum – Prodorsal lobes well developed, outer propodosomal lobes more or less triangularly shaped, inner lobes conical, 35–40 high, well separated by an incision 19–23 in depth varying from “V” to “U” shaped, with fused base slightly more than half their length. Incision between median and outer lobes wider, bottom rounded, moderately deep (Fig. 6A, E). Propodosomal setae v_2 of outer lobes reach the middle of setae v_1 or $\frac{2}{3}$ of setae v_1 of inner lobes, v_2 about 1.5 times the length of v_1 . Dorsal setae inserted on tubercles (except setae v_1 and v_2), stronger on hysterosoma and posteriorly. Prodorsal setae serrate, subspatulate except v_1 almost subspatulate. Hysterosomal setae serrate, setae c_1 to d_2 and e_1 subspatulate, enlarged distally, setae d_3 elongate slightly enlarged, setae e_2 to h_1 elongate, slender (Fig. 6A–D). Dorsocentral setae c_1 and d_1 more than twice shorter than distances between consecutive setae, setae v_1 and

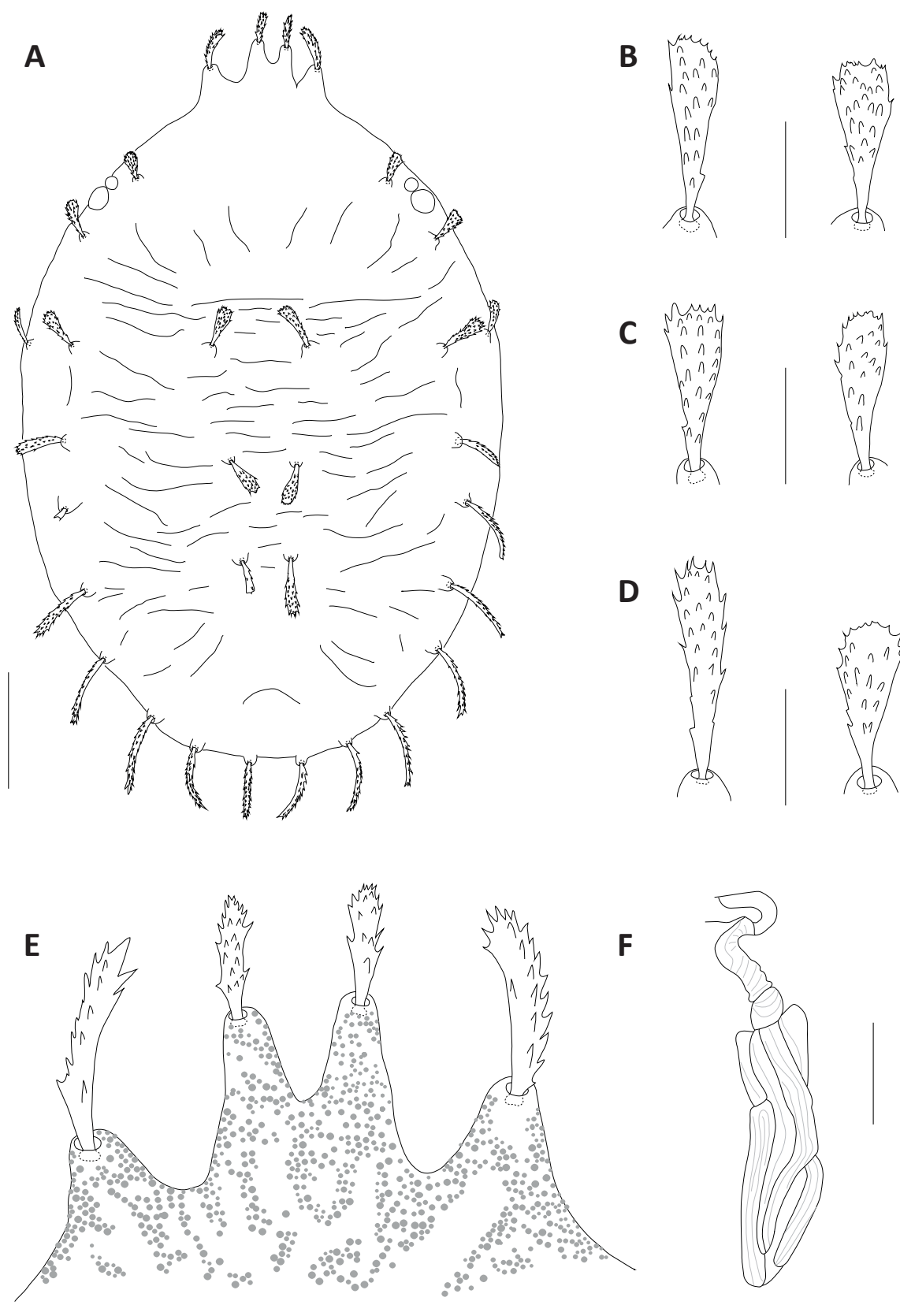


Figure 6 *Bryobia (Bryobia) alberensis* sp. nov., deutonymph: **A** – dorsal aspect; **B** – variations in setae c_1 ; **C** – variations in setae d_1 ; **D** – variation in setae e_1 ; **E** – prodorsal lobes; **F** – peritremal distal anastomosis. Scale bars = 100 µm (A), 25 µm (B–D), 50 µm (E), 10 µm (F).

sc_1 the shortest, e_2 , e_3 , f_1 and f_2 the longest: v_1 25–30; v_2 39–45; sc_1 22–29; sc_2 32–36; c_1 36–41; c_2 34–41; c_3 31–34; d_1 34–39; d_2 46–56; d_3 35–60; e_1 46–50; e_2 62–69; e_3 65–73; f_1 64–70; f_2 63–72; h_1 57–64. Distances between setae: c_1 – c_1 81–90, d_1 – d_1 57–61, e_1 – e_1 40–44, c_1 – d_1 91–103, d_1 – e_1 79–83, v_1 – v_1 24–26, v_2 – v_2 85–93. Setae f_1 in lateral position not contiguous to f_2 . Shoulders absent on prodorsal margins.

Gnathosoma – Stylophore emarginate, longer than wide, 105–110 and 80–105, respectively. Peritreme anastomosed distally in a relatively long and slender enlargement, 37–43 long, 7–8 wide (Fig. 6F). Palptasus 25–27 long (including eupathidia) and indented tibial claw subequal in length.

Legs – Length inferior to body length, leg I 470–475 long (from femur to tarsus), leg II 245–250, leg III 227–251, leg IV 245–270. Leg setal counts as follows:

I 2 – 1 – 12/13 – 4 – 11 + (1) – 14 + (1) + 2 duplexes;

II 1 – 1 – 7 – 4 – 5 – 12 + 1 duplex;

III 1 – 1 – 4 – 3 – 5 – 9 + 1 duplex;

IV 1 – 0 – 2 – 3 – 5 – 10.

True claws uncinated each with one pair of tenent hairs, empodium I with 2 or 3 pairs of tenent hairs, empodial pad short about 1/3 the claw, empodia II–IV, about as long as claw with two rows of tenent hairs. On femur I, longest seta on inner row 28–34.

Protonymph — (Fig. 7A–E). 4 paratypes measured, 480–528 long (including gnathosoma), distance between setae v_2 – h_1 430–460, width 315–350, distance between sc_2 members 220–242.

Dorsum – Outer propodosomal lobes small, triangular, inner lobes more developed cylindrical, 17–20 high, well separated by incision 10–12 in depth, bottom “U” shaped, with fused base about half their full length. Incision between median and outer lobes wider, very shallow. Propodosomal setae v_2 of outer lobes surpass the top of setae v_1 of inner lobes (Fig. 7A, D). Dorsal setae inserted on tubercles (except setae v_1 and v_2), tubercles becoming stronger caudally. All dorsal setae serrate, setae v_1 varying from almost subspatulate to spatulate; setae v_2 subspatulate wider distally; setae c_1 to d_1 subspatulate, widened distally (Fig. 7A–C), d_2 varying from subspatulate to elongate slender, remaining hysterosomal setae elongate slender. Dorsocentral setae c_1 and d_1 shorter than distances between consecutive setae, about half and half to 2/3 the distance between consecutive setae, for setae c_1 and d_1 , respectively (Fig. 7A). Setae v_1 the shortest, e_1 the longest. Lengths of dorsal setae (variations of 4 protonymphs): v_1 17–21; v_2 36–40; sc_1 24–28; sc_2 29–35; c_1 32–43; c_2 27–38; c_3 26–29; d_1 24–29; d_2 41–55; d_3 48–57; e_1 56–73; e_2 54–61; e_3 53–63; f_1 54–60; f_2 55–57; h_1 46–49. Distances between setae: c_1 – c_1 75–83, d_1 – d_1 38–43, e_1 – e_1 32–36, c_1 – d_1 87–90, d_1 – e_1 60–70, v_1 – v_1 15–25, v_2 – v_2 60–70. Setae f_1 in marginal position not contiguous to f_2 . Shoulders absent on prodorsal margins.

Gnathosoma – Stylophore emarginate, longer than wide, 80–95 and 75–85, respectively. Peritreme anastomosed distally in a long and slender enlargement, 25–30 long, 6–8 wide (Fig. 7E). Palptasus 21–23 long (including eupathidia), indented tibial claw similar in length.

Legs – Length inferior to body length, leg I 295–302 long (from femur to tarsus), leg II 170–176, leg III 170–180, leg IV 175–190. Leg setal counts as follows:

I 2 – 0 – 3 – 4 – 7 + (1) – 10 + 2 duplexes;

II 1 – 0 – 3 – 4 – 5 – 9 + 1 duplex;

III 1 – 0 – 2 – 3 – 5 – 8;

IV 0 – 0 – 2 – 2[3] – 5 – 6.

True claws uncinatate each with one pair of tenent hairs, empodium I with 2–3 pairs of tenent hairs, empodial pad very short, empodia II–IV shorter than claw (about 3/4 the length of the claw) with two rows of tenent hairs. On femur I, longest seta on inner row 21–25.

Remarks

Among species belonging to *Bryobia* s. str. [for subgenera see Mitrofanov (1971) and Arabuli et al., (2019)] only the female of *B. (B.) macrotibialis* Mathys, 1962, is morphologically very close to the female of *B. (B.) alberensis* sp. nov.: in both species the body and leg I are large, tibia I is large (a little bit shorter than femur I), the ratio between leg I length and body length

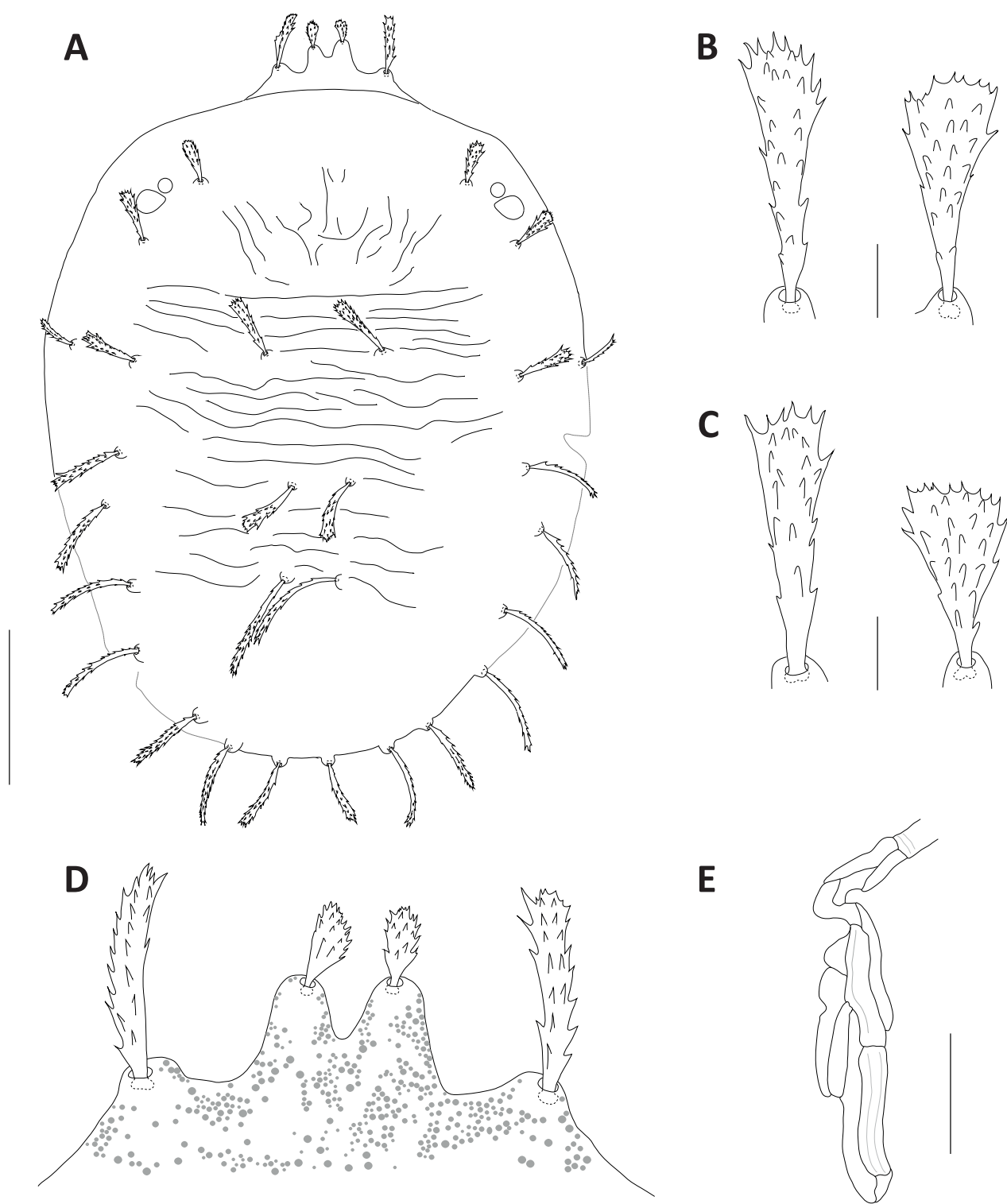


Figure 7 *Bryobia (Bryobia) alberensis* sp. nov., protonymph: **A** – dorsal aspect; **B** – variations in setae c_1 ; **C** – variations in setae d_1 ; **D** – prodorsal lobes; **E** – peritremal distal anastomosis. Scale bars = 100 μ m (A), 10 μ m (B–C), 25 μ m (D), 10 μ m (E).

is about 1.5, setal counts on femur and tibia of the leg I are similar, empodium I bears one pair of tenent hairs and others two rows. Only three morphological differences between adults of these two species are found: in *B. (B.) macrotibialis* duplex setae are absent on female tarsus II, the foreleg is 2.3 longer than the leg II and the longest lateral seta on femur I is 38–49 long whereas in *B. (B.) alberensis* a duplex seta is present on tarsus II, the foreleg is 2.6 (2.5–2.7) longer than the leg II and the longest lateral seta on femur I is 31 (33–35).

As mentioned by Mathys (1962), comparison of morphological features in juveniles like the shape and the length of dorsal setae allow to clearly separate species belonging to the *B. (B.) praetiosa* species complex. In our case, obvious differences between the juveniles of *B. (B.) macrotibialis* and *B. (B.) alberensis* **sp. nov.** are observed: i) in deutonymphs, on femur I there are 9 setae *versus* 12/13, dorsocentral setae c_1 , d_1 and e_1 are elongate, slender, acute distally *vs.* clearly subspatulate, widened distally, length of setae v_2 is about 32 *vs.* 39–45 and the longest dorsal setae is about 94 *vs.* 73 in *B. (B.) macrotibialis* and *B. (B.) alberensis* **sp. nov.**, respectively; ii) in protonymphs, dorsocentral setae c_1 to d_1 are elongate, slender, not enlarged distally but acute *vs.* obviously subspatulate, wider distally, setae d_1 reach well tubercles of setae e_1 *vs.* setae d_1 about 2/3 the distance between insertions of setae d_1 and e_1 , there is only one duplex setae on tarsus I *vs.* two and the longest dorsal setae is about 85 μ *vs.* 75 in *B. (B.) macrotibialis* and *B. (B.) alberensis* **sp. nov.**, respectively.

When alive, the body color of females of *B. (B.) alberensis* **sp. nov.** is dark green and legs are pale orange.

