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Article

On the genus *Pseudosmittia* from continental France. I. Description of *P. beverana* sp. n. from the upper basin of the River Bévéra (Diptera, Chironomidae, Orthocladiinae)

Joel Moubayed

Freshwater & Marine Biology, 10 rue des Fenouils, 34070 Montpellier, France ; chirojmb@gmail.fr

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ABSTRACT

Male adult and pupal exuviae of *Pseudosmittia beverana* sp. n. are described based on recent material collected in some riparian habitats bordering small springs and streams along the upper basin of the River Bévéra (SE-France). The male adult keys in the *brevifurcata*-gr, in particular, close to *P. carita* Ferrington & Sæther, 2011. Atypical morphological characters found in the male adult (antenna with apical seta, anal point triangular, short and pubescent; phallapodeme with large aedeagal lobe; virga fine spine shaped; dorsal lobe of inferior volsella large; gonostylus nearly semi-circular) and the pupal exuviae (anterior part of thorax with small spines and ridges; conjunctives II/III to V/VI with rows of orally projecting spinules; anal lobe divided in 2 larges characteristic postero-lateral mounds), allowed us to consider the new species as a local biogeographic representative. To date, the genus *Pseudosmittia* is represented worldwide by about 110 species, of which up to 20 are reported from Europe and 13 from France. The description of *P. beverana* sp. n. increases the total number to 14 of known species from this country. Remarks and comments on the ecology of the new species are given.

Keywords: Taxonomy, new species, SE-France, conservation measures.

Sur le genre *Pseudosmittia* de France continentale. I. Description de *P. beverana* sp. n. du bassin supérieur de la rivière Bévéra (Diptera, Chironomidae, Orthocladiinae)

RESUMÉ

L'adulte mâle et l'exuvie nymphale de *Pseudosmittia beverana* sp. n. sont décrits à partir d'un matériel récemment collecté dans des habitats ripicoles qui bordent le bassin supérieur de la rivière Bévéra (SE-France). *P. beverana* sp. n. est placé dans le groupe *brevifurcata*, particulièrement proche de *P. carita* Ferrington & Sæther, 2011. Des caractères morphologiques atypiques de l'adulte mâle (antenne avec soie apicale ; pointe anale triangulaire, courte et pubescente ; lobe aedéagal du phallapodème large ; virga en forme d'épine fine ; volselle inférieure double, lobe dorsal large ; gonostyle semi-circulaire) et de l'exuvie nymphale (partie antérieure du thorax munie de spinules et de carènes ; conjonctives II/III à V/VI avec des rangées de spinules dressées ; lobe anal divisé en 2 larges expansions postéro-latérales), permettent de considérer la nouvelle espèce comme un élément bio-

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géographique à l'échelle locale. À ce jour, le genre *Pseudosmittia* est représenté mondialement par près de 110 espèces, dont plus de 20 sont citées en Europe et 13 de France. La description de *P. beverana* sp. n. porte à 14 le nombre d'espèces connues de ce pays. Des commentaires sur la position taxonomique et l'écologie de la nouvelle espèce sont fournis.

Mots-clés : taxonomie, nouvelle espèce, Sud-Est France, mesures de conservation.

Photo 1. Gouargas stream, near Moulinet village (*Maritime Alps*)*; type-locality of* P. beverana *sp. n. Photo J. Moubayed, 25.VI.2016.*

Photo 1. Ruisseau de Gouargas, près du village de Moulinet (*Alpes-Martitimes*) *: localité-type de* P. beverana *sp. n. Cliché J. Moubayed, 25.VI.2016.*

1. Introduction

On the basis of knowledge provided on the taxonomy, geographical distribution and ecology of the genus *Pseudosmittia* Edwards, 1932 (Edwards 1929, 1932, Goetghebuer 1940-1950, Strenzke 1950, 1960, Brundin 1956, Freeman 1958, 1959, 1961, Tokunaga 1964, Albu 1968, Sasa 1979, 1985, 1993, 1998, Freeman & Cranston 1980, Caspers & Reiss 1989, Cranston et al. 1989, Wang 1990, Sasa & Okazawa 1992, Sæther & Ferrington 2003, Spies & Sæther 2004, Yamamoto 2004, Sæther 2004, 2006, Makarchenko & Makarchenko 2007, 2008, Langton & Pinder 2007, Ferrington & Sæther 2011, Ashe & O'Connor 2012, Langton 2012, Langton & Syrovatka 2013, Mauad et al. 2013, Sæther & Spies 2013, Moubayed & Mary 2023), currently there are about 110 known valid species distributed in up to thirteen groups and subgroups, of which up to 20 species are reported from Europe (Ferrington & Sæther 2011, Sæther & Spies 2013, Moubayed 2025a, 2025b, Moubayed & Langton 2025).

