

# Three new species of *Tetracanthella* (Collembola, Isotomidae) from western Europe

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## ABSTRACT

Three new species of *Tetracanthella* Schött, 1891 (Collembola, Isotomidae) are described in this paper: *T. bichaeta* n. sp. from Swiss Alps, *T. corsica* n. sp. from Corsica and *T. fusca* n. sp. from French Pyrenees. *T. bichaeta* n. sp. is characterised by a tergite macrochaetotaxy formula 2,2/2,2,2 and the presence of two dorsal clavate tenent hairs on tibiotarsi of first pair of legs; this unique combination of characters questions the validity of the current delimitation between *pilosa*- and *cassagnai*-groups in the genus. *T. corsica* n. sp. belongs to the *wahlgreni*-group, where it is isolated by a combination of chaetotaxic characters and by the remarkable shape of the papillae of its outer anal spines. *T. fusca* n. sp. of the *pilosa*-group is closely related to *T. similis* Deharveng, 1987 described from Alpes-Maritimes (SE France), from which it differs by shorter tergite s-chaetae and smaller dorsal plates on Abd. IV.

## KEY WORDS

Collembola,  
Isotomidae,  
*Tetracanthella*,  
France,  
Corsica,  
Switzerland,  
endemism,  
new species.

## RÉSUMÉ

*Trois nouvelles espèces de Tetracanthella (Collembola, Isotomidae) d'Europe occidentale.*

Trois nouvelles espèces de *Tetracanthella* Schött, 1891 (Collembola, Isotomidae) sont décrites dans ce travail : *T. bichaeta* n. sp. des Alpes suisses, *T. corsica* n. sp. de Corse et *T. fusca* n. sp. des Pyrénées françaises. *T. bichaeta* n. sp. est caractérisé par une formule macrochétotaxique dorsale 2,2/2,2,2 et par la présence de deux ergots capités dorsaux aux tibiotarses de la première paire de pattes ; cette combinaison unique de caractères remet en question la validité de la délimitation entre les groupes *pilosa* et *cassagnai* tels qu'ils sont actuellement définis. *T. corsica* n. sp. appartient au groupe *wahlgreni*, au sein duquel il se distingue par la combinaison de plusieurs caractères chétotaxiques et par une morphologie remarquable des papilles des épines anales externes. *T. fusca* n. sp. du groupe *pilosa* est étroitement apparenté à *T. similis* Deharveng, 1987 décrit des Alpes-Maritimes (SE France) ; il en diffère par des soies  $\sigma$  plus courtes sur les tergites et par des plaques dorsales moins développées sur Abd. IV.

## MOTS CLÉS

Collembola,  
Isotomidae,  
*Tetracanthella*,  
France,  
Corse,  
Suisse,  
endémisme,  
nouvelles espèces.

## INTRODUCTION

*Tetracanthella* Schött, 1891 is one of the largest genus of Collembola, with more than 80 species distributed in the whole holarctic region. Most of them are rare endemics of southern European mountains, often restricted to high altitude (Deharveng 1987 ; Potapov 2001). The genus is particularly well defined and most of its species are taxonomically clean, without synonymies or floating combinations. For this reason, and because of its extreme geographic diversification, *Tetracanthella* would be an excellent biogeographical model provided its phylogeny is established, a work currently in progress. The new European species described here were collected in Swiss Alps (*T. bichaeta* n. sp.), in Corsica (*T. cor-*

*sica* n. sp.) and in French Pyrenees (*T. fusca* n. sp.). The finding of new *Tetracanthella* in Swiss Alps and French Pyrenees is surprising as these regions are among the best surveyed in Europe, in contrast to Corsica. It suggests that a number of narrow endemic species may be expected in the virtually unexplored mountains of southeastern Europe.

