

***Polypedilum (Uresipedilum) tissoti* sp. n., a new species
occurring in alkaline peat bogs and wet sedge meadows
in north eastern France
[Diptera, Chironomidae, Chironominae]**

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Male adult of *Polypedilum (Uresipedilum) tissoti* sp. n. is described based on material collected by Malaise traps placed close to alkaline peat bogs and wet sedge meadows of ‘Les Vurpillières’ at the Nature Reserve of Remoray Lake (NE-France). The new species is easily distinguished from other members of the subgenus *Uresipedilum* in having some unusual characters: tibial scales of PII-III rounded, tergites with atypical distribution pattern of spots; anal point broad; base of superior volsella sausage-like bearing 9 setae including 1 proximally and 8 distally; gonostylus bulbous medially and abruptly tapering distally. *P. aviceps* Townes, 1945, *P. kakumense* Oyewo & Sæther, 2008, *P. surugense* Niitsuma, 1992 and *P. tesfayi* Harrison, 1996 appear to be the closest species to *P. tissoti* sp. n. on the basis of the following common characters: anal point broad as for *P. aviceps* and *P. surugense*, base of superior volsella evenly wide from base to apex as for *P. kakumense* and *P. tesfayi*. Currently, the subgenus *Uresipedilum* Sæther & Oyewo, 2008 is represented worldwide by about 48 valid species including only 2 reported species from France and Europe: *P. convictum* (Walker, 1856) and *P. cultellatum* Goetghebuer, 1931. The new species is known only from its type-locality (NE-France). Taxonomic remarks and differential diagnosis with key for known male adults from Europe are given.

Polypedilum (Uresipedilum) sp. n., une nouvelle espèce connue de tourbières et de prairies humides alcalines situées dans le nord-est de la France [Diptera, Chironomidae, Chironominae]

Mots-Clés : *Polypedilum (Uresipedilum) sp. n.*, Diptera Chironomidae, tourbières alcalines, NE-France, conservation.

L’adulte mâle de *Polypedilum (Uresipedilum) tissoti* sp. n. (= *P. (Ur.)* sp. 1, dans MOUBAYED et al. 2019) est décrit à partir d’un matériel collecté avec des tentes Malaise placées non loin de prairies humides (cariçaies) et de tourbières alcalines des Vurpillières, réserve naturelle nationale du Lac de Remoray (NE-France). La nouvelle espèce se distingue des autres membres du sous-genre *Uresipedilum* Sæther & Oyewo, 2008 par certains caractères atypiques de l’adulte mâle : extrémité des tibias des pattes PII-III arrondie, chaetotaxie et distribution atypique des taches sur les tergites I-VIII ; pointe anale large ; base de la volselle supérieure en

forme de saucisse, avec 9 soies dont 1 proximale et 8 distales ; gonostyle globuleux dans sa partie médiane et brusquement effilé dans sa moitié distale. *P. aviceps* Townes, 1945, *P. kakumense* Oyewo & Sæther, 2008, *P. surugense* Niitsuma, 1992 et *P. tesfayi* Harrison, 1996 constituent les espèces les plus proches de *P. tissoti* sp. n. sur la base des caractères communs suivants : pointe anale large (*P. aviceps* et *P. surugense*), volselle supérieure linéaire et de même largeur (*P. kakumense* et *P. tesfayi*). Actuellement, le sous-genre *Uresipedilum* est représenté mondialement par près de 48 espèces dont seulement 2 sont connues de France et d'Europe : *P. convictum* (Walker, 1856) and *P. cultellatum* Goetghebuer, 1931. La nouvelle espèce est uniquement connue de sa localité type. Des commentaires sur la position taxonomique avec des clés d'identification se rapportant aux adultes mâles d'espèces connues d'Europe sont proposés.