Etymology

The specific epithet “*alberensis*” refers to the location where the mites were found, the Albères massif (Serra de l’Albera) which is the name of the most oriental part of the Pyrénées mountains.

Bryobia (Lyobia) dekokki Eynhoven & Vacante, 1985

Specimens examined — 1 male, 8 females, 5 nymphs and 1 larva on *Ulex parviflorus* Pourr. (Fabaceae), Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 03-VI-2013, leg. A. Migeon & P. Auger.

Bryobia (Lyobia) berlesei Eynhoven, 1957

Specimens examined — 7 females, 1 nymph on *Cytisus scoparius* (L.) Link (Fabaceae), MNR, Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), 03-VI-2013, France, leg. A. Migeon & P. Auger.

Bryobia (Bryobia) kissophila Eynhoven, 1955

Specimens examined — 1 female, 2 nymphs on *Hedera helix* L. (Araliaceae), Coll d’en Verderol (42.4825°N 3.0358°E, alt. 788 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 04-VI-2013, leg. A. Migeon & P. Auger; 2 females on the same host plant, Correc de la Font dels Alemanys (42.4942°N 3.0284°E, alt. 603 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 06-VI-2013, leg. A. Migeon & P. Auger (Fig. 23A).

Bryobia (Periplanobia) polymorpha sp. nov. Auger & Migeon

Zoobank: 97C3E630-F365-410A-96AE-B42350F01CAC

Figures 8–15

Type material

Holotype (female), 8 female, 6 male, 9 nymph and 2 larva paratypes on 24 microscopic preparations, from *Genista pilosa* L. (Fabaceae), between Corral del porcs and Coll d’en Verderol, Argelès-sur-Mer (42.4863°N 3.0308°E, alt. 742 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 12-VII-2017, leg. A. Migeon & P. Auger; 8 female, 3 male,

15 nymph and 5 larva paratypes on 25 microscopic preparations, same host, Col de la plaça d'Armes (42.4943°N 3.0323°E, alt. 672 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 12-VII-2017, leg A. Migeon & P. Auger. All material deposited in the collection of the CBGP, coll. Auger-Migeon slides 2076 for holotype and 2077–2123 for paratypes.

Additional material

Four females, 1 male and 3 nymphs, same host species and collectors, Coll del Pal (42.4750°N 3.0327°E, alt. 902 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 4-VI-2013; 4 females, same host species and collectors, Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 4-VI-2013; 7 females, 3 larvae and 1 male, same host species and collectors, Corral dels porcs (42.4942°N 3.0321°E, alt. 685 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 4-VI-2013; 8 females, 8 nymphs, 4 larvae and 6 males, same host species and collectors, Plo de Soupergues, along road D136 (43.6014°N 3.2632°E, alt 370 m a.s.l.), Pézènes-les-Mines (Hérault), France, 19-VI-2012; 5 females, 2 nymphs and 1 male, same host species and collectors, Col de l'Espinass (44.1188°N 3.6746°E, alt. 848 m a.s.l.), Saint-André-de-Valborgne (Gard), France, 26-VII-2012; 1 female and 2 males, same host species and collectors, Le Jouquet, Forêt Domaniale de Notre-Dame de Parlatges (43.7747°N 3.4394°E, alt 770 a.s.l.), Saint-Pierre-de-la-Fage, (Hérault), France, 26-VII-2012.

Sequenced material

Two sequenced females, 1 sequenced and measured female, same host species and collectors, Coll del Pal (42.4750°N 3.0327°E, alt. 902 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 4-VI-2013; 3 sequenced and measured females, same host species and collectors, Col de la plaça d'Armes (42.4943°N 3.0323°E, alt. 672 m a.s.l.), MNR, Argelès-sur-mer (Pyrénées-Orientales), France, 12-VII-2017; 1 sequenced female, 3 sequenced and measured females, same host species and collectors, Plo de Soupergues, along road D136 (43.6014°N 3.2632°E, alt 370 m a.s.l.), Pézènes-les-Mines (Hérault), France, 19-VI-2012; 4 sequenced females, same host species and collectors, Engayresque along road D94 (44.2542°N 3.0689°E, alt. 865 m a.s.l.), Séverac-le-Château (Aveyron), France, 19-VII-2012; 1 sequenced female, same host species and collectors, Le Jouquet, Forêt Domaniale de Notre-Dame de Parlatges (43.7747°N 3.4394°E, alt 770 a.s.l.), Saint-Pierre-de-la-Fage, (Hérault), France, 26-VII-2012; 2 sequenced females, Puech de l'Oule (44.1186°N 3.0210°E, alt. 700 m a.s.l.), Millau (Aveyron), France, 26-VII-2012; 1 sequenced female, same host species and collectors, Col de l'Espinass (44.1188°N 3.6746°E, alt. 848 m a.s.l.), Saint-André-de-Valborgne (Gard), France, 26-VII-2012; 2 sequenced females, 4 sequenced and measured females, same host species and collectors, Le grand Tourtoul along road D18 (43.9809°N 5.6376°E, alt. 675 m a.s.l.), Vachères (Alpes-de-Haute-Provence), France, 4-X-2012; 1 sequenced female, 2 sequenced and measured females, same host species and collectors, Lou Coudrères (44.6123°N 3.1898°E, alt. 1212 m a.s.l.), Saint-Laurent-de-Muret (Lozère), France, 23-VII-2013.

Diagnosis

Limited anterior dorsal propodosomal projections over gnathosoma, outer prodorsal lobes poorly developed, inner lobes small with base fully fused, tubercle-like distally, shallow incision between inner vertical setae (v_1) present. Dorsal setae serrate inserted on tubercles, varying from short slightly subspatulate to elongate, slender; first pair of dorsocentral hysterosomal setae (c_1) about half the length the distance to consecutive seta (d_1) insertion, f_1 and f_2 setae marginal and contiguous. Peritreme anastomosed moderately elongated, more or less oval shaped. Leg I short, shorter than female body width, duplex setae present on tarsus III. Spermatheca sacculus elongate, rounded distally. Empodia with two rows of tenent hairs.

Description

Female — (Figs. 8–10). Holotype 548 long (including gnathosoma) gnathosoma 100 (90–125) long (measured to the tip of palps), distance between setae v_2 – h_1 418 (460–530), width 355 (350–395), distance between sc_2 members 225 (230–260) (9 paratypes measured).

Dorsum – Prodorsum with four pairs of setae and with weakly developed anterior lobes (Figs. 8A, 9B). Outer propodosomal lobes small, more or less similar in length to dorsohysterosomal setal tubercles, inner lobes about 23 (20–26) high with large fused base forming a small cone-shaped projection about 67 (61–75) in width (=distance between inner margins of outer prodorsal lobes); incision between median lobes relatively shallow, distance between first (v_1) and second (v_2) pair of propodosomal setae insertions 18 (14–22) and 75 (64–89), respectively; setae v_2 about 2.4 (1.9–2.7) the size of v_1 ; v_2 setae usually extending well beyond tip of v_1 setae. Dorsal body setae inserted on tubercles, serrate, larger caudally, variable in size and shape between specimens: from quite short, subspatulate, stout to elongate, slender, acute distally (Figs. 8A, 9A). Dorsocentral setae c_1 and d_1 about half shorter than distances between consecutive setae, c_1 shorter than distance between c_1 member insertions, d_1 larger than distance between d_1 member insertions (length of holotype and variations of 9 paratypes): v_1 18 (15–21); v_2 43 (36–47); sc_1 44 (34–44); sc_2 44 (34–48); c_1 51 (42–55); c_2 48 (35–54); c_3 37 (28–39); d_1 40 (28–52); d_2 48 (33–47); d_3 73 (39–61); e_1 57 (34–57); e_2 71 (44–64); e_3 73 (45–71); f_1 65 (41–64); f_2 66 (47–60); h_1 57 (38–53). Distances between setae: c_1 – c_1 59 (59–74), d_1 – d_1 27 (26–36), e_1 – e_1 28 (27–33), c_1 – d_1 99 (88–106), d_1 – e_1 68 (62–83). Ratio c_1 / c_1 – c_1 0.86 (0.63–0.89), ratio d_1 / d_1 – d_1 1.48 (0.94–1.85), ratio c_1 / c_1 – d_1 0.51 (0.42–0.6), ratio d_1 / d_1 – e_1 0.59 (0.35–0.77), ratio d_1 – d_1 / e_1 – e_1 0.96 (0.88–1.33). Sacral setae (f_1 and f_2) in marginal position and contiguous. Dorsal propodosomal striation forming an irregular rounded pattern medially, oblique laterally (Figs. 8A, 9D–E), transversal large irregular folds with fine striation on hysterosoma (Figs. 8A, 9F) irregularly arched in the caudal part. Area immediately anterior to setae h_1 with fine arched reticulation (Fig. 8C), area with irregular oblique fine striation pattern present among large folds between insertions of setae e_1 and e_3 .

Gnathosoma – Stylophore slightly emarginate anteriorly, rarely rounded, longer than wide, 90–95 and 66–82, respectively (Fig. 9C). Tibial claw of palpus bidentate (Fig. 9G). Palptarsus slightly elongated, longer than tibial claw, 20–22 long (including setae) with six setae and one solenidion. Eupathidia $ul''\zeta$, $ul''\zeta$ and $su\zeta$ slightly shorter than solenidion ω . Peritreme anastomosed distally in an oval enlargement: length 37 (46–50), width 15 (11–19) (Fig. 9H).

Venter – Fine striation found anteriorly to the 1st pair of setae ($1a$), transversal striation (folds) present between $1a$ and 2nd ($3a$) pairs of setae, more or less hourglass striation pattern present between $3a$ and 3rd ($4a$) pairs of setae, large transversal folds between $4a$ and aggenital (ag) pairs of setae. Area immediately anterior to genital flap with irregular longitudinal striation, V-shaped between ag setae (Fig. 9I). Sacculus of spermatheca elongate, rounded distally 15 (14–22) (Fig. 9J). Three pairs of pseudanal setae (ps_{1-3}) and two pairs of ventrocaudal (h_{2-3}) setae present.

Legs – Length inferior to body length. Leg I 291 (280–340) long (measured from femur to tarsus), leg II 215 (200–240), leg III 205 (200–265), leg IV 245 (235–295). Length of segments of leg I as follows: femur 100 (76–113), genu 52 (49–66), tibia 67 (55–76), tarsus 76 (73–93). Ratio tarsus I / femur I 0.76 (0.75–1.12), ratio femur I / tibia I 1.49 (1.36–1.61), ratio leg I / femur I 2.9 (2.96–3.07). Leg setal counts as follows (Fig. 10A–D):

I 2 – 1 – 9 [7, 10–11] – 4 – 9 + (1) – 17[16] + (2) + 2 duplexes;

II 1 – 1 – 7 [5] – 4 – 4[3] – 15 [14] + (2) + 1 duplex;

III 1 – 1 – 5 [4–6] – 2 [3] – 5[4] – 13 + 1 duplex;

IV 1 – 1 – 5 [4] – 2[3] – 6 [5–7] – 13[12–14] + (1).

True claws uncinat, with one pair of tenent hairs, empodial pads I–IV similar with two rows of ventrally directed tenent hairs (Fig. 10E). Largest serrated seta l'' present on femur I 32 (24–31). Proximal coxisternal seta $1b$ slender, smooth 45 (41–56), distal coxisternal seta $1c$ shorter 12 (12–16), serrate, stout, sometimes acute distally (Fig. 10J–K). Fastigial setae (ft' ,

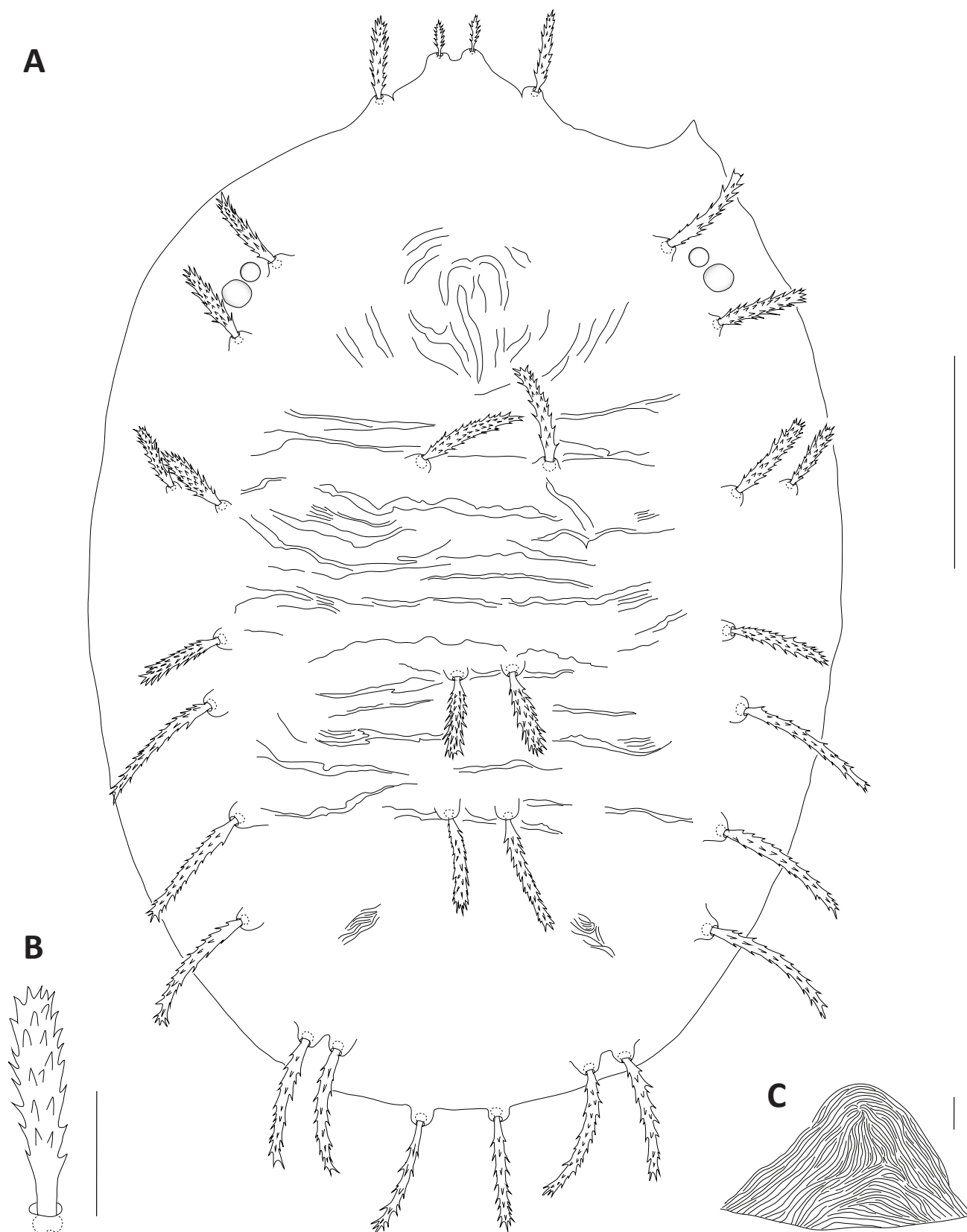


Figure 8 *Bryobia (Periplanobia) polymorpha* sp. nov., female: **A** – dorsal aspect; **B** – dorsocentral seta c_1 ; **C** – caudal dorsal hysterosomal striation pattern. Scale bars = 100 μ m (A), 25 μ m (B), 10 μ m (C).