2. Material and methods

The studied material is composed of male adult and pupae collected by sweeping and drift net in some riparian habitats bordering several cold springs and streams delimited by the upper basin of the River Bévéra (Gouargas, Serre de Berrins, etc.), SE-France. The material was preserved in 80-85% ethanol for the taxonomic examination and description. Information on the methodology of mounting and conservation of the type-material is provided in Moubayed & Langton (2019). Morphological terminology and measurements follow those of Sæther (1980) and Langton & Pinder (2007) for the imagines and Sæther (1980) and Langton (1991) for the pupae.

3. Description

Pseudosmittia beverana sp. n.

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Material examined

Holotype. One male pharate adult collected in the Gouargas stream, River Bévéra upper basin, SE-France (43.937632° N; 7.415186° E); near Moulinet (06086); riparian habitats bordering cold springs densely covered with bryophytes (Photo 1); alt. about 720-750 m; leg. J. Moubayed, 25.VI.2016.

Paratype. One male adult and one male pupal exuvia, collected in some tributaries of the River Bévéra, located close to Serre de Berrins, (43.896 N; 7.440 E); near Sospel (06136); springs and small streams densely covered with bryophytes (Photo 2); alt. 660 m; leg. J. Moubayed, 25.VI.2016.

Holotype (mounted on one slide with its kin) is deposited (GBIFCH01223200) in the collections of the Cantonal Museum of Natural Sciences, dept of zoology, Palais de Rumine, 6 place de la Riponne, CH-1014 Lausanne (MZL), Switzerland. The paratype is deposited in the collection of the author.

Etymology: the name *"beverana"* refers to the River Bévéra (SE-France), which runs in southeastern France (upper and middle basins) along the French-Italian boarder till its estuary at the Italian city of Ventimiglia.

Diagnostic characters

Male adult

The following combination of characters will separate the new species from other related members of the genus. Head. Eyes bare, coronals present; temporals consist only of 4 outer verticals, inner verticals absent; antenna 715 μm long, last flagellomere 375 μm long, densely covered with long setae (350- 450 μm long), apical seta

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**	**ta_4**	**ta_5**	**LR**	**BV**	**SV**	**BR**
PI	420	485	295	180	135	90	80	0,61	2,47	3,07	1.90
PII	455	455	240	130	100	70	70	0,53	3,11	3,79	2.00
PIII	470	560	325	150	115	70	75	0,58	3,30	3,17	2.20

Table 1. "LR = Length of tarsomere ta_1 divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta_1 divided by combined length of tarsomeres ta_2-ta_5; SV = Ratio of femur plus tibia to tarsomere ta_1; BR = Ratio of longest seta of ta_1 divided by minimum width of ta_1, measured one third from apex."

absent, AR 1.10; clypeus semi-circular, with 11 setae; palpomere with one pointed sensilla coeloconica. Lobes of antepronotum not gaping, acrostichals 2. Vein R_1 with 6 setae. Sensilla chaetica present on tarsomeres ta_1-ta_5 of PI-PIII. Tergites IX without dorsal hump, with 8 setae located close to the base of anal point; anal point triangular, pubescent. Transverse sternapodeme rounded, lateral expansion absent; phallapodeme racket-like, aedeagal lobe enlarged basally. Virga consists of one fine spine. Inferior volsella double, dorsal lobe large, bare apically; ventral lobe densely covered with setae. Gonostylus typically semicircular, upwardly projecting posteriorly; crista dorsalis weak.