1. Introduction

Polypedilum (Uresipedilum) tissoti sp. n. (= *P. (Ur.)* sp. 1 in MOUBAYED et al. 2019) is diagnosed and described based on male adults collected by Malaise traps placed close to alkaline peat bogs and wet sedge meadows of 'Les Vurpillières' at the Nature Reserve of Remoray Lake (NE-France). The male of the new species is easily separated from other related members of the subgenus *Uresipedilum* by some unusual characters: tibial combs of PII-III rounded, broad anal point, superior volsella evenly wide from base to apex, gonostylus extremely broad medially and abruptly narrowed and tapering distally. On the basis of some common morphological characters, *P. aviceps* Townes, 1945, *P. kakumense* Oyewo & Sæther, 2008, *P. surugense* Niitsuma, 1992 and *P. tesfayi* Harrison, 1996 appear to represent the closest species to *P. tissoti* sp. n.

Data with diagnostic characters, taxonomy, key for identification and geographical distribution for known *Polypedilum (Uresipedilum)* species worldwide (GOETGHEBUER 1937; TOWNES 1945; FREEMAN 1958; LEHMANN 1971; SHILOVA 1976; ALBU 1980; ROSSARO 1984; CRANSTON et al. 1989; SASA 1989; NIITSUMA 1992; SASA & KIKUCHI 1995; HARRISON 1996; OYEWO & SÆTHER 1998; LANGTON & PINDER 2007; SÆTHER & OYEWO 2008; SÆTHER & SPIES 2013, XIALONG et al. 2013; MOUBAYED-BREIL & ASHE 2016) have been provided and show that there are about 48 species of which only 2 are currently reported from Europe: *P. convictum* (Walker, 1856) and *P. cultellatum* Goetghebuer, 1921. Consequently, the description of *P. tissoti* sp. n. increases the total number of valid species to 3 for France. Remarks with differential diagnosis and key for known male adults from France are given.

2. Material and methods

The male adults were collected exclusively by Malaise traps placed close to each of the most representative habitats of the Nature Reserve of Remoray Lake. Preserved male adult in 80% ethanol, was cleared of musculature in 90% lactic acid (head, thorax, abdomen and anal segment) for about 60 to 80 minutes; this can be left overnight at room temperature without any detrimental effect or damage. When clearing was complete the specimen were washed in two changes of 50-60% ethanol to ensure that all traces of lactic acid were removed. The holotype and paratypes were mounted in polyvinyl lactophenol. Before the final slide mountings (dorsally) of the type material, the hypopygium including tergite IX, the anal point, the gonocoxite and the gonostylus, were viewed ventrally and laterally to examine and draw from both sides all the necessary details of the species. The proximal part of the abdomen and the halteres of the male adults were preserved in

85% ethanol for an eventual DNA analysis. Morphological terminology and measurements follow that of SÆTHER (1980) and LANGTON & PINDER (2007).

3. Results and descriptions

Polypedilum (Uresipedilum) tissoti sp. n.

Material examined

Holotype. **France.** 1 male adult, leg. B. Tissot, Malaise traps, alkaline peat bogs and wet sedge meadows of « LesVurpillières » (Figs 3-4), upper valley of the Doubs River, Nature Reserve of Remoray Lake, north eastern France (46.7717° N; 6.2632° E); altitude 800-850 m, 12.IV.2019.

Paratypes (leg. B. Tissot). 2 male adults preserved in 80% ethanol, same locality and data as for holotype.

Holotype (male adult, on one slide) is deposited in the collections of the Zoologische Staatssammlung of (ZSM), Munich, Germany. The paratypes are deposited in the collection of the senior author.

Etymology. The new species is named “*tissoti*” in honour to Bruno Tissot who remains active as a curator of the Nature Reserve of Remoray Lake (NE-France) in contributing to preserving the environment and species confined to aquatic habitats delimited by this protected area.

Diagnostic characters

Based on some common morphological characters found in the male adult, *P. aviceps*, *P. kakumense*, *P. surugense* and *P. tesfayi* appear to be the closest species to *P. tissoti* sp. n.: anal point wide and drop-like as for *P. aviceps* and *P. surugense*, base of superior volsella evenly wide from base to apex as for *P. kakumense* and *P. tesfayi*. However, the new species is easily distinguished from other described members of the subgenus *Uresipedilum* in having some unusual characters in the male adult: palpomere 3 with only one pin-like sensilla coeloconica; clypeus semi-circular; tibial scales rounded; tibial comb of PII-III rounded apically; tergites with a far unique pattern of spots; anal point distinctly broad diamond-shaped, swollen medially and tapering distally, proximal half with a distinct well-developed crest visible in both dorsal and lateral view; base of superior volsella sausage-like, parallel-sided from base to apex and bearing 9 setae including 1 proximally and 8 distally; gonostylus atypical, extremely bulbous medially and abruptly narrowed and tapering distally.