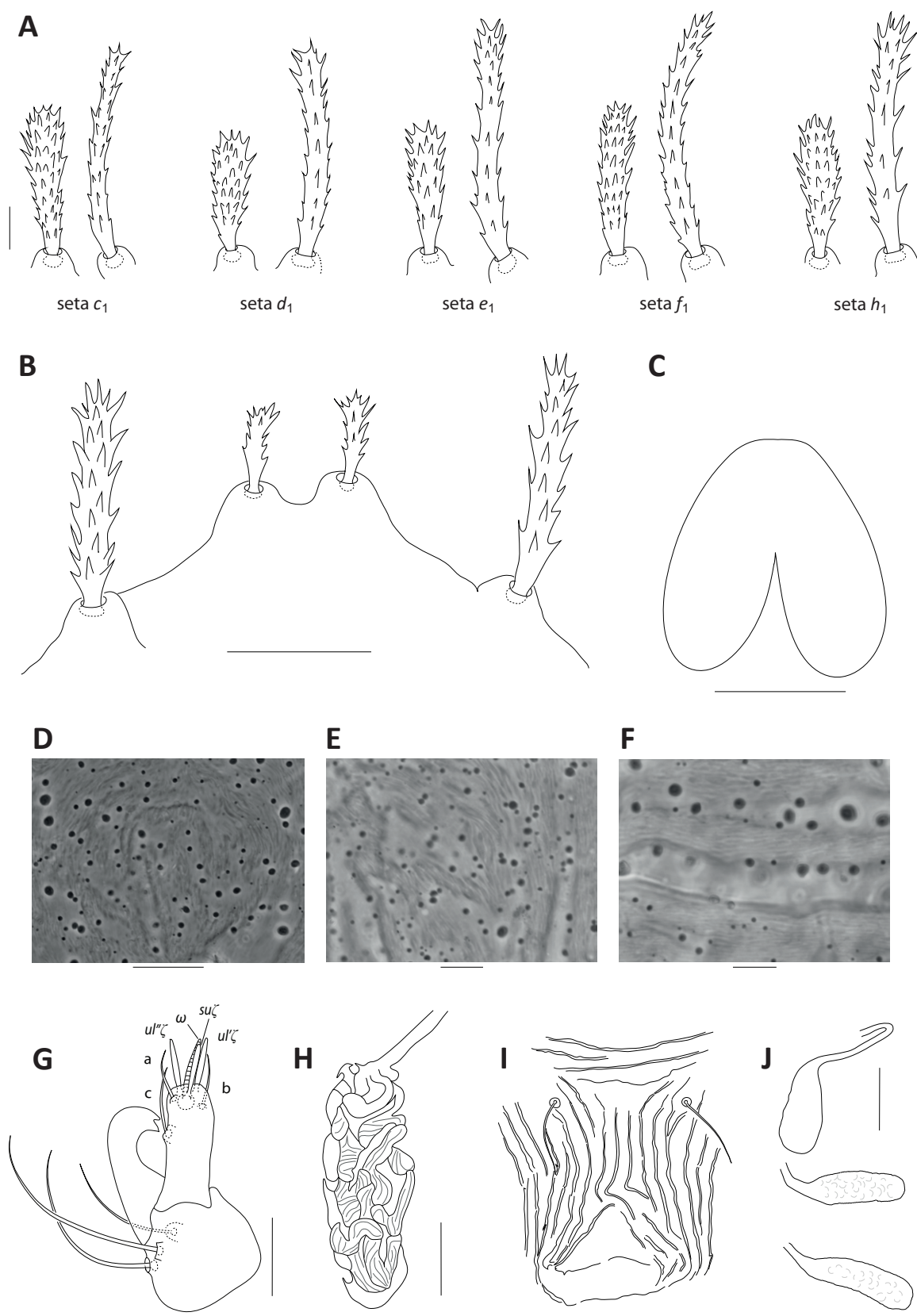


Figure 9 *Bryobia (Periplanobia) polymorpha* sp. nov., female: **A** – length and shape variations in dorsohysterosomal setae c_1 , d_1 , e_1 , f_1 and h_1 (for each seta, the longest and the shortest are illustrated); **B** – prodorsal lobes; **C** – stylophore (paratype); **D** – medial prodorsal striation pattern (phase contrast); **E** – detail of prodorsal striation (phase contrast); **F** – detail of striation on dorsohysterosomal folds (phase contrast); **G** – palpal tibia and tarsus; **H** – peritremal distal enlargement; **I** – anterogential striation; **J** – spermatheca (holotype up). Scale bars = 10 μ m (A, E–F, G–H, J), 25 μ m (B–D), 50 μ m (C, I).

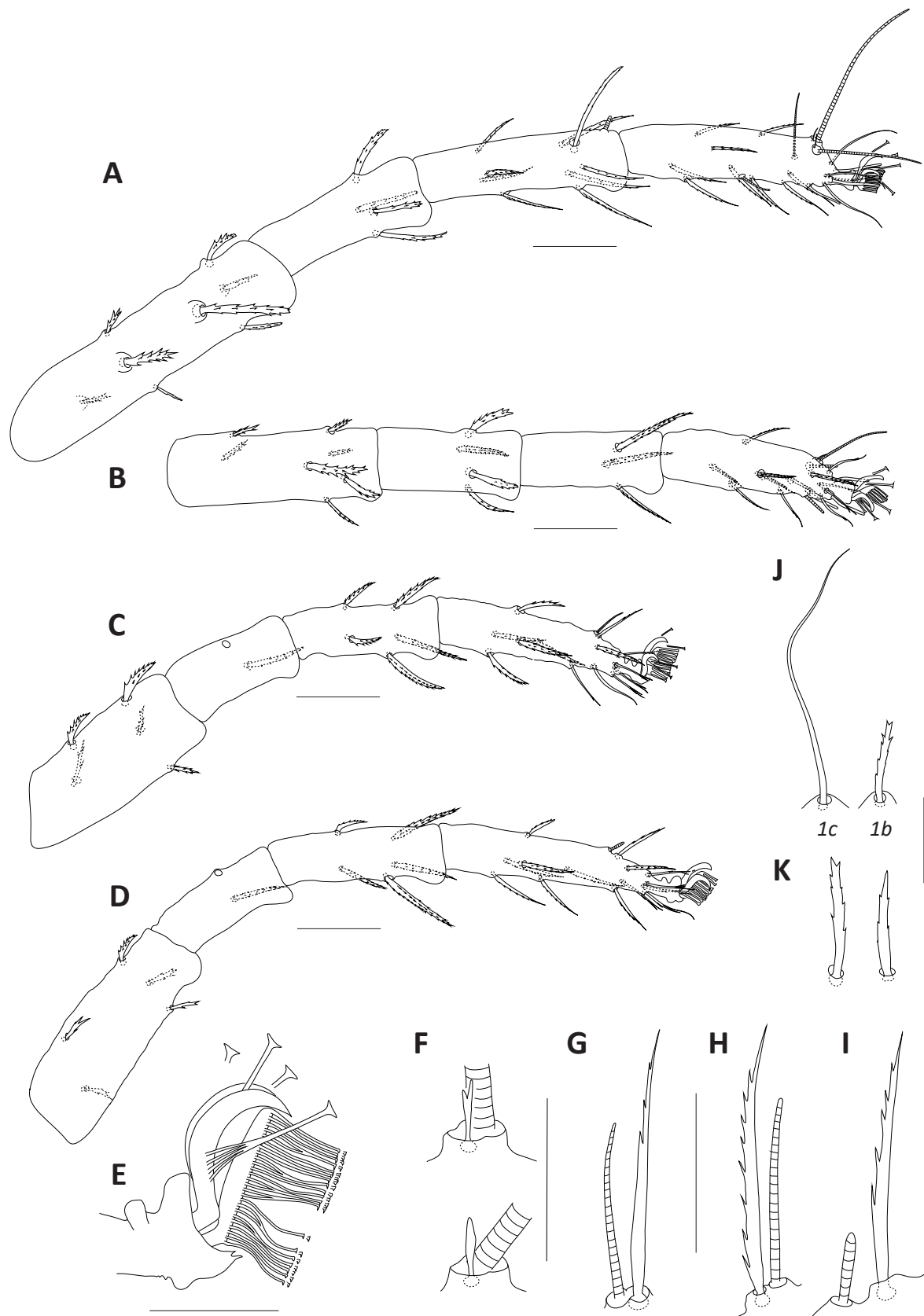


Figure 10 *Bryobia (Periplanobia) polymorpha* sp. nov., female: **A** – leg I (femur to tarsus); **B** – leg II; **C** – leg III; **D** – leg IV; **E** – claws and empodium; **F** – furcate and stout (paratype) tactile associated setae (*fi'*) on duplex setae of leg I; **G** – duplex setae on tarsus III; **H** – tarsus III duplex setae commonly found in paratypes; **I** – solenidion and associated seta on tarsus IV; **J** – coxisternal setae *1b* and *1c*; **K** – variations in coxisternal seta *1b*. Scale bars = 25 μ m (A–D, G–I), 10 μ m (E–F, J–K).

ft'') of duplex setae on tarsi I and II not elongate slender, stouter, sometimes serrate or furcate (Fig. 10F). On legs II–IV, tectals (*tc'*, *tc''*) and unguinals (*u'*, *u''*) divided distally, furcate distally on leg IV. Tarsus III associated setae serrate and approximate with solenidion forming duplex, tactile member longer, proximal or distal in holotype, proximal in paratypes, solenidion about $\frac{3}{4}$ the length of tactile (Fig. 10G–H); tarsus IV with solenidion well-separated from tactile, proximal, about $\frac{1}{3}$ to $\frac{1}{4}$ the length of tactile (Fig. 10I).

Male — (Figs. 11–12): Body 359–430 long (including gnathosoma) gnathosoma 88–100 (measured to the tip of palps), distance between setae v_2 – h_1 289–310, width 200–220, distance between sc_2 members 168–180 (7 paratypes measured).

Dorsum – Prodorsum with four pairs of setae and with weakly developed propodosomal anterior lobes (Fig. 11A–C). Outer propodosomal lobes small, tubercle like, inner lobes tubercle like distally with reduced fused base; median lobes separated by small shallow bottom rounded incision; incision between median and outer lobes wide and very shallow (Fig. 11A–B) sometimes almost absent (Fig. 11B). Distance between first (v_1) and second (v_2) pair of propodosomal setae insertions 13–18 and 64–76, respectively; setae v_2 elongate, serrate about 1.7–2.5 the size of v_1 , setae v_1 varying from serrate elongate thin to serrate short subspatulate (Fig. 11C). Setae v_2 extend beyond tip of inner lobes, not reaching tip of setae v_1 except when v_1 spatulate short. Propodosomal dorsal surface with irregular folds forming an oval pattern medially, mostly oblique laterally; hysterosoma with horizontal furrows dividing dorsal surface in three parts with irregular ornamentation (Fig. 11A). Dorsal body setae inserted on tubercles, elongate, serrate, more or less acute distally. Dorsocentral setae c_1 and d_1 shorter than distances between consecutive setae (variations of 7 paratypes): v_1 11–14; v_2 21–29; sc_1 29–37; sc_2 29–35; c_1 36–44; c_2 29–36; c_3 25–33; d_1 33–41; d_2 27–35; d_3 35–50; e_1 35–48; e_2 31–44; e_3 37–51; f_1 34–44; f_2 33–44; h_1 26–33. Distances between setae: c_1 – c_1 59 (59–74), d_1 – d_1 27 (26–36), e_1 – e_1 28 (27–33), c_1 – d_1 99 (88–106), d_1 – e_1 68 (62–83). Ratio c_1 / c_1 – c_1 0.55–0.8, ratio c_1 / c_1 – d_1 0.61–0.79, ratio d_1 / d_1 – e_1 0.69–0.88, ratio d_1 – d_1 / e_1 – e_1 1.2–1.55. Sacral setae (f_1 and f_2) in marginal position and contiguous.

Gnathosoma – Stylophore, longer than wide, smoothly rounded or slightly emarginated apically. Tibial claw of palpus bidentate (Fig. 11E). Palptarsus slightly elongated, longer than tibial claw, 18–20 long (including setae) with six setae and one solenidion. Eupathidia $ul''\zeta$, $ul'''\zeta$ slightly longer than $su\zeta$, solenidion larger. Peritreme anastomosed distally more or less in an oval enlargement: length 13–18 width 7–11, distal anastomosis sometimes reduced (Fig. 11D).

Venter – Striation transverse between $1a$ and $3a$ pairs of setae, area between $3a$ and $4a$ pairs of setae smooth, transverse between members of $4a$ and immediately posteriorly, area posterior to ag pairs of setae with striation varying with mounting.

Legs. Leg I length similar or slightly superior to body length, other legs shorter. Leg I 409–466 long (measured from femur to tarsus), leg II 233–276, leg III 222–272, leg IV 260–309. Length of segments of leg I as follows: femur 142–163, genu 79–91, tibia 96–111, tarsus 92–110; ratio tarsus I / femur I (0.64–0.7), ratio femur I / tibia I 1.36–1.51, ratio leg I / femur I 2.86–3.05. Leg setal counts as follows (Fig. 12A–D):

I 2 – 1 – 15 [14] – 8 – 9 + (1) – 17 + (8)[(9)] + 2 duplexes;

II 1 – 1 – 9[8–11] – 4 – 7[8] – 15 + (2) + 1 duplex;

III 1 – 1 – 6[8] – 5 [4–3] – 7 – 13 + 1 duplex;

IV 1 – 1 – 5 [4] – 4[3] – 7 – 14[13] + (1).

True claws uncinat, with one pair of tenent hairs, empodial pads I–IV similar with two rows of ventrally directed tenent hairs. Proximal coxisternal seta $1b$ smooth, slender (45–51), distal coxisternal seta $1c$ shorter (14–20), stouter, serrate, elongate, acute distally (Fig. 12E). Five large setae l'' present on femur I 17–23, 35–42, 31–43, 30–39 and 33–38 from proximal to distal part of the segment, respectively. On leg I, tectals and prorals slender smooth, on legs II–IV slender, divided distally. Tactile of duplex setae on tarsi I and II not slender, stouter, sometimes serrate or furcate (Fig. 12F). Tarsus III associated setae approximate with solenidion forming duplex, tactile member (15–24) slightly serrate dorsally, proximal, about $\frac{3}{4}$ the length

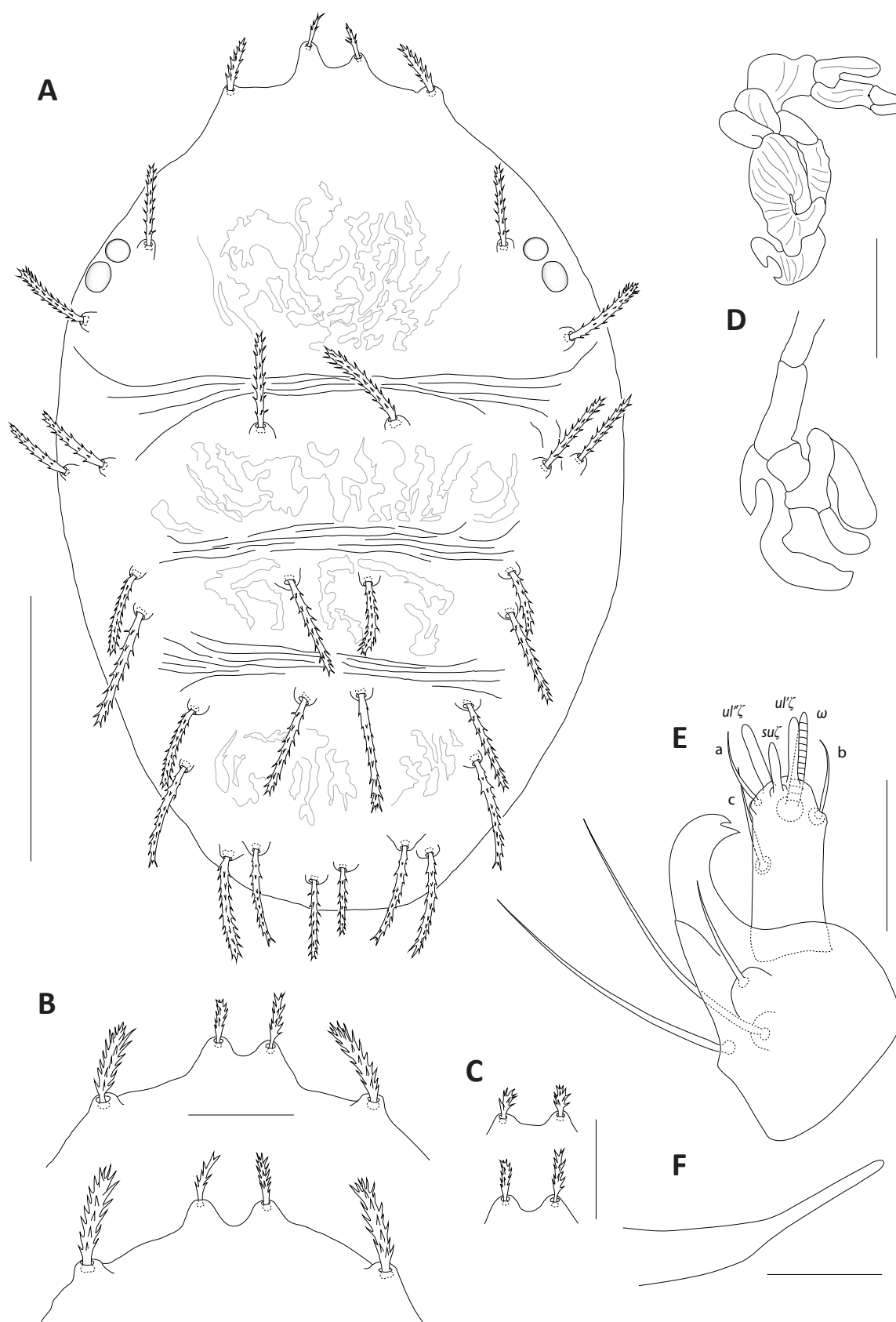


Figure 11 *Bryobia (Periplanobia) polymorpha* sp. nov., male: **A** – dorsal aspect; **B** – prodorsal lobes variation; **C** – subspatulate short and elongate v_1 setae; **D** – peritremal distal anastomosis variation; **E** – palpal tibia and tarsus; **F** – aedeagus. Scale bars = 100 μ m (A), 25 μ m (B–C), 10 μ m (D–F).