## ABBREVIATIONS

Abbreviations in the text after Deharveng (1987) and Potapov (2001). Additional abbreviations as follows:

a2 second chaeta from axis in the row a;  
Abd. abdominal tergites;  
ASe external anal spines;  
PAO postantennal organ;

S-chaetae and S-microchaetae are used here instead of "sensilla", "sensorial setae" or "setae sensuales"; these

last terms widely used in the literature are inaccurate, as all chaetae are sensorial in Collembola (see Deharveng 1983);

Th. thoracic tergites;

Tita tibiotarsus;

MNHN Muséum national d'Histoire naturelle, Paris;

MSPU Moscow State Pedagogical University.

## SYSTEMATICS

Genus *Tetracanthella* Schött, 1891

*Tetracanthella bichaeta* n. sp.

(Fig. 1)

TYPE MATERIAL. — **Switzerland.** Les Diablerets, 2550 m, lichens and mosses on limestone rocks, 1.VIII.1982, L. Deharveng leg. (sample # SU13), ♂ holotype and 2 paratypes (MNHN); 1 paratype (MSPU).

ETYMOLOGY. — The specific name is given for the unusual presence of two clavate tenent hairs on tibiotarsi of the first pair of legs.

DISTRIBUTION. — Only known from the type locality.

### DESCRIPTION

Body length 1-1.2 mm. Body rather broad. Coloration dark, including antennae. Two kinds of dorsal plates: many small polygons (much smaller than mesochaeta socket) regularly scattered among larger ones (roundish, slightly smaller than mesochaeta socket) (Fig. 1G); polygons not larger on Abd. IV or V. Canals between polygons well marked. Smooth fields absent. Dorsal mesochaetae of medium size, longer in posterior rows of tergites. Mesochaetae not shortened in axial part of tergites: Abd. IV with p3 subequal to p1. Macrochaetae long and acuminate, curved at apex. 8+8 ocelli, G and H reduced (dcA/dcH = 1.5-1.7). PAO short, about two times as long as the diameter of ocellus A (Fig. 1A). Chaeta s' of ant. III in males absent. Three prelabral chaetae. Outer maxillary lobe with two sublobal hairs. Five chaetae between medial line and pc3 on head. Frontal chaeta ap present.

Chaetom rather abundant (Fig. 1E, F). Axial chaetotaxy: 12,8/4,4,4,8-10, macrochaetotaxy:

2,2/2,2,2. Corner mesochaetae on Th. II and III stronger than other mesochaetae of p-row. Number of s-chaetae: 3,3/2,2,2,2,4 (s), 1,1/1,1,1 (ms). S-chaetae of medium size, medial ones on Abd. I-III arranged behind and laterally to Mdl macrochaetae. S-microchaetae on Th. III and Abd. II well developed. Sternite of Th. III without chaeta.

Coxa I without an external chaeta. Tibiotarsi with 2,2,2 long and clavate dorsal tenent hairs and 1,1,0 (1) enlarged ventral tenent hair slightly curved at apex (Fig. 1B, C). Males with chaeta B5 and X on tibiotarsi III long and thin. Tibiotarsi I and II with 21 chaetae each, III with 23 chaetae. Claw bent in apical third. Empodial appendage short, 1/4-1/3 as long as inner edge of claw.

Retinaculum absent. Anterior furcal subcoxa with six to nine chaetae, posterior one with four to six chaetae. Manubrium with 13 dorsal chaetae. Mucro absent. Dens reduced to two knobs (dens/claw III = 1/3; manubrium/dens = 6), each with one (sometimes two) posterior chaeta (Fig. 1D).

Anal spines parallel, small, on low weakly sclerotised papillae. Medial mesochaetae (a1) of Abd. V slightly posterior to medial macrochaetae (a2). Arrangement of chaetae and spines on dorsum of Abd. V as a2-a2/a1-a1 = 3; a2-a2/a2-ASe = 1.2 (Fig. 1F).