Description

Male adult

(= *Polypedilum (Ur.)* sp. 1 in MOUBAYED et al. 2019)

(n = 3; Figs 1A, B, E, G-I, M-Q, 2A, J)

Large. Total length 5.35-5.45 mm. Wing length 3.75-3.80 mm, TL/WL = 1.43. General colouration contrasting pale brown to dark brown. Head dark brown with blackish eyes; vertex black at base and less dark apically; palpomeres brownish; antennae contrasting brown to dark brown with pale intersegments; thorax contrasting brown to dark brown, mesonotal stripes dark brown; humeral area yellowish; wing unmarked, with brownish veins. Legs with blackish spots on femora and tibiae, largest spot is located on basal part of tibia of PI; spots on femora and tibiae: PI (apex of femur, base and apex of tibia), PII-PIII (apex of femora, base and apex of tibiae). Abdomen (Fig.

1M); tergites I-III pale brown with basal half brownish; tergites IV brown medially and pale laterally; tergites V-VII dark brown, postero-median area with a small semicircular pale spot; tergite VIII pale laterally, median area with a bell-shaped dark brown spot. Head. Eyes bare between ommatidia, hairs absent on inner lateral and outer posterior margin of eye. Coronals 4; vertex distinctly thicker at base, suture uniformly linear; tubercles absent. Temporals 23 including 16 inner and 7 outer verticals in 1-2 rows; inner verticals (Fig. 1A) composed of 15-16 long and 7-8 short setae located in 2 distribution pattern groups. Palp 5-segmented, first and second segments are fused, segment 2 rectangular; length (μm) of palpomeres: 75, 85, 255, 290, 395; palpomeres 3 (Fig. 1B) with 4 sensilla clavata and 1 needle-like sensilla coeloconica; sensilla clavata present on segments: 2 (4), 4 (4) and 5 (6). Clypeus (Fig. 1E) about 110 μm long and 140 μm maximum width, semi-circular with distinct sclerotization at apical part, with 18-19 setae 80-85 μm long in 4-5 rows. Antenna 1750 μm long, 13-segmented; ultimate flagellomere 1250 μm long, linearly elongated and not clubbed distally, bearing a dense brush of sensilla chaetica apically, pre-apical seta absent; antennal groove beginning on segments 3-4 and reaching ultimate flagellomere; AR 2.50. Thorax. Lobes of anteprototum widely open and moderately thick medially, lateral anteprototals apparently absent; acrostichals 11-13 arising a short distance from the anteprototum; dorsocentrals 20-21 in 1-2 rows; prealars 5 in one row; humeral area with yellowish granulation, humeral pit absent; scutellum with 14 setae in one row. Wing without spots. Brachiolum with 3 setae; number of setae on veins: R, 19-21; R₁, 19-21; R₂₊₃, indistinct; R₄₊₅, 29-31 located on distal half; remaining veins bare; squama with 24-26 setae in 1-2 rows. Legs. Tibial comb of PI-PIII as in Figs 1G-I: smoothly rounded on PI (Fig. 1G) and more projecting on PII (Fig. 1H) and PIII (Fig. 1I); tibial spur absent on PI, present on PII (only 1) and PIII (2 subequal); length of tibial spur about 50 μm . Sensilla chaetica present on tibia and tarsomeres ta₁-ta₅ of PI-PIII. Length (μm) and proportions of prothoracic (PI), mesothoracic (PII) and metathoracic (PIII) legs as in Table 1.

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR	BV	SV	BR
PI	1785	1490	1105	650	540	420	180	0.74	2.45	2.96	2.80
PII	1675	1525	865	450	380	240	160	0.57	3.30	3.70	2.60
PIII	1825	1680	1255	750	550	315	170	0.75	2.67	2.79	3.40

Table I. Male adult of *P. tissoti* sp. n. Length (μm) and proportions of prothoracic (PI), mesothoracic (PII) and metathoracic (PIII) legs. LR = Length of tarsomere ta₁ divided by length of tibia (ti); BV = Combined length of femur (fe), tibia and ta₁ divided by combined length of tarsomeres ta₂-ta₅; SV = Ratio of femur plus tibia to tarsomere ta₁; BR = Ratio of longest seta of ta₁ divided by minimum width of ta₁, measured one third from apex.