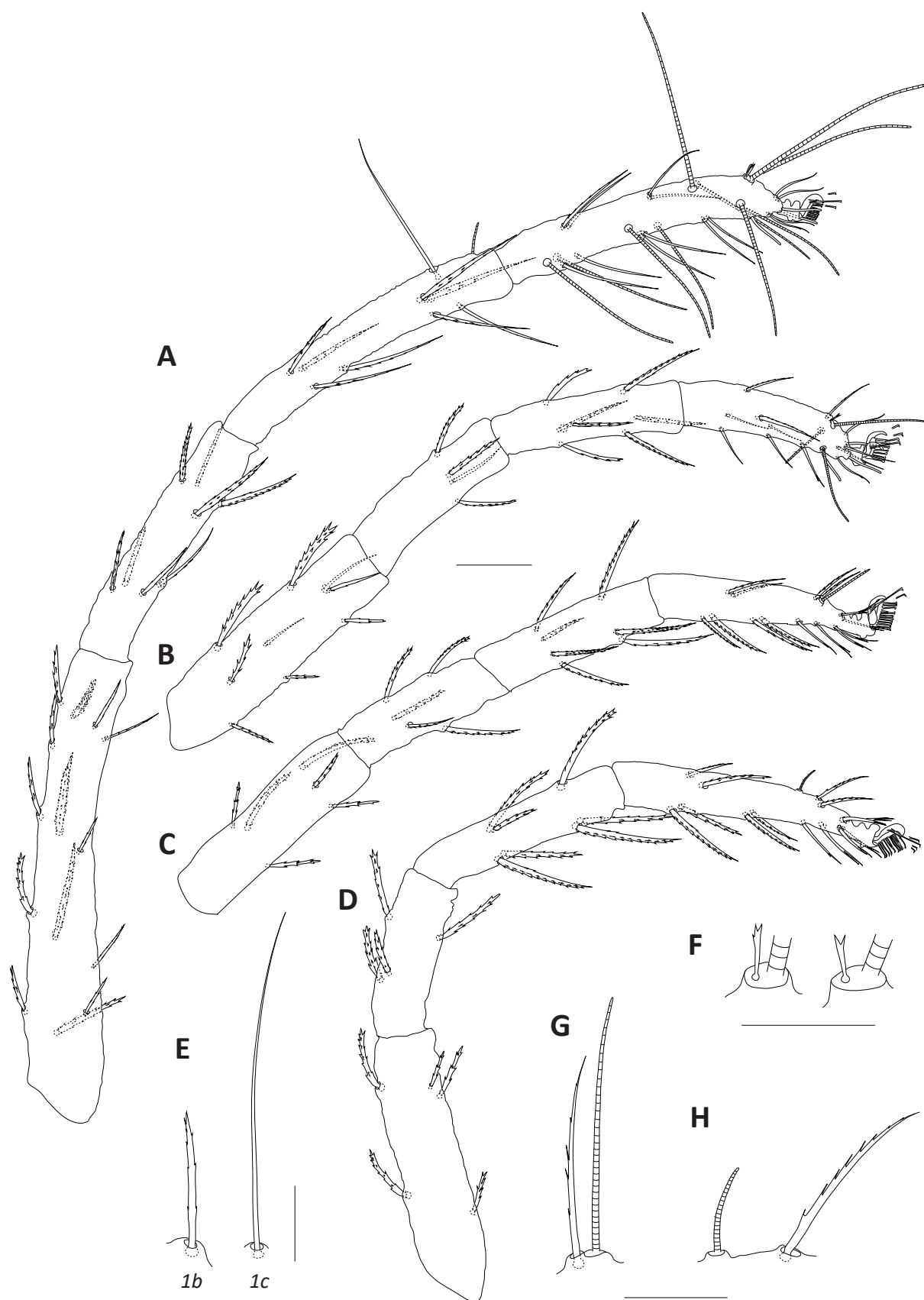


Figure 12 *Bryobia (Periplanobia) polymorpha* sp. nov., male: **A** – leg I (femur to tarsus); **B** – leg II; **C** – leg III; **D** – leg IV; **E** – coxisternal setae *1b* and *1c*; **F** – serrate and furcate tactile associated setae (fastigials setae *ft'* and *ft''*) on duplex setae of legs I and II; **G** – duplex setae on tarsus III; **H** – solenidion and associated setae on tarsus IV. Scale bars = 25 μ m (A–D), 10 μ m (E–H).

of solenidion (18–26) (Fig. 12G); tarsus IV with solenidion (7.5–11) well-separated from tactile (20–25), proximal, about 1/3–1/2 the length of tactile (Fig. 12H).

Aedeagus – Typical of some species belonging to the genus *Bryobia*, straight, without knob, shaft of aedeagus quite abruptly narrowed to form a slender apex, dorsal margin 30 long (Fig. 10F)

Deutonymph — (Fig. 13): 8 specimens measured, 400–460 long (including gnathosoma), distance between setae v_2 – h_1 322–380, width 245–300, distance between sc_2 members 170–195.

Dorsum – Prodorsal lobes poorly developed, outer reduced to tubercles, inner with base fused, not well separated, more or less mammeliform, varying with mounting (Fig. 13A, F–I); Prodorsal striation resembling that of female, with irregular rounded pattern medially becoming oblique laterally; prodorsal setae v_1 and v_2 elongated and serrate, v_2 about 3–3.5 times the length of v_1 ; other dorsal body setae serrate, elongate varying from moderately stout to slender needle-like, inserted on tubercles (Fig. 13A–D). Setae c_1 shorter than distances between consecutive setae, setae f_1 and f_2 in marginal position, contiguous. Lengths of dorsal setae: v_1 10–14; v_2 34–42; sc_1 37–48; sc_2 33–45; c_1 44–65; c_2 36–64; c_3 27–36; d_1 42–64; d_2 36–57; d_3 47–67; e_1 44–63; e_2 47–70; e_3 53–71; f_1 51–63; f_2 46–65; h_1 43–54. Distances between setae: c_1 – c_1 52–66, d_1 – d_1 22–24, e_1 – e_1 21–26, c_1 – d_1 71–82, d_1 – e_1 49–54. Ratio c_1 / c_1 – c_1 0.76–1.07, ratio c_1 / c_1 – d_1 0.52–0.94, ratio d_1 / d_1 – e_1 0.86–1.45, ratio d_1 – d_1 / e_1 – e_1 0.8–1.14.

Gnathosoma – Peritreme anastomosed distally, moderately elongate 21–27 in length (Fig. 13E).

Legs – Length inferior to body length, leg I 211–227 long (from femur to tarsus), leg II 149–165, leg III 153–170, leg IV 162–180 Leg setal counts as follows:

I 2 – 1 – 5 – 4 – 5 + (1) – 13 + (1) + 2 duplexes;

II 1 – 1 – 3 – 4 – 3 – 11 + 1 duplex;

III 1 – 1 – 2 – 1 – 3 – 9 [10] + (1);

IV 1 – 0 – 2 – 1 – 3 – 10.

True claws uncinat with one pair of tenent hairs, empodia with two rows of tenent hairs. Tarsus III with solenidion well-separated from tactile (found associate in one leg of specimens examined), about half tactile, proximal.

Protonymph — (Fig. 14): 8 specimens measured, 280–360 long (including gnathosoma), distance between setae v_2 – h_1 225–286, width 195–240, distance between sc_2 members 120–157.

Dorsum – Outer prodorsal lobes reduced to tubercles, inner absent, prodorsal setae v_1 short serrate elongate sometimes furcate, v_2 larger about 3.5 to 5 times the length of v_1 , elongate and serrate (Fig. 14A–B). Medial prodorsal striation as in Fig. 14E. Dorsohysterosomal body setae serrate, elongate, slender inserted on tubercles, c_3 the shortest, $e_{1,3}$ the longest. Setae c_1 shorter than distances between insertions of members of c_1 setae and shorter than between consecutive setae. Setae d_1 surpass e_1 setal insertions, setae f_1 and f_2 marginal, contiguous. Lengths of dorsal setae: v_1 6–8; v_2 24–33; sc_1 27–40; sc_2 25–39; c_1 35–49; c_2 30–41; c_3 19–26; d_1 36–57; d_2 27–49; d_3 37–50; e_1 42–60; e_2 41–59; e_3 41–61; f_1 40–55; f_2 35–50; h_1 31–46. Distances between setae: c_1 – c_1 54–66, d_1 – d_1 17–24, e_1 – e_1 18–27, c_1 – d_1 48–60, d_1 – e_1 34–48. Ratio c_1 / c_1 – c_1 0.65–0.86, ratio c_1 / c_1 – d_1 0.72–0.84, ratio d_1 / d_1 – e_1 0.98–1.4, ratio d_1 – d_1 / e_1 – e_1 0.7–1.15. Dorsohysterosomal setae length may vary between specimens, setal shape does not.

Gnathosoma – Peritreme varies in size and shape. Small, usually anastomosed distally in an oval enlargement 5–12 in length, sometimes very reduced to two or three branches (Fig. 14C–D).

Legs – Length inferior to body length, leg I 145–160 long (from femur to tarsus), leg II 115–125, leg III 115–125, leg IV 115–125. Leg setal counts as follows:

I 2 – 0 – 3 – 4 – 5 + (1) – 9 + 2 duplexes;

II 1 – 0 – 3 – 4 – 3 – 9 + 1 duplex;

III 1 – 0 – 2 – 1 – 3 – 8;

IV 0 – 0 – 2 – 1 – 3 – 6.

True claws uncinat with one pair of tenent hairs, empodia with two rows of tenent hairs.

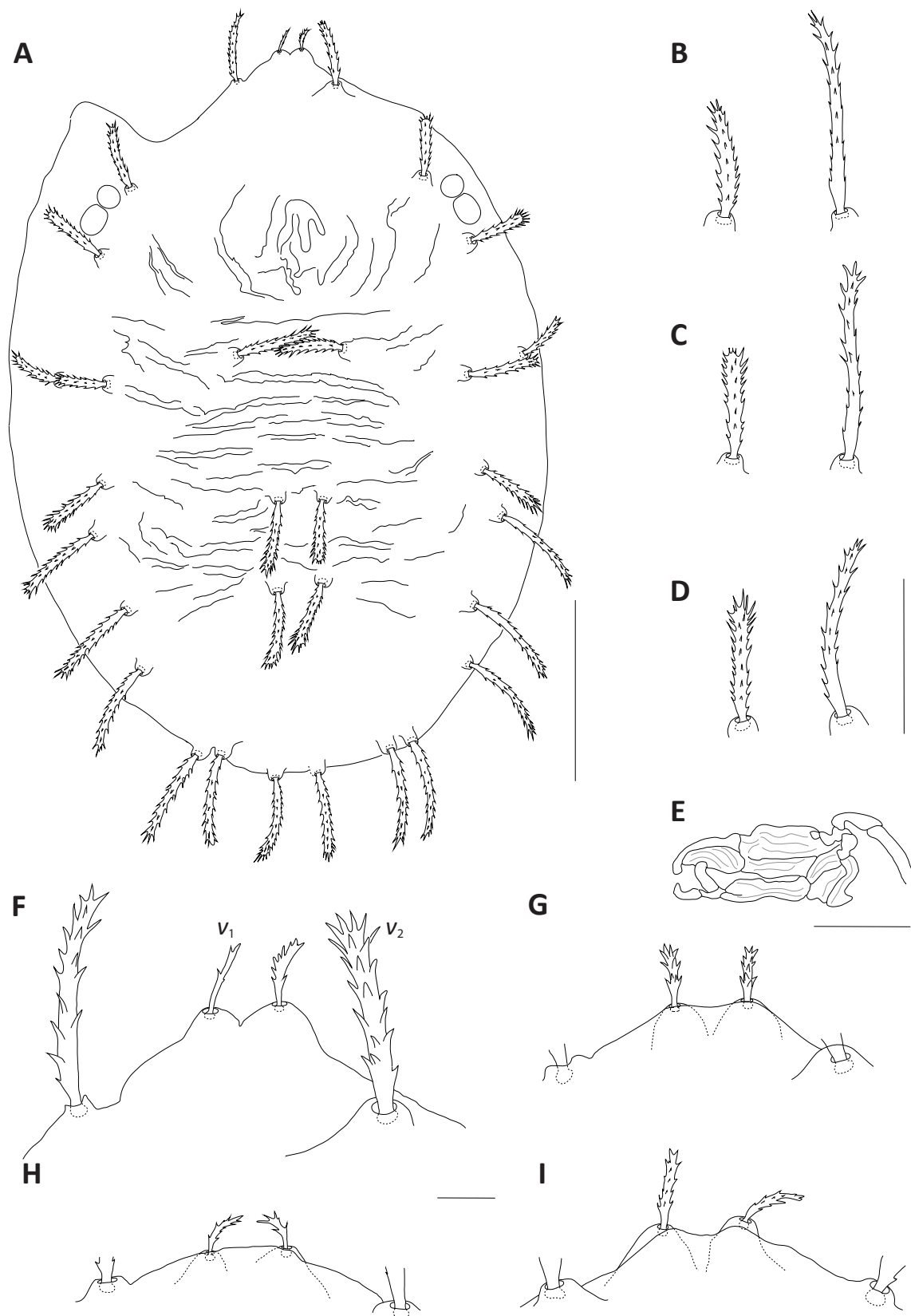


Figure 13 *Bryobia (Periplanobia) polymorpha* sp. nov., deutonymph: **A** – dorsal aspect; **B** – variations in setae c_1 ; **C** – variations in setae d_1 ; **D** – variation in setae e_1 ; **E** – peritremal distal anastomosis; **F** – prodorsal lobes (typical); **G–I** prodorsal lobes variation probably mainly due to mounting (setae v_2 are not drawn in full). Scale bars = 100 μ m (A), 50 μ m (B–D), 10 μ m (E–I).

