

On the genus *Polypedilum*, subgenus *Pentapedilum* Kieffer, 1912 from New Caledonia. I. Description of three new species occurring in the littoral ecosystem [Diptera, Chironomidae, Chironomini]

by Joel MOUBAYED* & Nathalie MARY**

*Freshwater & Marine biology, 10 rue des Fenouils, F-34070 Montpellier, France
chirojmb@free.fr

**Ethyco, B. P. 13 821, 98803 Nouméa Cedex, Nouvelle-Calédonie
ethyco2005@gmail.com

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Male adult of three new species of *Polypedilum*, subgenus *Pentapedilum* Kieffer, 1912 (*P. aramanus* sp. n., *P. bisetosus* sp. n. and *P. neocaledonicus* sp. n.) is described based on material collected in the down basin of streams and rivers covered by the littoral ecosystem of New Caledonia (Grande Terre, northern part). On the basis of some distinguishing characters, the three new species appear to belong to 3 separate groups of *Pentapedilum* species. The first and second species key near some known species from the Afrotropical, Australasian and Oriental Regions, namely: *P. leei* Freeman, 1961; *P. sordens* (van der Wulp, 1874); *P. uncinatum* (Goetghebuer, 1921); *P. vittatum* (Freeman, 1958); *P. wittei* (Freeman, 1958). Some characters present in *P. neocaledonicus* sp. n. (tergite IX with V-shaped ridges; anal point large, apex truncate in lateral view; superior volsella with a cluster of setae on outer basal side) will key it beside some known species from the above-cited zoogeographical Regions, namely: *P. analis* (Freeman, 1954), *P. convexum* (Johansen, 1932), *P. fanjingensis* Zhang & Wang, 2005; *P. paraconvexum* Zhang & Wang, 2005. The unusual group of outer setae on basal part of superior volsella represents a strong distinctive character to separate *P. neocaledonicus* sp. n. from all other congeners. Worldwide, there are about 60 known valid species, of which *P. convexum*, *P. leei* and *P. nodosum* (Johansen, 1932) are currently reported from Australia. Consequently, the description of *P. aramanus*, *P. bisetosus* and *P. neocaledonicus* spp. n. increases the total number of known species from the Australasian Region to 6. Remarks with differential diagnoses and key to known male adults from New Caledonia are given.

Sur le genre *Polypedilum*, sous-genre *Pentapedilum*, de Nouvelle-Calédonie. I. Description de trois nouvelles espèces connues de l'écosystème littoral [Diptera, Chironomidae, Chironomini]

Mots-clés: Diptera Chironomidae, genre *Polypedilum*, sous-genre *Pentapedilum*, description de 3 spp. n, Nouvelle-Calédonie, conservation.

L'adulte mâle de trois nouvelles espèces appartenant au genre *Polypedilum*, sous-genre *Pentapedilum* Kieffer, 1912 (*P. aramanus*, *P. bisetosus* and *P. neocaledonicus* spp. n.) est décrit à partir d'un matériel collecté dans le bassin inférieur de ruisseaux et rivières délimité par l'écosystème littoral de Nouvelle-Calédonie (Grande Terre, partie nord). Sur la base de certains caractères morphologiques distinctifs, les trois nouvelles espèces semblent appartenir à trois différents groupes du sous-genre *Pentapedilum*. La

première et la seconde sont proches de certaines espèces connues des régions Afrotropicale, Australasiennes et Orientale, notamment: *P. leei* Freeman, 1961; *P. sordens* (van der Wulp, 1874); *P. uncinatum* (Goetgheluwe, 1921); *P. vittatum* (Freeman, 1958); *P. wittei* (Freeman, 1958). Certains caractères présents dans *P. neocaledonicus* sp. n. (tergite IX avec des carènes en forme de V; pointe anale large, apex tronqué en vue latérale; volselle supérieure munie d'un groupe de soies sur son côté extérieur) permettent de la placer à côté de certaines espèces connues des trois régions précédemment citées, en particulier: *P. analis* (Freeman, 1954); *P. convexum* (Johansen, 1932); *P. fanjingensis* Zhang & Wang, 2005; *P. paraconvexum* Zhang & Wang, 2005. L'inhabituel groupe de soies externes sur la volselle supérieure représente un caractère distinctif pertinent pour séparer *P. neocaledonicus* sp. n. de tous ses congénères. Actuellement, près de 60 espèces sont connues au niveau mondial, dont *P. convexum*, *P. leei* et *P. nodosum* (Johansen, 1932) déjà citées d'Australie. Par conséquent, la description de *P. aramanus*, *P. bisetosus* et *P. neocaledonicus* spp. n. porte à 6 le total d'espèces connues de la région Australasienne. Des commentaires sur leur position taxonomique et une clé pour les espèces connues de la région Australasienne sont ajoutés.