### DISCUSSION

Though *T. bichaeta* n. sp. belongs to *pilosa*-group by its dorsal macrochaetotaxy, the new species is outstanding in having two clavate dorsal tenent hairs on tibiotarsus of first pair of legs (Fig. 1B), a character only shared with *T. calcarata* Deharveng, 1987 of *cassagnaii*-group. Both species are found in similar extreme habitats, i.e. moss or lichens on limestone rocks at high altitude, and both are restricted to northwestern Alps. Convergent evolution of *Tetracanthella* lineages living in extreme habitats cannot be ruled out, but among the many other *Tetracanthella* species which live in such a harsh environment, none has two tenent hairs on first leg tibiotarsus. This unusual feature casts doubts on the validity of the

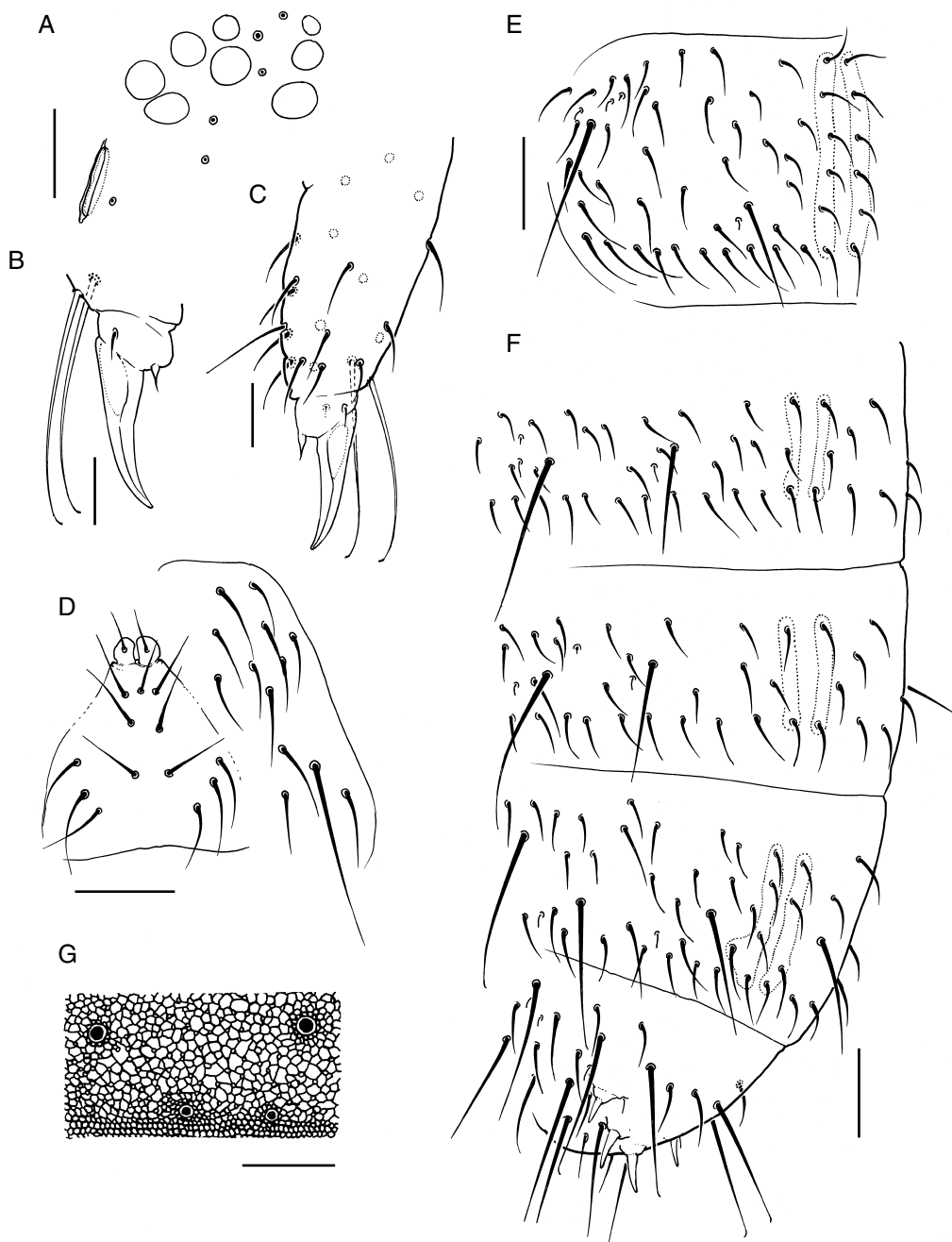


FIG. 1. — *Tetracanthella bichaeta* n. sp.: **A**, ocelli and PAO; **B**, distal part of Tita I; **C**, chaetotaxy of Tita III in adult male; **D**, furcal area; **E**, dorsal chaetotaxy of Th. II; **F**, dorsal chaetotaxy of Abd. II-VI; **G**, dorsal plates in axial area near p1-chaetae of Abd. IV. In E and F, axial chaetae are marked. Abbreviations: **Abd. II-VI**, abdominal tergites II-VI; **PAO**, postantennal organ; **Th. II**, thoracic tergite II; **Tita I, III**, tibiotarsus I, III. Scale bars: A, D, 40 μm; B, C, G, 30 μm; E, F, 50 μm.

current delimitation between *cassagnai* and *pilosa* species-groups as they were defined by Deharveng (1987). Its synapomorphic nature remains however to be established by a phylogenetic analysis of the genus.

*Tetracanthella corsica* n. sp.  
(Fig. 2)

TYPE MATERIAL. — **Corsica.** Valdo-Niello forest, no date, R. Dallai leg., ♀ holotype and 4 paratypes (MNHN); 2 paratypes (MSPU); 2 paratypes (Department of Evolutionary Biology, University of Siena). — Evisa, Aitone forest, meadow, 950 m, 4.IV.1976, L. Deharveng leg. (sample # Co007), 1 paratype (MNHN). — Albertacce, Valdo-Niello forest, under rotten wood, 1200 m, 4.IV.1976, L. Deharveng leg. (sample # Co005), 2 paratypes (MNHN). — Lonca, no date, J. Orousset leg., 1 paratype (MNHN).