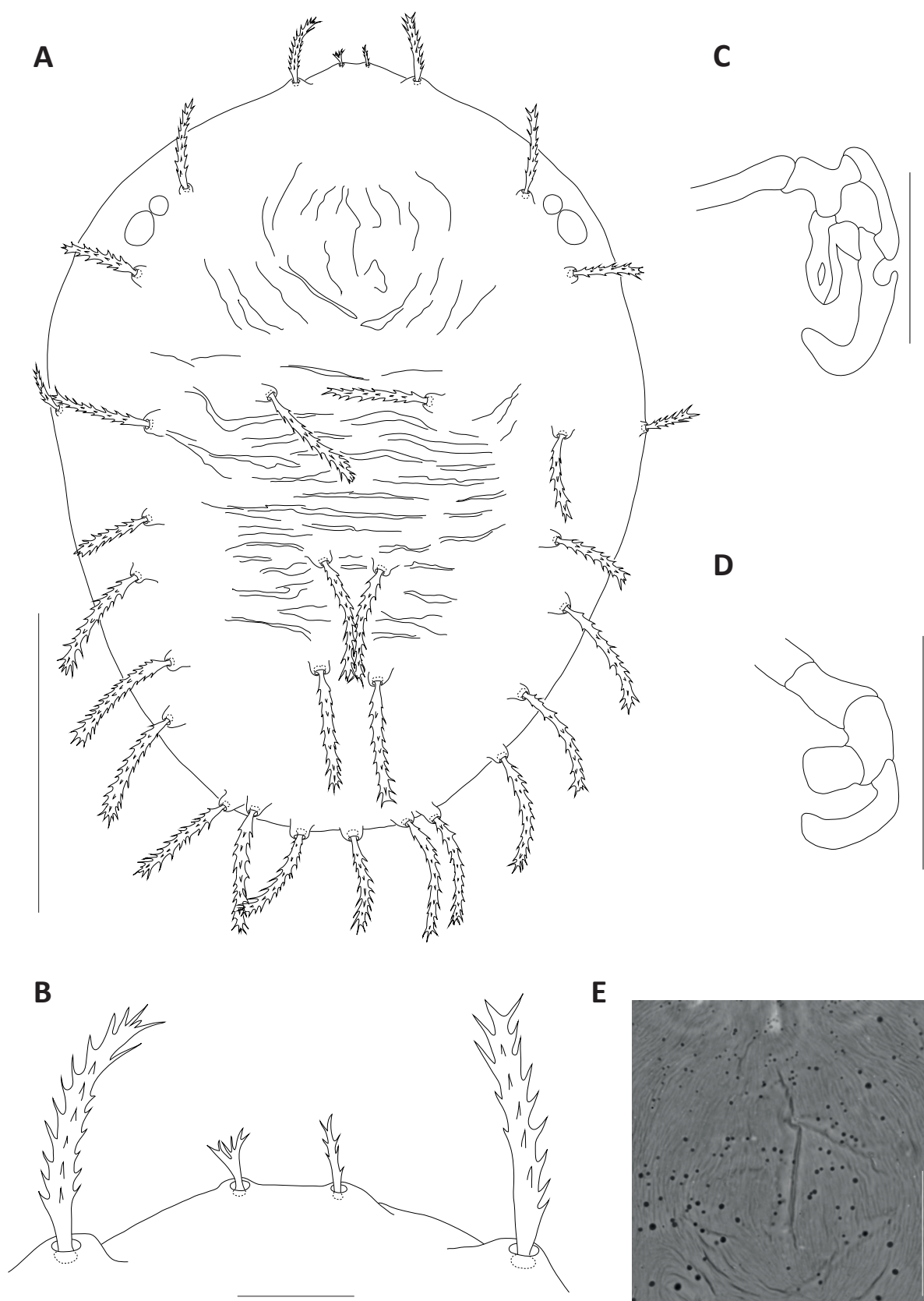


Figure 14 *Bryobia (Periplanobia) polymorpha* sp. nov., protonymph: **A** – dorsal aspect; **B** – prodorsal lobes; **C** – oval peritremal distal anastomosis; **D** – reduced peritremal distal end; **E** – medial prodorsal striation. Scale bars = 100 µm (A), 25 µm (E), 10 µm (B–D).

Larva — (Fig. 15): 6 specimens measured, 255–285 long (including gnathosoma), distance between setae v_2 – h_1 185–200, width 165–185, distance between sc_2 members 125–130.

Dorsum – Prodorsal lobes absent, prodorsal setae v_1 very short, slender, v_2 larger about 3.5 to almost 5 times the length of v_1 , elongate, serrate, slender, inserted on small bulges; other prodorsal setae serrate, elongate, slender on small tubercles (Fig. 15A). Medial prodorsal striation deeply ornamented (Fig. 15B). Hysterosomal setae serrate, elongate, slender inserted on tubercles, c_3 the shortest, e_1 the longest. Setae c_1 obviously shorter than distances between insertions of members of c_1 and than distance between c_1 and d_1 setal insertions. Setae d_1 surpass e_1 setal insertions, setae f_1 in normal position.

Gnathosoma – Distal end of peritreme small, very reduced (Fig. 15C).

Legs. Lengths of dorsal setae: v_1 6–7; v_2 23–29; sc_1 19–27; sc_2 20–27; c_1 32–38; c_2 26–29; c_3 17–20; d_1 37–43; d_2 30–33; d_3 33–39; e_1 41–46; e_2 39–43; e_3 36–40; f_1 38–45; f_2 35–39; h_1 32–39. Distances between setae: c_1 – c_1 54–63, d_1 – d_1 21–26, e_1 – e_1 22–30, c_1 – d_1 48–60, d_1 – e_1 34–37. Ratio c_1 / c_1 – c_1 0.58–0.61, ratio c_1 / c_1 – d_1 0.59–0.77, ratio d_1 / d_1 – e_1 1–1.15, ratio d_1 – d_1 / e_1 – e_1 0.83–1.08. Dorsohysterosomal setae length varies very little between specimens, setal shape does not vary.

Legs – Length inferior to body length, leg I 125–130 long (from femur to tarsus), leg II 100–105, leg III 100–105. Leg setal counts as follows:

I 1–0–3–4–5 + (1)–7 + 1 duplex;

II 0–0–3–4–3–7 + 1 duplex;

III 0–0–2–1–3–6.

True claws uncinat with one pair of tenent hairs, empodia with two rows of tenent hairs.

Etymology

The species designation “*polymorpha*” refers to the high morphological plasticity of its dorsal setae, which vary in length and shape among conspecific specimens.

Remarks

Among the species belonging to the subgenus *Bryobia* (*Periplanobia*) [prodorsal lobes absent or poorly developed, if present, outer and inner lobes not separated by deep incision; distance between f_1 setae members inferior to distance between f_2 members; setae f_1 and f_2 contiguous, sublateral (Livshits and Mitrofanov, 1971)], the combination of dorsal setae elongate and serrate and empodia with two rows of tenent hairs brings this species close to *B. (P.) variabilis* Manson 1967, *B. (P.) cinereae* Auger & Migeon (2014) and *B. (P.) belliloci* Auger, Arabuli & Migeon (2015). Despite the dorsal setae variation in size and shape brings it close to *B. (P.) variabilis*, the body females of *B. (P.) polymorpha* **sp. nov.** is obviously smaller, the legs are clearly shorter and there are obvious (in 9 leg segments) and sometimes large differences in female leg setal counts between these two species. Again, in males of *B. (P.) polymorpha* **sp. nov.**, legs are clearly shorter and large differences in leg setal counts are observed in 2 leg segments; in males of *B. (P.) polymorpha* **sp. nov.** the fused base of inner prodorsal lobes is also less developed than in *B. (P.) variabilis* and the incision between inner setae v_1 is different.

Bryobia (P.) polymorpha **sp. nov.** is very similar to *B. (P.) cinereae* and *B. (P.) belliloci* and according to the leg setal counts it resembles more to *B. (P.) belliloci* from which it can be separated by a single additional seta on tarsus III. It also differs from the two remaining species by the shape of the spermatheca that is elongate in *B. (P.) polymorpha* **sp. nov.** only vs. more or less rounded in the two other species; by the peritremal enlargement more developed in *B. (P.) polymorpha* **sp. nov.** length 37 (46–50) vs. 20 (20–26) and 33 (26–28) in *B. (P.) belliloci* and *B. (P.) cinereae*, respectively; by differences between the relative length of the two first pairs of dorsocentrosternohysterosomal setae related to the distances between setal insertions: the ratio between the length of setae c_1 and the distance between c_1 members 0.86 (0.62–0.9) observed in *B. (P.) polymorpha* **sp. nov.** (setae c_1 shorter than the distance between c_1 members) is always

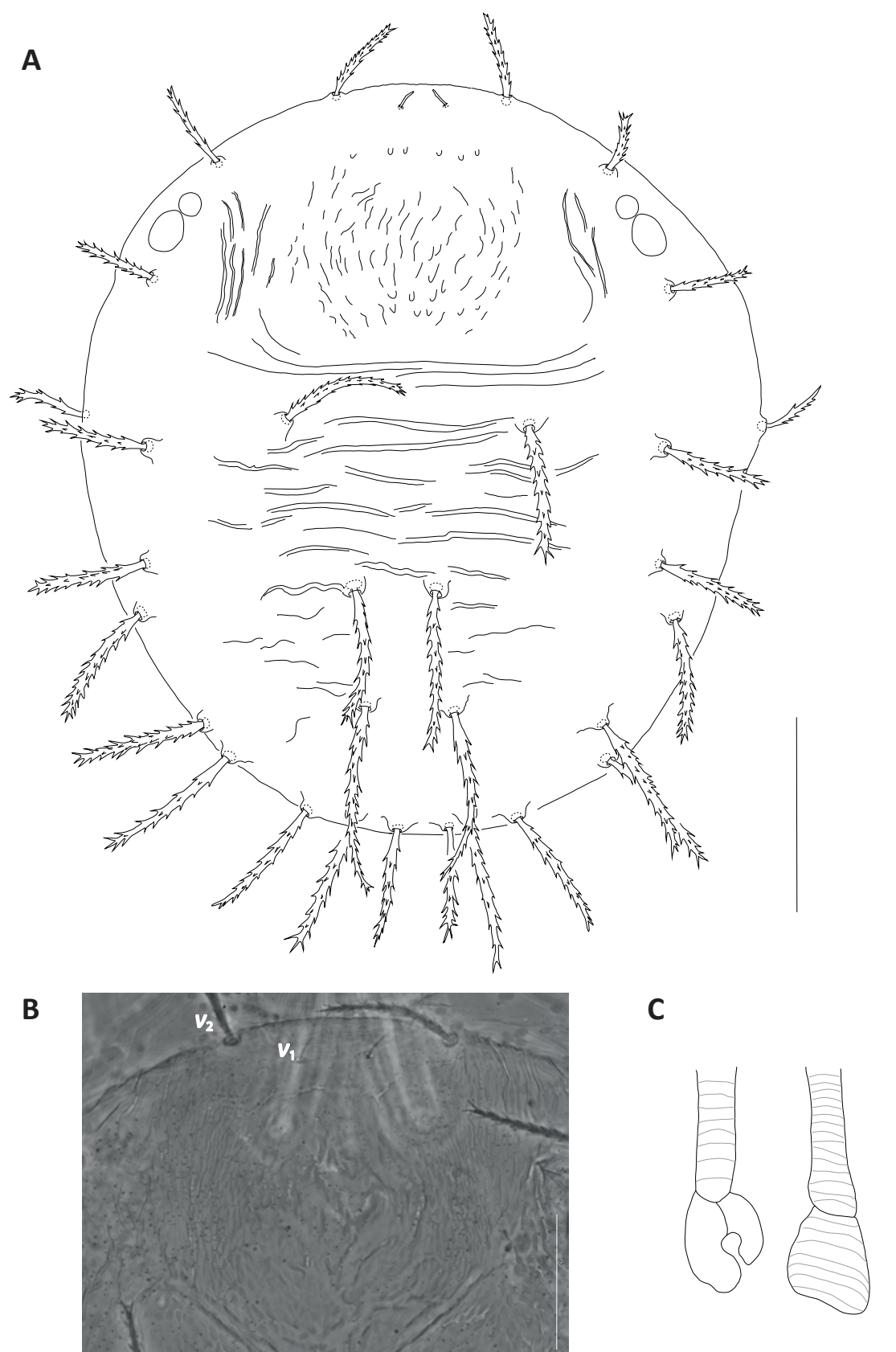


Figure 15 *Bryobia (Periplanobia) polymorpha* sp. nov., larva: **A** – dorsal aspect; **B** – medial prodorsal striation pattern; **C** – distal end of peritreme. Scale bars = 50 μ m (A), 25 μ m (B), 10 μ m (C).

lower than in *B. (P.) cinereae* and *B. (P.) belliloci*, 1 (1.05–1.1) and 1.1 (1.05–1.4) (setae c_1 similar or longer than the distance between c_1 members), respectively. Again, the ratio between the length of seta d_1 and the distance between d_1 – e_1 members 0.58 (0.35–0.77) is always lower than in *B. (P.) cinereae* and *B. (P.) belliloci*, 0.8 (0.8–0.85) and 1.25 (1–1.3), respectively and by males only recorded in colonies of *B. (P.) polymorpha* **sp. nov.**

Molecular data analysis and integrated taxonomy

The final alignment of the 30 sequences of *B. (P.) polymorpha* **sp. nov.** comprised 873 nucleotide positions out of 31 were variables and revealed 10 haplotypes (Tables 1 and 2). The maximum distance obtained was 3.06% a value close to previous intraspecific studies (Gotoh *et al.*, 2009, Boubou *et al.*, 2011). The TCS haplotype network presented highlighted the presence of two clades confirmed by a neighbour-joining tree (not shown). One clade was grouping all the specimens from all the localities sampled except the Massane Nature Reserve ones which were separated by 21 mutational steps from the closest specimens from Séverac-le-Château and Vachères (Fig. 16A). Although genetic distance between the two clades is too small to consider two species (Boubou *et al.*, 2011), it is noteworthy to consider a post-glacial evolutionary scheme of the two strains as many organisms in Western Europe (Hewitt, 1999, Taberlet *et al.*, 2002).

Among the 30 sequences we managed to recover 15 vouchers specimens. For each of them we measured the lengths of the pairs of dorsocentral setae c_1 , d_1 and e_1 and categorized them in short, medium or long. We did not observe any link between setal lengths and haplotypes (Table 2 and Fig. 16B), nor between setal lengths and origin of the mites, which reinforce the conspecific character of all the specimens examined.

Table 1 *Bryobia (Periplanobia) polymorpha* **sp. nov.** Specimens sequenced for each locality, slide number, GenBank accession numbers and genetic distance between sequences (Kimura 2-parameter).

Slide number	Sequence number	GenBank number	Locality	Haplotype	2	7	8	11	13	16	17	24	26	28
	1		Pézènes-les-Mines	8										
2183	2	OQ064092	Pézènes-les-Mines	8	0.0000									
2184	3		Pézènes-les-Mines	8										
2185	4		Pézènes-les-Mines	7										
	5		Millau	2										
	6		Millau	2										
	7	OQ064093	Séverac-le-Château	1	0.0081	0.0000								
	8	OQ064094	Séverac-le-Château	5	0.0081	0.0092	0.0000							
	9		Séverac-le-Château	1										
	10		Séverac-le-Château	1										
	11	OQ064095	Saint-Pierre-de-la-Fage	6	0.0069	0.0081	0.0034	0.0000						
	12		Saint-André-de-Valborgne	7										
2188	13	OQ064096	Saint-André-de-Valborgne	7	0.0081	0.0092	0.0046	0.0011	0.0000					
2189	14		Saint-André-de-Valborgne	7										
	15		Vachères	3										
2193	16	OQ064097	Vachères	4	0.0081	0.0069	0.0046	0.0058	0.0069	0.0000				
2194	17	OQ064098	Vachères	3	0.0046	0.0034	0.0058	0.0046	0.0058	0.0034	0.0000			
	18		Vachères	3										
2195	19		Vachères	3										
	20		Vachères	3										
2196	21		Vachères	3										
	22		RN forêt de la Massane	9										
	23		RN forêt de la Massane	9										
2190	24	OQ064099	RN forêt de la Massane	9	0.0258	0.0294	0.0246	0.0258	0.0270	0.0246	0.0258	0.0000		
	25		Saint-Laurent-de-Muret	2										
2191	26	OQ064100	Saint-Laurent-de-Muret	2	0.0069	0.0011	0.0081	0.0069	0.0081	0.0058	0.0023	0.0282	0.0000	
2192	27		Saint-Laurent-de-Muret	2										
2199	28	OQ064101	RN forêt de la Massane	10	0.0270	0.0306	0.0258	0.0270	0.0282	0.0258	0.0270	0.0011	0.0294	0.0000
2200	29		RN forêt de la Massane	9										
2201	30		RN forêt de la Massane	9										

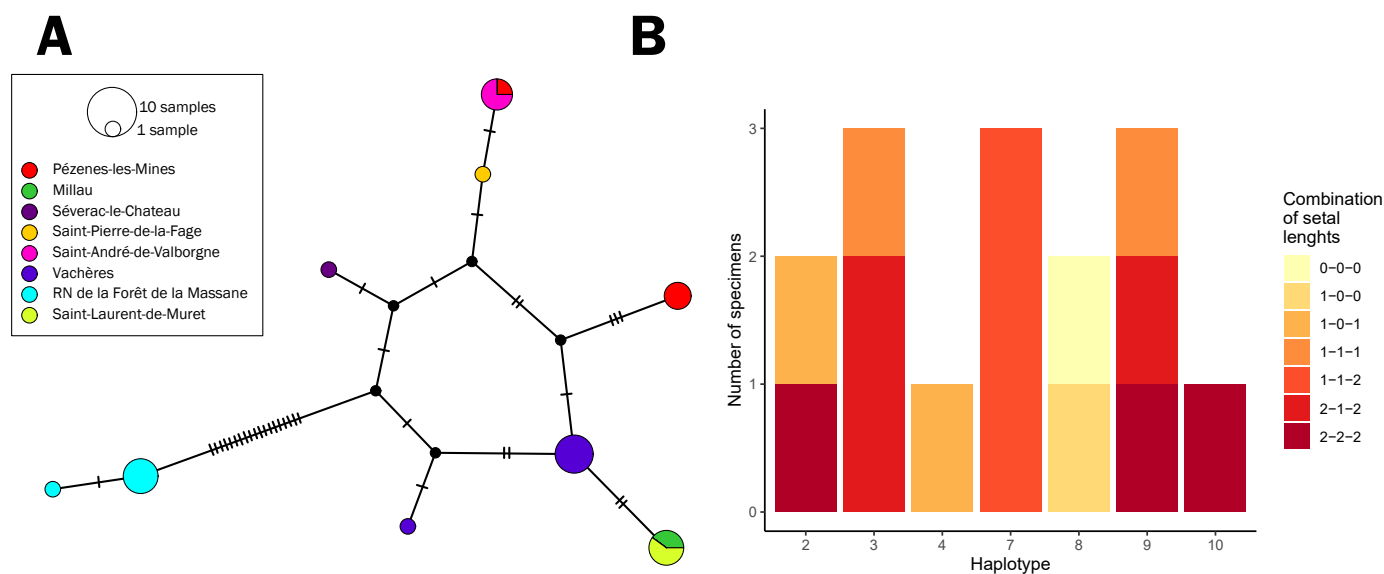


Figure 16 A – Haplotype network of 30 COI sequences of *Bryobia (Periplanobia) polymorpha* sp. nov. obtained with TCS using PopArt program. The size of a circle represents the number of individuals. The colour represents the location of each individual. Hash marks on branches indicate the number of mutation between nodes; B – Stacked bar chart showing the distribution of c_1 - d_1 - e_1 setal lengths (0: short setae < 30 μ m; 1: medium setae between 30 and 40 μ m; 2: long setae > 40 μ m) within COI haplotypes (see measurement Table 2).