Pupal exuviae

Head. Frontal apotome nearly smooth, frontal setae absent. Thorax. Anterior part densely covered with points, anteromedian area with characteristic thin ridges. Lateral antepronotals 2, needle-like, median antepronotals absent; precorneals 3, well-developed, including 2 needle-like shaped; thoracic horn absent, precorneal tubercle reduced; dorsocentrals 3, vestigial. Abdomen. Tergite I with sparse shagreen; tergites II-VIII densely covered with coarse shagreen and points, progressively larger posteriorly; spinules spars on paratergites II-V becoming denser on paratergites VI-VIII. Sternites: I-III bare, IV-VIII with sparse antero-lateral shagreen. Lateral setae on segments: I, 1; II-III, 3; IV-VIII, 4. Conjunctives II/III to V/VI with rows of spinules. Anal lobe bilobed apically, distinctly enlarged in 2 large typical ellipsoidal mounds, postero-median area with covered with dense short spines, weakly wrinkled; anal macrosetae absent. Genital sac wrinkled laterally, overreaching tip of anal lobe.

Male imago

(n = 2; Figs 1A-M)

Medium to big sized species. Total length 1.90 mm; wing length 0.95 mm; TL/WL = 2.00. General colouration contrasting dark brown to blackish; head dark brown; antenna brownish; thorax contrasting dark brown to blackish with blackish mesonotal stripes; legs and abdomen brownish; anal segment contrasting brown to dark brown. Head. Eyes bare; suture of coronal triangle well developed; temporals composed only of 4 outer verticals, inner verticals absent. Antenna 13-segmented, 715 μm long, last flagellomere (Figs 1A-B) 375 μm long, not clubbed, apical seta absent; segments 2-12 subequal (25 μm long); all segments densely covered with long setae (450 μm on segments, 350 μm on terminal segment); antennal groove reaching segments 3; AR 1.10. Clypeus (Fig. 1D) semicircular, with 11 setae in 3 rows. Palp 5-segmented, segments 1-2 fused, length (in μm) of segments: 25, 30, 45, 55, 65. Thorax. Lobes of antepronotum (Fig. 1F) not gaping; lateral antepronotals 5; acrostichals 2 starting close to scutum; dorsocentrals 9 uniserial; prealars 4 uniserial; scutellum with 6 setae (3 on each side of the midline). Wing. Brachiolum with 1 seta; subcosta overreaching fork of radius; costal expansion 25 μm long; distribution of setae on veins: R, 6; remaining veins and squama bare. Legs. Length (in μm) of tibial spurs: PI, 45; PII, 40, 25; PIII, 50, 30. Sensilla chaetica present on tarsomeres ta_1-ta_5 of PI-PIII. Length (μm) and