ETYMOLOGY. — The name refers to the island of Corsica where the species has been found.

DISTRIBUTION. — Restricted to Corsica.

DESCRIPTION

Body length 0.9 mm. Pigment present, including antennae (more exact description impossible because pigmentation is partly lost). Dorsal plates polygonal, from 0.5 to 2 times as long as diameter of mesochaeta socket from head to Abd. I; from Abd. II to VI, up to six times as long as a mesochaeta socket, specially around the smooth areas (Fig. 2E); laterally and around the chaetae, polygons are much smaller. Canals between polygons well marked. Smooth fields present on Abd. IV and V (Fig. 2E), and on Abd. III in some specimens. Dorsal mesochaetae of medium size, in posterior row of Abd. IV not longer than on other parts of body (Md/p1 = 2.3-2.7). Mesochaetae not shortened in axial part of tergites: Abd. IV with p3 slightly longer than p1. Macrochaetae rather long, pointed (Fig. 2D). 8+8 ocelli, G and H slightly reduced (dcA/dcH = 1.2-1.3), PAO slender (PAO/dcA = 3-4) (Fig. 2A). Chaeta s' of ant. III present in males. Two prelabral chaetae. Outer maxillary lobe with probably four sublobal hairs. Five chaetae between medial line and pc3 on head. Frontal chaeta ap absent.

Chaetotaxy reduced. Axial chaetotaxy: 8-10,8/4,4,4,4, macrochaetotaxy: 2/2,2/2,2,3. One of corner mesochaetae on Th. II and III distinctly stronger than other mesochaetae of p-row, alike small macrochaeta Mdl of *wahlgreni*-type. Number of s-chaetae: 3,3/2,2,2,2,4 (s), 1,0/1,0,1 (ms). S-chaetae rather long, medial ones on Abd. I-III arranged behind Mdl macrochaetae (Fig. 2D). S-microchaetae on Th. III and Abd. II absent. Sternite of Th. III with 1+1 chaetae.