***Bryobia (Lyobia) rubrioculus* (Scheuten, 1857)**

Specimens examined — 7 females and 2 nymphs from *Prunus spinosa* L. (Rosaceae), Coll d'en Verderol (42.4852°N 3.0330°E, alt. 768 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 04-VI-2013, leg. A. Migeon & P. Auger; 7 females, 3 nymphs and 1 larva, same data, 24-VI-2015; 7 females, 4 nymphs, 3 larvae from *Prunus avium* (L.) L. (Rosaceae), Coll d'en Verderol (42.4811°N 3.0263°E, alt. 801 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 17-IX-2013, leg. A. Migeon & P. Auger.

Table 2 *Bryobia (Periplanobia) polymorpha* sp. nov. Measurements and categorization of c_1 - d_1 - e_1 setae (0: short setae < 30 μ m; 1: medium setae between 30 and 40 μ m; 2: long setae > 40 μ m). Only one seta of the pair could be measured on some specimens of c_1 - d_1 - e_1 setal lengths.

Slide #	Locality	c_1	d_1	e_1	Setae combination	Haplotype
2183	Pézenes-les-Mines	33-36	26	24-26	1-0-0	8
2184	Pézenes-les-Mines	28-31	25-26	27-29	0-0-0	8
2185	Pézenes-les-Mines	38-39	34-36	38-42	1-1-2	7
2188	Col de l'Espinass	35-40	31-35	46-48	1-1-2	7
2189	Col de l'Espinass	38-39	31-34	42-45	1-1-2	7
2193	Vachères	45	27.5-33	38-39	1-0-1	4
2194	Vachères	32-33	30-32	33-34	1-1-1	3
2195	Vachères	45	35-38	39-45	2-1-2	3
2196	Vachères	44-48	36-39	44-50	2-1-2	3
2190	NR forêt de la Massane	42-51	37-40	38-42	2-1-2	9
2191	Saint-Laurent-de-Muret	38	24-26	31-33	1-0-1	2
2192	Saint-Laurent-de-Muret	45-50	39-43	48-55	2-2-2	2
2199	RN forêt de la Massane	45-51	39-44	47	2-2-2	10
2200	RN forêt de la Massane	38-43	36-39	36-40	1-1-1	9
2201	RN forêt de la Massane	44-48	48-49	48-49	2-2-2	9

***Bryobia (Bryobiopsis) serifiotica* Hatzinikolis, Papadoulis & Kapaxidi, 2007**

Specimens examined — 6 females, 5 nymphs, 6 larvae and 3 males from *Lavandula stoechas* L. (Lamiaceae), Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 03-VI-2013, leg. A. Migeon & P. Auger. New spider mite record for France.

Tribe Hystrihonychini Pritchard & Baker, 1955

Genus *Tetranychopsis* Canestrini, 1889

Tetranychopsis Canestrini, 1889: 494. Type-species: *Tetranychopsis horridus* Canestrini & Fanzago.

***Tetranychopsis horridus* (Canestrini & Fanzago, 1876)**

Specimens examined — 3 females, 2 nymphs from *Corylus avellana* L. (Betulaceae), riverine forest Font des Alamans (42.4918° N 3.0304°E, alt. 633 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 18-IX-2013, leg. A. Migeon & P. Auger; 3 females, same host, riverine forest Font des Alamans (42.4918°N 3.0304°E, alt. 633 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 24-VI-2015, leg. A. Migeon & P. Auger (Fig. 23B).

Tribe Petrobini Reck, 1952

Genus *Schizonobia* Womersley, 1940

Schizonobia Womersley: 1940:251. Type-species: *Schizonobia sycophanta* Womersley.

***Schizonobia bundi* Gutierrez, 1972**

Specimens examined — 2 females, 1 nymph, 1 larva and 1 male on *Cistus albidus* L. (Cistaceae), Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 03-VI-2013, leg. A. Migeon & P. Auger; 1 female, same host, Font dels Alemanys (42.4945°N 3.0279°E, alt. 639 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 06-VI-2013, leg. A. Migeon & P. Auger (Fig. 23C).

Subfamily Tetranychinae Berlese, 1913

Tribe Tetranychini Reck, 1950

Genus *Amphitetranynchus* Oudemans, 1931

Amphitetranynchus Oudemans, 1831: 224. Type-species: *Tetranychus viennensis* Zacher.

***Amphitetranynchus viennensis* (Zacher, 1920)**

Specimens examined — 2 males on *Prunus spinosa* L. (Rosaceae), Coll d'en Verderol (42.4851°N 3.0330°E, alt. 768 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 04-VI-2013, leg. A. Migeon & P. Auger; 1 male, 3 females on *P. spinosa*, Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 16-IX-2013, leg. A. Migeon & P. Auger; 7 females on *P. spinosa*, les Colomates (42.4807°N 3.0263°E, alt. 801 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 17-IX-2013, leg. A. Migeon & P. Auger (Fig. 23D).

Genus *Eotetranychus* Oudemans, 1931

Eotetranychus Oudemans, 1831: 225. Type-species: *Trombidium tiliarium* Hermann.

***Eotetranychus aurantii* (Targioni Tozzetti, 1878)**

Specimens examined — 3 males, 11 females on *Quercus ilex* L. (Fagaceae), Font dels Alemany (42.4945°N 3.0283°E, alt. 628 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 06-VI-2013, leg. A. Migeon & P. Auger; 5 males, 3 females on *Q. ilex*, Coll de la Plaça d'Armes (42.4945°N 3.0317°E, alt. 687 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 16-IX-2013, leg. A. Migeon & P. Auger. New spider mite record for France.

This species is only known from topotype material and the original description and figures by Targioni Tozzetti (1878) are very scarce. For this reason, it is not possible to know with certainty if the material collected in this study belongs to this species. As mentioned by Pritchard & Baker (1955) topotype material should be studied to clearly define the status of this species. Nevertheless, we consider that the spider mite species we collected on *Q. ilex* most probably belongs to this species for the two following reasons: i) the specimens we collected cause eriosis on the undersurface of *Q. ilex* leaves like *E. aurantii* whose the Italian name given by Targioni Tozzetti (1878) is “tetranico della erinosi del leccio” meaning the spider mites of evergreen oak eriosis; ii) ; the host plant is the same and is widespread from Tuscany in Italy to French Pyrénées-Orientales and to Catalonia in Spain (see GBIF data here <https://www.gbif.org/species/2879098>).

***Eotetranychus carpini* (Oudemans, 1905)**

Specimens examined — 2 males, 1 female on *Acer monspessulanum* L. (Sapindaceae), Xatardes (42.4847°N 3.03168°E, alt. 733 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 17-IX-2013, leg. A. Migeon & P. Auger (Fig. 23E).

***Eotetranychus coryli* Reck, 1950**

Specimens examined — 3 males, 2 females on *Corylus avellana* L. (Betulaceae), riverine forest Font des Alamans (42.4918°N 3.0304°E, alt. 633 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 18-IX-2013, leg. A. Migeon & P. Auger; 2 males, 1 female, same host, same location, 24-VI-2015, leg. A. Migeon & P. Auger.

***Eotetranychus fagi* (Zacher, 1922)**

Specimens examined — 7 males, 6 females on *Fagus sylvatica* L. (Fagaceae), riverine forest (42.4883°N 3.0287°E, alt. 661 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 06-VI-2013, leg. A. Migeon & P. Auger; 7 males, 3 females, same host, Els Horts (42.4814°N 3.0286°E, alt. 772 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 17-IX-2013, leg. A. Migeon & P. Auger (Fig. 23F). New spider mite record for France.

***Eotetranychus pruni* (Oudemans, 1931)**

Specimens examined — 8 males, 13 females on *Sorbus aria* (L.) Crantz (Rosaceae), riverine forest Font des Alamans (42.4918°N 3.0304°E, alt. 633 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 18-IX-2013, leg. A. Migeon & P. Auger (Fig. 23G). New host plant record.

Genus *Oligonychus* Berlese, 1886

Oligonychus Berlese, 1886: 24; Type-species: *Heteronychus brevipodus* Targioni Tozzetti.

***Oligonychus ununguis* (Jacobi, 1905)**

Specimens examined — 5 males, 4 females on *Juniperus oxycedrus* L. (Cupressaceae), Torre de la Maçana (42.4982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 16-IX-2013, leg. A. Migeon & P. Auger.

Genus *Tetranychus* Dufour, 1832

Tetranychus Dufour, 1832:276. Type-species: *Tetranychus lintearius* Dufour

Tetranychus (*Tetranychus*) *turkestanii* (Ugarov & Nikolskii, 1937)

Specimens examined — 3 males, 2 females on *Helianthemum nummularium* Mill. (Cistaceae), Torre de la Maçana (42.1982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 16-IX-2013, leg. A. Migeon & P. Auger. New host plant record; 4 males, 2 females on *Viola* sp. (Violaceae), Bas Puig Redo (42.4922°N 3.0333°E, alt. 696 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 17-IX-2013, leg. A. Migeon & P. Auger; 4 males, 2 females on *Polygonatum odoratum* (Mill.) Druce (Asparagaceae), Torre de la Maçana (42.1982°N 3.0277°E, alt. 749 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 17-IX-2013, leg. A. Migeon & P. Auger; 2 males, 5 females on *Cerastium arvense* L. (Caryophyllaceae), Coll d'en Verderol (42.4852°N 3.0327°E, alt. 768 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 24-VI-2015, leg. A. Migeon & P. Auger. New host plant record.

Tetranychus (*Tetranychus*) *urticae* Koch, 1835

Specimens examined — 2 males, 4 females on *Cerastium arvense* L. (Caryophyllaceae), Coll d'en Verderol (42.4851°N 3.0333°E, alt. 773 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 04-VI-2013, leg. A. Migeon & P. Auger. New host plant record.

Tetranychus (*Tetranychus*) *visigothus* sp. nov. Auger & Migeon

Zoobank: 00904bc9-2d99-4e1f-ae58-28241bfac34

Figures 17–22, 23H

Type-material

Holotype (male), 9 male and 10 female paratypes on 20 preparations from *Eryngium campestre* L., (Apiaceae), Termanera (42.4784°N 3.0183°E, alt. 856 m a.s.l.), MNR, Argelès-sur-Mer (Pyrénées-Orientales), France, 21-VIII-2017, leg. J. Garrigue. All material deposited in the collection of the CBGP, coll. coll. Auger-Migeon slides 2124 for holotype and 2125–2143 for paratypes.

Additional material

One male and 2 females from *Asparagus acutifolius* L. (Asparagaceae), (43.5629°N 3.8258°E, alt. 34 m a.s.l.) Saint-Jean le Sec, Saint-Jean-de-Védas (Hérault), France, 06-IV-2008, leg. P. Auger; 5 males and 3 females, same host, Four de la Caux (43.5871°N 3.7487°E, alt. 92 m a.s.l.) Pignan (Hérault), France, 02-IX-2013, leg. P. Auger; 6 males and 8 females from *Calicotome spinosa* (L.) Link (Fabaceae), Les Boutarigues (42.9079°N 2.7456°E, alt. 176 m a.s.l.), Tuchan (Aude), France, 25-VI-2012, leg. A. Migeon & P. Auger; 4 males and 2 females, from *Trifolium* sp. (Fabaceae), Fuensanta Mirador del Puerto (36.8224°N 4.2462°W, alt. 439 m a.s.l.), El Borge, Málaga, Spain, 26-V-2018, leg. A. Migeon & P. Auger.

Diagnosis

Females with four tactile setae proximal to the proximal pair of duplex setae on tarsus I, empodia with a dorsomedian spur. Male empodia I and II clawlike. Aedeagus knob axis forming an acute angle with shaft axis; aedeageal anterior projection well developed, rounded, posterior less developed, truncate, ending in a small acute tip downward.

Description

Male — (Holotype and five paratypes measured) (Figs. 17–18): Body length 420 (372–425) including gnathosoma, gnathosoma 114 (102–116), v_2 – h_2 (235–264), sc – sc_2 310 (290).

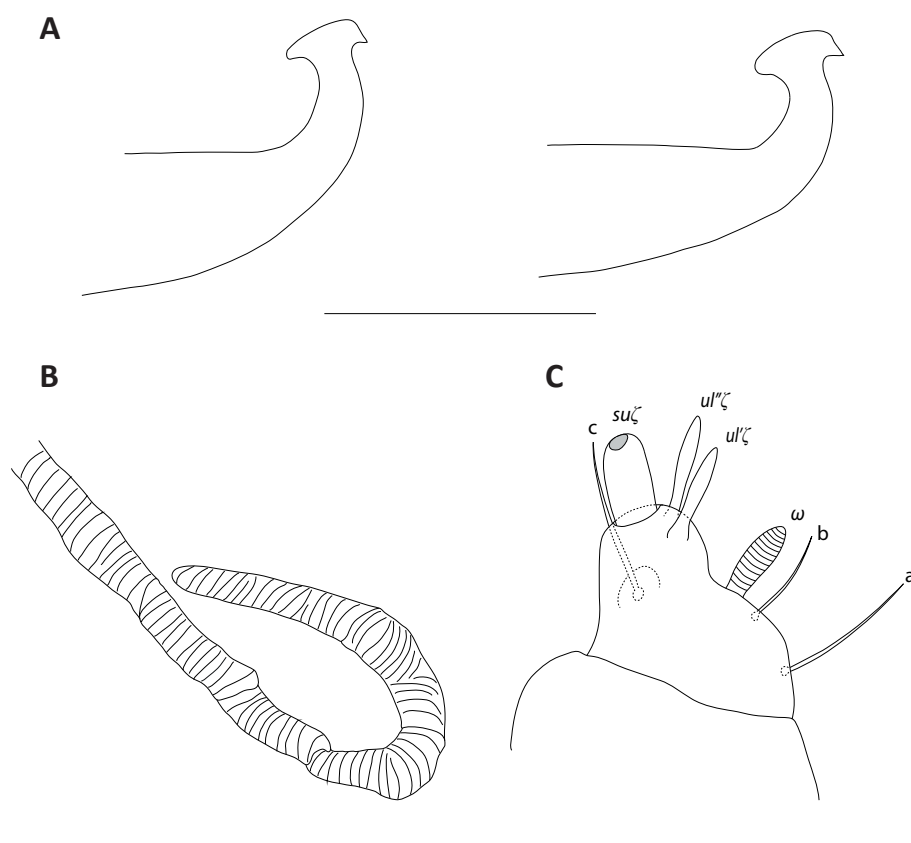


Figure 17 *Tetranychus (Tetranychus) visigothus* sp. nov., male: **A** – aedeagus (left: holotype); **B** – distal end of peritreme; **C** – palptarsus. Scale bars = 10 μ m (A–C).