Tableau I. Adulte mâle de *P. tissoti* sp. n. Longueur (μm) et proportions des pattes prothoracique (PI), mésothoracique (PII) et métathoracique (PIII). LR = longueur du tarsomère ta₁ divisée par la longueur du tibia (ti); BV = longueurs cumulées des fémurs (fe), tibia et ta₁ divisées par les longueurs cumulées des tarsomeres ta₂-ta₅; SV = rapport du fémur plus tibia au tarsomère ta₁; BR = rapport de la soie de ta₁ la plus longue à la largeur minimale de ta₁, mesurée à un tiers de l'apex.

Abdomen with chaetotaxy and pattern of spots on tergites I-VIII as in Fig. 1M; tergites I-III with a median semicircular to drop-like area covered with decumbent (a-type) setae, lateral areas are lacking such setae as for tergites IV-VIII. Hypopygium in dorsal (Fig. 1N) and ventral view with tergite IX and anal point omitted as in Fig. 1O. Tergite IX about 250 μm long and 310-320 μm maximum width, broadly semi-circular antero-medially and narrowing posteriorly; anal tergite bands widely separated basally, tapering medially and abruptly interrupted near the base of anal point, regularly thick from base to tip, separated by 60-65 μm apically; 14 dorsomedian setae are located between the tergite bands in 2 groups of 7 setae on each side of the midline; posterior margin with 12-14 lateral setae inserted at base of anal point (6-7 on each side).