Coxa I with an external chaeta. Tibiotarsi with 1,2,2 thin and weakly or indistinctly clavate dorsal tenent hairs and 1,1,1 hardly differentiated ventral tenent hair. Males with chaetae X and B5 as thin sticks on tibiotarsi III. Tibiotarsi I and II with 21 chaetae each, III with 24-(25) chaetae. Claw of normal width, slightly curved. Empodial appendage slightly longer than half as long as inner edge of claw (Fig. 2C).

Retinaculum with 3+3 teeth and one chaeta. Anterior furcal subcoxa with five chaetae, posterior one with three chaetae. Manubrium with 8+8 (8+9) dorsal chaetae. Dens rather long (dens/claw III = 1.9-2.4), with two posterior and one anterior chaetae. Mucro slender, bidentate. Ratio manubrium/dens/mucro as 7.7-9.4/5.1-6.8/1 (Fig. 2B).

Anal spines perpendicular, short. Outer spines short, directed backwards, on strong sclerotised papillae with a short ventro-distal processus. Medial mesochaetae (a1) of Abd. V anterior to medial macrochaetae (a2). Arrangement of chaetae and spines on dorsum of Abd. V as a2-a2/a1-a1 = 1.5-1.7; a2-a2/a2-ASe = 1.1-1.4 (Fig. 2E).

DISCUSSION

*Tetracanthella corsica* n. sp. belongs to the *wahlgreni*-group. In the key of Potapov (2001), the new species comes near *T. nitida* Deharveng, 1987 and *T. raynalae* Deharveng, 1987. From the former, it differs in less developed smooth fields (on all abdominal tergites in *T. nitida*, only on Abd. III to V or IV to V in *T. corsica* n. sp.), and longer furca (ratio dens/claw as 1.5-1.9 in *T. nitida*, 1.9-2.4 in *T. corsica* n. sp.). From the latter, it differs in longer axial chaetae on Abd. IV (strongly shortened in *T. raynalae*, with ratio