Dorsum – Dorsal body setae long, linear lanceolate, well surpassing in length distance between consecutive bases: v_2 56 (55–58); sc_1 89 (90–98); sc_2 63 (60–67); c_1 78 (76–81); c_2 79 (79–88); c_3 72 (65–75); d_1 79 (76–87); d_2 78 (76–84); e_1 68 (67–86); e_2 76 (78–81); f_1 61 (57–62); f_2 57 (54–61); h_2 23 (21–25). Dorsal striation without lobes.

Gnathosoma – Palptarsus terminal sensillum about 2 times as long as broad, 4.9 (4.5–5) μ m long, 2.5 (2.4–2.7) μ m wide (Fig. 16C). Peritreme strongly hooked distally (Fig. 17B).

Venter – Ventral striae without lobes.

Legs – Legs I and IV about half as long as body length, legs II to III less than half the body length. Leg I 213 (205–212) long (measured from femur to tarsus tip), leg II 177 (160–168), leg III 171 (163–177), leg IV 201 (191–208). Empodium I claw like, each side composed of three claw-like digits, outer the largest, inner smaller. Large mediodorsal spur present, about three-quarters the length of empodium (Fig. 18C–D). Empodium II clawlike each side with three claw like structures as in empodium I, mediodorsal spur about three-quarters the length of empodium (Fig. 18E). Empodia III and IV split distally into three pairs of proximoventral hairs, short mediodorsal spur present (Fig. 18F). Leg setal counts as follows (Fig. 18A–B):

I 2 – 1 – 10 [9] – 5 – 9 + (4) – 13 + (3) + 2 duplexes;

II 2 – 1 – 6 – 5 – 7 – 13 + (1) + 1 duplex;

III 1 – 1 – 4 – 4 – 6 – 9 + (1);

IV 1 – 1 – 4 – 4 – 7 – 10 + (1).

Aedeagus – Aedeagal shaft bent dorsad at about a right angle, neck long (Fig. 17A). Aedeageal knob axis forming an acute angle about 21° (20–26) with shaft axis. Knob 3.2

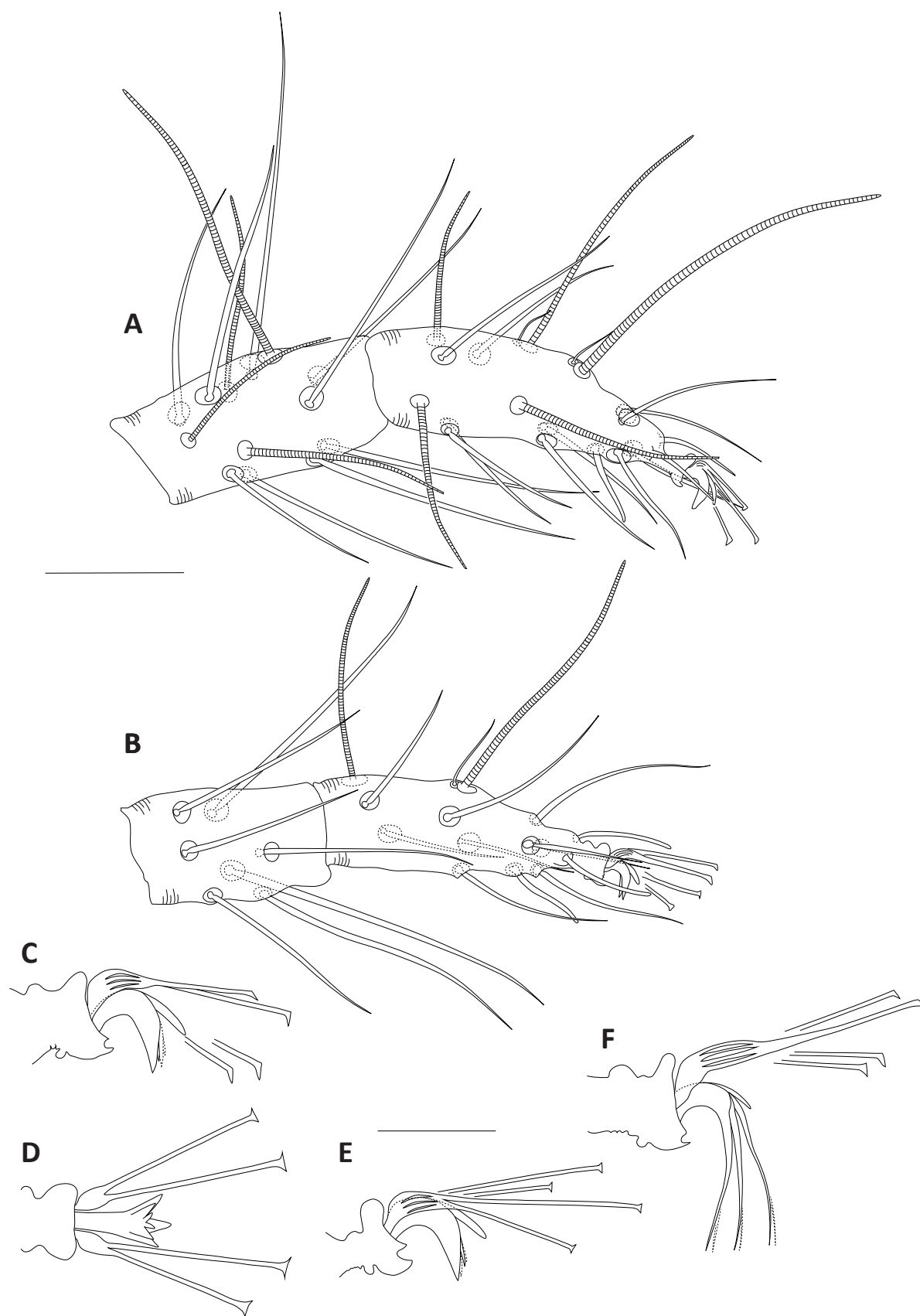


Figure 18 *Tetranychus (Tetranychus) visigothus* sp. nov., male: **A** – tarsus and tibia I; **B** – tarsus and tibia II; **C** – empodium I; **D** – empodium I ventral view (paratype); **E** – empodium II (paratype); **F** – empodia III-IV. Scale bars = 25 μm (A–B), 10 μm (C–F).

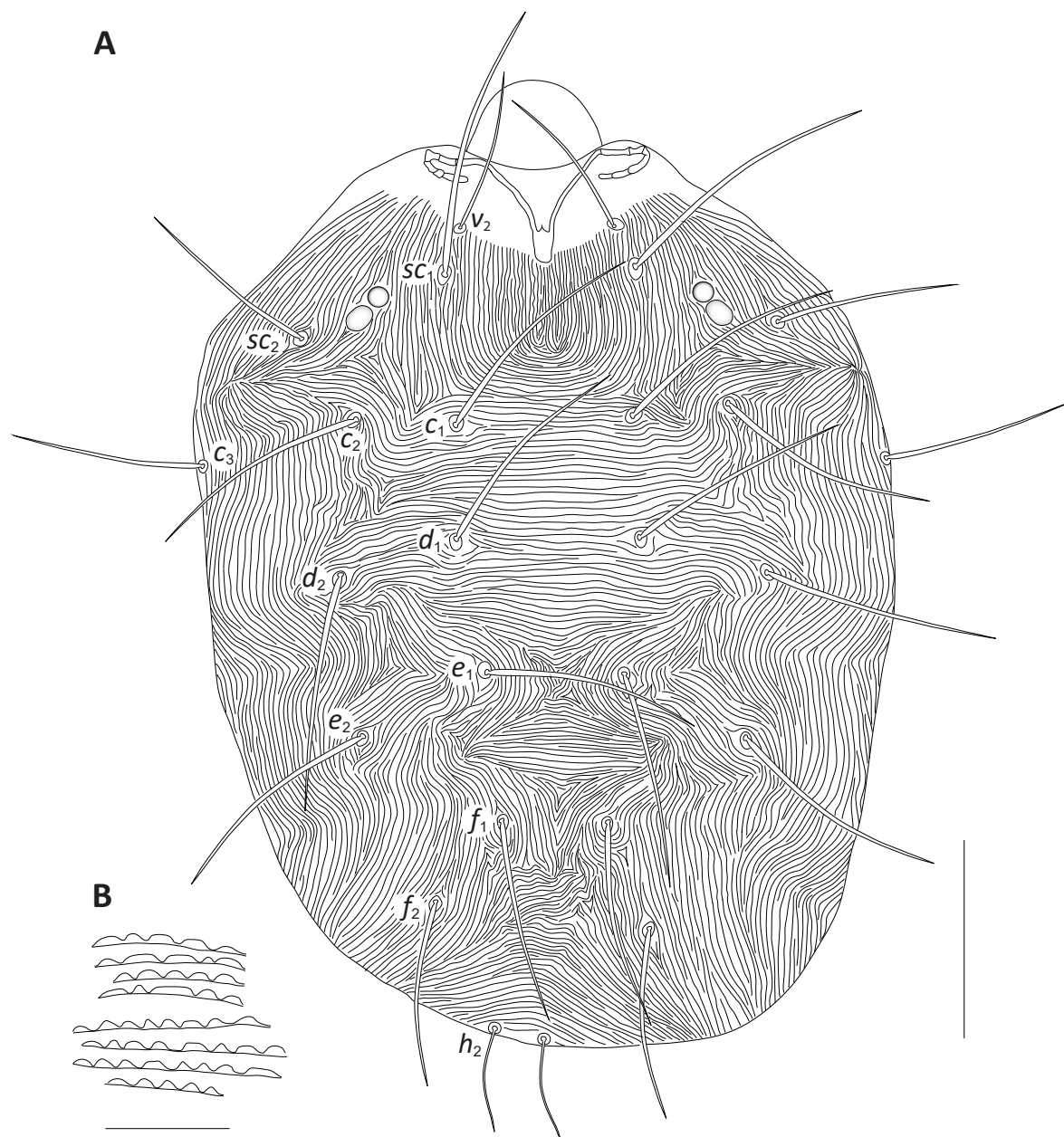


Figure 19 *Tetranychus (Tetranychus) visigothus* sp. nov., female: **A** – dorsal aspect; **B** – lobes on dorsal striae. Scale bars = 100 μ m (A), 10 μ m (B).

(3.2–3.3 μ m), about 2 times neck width 1.4 (1.4–1.7 μ m), asymmetrical with well-developed anterior rounded projection, smaller posterior projection, truncate, ending in a small acute tip down directed, knob dorsal margin slightly convex.

Female — (5 females measured) (Figs. 19–21): Idiosoma length 484–560 (including gnathosoma), width 266–340, distance between setae v_2 – h_2 and between sc_2 members, 315–406 and 205–241, respectively.

Dorsum – Dorsal body setae lanceolate, longer than distances between bases of consecutive setae: v_2 76–87; sc_1 131–138; sc_2 95–100; c_1 115–123; c_2 112–123; c_3 102–108; d_1 115–123; d_2 118–124; e_1 110–115; e_2 113–119; f_1 87–102; f_2 88–96; h_2 47–46. Propodosomal

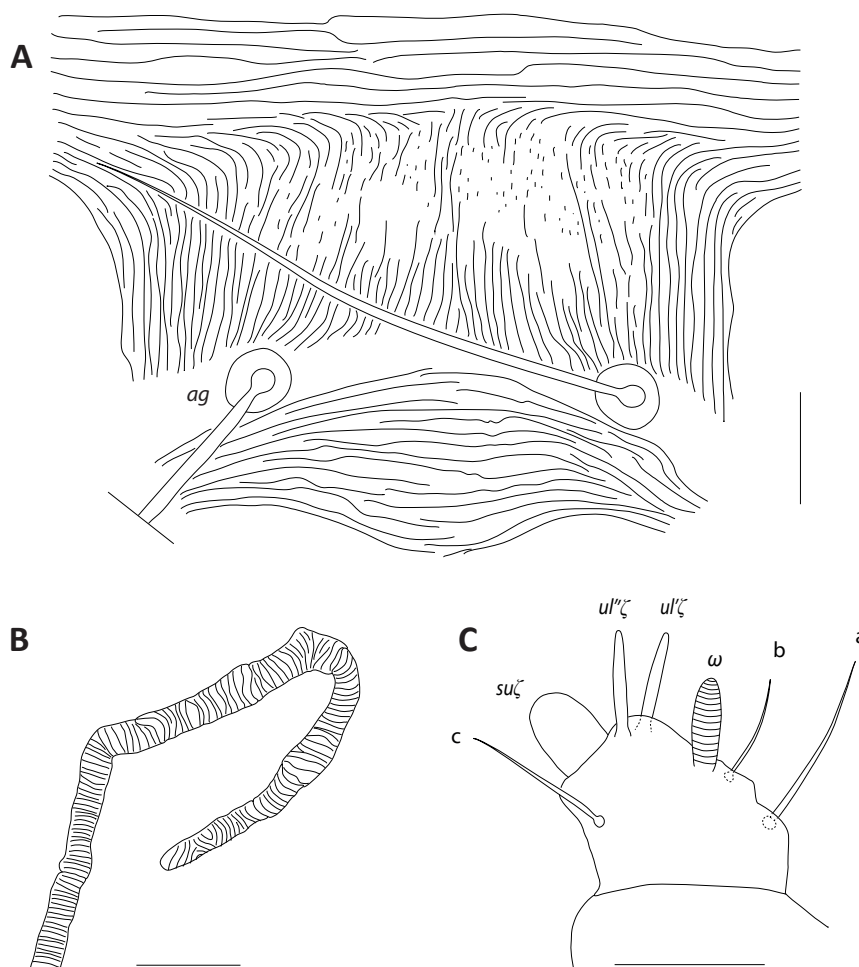


Figure 20 *Tetranychus (Tetranychus) visigothus* sp. nov., female: A– anterogenital area; B– distal end of peritreme; C – palptarsus. Scale bars = 10 μ m (A–C).

striation longitudinal mostly with rounded and oblong lobes, rare triangularly rounded lobes present. Hysterosomal striation transverse except between setae e_1-e_1 and f_1-f_1 (longitudinal) bases forming diamond-shaped pattern between these setae, lobes on dorsal striation variable, rounded, triangularly rounded, as tall as broad to oblong (Fig. 19A–B).

Gnathosoma – Palptarsus terminal sensillum a little bit longer than broad, 4–5.8 long, 3–4.7 wide. Peritreme strongly hooked distally (Fig. 20B–C).

Venter – Ventral striation without lobes. Area immediately anterior to genital flap with longitudinal striation, broken medially (Fig. 20A). Genital flap with transverse slightly arched striae. One pair of ventrocaudal (h_3) and two pairs of pseudanal setae (ps_{1-2}) present.

Legs – Legs I and IV about half as long as body length, legs II to III obviously less than half the body length. Leg I 272–286 long (measured from femur to tarsus tip), leg II 208–218, leg III 214–230, leg IV 270–285. Empodia I–IV with three pairs of proximoventral hairs, mediodorsal spur present; spur small on empodium I, smaller on empodium II and tiny on empodia III–IV (Fig. 21C). Leg setal counts as follows (Fig. 20A–B):

I 2 – 1 – 10 – 5 – 9 + (1) – 13 + (1–3) + 2 duplexes;

II 2 – 1 – 6 – 5 – 7 – 13 + (1) + 1 duplex;

III 1 – 1 – 4 – 4 – 6 – 9 + (1);

IV 1 – 1 – 4 – 4 – 7 – 10 + (1).