1. Introduction

Recent material, composed of male adults, pupae and larvae of Chironomidae (Diptera), was collected by Surber, drift and entomological nets and Malaise traps in the down basin of streams and rivers delimited by the littoral ecosystem of New Caledonia (Grande Terre). Examined male adults captured in the down basin of streams and large rivers, lentic habitats (doline or thinking holes) bordering wetlands, revealed the presence of three new species belonging to the genus *Polypedilum*, subgenus *Pentapedilum*, which are described as: *P. aramanus* sp. n., *P. bisetosus* sp. n. and *P. neocaledonicus* sp. n.

Within the genus *Polypedilum* as for many other listed genera in our paper MOUBAYED-BREIL et al. (2021), there is a large divergence between the number of described species and the estimated number of undescribed species from New Caledonia. Our current knowledge of the specific diversity between the hitherto described species and higher estimated taxa is often poorly known, as are the long taxonomic processes for describing new species. Moreover, there is always an increasing need to assume not only a better knowledge in biodiversity estimates but also in species inventories, as well in description and classification of new species.

As reported in knowledge from the literature (ZHANG & WANG 2005, OYEWO & SÆTHER 2008, YAMAMOTO et al. 2012, etc.), the subgenus *Pentapedilum* is cosmopolitan and almost worldwide distributed. Data on the taxonomy, key for identification, geographical distribution and ecology of the subgenus *Pentapedilum* (JOHANSEN 1932, 1934; TOWNES 1945; FREEMAN 1959, 1961; TOKUNAGA 1964; SHILOVA 1976; ALBU 1980; HASHIMOTO 1983; SASA 1979, 1985, 1989, 1998; FREEMAN & CRANSTON 1980; GUHA & CHAUDHURI 1985; SASA & HASEGAWA 1988; REE & KIM 1988; CRANSTON et al. 1989; SKUSE 1989; REE 1992; SASA & OKAZAWA 1992; CRANSTON 1996; SASA & SUZUKI 2001, 2002; ZHANG & WANG 2005; LANGTON & PINDER 2007; VINOGRADOVA 2008; OYEWO & SÆTHER 2008; YAMAMOTO et al. 2012; SÆTHER & SPIES 2013; SÆTHER et al. 2010; ANDERSEN et al 2015; SPIES & DETTINGER-KLEMM 2015; EKREM & STUR 2016; MOUBAYED-BREIL et al. 2021; CORNETTE et al. 2022), show that there are worldwide about 60 known valid species, of which only 3 were reported from Australia: *P. convexum* (Johansen, 1932), *P. nodosum* (Johansen, 1932) and *P. leei* Ferrington & Sæther 2011. Consequently, the descriptions of *P. aramanus* sp. n., *P. bisetosus* sp. n. and *P. neocaledonicus* increase the total number of known valid species in the subgenus *Pentapedilum* to 6 from the Australasian

Region. Remarks with differential diagnosis and key to known male adults from New Caledonia are given.

2. Material and methods

The described male adults were collected exclusively by swift and Surber nets located along the most representative habitats of New Caledonia. Preserved male adults in 80% ethanol, were 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 specimens 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. Morphological terminology and measurements follow those of SÆTHER (1980) and LANGTON & PINDER (2007).

3. Results and descriptions

Polypedilum (Pentapedilum) aramanus sp. n.

Material examined.