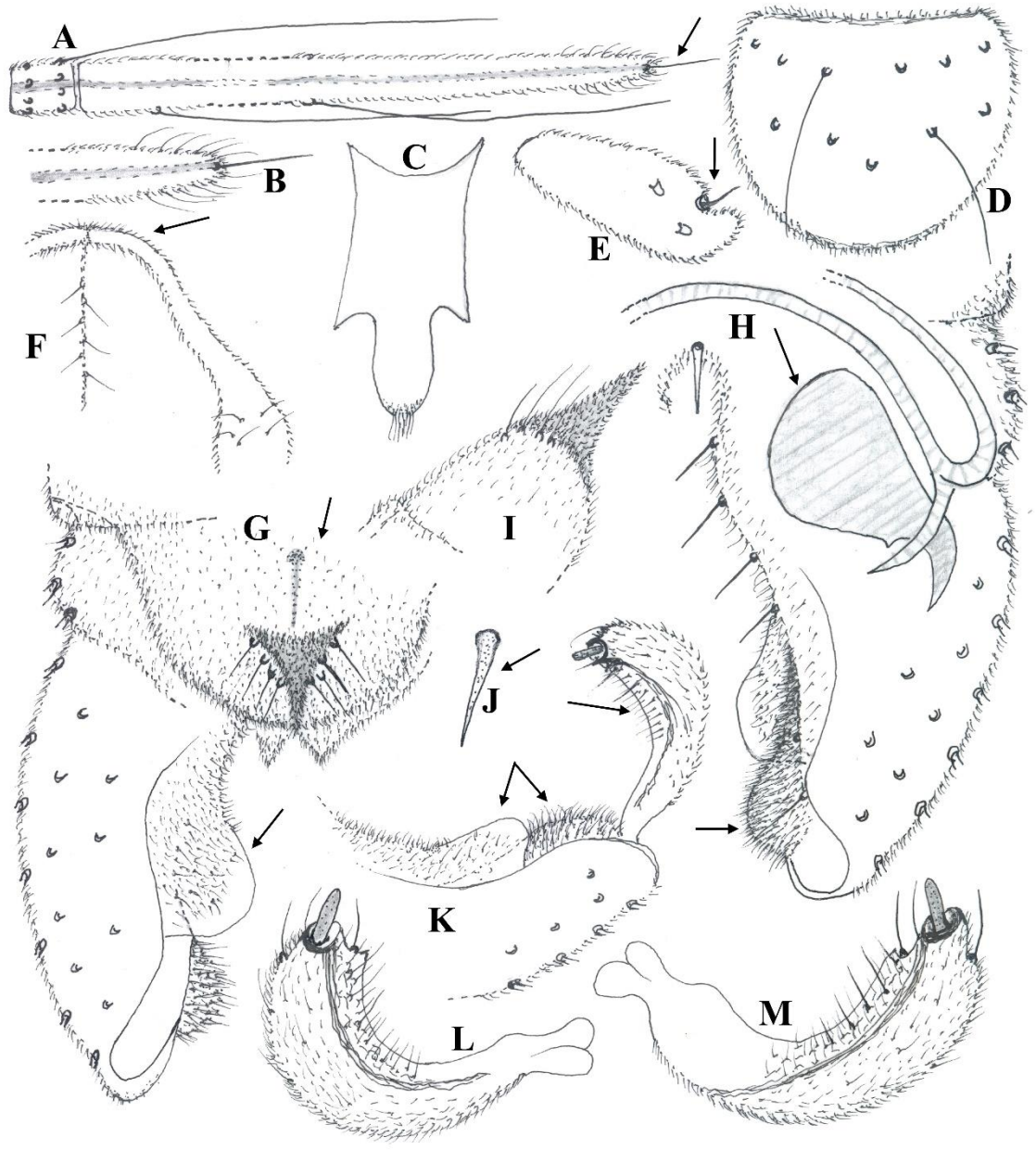

Figure 1. Male imago of Pseudosmittia beverana *sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); antenna, two last segments (B); clypeus (C); palpomeres 3 (D); tergite IX and anal point in lateral view (E); hypopygium in dorsal (F) and ventral view (G, with virga and pars ventralis); inferior volsella, right side (H); gonostylus at acute (I) and right angle (J). The arrows indicate some distinctive characters.*

Figure 1. Imago mâle de Pseudosmittia beverana *sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex et soies temporales (A) ; antenne, deux derniers segments (B) ; clypéus (C) ; palpomères 3 (D) ; tergite IX et pointe anale en vue latérale (E); hypopyge en vue dorsale (F) et ventrale (G, avec virga et pars ventralis) ; volselle inférieure, côté droit (H) ; gonostyle, angle aigu (I) et angle droit (J). Les flèches indiquent quelques caractères distinctifs.*

(PII) and metathoracic (PIII) legs (n =1) as in the Table 1.

Abdomen. Hypopygium in dorsal and ventral view as in figures 1G-H (Fig. 1G, dorsal; 1H, ventral with tergite IX and anal point omitted, apodemes, virga and inferior volsella). Tergites IX 100 μm long, 140 μm maximum width; without dorsal hump; with 8 setae located close to the base of anal point as shown in lateral view (Fig. 1I). Anal point (Figs 1 G, I) 25 μm long, 15 μm maximum width at base, triangular, pubescent. Laterosternite IX with 6 setae (3 on each side). Apodemes (Fig. 1H), transverse sternapodeme semi-circular, lateral expansion absent; phallapodeme racket-like, base of aedeagal lobe enlarged. Virga about 10-15 μm long, composed of one fine spine. Gonocoxite 125 μm long, 55 μm maximum width including inferior volsella; inner margin with 8-9 setae. Inferior volsella (Figs 1G-H, dorsal; 1K, lateral) double, dorsal lobe 40 μm long, 25 μm maximum width, located medially, lobe-like shaped, slightly bent downwards, bare apically; ventral lobe 35 μm long, 15 μm maximum width, smaller, proximal part linearly fused to inner margin of gonocoxite, densely covered with setae. Gonostylus (Figs 1K-M; 1K, lateral; 1L, acute angle; 1M, right angle), about 60 μm long, 15 μm maximum width; atypically semicircular, projecting upwardly in its distal half; crista dorsalis weak located preapically; megaseta well-developed. HR = 3.17; HV = 2.08.