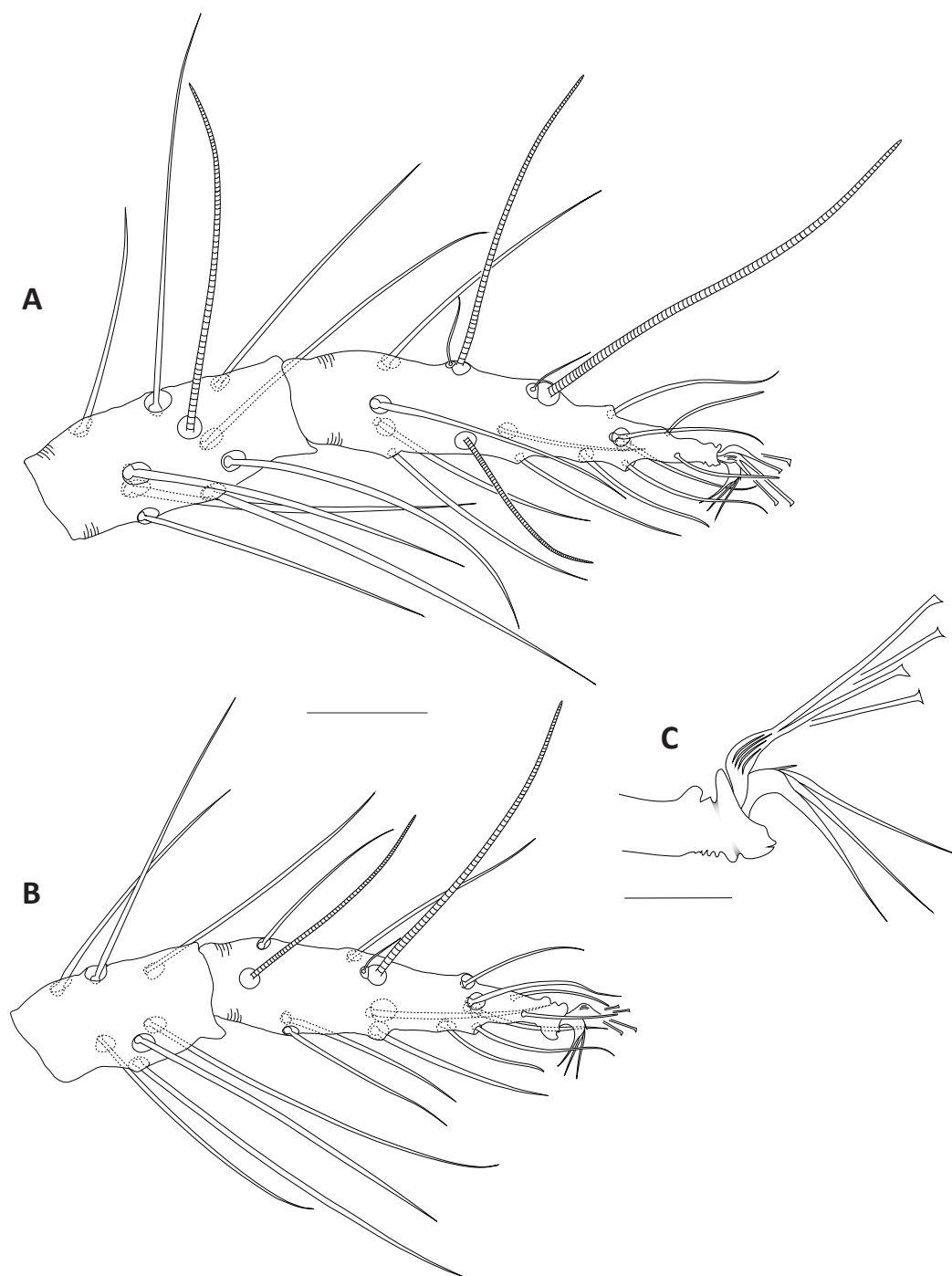


Figure 21 *Tetranychus (Tetranychus) visigothus* sp. nov., female: **A** – tarsus and tibia I; **B** – tarsus and tibia II; **C** – empodia I-IV. Scale bars = 25 μm (A–B), 10 μm (C).

Tarsus I with four tactile setae proximal to proximal duplex setae. One solenidion at or near proximal duplex level (Fig. 21A).



Figure 22 *Tetranychus (Tetranychus) visigothus* sp. nov.: **A** – mite colony on *Eryngium campestre* L. showing typical abundant webbing; **B** – young colony on *Asparagus acutifolius* L. showing yellowing and drying of cladodes.

Etymology

The species designation, “*visigothus*”, refers to the distribution of the mite which overlaps a large part with that of the Visigothic Kingdom in South Western Europe in the VIth century.

Remarks

Among the *Tetranychus* of the 8th group defined by Flechtmann and Knihinicki (2002) (including ungrouped species that bear four tactile setae proximal to the proximal duplex setae on tarsus I and mediodorsal spurs on the empodia), the aedeagus shape of *T. visigothus* sp. nov. is unique and allows a clear separation with closely related species. The aedeagus of *T. visigothus* sp. nov. is close to that of *T. shanghaiensis* [ungrouped species in Flechtmann and Knihinicki (2002)] but clearly differs by the absence of angle between the knob and the shaft axis and by the posterior projection that is not directed ventrad in *T. shanghaiensis*. *Tetranychus visigothus* sp. nov. resembles to *T. lintearius* according to the shape of the male empodium II but clearly differs by the shape of its aedeagus. Its aedeageal knob is intermediate in size and shape between two species that belong to the 9th group of *Tetranychus* species (Flechtmann and Knihinicki, 2002): *T. urticae* Koch and *T. turkestani* (Ugarov & Nikolskii). In addition to the spur present on its female empodia and to the claw-like male empodium II, it can also be separated from these two species by the combination between the rounded dorsal margin of its knob aedeagus and its poorly developed acute downward directed posterior projection.

Biological observations

The adult females are red to dark red in colour, darkening with age, their legs are orange (Fig. 22). The colour of adult males varies from shiny orange to yellowish brown (older specimens)

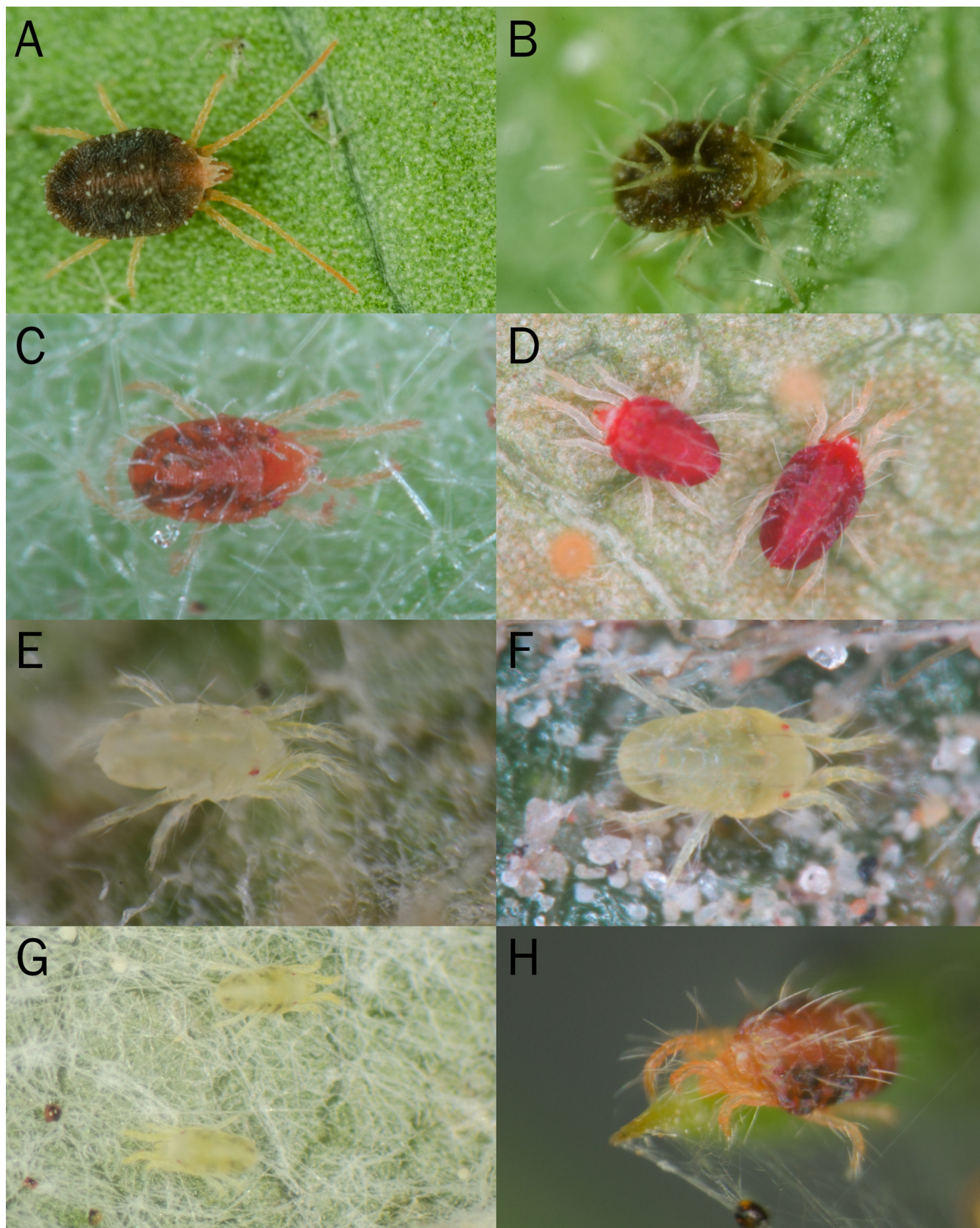


Figure 23 A – *Bryobia (Bryobia) kissophila* Eyndhoven, 1955, female on *Hedera helix* L.; B – *Tetranychopsis horridus* (Canestrini & Fanzago, 1876), female on *Corylus avellana* L.; C – *Schizonobia bundi* Gutierrez, 1972, female on *Cistus albidus* L.; D – *Amphitetranychus viennensis* (Zacher, 1920), female on *Prunus spinosa* L.; E – *Eotetranychus carpini* (Oudemans, 1905), female on *Acer monspessulanum* L.; F – *Eotetranychus fagi* (Zacher, 1922), female on *Fagus sylvatica* L.; G – *Eotetranychus pruni* (Oudemans, 1931), female on *Sorbus aria* (L.) Crantz; H – *Tetranychus (Tetranychus) visigothus* **sp. nov.**, female on *Asparagus acutifolius* L.

and the eggs are pale amber in colour turning into dark orange/brownish-red before hatching. This species is gregarious and it produces a large amount of silk that can completely cover its host plant (Fig. 23A–B). It is closely related to *T. lintearius* in body colour and behaviour.

Acknowledgements

We are deeply thankful to “l’Association des Amis de la Massane” for giving us the opportunity to survey the national Massane Forest Nature Reserve, for giving us useful advices during samplings, for providing us laboratory facilities and for housing during the first survey. Thanks are also due to the three anonymous referees for their helpful comments.

ORCID

Philippe Auger  <https://orcid.org/0000-0002-2671-9561>

Alain Migeon  <https://orcid.org/0000-0003-4041-5158>

References

- Arabuli T., Marić I., Auger P. 2019. Revision of the genus *Pseudobryobia* McGregor, 1950 (Acari, Tetranychidae). *Acarologia*, 59: 291-300. <https://doi.org/10.24349/acarologia/20194331>
- Athias-Binche F. 1997. Etude quantitative des Uropodides (Acariens Anactinotriches) d’un arbre mort de la hêtraie de la Massane 1- Caractères généraux du peuplement. *Vie et Milieu, Observatoire Océanologique - Laboratoire Arago*, XXVII, 157-175.
- Auger P., Arabuli T., Migeon A. 2015. Two new species of *Bryobia* (Acarina, Prostigmata, Tetranychidae) from South France. *ZooKeys*, 480: 21-39. <https://doi.org/10.3897/zookeys.480.9166>
- Auger P., Migeon A. 2014. Three new species of Tetranychidae (Acari, Prostigmata) from the French Alps (South-Eastern France). *Acarologia*, 54: 15-37. <https://doi.org/10.1051/acarologia/20142111>
- Boubou A., Migeon A., Roderick G., Navajas M. 2011. Recent emergence and worldwide spread of the red tomato spider mite, *Tetranychus evansi*: genetic variation and multiple cryptic invasions. *Biological Invasions*, 13: 81-92.
- Clement M., Snell Q., Walker P., Posada D., Crandall K. 2002. TCS: Estimating gene genealogies. *Parallel and Distributed Processing Symposium, International Proceedings*, 2, 184. <https://doi.org/10.1007/s10530-010-9791-y>
- Flechtman C.H.W., Knihinicki D.K. 2002. New species and new record of *Tetranychus* Dufour from Australia, with a key to the major groups in this genus based on females (Acari: Prostigmata: Tetranychidae). *Australian Journal of Entomology*, 41: 118-127. <https://doi.org/10.1046/j.1440-6055.2002.00289.x>
- Garrigue J., Magdalou J.-A. 2000. Suivi forestier et cartographie assistée par Système d’Information Géographique. *Travaux de la Réserve Nationale de la Massane*, 55: 1-44.
- Gotoh T., Araki R., Boubou A., Migeon A., Ferragut F., Navajas M. 2009. Evidence of co-specificity between *Tetranychus evansi* and *Tetranychus takafujii* (Acari: Prostigmata, Tetranychidae): comments on taxonomic and agricultural aspects. *Internat. J. Acarol.*, 35: 485-501. <https://doi.org/10.1080/01647950903431156>
- Hewitt G. M. 1999. Post-glacial re-colonization of European biota. *Biological Journal of the Linnean Society*. 68(1-2): 87-112. <https://doi.org/10.1111/j.1095-8312.1999.tb01160.x>
- Kimura M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *J. Mol. Evol.*, 16: 111-120. <https://doi.org/10.1007/BF01731581>
- Kumar S., Stecher G., Li M., Knyaz C., Tamura K. 2018. MEGA X: Molecular Evolutionary Genetics Analysis across computing platforms. *Mol. Biol. Evol.*, 35: 1547-1549. <https://doi.org/10.1093/molbev/msy096>
- Leigh J. W., Bryant D. 2015. PopART: Full-feature software for haplotype network construction. *Methods Ecol Evol* 6(9): 1110-1116. <https://doi.org/10.1111/2041-210X.12410>
- Lindquist E.E. 1985. External anatomy. In: Helle W., Sabelis M.W., (Eds). *Spider mites. Their Biology, natural enemies and control*. Amsterdam: Elsevier Science Publishing. p. 3-28.
- Livshits I.Z., Mitrofanov V.I. 1971. The mites of the genus *Bryobia* C.L. Koch, 1836 (Acariformes, Bryobiidae). *Trudy Gosudarstvennogo Nikitskogo Botanicheskogo Sada*, 51: 1-112.
- Mathys G. 1962. *Bryobia macrotibialis*, nouvelle espèce du complexe “*Praetiosa*” (Acarina: Tetranychidae). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft*, 35: 317-332.
- Mitrofanov V.I. 1973. On the taxonomy of the Bryobiidae (Acariformes, Tetranychoidae). In: *Proceedings of the 3rd International Congress of Acarology; Prague*. p. 297-298. https://doi.org/10.1007/978-94-010-2709-0_55
- Quézel P., Médail F., 2003. *Ecologie et biogéographie des forêts du bassin méditerranéen*, Elsevier, collection Environnement, Paris. pp 573.

- Saito Y., Mori K., Chittenden A.R. 1999. Body characters reflecting the body size of spider mites in flattened specimens (Acari, Tetranychidae). *Applied Entomology & Zoology*, 34: 383-386. <https://doi.org/10.1303/aez.34.383>
- Sidorchuk E., Vorontsov D.D. 2014. Computer-aided drawing system substitute for camera lucida. *Acarologia*, 54: 229-239. <https://doi.org/10.1051/acarologia/20142130>
- Taberlet P., Fumagalli L., Wust-Saucy A.-G, Cosson J.-F. 2002. Comparative phylogeography and postglacial colonization routes in Europe. *Molecular Ecology*, 7: 453-464. <https://doi.org/10.1046/j.1365-294x.1998.00289.x>
- Targioni Tozzetti A. 1878. Relazione intorno ai lavori della Stazione di entomologia agraria di Firenze per l'anno 1876. *Acaridei. Annali di Agricoltura*, 1: 242-275.
- Travé J. 1963. *Ecologie et biologie des Oribates (Acariens) saxicoles et arboricoles*. Vie et Milieu, Observatoire Océanologique - Laboratoire Arago, supplément n°14, 308 pp.
- Travé J. 2000. La réserve naturelle de la Massane, un exemple de forêt ancienne protégée. *Forêt Méditerranéenne*, 21: 278-283.