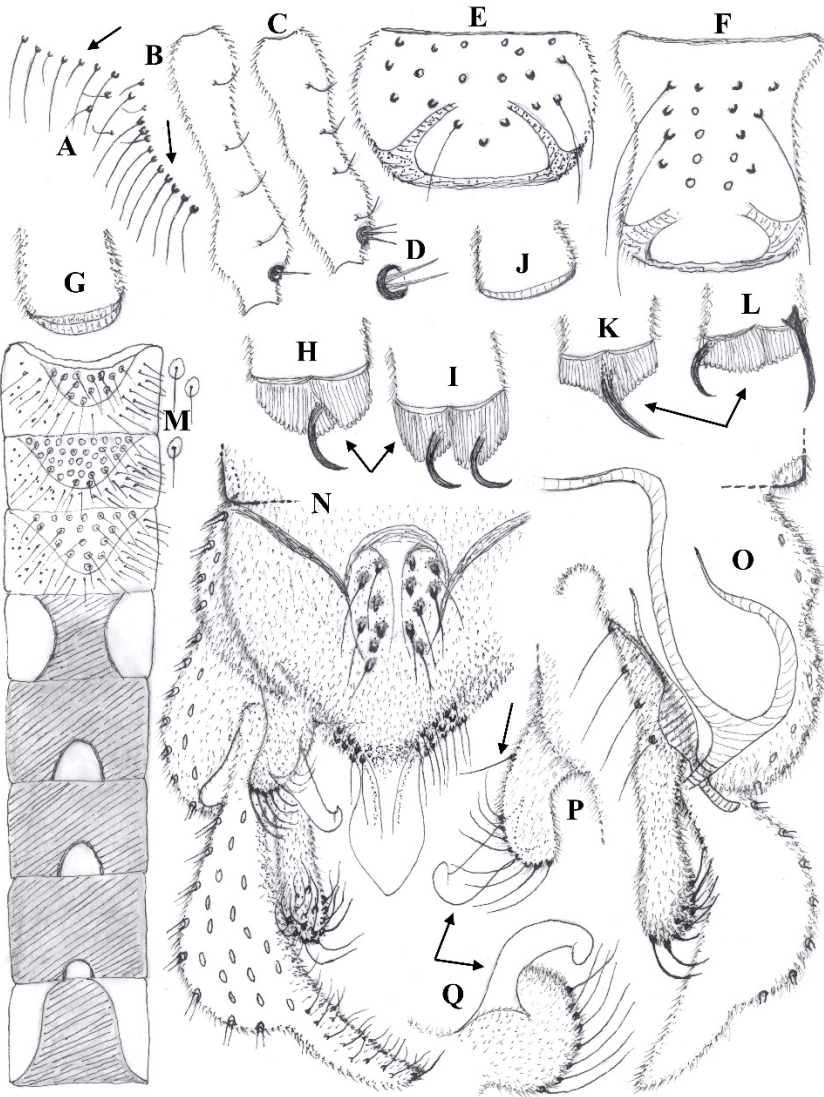


Figure 1. Male imago of *Polypedilum* (Ur.) spp. *P. tissoti* sp. n.: temporal setae, inner verticals (A); palpomere 3 (B). Palpomere 3 of *P. cultellatum* (C). Sensilla coeloconica of *P. convictum* (D). Clypeus of: *P. tissoti* sp. n. (E), *P. cultellatum* (F). *P. tissoti* sp. n.: tibial scale of PI (G), PII (H), PIII (I). *P. cultellatum*: tibial scale of PI (J), PII (K), PIII (L). *P. tissoti* sp. n.: tergites I-VIII with details of chaetotaxy on tergites I-III and spots on tergites IV-VIII (M); hypopygium in dorsal (N) and ventral view (O); superior volsella in ventral (P) and lateral view (Q).

Figure 1. Imago mâle de *Polypedilum* (Ur.) spp. *P. tissoti* sp. n.: soies temporales internes (A); palpomere 3 (B). Palpomere 3 de *P. cultellatum* (C). Sensilla coeloconica de *P. convictum* (D). Clypéus de: *P. tissoti* sp. n. (E), *P. cultellatum* (F). *P. tissoti* sp. n.: apex tibial de PI (G), PII (H), PIII (I). *P. cultellatum*: apex tibial de PI (J), PII (K), PIII (L). *P. tissoti* sp. n.: tergites I-VIII, chaetotaxy et distribution des tâches (M); hypopyge en vue dorsale (N) et ventrale (O); volselle supérieure en vue ventrale (P) et latérale (Q).