Male pupal exuviae

(n = 1; Figs 2A-F)

Total length 1.90 mm; abdomen 1.75 mm long. General colouration nearly colourless, as in other semiterrestrial genera (*Hydrosmittia*, *Limnophyes*, *Pseudosmittia*, *Smittia*). Frontal apotome, cephalothorax and wing sheath transparent; abdomen with pale brown and yellowish nuances of anterior and posterior rows of spines; anal lobe and genital sac pale brown to brown. Cephalothorax (Figs 2A-B). Frontal apotome (Fig. A) smooth, with faint wrinkles, frontal setae absent. Antepronotals consist only of 2 subequal needle shaped lateral antepronotals (75 μm long), median antepronotals absent; thoracic horn absent, precorneal tubercle weak; precorneals 3, 40-45 μm long, composed of 2 subequal needle-like setae and 1 hair like seta. Dorsocentrals 3, vestigial, 1-1.5 μm long; Dc_1 and Dc_2 are close, distance between Dc_1 and Dc_2-Dc_3 75 μm. Abdomen. Tergites I with sparse shagreen; tergites II to VIII covered with shagreen and short spinules; tergites II-VIII with rows of shagreen and points (Figs 2C, E) becoming progressively larger towards the posterior part; spinules spars on paratergites II-V becoming denser on paratergites VI-VIII. Sternites I-II bare; rows of shagreen and points on sternites III-VIII sparse, located on antero-lateral part. Lateral setae on segments: I, 1; II-III, 3; IV-VIII, 4. Conjunctives II/III to V/VI with rows of orally directed spinules becoming denser on IV/V and V/VI, details of erected spinules as in Fig. 2D). Anal lobe 190 μm long, 160 μm maximum width; bilobed apically, divided in 2 large rounded posterior mounds; anterior part and postero-median area covered with short spines; anal macrosetae absent. Genital sac 170 μm long, overreaching tip of anal lobe by 15-20 μm, well-wrinkled.

Female adult and larva: unknown

4. Remarks and discussion

P. beverana sp. n. keys in the *brevifurcata*-gr, in particular, close to *P. carita* Ferrington & Sæther, 2011 known from Spain and France. Atypical morphological characters found in the male adult (antenna with apical seta, anal point triangular, short and pubescent; phallapodeme with large aedeagal lobe; virga fine spine shaped; inferior volsella bilobed; gonostylus nearly semicircular) and the pupal exuviae (lateral antepronotals and 2 precorneals needle-like shaped; anterior area of thorax with small spines and ridges; conjunctives II/III to V/VI with rows of orally projecting spinules; anal lobe with 2 characteristic postero-lateral ovoid mounds), allowed us to consider the new species as a local biogeographic representative.