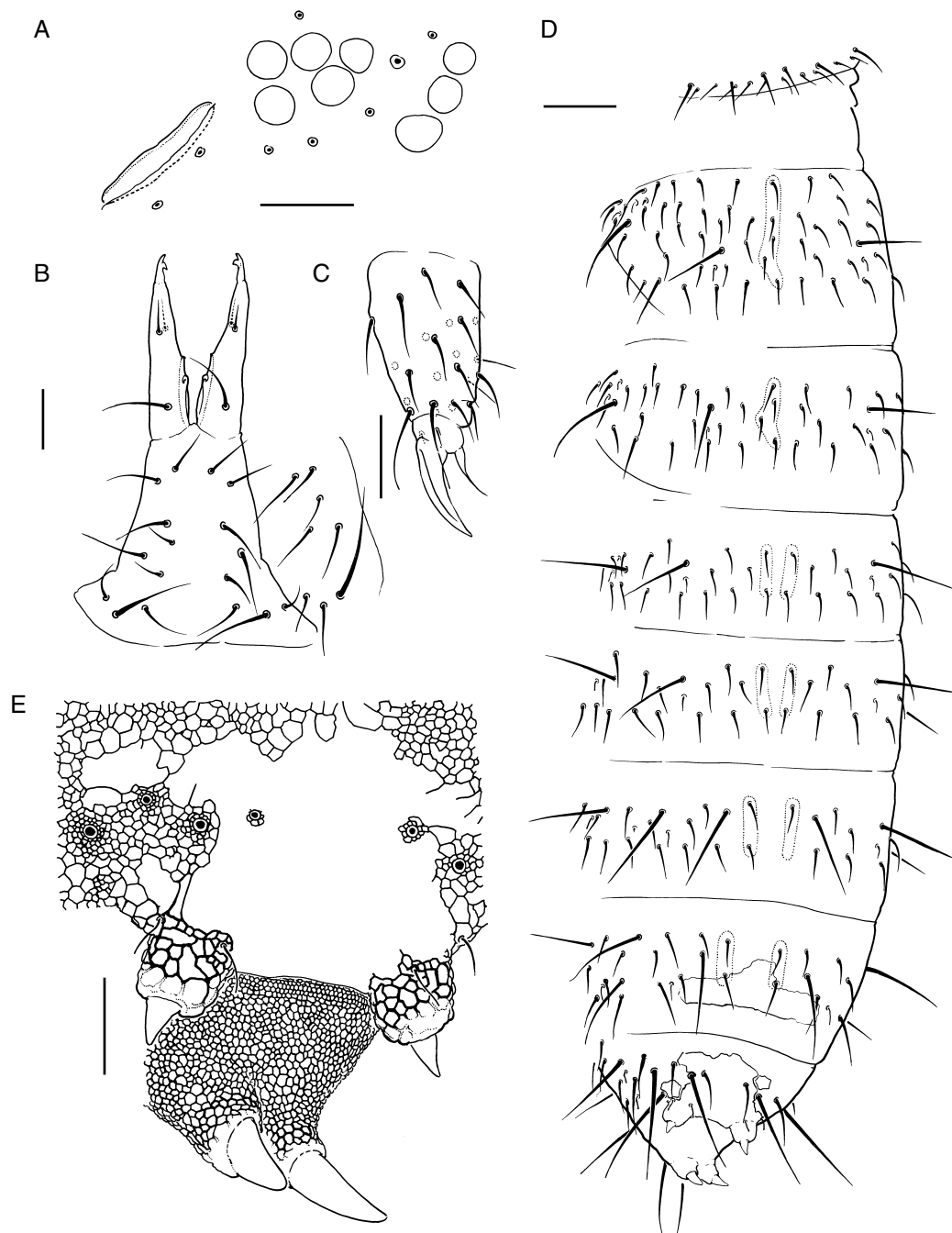


FIG. 2. — *Tetracanthella corsica* n. sp.; **A**, ocelli and PAO; **B**, furcal area; **C**, chaetotaxy of Tita III in adult male; **D**, dorsal chaetotaxy of tergites and posterior edge of head; **E**, dorsal plates of Abd. V-VI. In D, axial chaetae are marked (only left side on Th. II-III). Abbreviations: **Abd. V-VI**, abdominal tergites V-VI; **PAO**, postantennal organ; **Th. II, III**, thoracic tergite II, III; **Tita III**, tibiotarsus III. Scale bars: A, C, E, 20  $\mu$ m; B, 30  $\mu$ m; D, 50  $\mu$ m.

Md/p1 as 3.6). Besides, *T. corsica* n. sp. has a remarkable shape of papillae of outer anal spines that is not seen in the two species mentioned above nor in other *Tetracanthella*.

*Tetracanthella fusca* n. sp.  
(Fig. 3)

TYPE MATERIAL. — **France**. Ariège, Auzat, Vallée de Mounicou (1.445°E, 42.615°N), moss and lichens on soil at 2100 m, 11.X.1976, L. Deharveng leg. (sample # 09-156), ♂ holotype (MNHN); 2 paratypes (MSPU). — *Ibid.*, humid mosses on soil at 2180 m, L. Deharveng leg. (sample # 09-158), 1 paratype (MNHN). — *Ibid.*, saxifrages on rocks at 2200 m, 12.VIII.1978, L. Deharveng leg. (sample # 09-192), 2 paratypes (MNHN).

OTHER MATERIAL EXAMINED. — **France**. Ariège, Bethmale, Pic de Montgariè (1.06148°E, 42.8369°N), meadow near a névé at 2000-2100 m, 17.VIII.1978, L. Deharveng leg. (sample # 09-199), 1 specimen. — Bethmale, Cirque de Campuls (1.063°E, 42.848°N), moss and litter in beech-fir forest at 1650 m, 1.V.1976, L. Deharveng leg. (sample # 09-045), 4 specimens. — Couflens, Cirque d'Anglade (1.199°E, 42.729°N), moss and humus near a névé at 1580 m, 20.VI.1976, L. Deharveng leg. (sample # 09-049), 5 specimens.

ETYMOLOGY. — The name refers to the dark color of the species.

DISTRIBUTION. — Restricted to mountains of Ariège in French Pyrenees.

DESCRIPTION

Body length 0.9-1 mm. Body stout. Coloration greyish black including antennae.