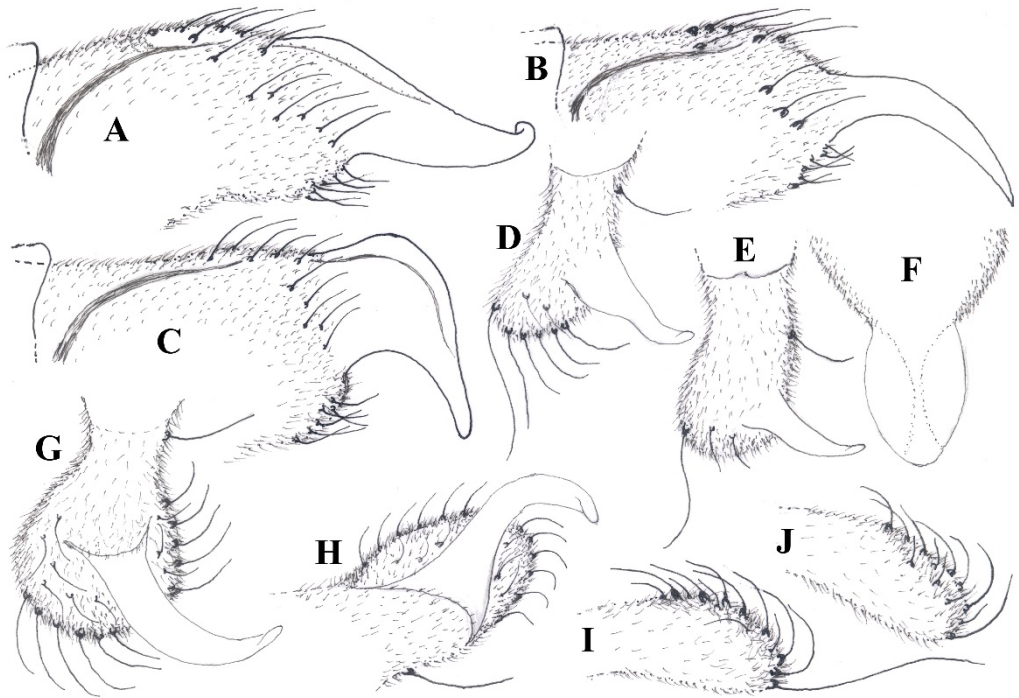


Figure 2. Male imago of *Polypedium (Uresipedilum)* spp. Tergite IX and anal point in lateral view of: *P. tissoti* sp. n. (A); *P. cultellatum* (B); *P. sp. 2* (C). *P. cultellatum*: superior volsella (D). *P. aviceps*: superior volsella (E), anal point (F). *P. sp. 2*: superior volsella in dorsal (G) and lateral view (H). Inferior volsella (lateral view) with setiferous ventral lobe of: *P. cultellatum* (I), *P. tissoti* sp. n. (J).

Figure 2. Imago mâle de *Polypedilum (Ur.)* spp. Tergite IX et pointe anale en vue latérale de: *P. tissoti* sp. n. (A); *P. cultellatum* (B); *P. sp. 2* (C). *P. cultellatum*: volselle supérieure (D). *P. aviceps*: volselle supérieure (E), pointe anale (F). *P. sp. 2*: volselle supérieure en vue dorsale (G) et latérale (H). Volselle supérieure (vue latérale) et lobe sétifère ventral de: *P. cultellatum* (I), *P. tissoti* sp. n. (J).

Anal point (dorsal, Fig. 1N; lateral, Fig. 2A) about 110 μm long, maximum width 65-70 μm medially; in dorsal view (Fig. 1N) is broad and diamond-like shaped, parallel-sided proximally, swollen medially and tapering distally, proximal half bearing a well-developed crest clearly visible when the anal point is viewed laterally (Fig. 2A), 24-26 setae are present, including 18-20 laterally (9-10 on each side) and 6 ventrally; in lateral view (Fig. 2A) its apex is hooked and upwardly projecting. Laterosternite VIII with 6 setae. Apodemes (Fig. 1O), sternapodeme orally projecting, transverse sternapodeme about 90-95 μm long, lateral coxapodeme 170 μm long; phallapodeme 125-130 μm long, linearly elongated except in its median part which is distinctly swollen. Superior volsella in dorsal (Fig. 1N), ventral (Fig. 1P) and lateral view (Fig. 1Q) 50 μm long and 20-25 μm wide; basal part about 85 μm long and 25-30 μm wide, sausage shaped, densely covered with microtrichia, slightly bent outwards distally, bearing 9 setae including 1 inserted proximally and 8 distally; in dorsal view it is evenly wide from base to apex; in lateral view it is protruding and

spherical; apicomedial projection bare, long finger-like and hooked in lateral view (Fig. 1Q), parallel-sided and linearly extended except for the apex which is inwardly bent. Gonocoxite about 215 µm long, 150 µm wide, bearing 11-12 dorsolateral setae; basal inner margin (Fig. 1O) with 4 stout ventral setae. Inferior volsella (dorsal, Fig. 1N; ventral, Fig. 1O; lateral, Fig. 2J) 250 µm long and 25-30 µm maximum width at distal part, with 15-16 dorsolateral setae upwardly and inwardly directed; setiferous ventral lobe (Figs 1O, 2J) with 9-10 setae including 3 located apically and 6-7 laterally. Gonostylus (Figs 1N-O) 250 µm long, 110 µm maximum width (medially) and 25-30 µm wide distally; extremely broadened and bulbous in its median part and abruptly narrowed and tapering distally; distal area with 21-23 curved setae including 12-13 inserted on inner margin.

Pupa and larva: unknown.