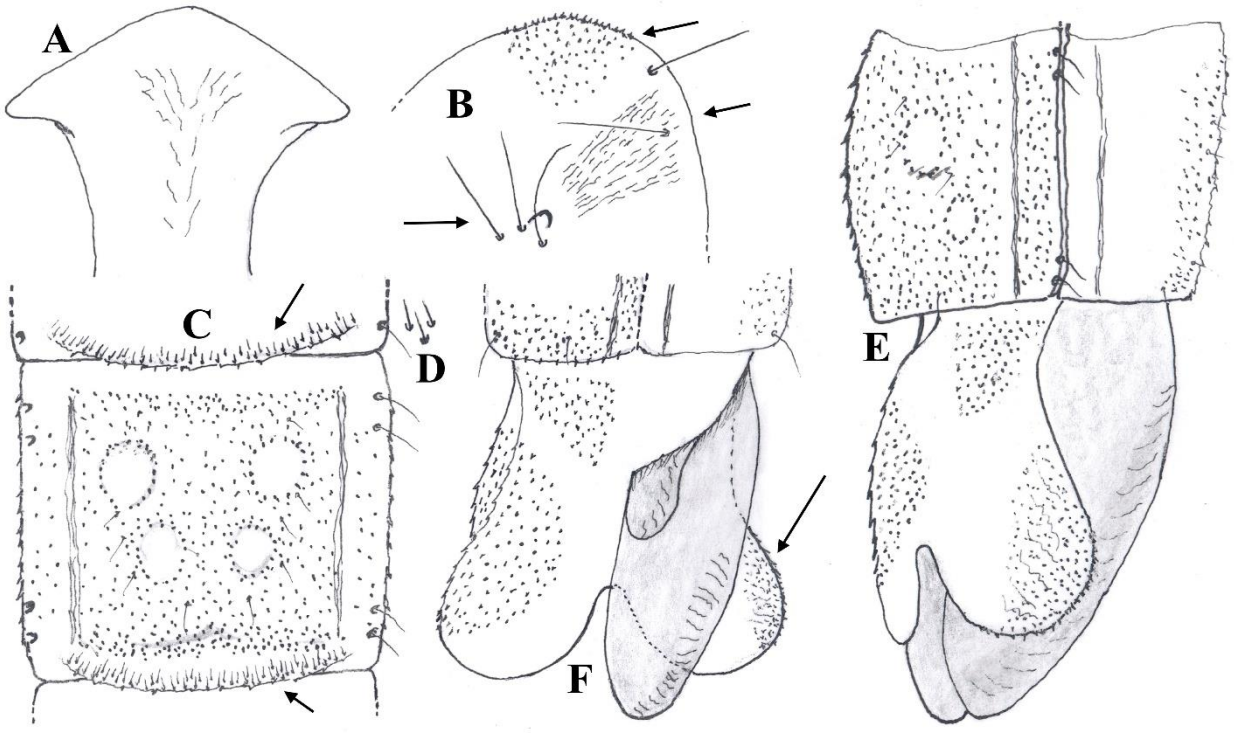

Figure 2. Male pupal exuviae of Pseudosmittia beverana sp. n. Frontal apotome (A); anterior part of thorax with antepronotal, precorneals and ridges (B); conjunctive III/IV and tergite IV (C); details of setae on conjunctive III/IV (D); segment VIII and anal segment, lateral (E); posterior part of segment VIII and anal segment (F), dorsal side (left), ventral side (right). The arrows indicate some distinguishing characters.

Figure 2. Exuvie nymphale mâle de Pseudosmittia beverana sp. n. Apotome frontal (A) ; partie antérieure du thorax, soies antépronotales, précornéales et carènes (B) ; conjonctive III/IV et tergite IV (C) ; détails des soies sur la conjonctive III/IV (D) ; segment VIII et segment anal, vue latérale (E) ; partie postérieure du segment VIII et segment anal (F), côté dorsal (à gauche), côté ventral (à droite). Les flèches indiquent quelques caractères distinctifs

As reported by FERRINGTON & SÆTHER (2011), the genus *Pseudosmittia* is widely distributed in the major zoogeographical Regions. To date, there are about 110 known valid species worldwide, of which up to 20 are known from Europe (SÆTHER & SPIES 2013) and 13 from France, namely: *P. acquavivai* Moubayed, 2025, *P. albipennis* (Goetghebuer, 1921); *P. angusta* (Edwards, 1929); *P. baueri* Strenzke, 1960; (Goetghebuer, 1913); *P. brevifurcata* (Edwards, 1926); *P. danconai* (Marcuzzi, 1947); *P. forcipata* (Goetghebuer, 1921); *P. gracilis* (Goetghebuer, 1913); *P. holsata* Thienemann & Stenzke, 1940; *P. obtusa* Strenzke & Thienemann, 1942; *P. simplex* Strenzke & Thienemann, 1942; *P. trilobata* (Edwards, 1929); *P. tyrrhena* Moubayed, 2025. Consequently, the description of *P. beverana* sp. n. increases the total number to 14 of known species from this country.

5. Ecology and geographical distribution

Male adults of the new species were captured in some riparian habitats bordering some cold springs and streams surrounding tributaries at the upper basin of the River Bévéra (alt. between 600 and 750 m, SE-France). Shaded semiterrestrial habitats enriched with bryophytes and aquatic plants (Photos 1-2), represent the favourable microhabitats for larvae of *P. beverana* sp. n.,

Photo 2. Type-locality of Pseudosmittia beverana *sp. n.: riparian habitats bordering the upper basin of the River Bevera, where the type-material was collected. Photo J. Moubayed, 25.VI.2016.*

Photo 2. Localité-type de Pseudosmittia beverana *sp. n.: habitats ripicoles en bordure du bassin supérieur de la rivière Bévéra, où le matériel-type a été collecté. Photo J. Moubayed, 25.VI.2016.*

which appears to belong to the crenophilous community of species as documented by Lindegaard (1995). Emergence period: late spring. The new species could be more widely distributed in other wetlands over the southeastern areas of France. It is considered to be biogeographic local representative, which deserves greater consideration and conservation measures.

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