Dorsal plates as roundish polygons, irregular, from medium to large, as long as 1-2 diameter of mesochaeta socket, locally smaller (specially laterally and around chaetae bases) (Fig. 3D). Canals between polygons deep. Smooth fields absent. Dorsal mesochaetae of medium size, longer in posterior row of Abd. IV (Md/p1 = 1.3-1.6). Mesochaetae not shortened in axial part of tergites: Abd. IV with p3 almost equal to p1 (p3/p1 = 1.0-1.2). Macrochaetae rather long, strong, straight, blunt or slightly clavate (Fig. 3B).

8+8 ocelli, G and H reduced (dcA/dcH = 1.5), PAO of medium size (PAO/dcA = 2.0-2.4)

(Fig. 3A). Chaeta s' of ant. III absent in males. Three prelabral chaetae. Outer maxillary lobe with one sublobal hair. With five chaetae between medial line and pc3 chaetae on head. Frontal chaeta ap present.

Chaetom rather abundant. Axial chaetotaxy: 12,8/4,4,4,6, macrochaetotaxy: 2/2,2/2,2,2. Md macrochaetae on Th. II and III and Mdl macrochaetae on Abd. I considerably shorter than macrochaetae Ml on these segments. Corner mesochaetae on Th. II and III not stronger than other mesochaetae of p-row. Number of s-chaetae: 3,3/2,2,2,2,4 (s), 1,1/1,1,1 (ms). S-chaetae very short, medial ones on Abd. I-III arranged behind and slightly lateral to Mdl macrochaetae. S-microchaetae on Th. III and Abd. II only slightly smaller than on other tergites. Sternite of Th. III without chaetae.

Coxa I with an external chaeta. Tibiotarsi with 1,2,2 long and slightly clavate dorsal tenent hairs and 1,1,0 pointed ventral tenent hair. Males with chaetae X and B5 on tibiotarsi III not thickened. Tibiotarsi I and II with 21 chaetae each, III with 24 chaetae. Claw slender and curved at the apex. Empodial appendage more than half as long as inner edge of claw (Fig. 3E).

Retinaculum with 3+3 teeth and one chaeta. Anterior furcal subcoxa with four or five (more rarely six or seven) chaetae, posterior one with four (more rarely five) chaetae. Manubrium with 9-11+9-11 dorsal chaetae. Dens of medium size (dens/claw III = 1.3-1.8), with three posterior and one anterior chaetae. Mucro straight, bidentate. Ratio manubrium/dens/mucro as 8-11/4-6/1 (Fig. 3C).

Anal spines parallel, on rather low weakly sclerotised papillae, the internal ones stronger than the external ones. Medial mesochaetae (a1) of Abd. V posterior to medial macrochaetae (a2). Arrangement of chaetae and spines on dorsum of Abd. V as a2-a2/a1-a1 = 2.0-2.4; a2-a2/a2-ASe = 1.4-1.8 (Fig. 3B).

DISCUSSION

According to the revision of Deharveng (1987), *T. fusca* n. sp. belongs to the *pilosa*-group.