Differential diagnosis

P. tissoti sp. n. can be separated from other related members of the subgenus *Uresipedilum* by the following combination of characters:

- distribution of temporals in 2 groups of 2 types of setae (Fig. 1A); differently figured in *P. cultellatum*;
- palpomere 3 with one single pin-like sensilla coeloconica (Fig. 1B), is bearing 3 in *P. cultellatum* (Fig. 2C) and 2 in *P. convictum* (Fig. 2D);
- clypeus nearly semi-circular (Fig. 1E); markedly rectangular in *P. cultellatum*;
- tibial comb of PII-III rounded (Figs 1H-I), is projecting on PII and nearly straight on PIII in *P. cultellatum*;
- tergites I-III and IV-VIII distinctly spotted (Fig. 1M), are unspotted in both *P. cultellatum* and *P. convictum*;
- anal point wide with orally projecting apex (Figs 1N, 2A), while is slender and parallel-sided in *P. cultellatum* (Fig. 2B; ALBU 1980, Fig. 143; ROSSARO 1984, Fig. 10), or ellipsoidal to rectangular in *P. aviceps* (Fig. 2F; Fig. 9, NIITSUMA 1992), *P. paraviceps* (Fig. 18, NIITSUMA 1992) and *P. surugense* (Fig. 11, NIITSUMA 1992);
- base of superior volsella sausage-like, parallel-sided and bearing 9 setae including 1 located anteriorly and 8 posteriorly (Figs 1N, P), with a distinct posterior lobe in *P. cultellatum* (Fig. 2D; LEHMANN 1971, Fig. 38; ALBU 1980, Fig. 143; LANGTON & PINDER 2007, Figs 97 B, 229B), *P. convictum* (Langton & Pinder 2007, Figs 97 A, 229A), and *P. aviceps* (Fig. 2E; NIITSUMA 1992, Figs 9-10; SÆTHER & OYEWO 2008, Figs 7A-B);
- posterior lobe of superior volsella absent (Figs 1N, P); bulbous to spherical in *P. sp. 2* (Figs 2G-H);
- gonostylus strongly swollen medially and abruptly narrowed and tapering distally (Figs 1N-O), is mostly slender in the other species of the subgenus *Uresipedilum*;
- long apical seta on setiferous ventral lobe of inferior volsella absent (Figs 1O, 2J); is present in *P. cultellatum* (Fig. 2I).

Moreover, *P. tissoti* sp. n. can be distinguished from the known European species on the basis of some relevant morphological features, which are summarized in the following key.

Key to male adults of known *Polypedilum* (*Uresipedilum*) species from Europe

1. Anal point broadly ellipsoidal, diamond-like to rectangular, base of superior volsella evenly wide from base to apex, gonostylus extremely broadened medially, abruptly narrowed and tapering distally *P. tissoti* sp. n
- Anal point slender and parallel-sided, base of superior volsella wider apically; gonostylus mostly slender, not tapering distally 2
2. Base of superior volsella with one single long apical seta *P. convictum*
- Base of superior volsella with several subequal apical setae *P. cultellatum*

4. Ecology and geographical distribution

Type material of *P. tissoti* sp. n. was collected by Malaise trap in the alkaline peat bogs and wet sedge meadows of ‘Les Vurpillières’ (Figs 3-4) at the Nature Reserve of Remoray Lake (upper basin of the Doubs River, NE-France). Emergence is recorded from April till early Jun. Associated species encountered in the same localities include: *Procladius signatus* (Zetterstedt, 1850); *Bryophaenocladus flexidens* (Brundin, 1947); *B. scanicus* (Brundin, 1947); *Gymnometriocnemus brumalis* (Edwards, 1929); *Hydrobaenus lugubris* (Fries, 1830); *Limnophyes gelasinus* Sæther, 1990; *L. ninae* Sæther, 1975; *Metriocnemus albolineatus* Meigen, 1818; *M. fuscipes* (Meigen, 1818); *Paraphaenocladus penerasus* Edwards, 1929; *Smittia reissi* Rossaro & Orendt, 2001; *S. remoraya* Moubayed, 2019; *Microtendipes nitidus* (Meigen, 1818); *M. tarsalis* (Walker, 1856); *Polypedilum nubeculosum* (Meigen, 1804); *Micropsectra notescens* (Walker, 1856); *M. pallidula* (Meigen, 1830); *Tanytarsus debilis* (Meigen, 1830).

The new described species is known only from its type locality.

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Figures 3-4. Surrounding habitats where the type material has been captured (photo Bruno Tissot).

Figures 3-4. Habitats où le matériel type a été collecté (cliché Bruno Tissot).