Holotype. New Caledonia, Arama Captage stream. 1 male adult captured by swift net in the stream of Arama Captage, northern New Caledonia (164°12'04.1371"E; 20°16'16.3117"S); rhithral with lentic and riparian habitats bordering the down basin (Photo 1); site N° 5 as reported in MOUBAYED-BREIL et al. 2021 (table VI); altitude 53 m; 16.XI.2012 (N. Mary leg).



Photo 1. Type-locality of *Polypedilum (Pentapedilum) aramanus* sp. n. (photo N. Mary 16.XI.2012).

Photo 1. Localité type de *Polypedilum (Pentapedilum) aramanus* sp. n. (cliché N. Mary 16.XI.2012).

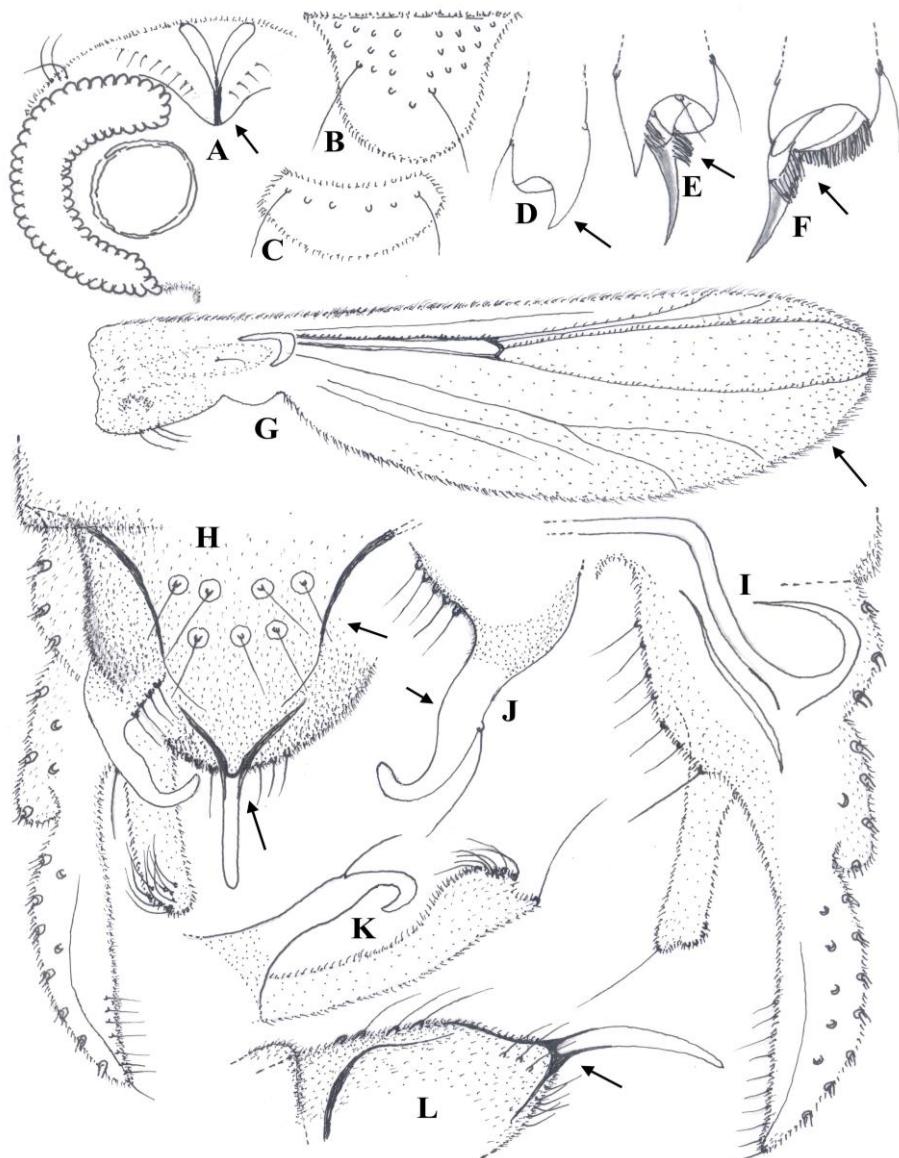


Figure 1. Male imago of *Polypedilum (Pe.) aramanus* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); clypeus (B); scutellum (C); tibial scale of PI (D), PII (E) and PIII (F); wing (G); hypopygium in dorsal (H) and ventral view (I); superior volsella, right (J); anal point and inferior volsella, lateral (K); tergite IX and anal point, lateral (L). The arrows indicate some distinctive characters.