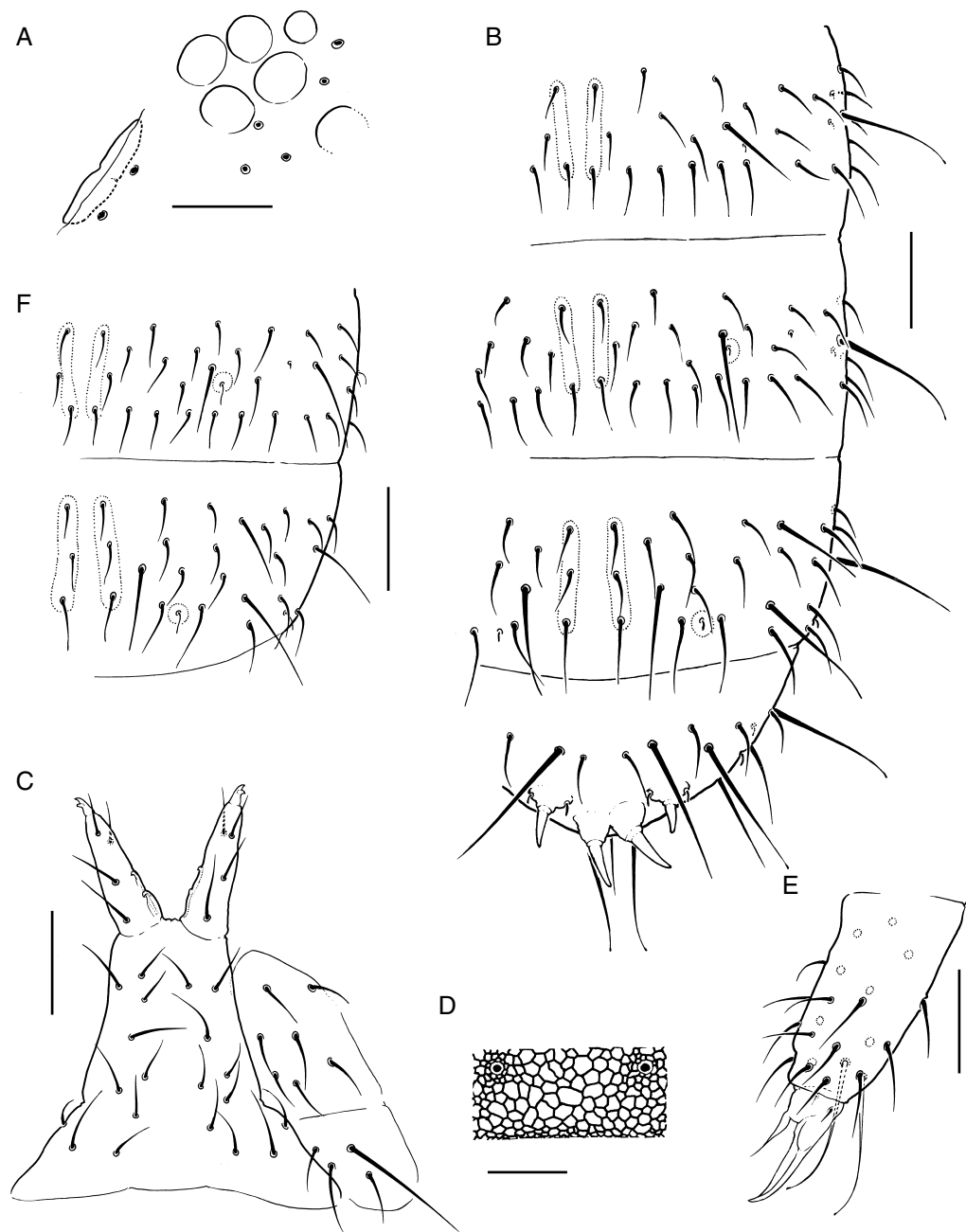


FIG. 3. — **A-E**, *Tetracanthella fusca* n. sp.: **A**, ocelli (pars) and PAO; **B**, dorsal chaetotaxy of Abd. II-VI; **C**, furcal area; **D**, dorsal plates in axial area near p1-chaetae of Abd. IV; **E**, chaetotaxy of Tita III; **F**, *T. similis* Deharveng, 1987, dorsal chaetotaxy of Abd. III-IV. In B and F, axial chaetae and s-chaetae are marked. Abbreviations: **Abd. II-VI**, abdominal tergites II-VI; **PAO**, postantennal organ; **Tita III**, tibiotarsus III. Scale bars: A, D, 20  $\mu$ m; B, F, 50  $\mu$ m; C, E, 30  $\mu$ m.



Presence of chaeta on retinaculum, long empodium, reduced axial chaetom and short furca are shared only with *T. similis* Deharveng, 1987, a rare species of Alpes-Maritimes. The new species differs from it in much shorter s-chaetae on tergites (Fig. 3B, F), darker coloration and smaller dorsal plates on Abd. IV.

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