Figure 1. Imago mâle de *Polypedilum (Pe.) aramanus* sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex et soies temporales (A) ; clypéus (B) ; scutellum (C) ; éperon tibial de PI (D), PII (E) et PIII (F) ; aile (G) ; hypopyge en vues dorsale (H) et ventrale (I) ; volselle supérieure, droite (J) ; pointe anale et volselle inférieure en vue latérale (K) ; tergite IX et pointe anale, vue latérale (L). Les flèches indiquent quelques caractères distinctifs.

Paratype. 1 male adult, same locality and date as for holotype (leg N. Mary).

Holotype (mounted on one slide) is deposited in the collections of the ‘Musée cantonal de Zoologie, Palais de Rumine, 6 place de la Riponne, CH-1014 Lausanne (MZL), Switzerland’. The paratype is deposited in the collection of the senior author.

Etymology: the name “*aramanus*” of the new species refers to the River Arama, which is located in northern area of New Caledonia.

Male adult

(n = 2), Figs 1A-L

Diagnostic characters

Head. Antenna 13-segmented, 590 µm long, last flagellomere 230 µm long not clubbed, AR 0.64; clypeus cup-like with 23 setae. Thorax. Lobes of antepronotum not gaping; acrostichals 18 all decumbent. Wing. All cells covered with dense microtrichia; squama with 2-3 setae. Legs. Tibial scale of PI pointed apically, tibial spurs on PII-III well-developed; sensilla chaetica present on tarsomeres. Abdomen. Tergite IX with 7 dorsal decumbent setae located in 2 transverse characteristic rows; anal tergite band interrupted on posteromedian part. Anal point linear, basal part enlarged, distal part parallel-sided; lateral margins with sclerotization at base, ventrolateral margins of basal part with 18 setae (6 lateral and 12 ventral). Laterosternite IX with 6 setae. Superior volsella with 4-5 inner setae at base; projection distinctly swollen medially, apex markedly projecting orally, with 1 lateral seta on outer median part. Inferior volsella linear, parallel-sided, apex bilobed. Gonocoxite well-developed, with 7 inner setae, lateral expansion present. Gonostylus swollen medially, with thin needle-like setae on inner distal margin.

Description

Small sized species. Total length 1.75 mm. Wing length 0.46 mm, TL/WL = 3.70. General colouration brownish with brownish to dark brown thorax. Antenna brownish; thorax contrasting brown to dark brown; mesonotal stripes dark brown; wing pale, unmarked; legs brownish. Abdomen brownish without spots; anal segment contrasting brown to dark brown; anal tergite bands and base of anal point blackish.

Head (Fig. 1A). Eyes bare; frontal tubercles absent, frontal margin rounded; coronal triangle much thicker at base; temporals 11 including 8 inner and 3 outer verticals. Antenna 590 µm long; ultimate flagellomere 230 µm long, not clubbed, sensilla chaetica weakly-developed; antennal groove beginning on segments 2/3; AR 0.64. Clypeus (Fig. 1B) cup-like 85 µm long, 105 µm maximum width, with 23 setae in 5 rows. Palp (paratype) 5-segmented, first and second segments fused; length (µm) of palpomeres: 20, 25, 55, 75, 125; palpomere 3 with sensilla clavata, sensilla coeloconica absent.

Thorax. Lobes of antepronotum not gaping, lateral antepronotals 5; acrostichals 18 (all decumbent), located close to scutum in 2 rows; dorsocentrals 21 in 1-2 rows; prealars 5 uniserial; scutellum (Fig. 1C) with 6 setae in 1 row (3 on each side of the midline). Wing (Fig. 1G). Brachiolium with 1 seta; subcosta overreaching fork of radius. Number of setae on veins: R, 40; R₁, 17-20; R₄₊₅, 75; M₁₊₂, 55; remaining veins bare. All cells covered with macrotrichia (about 550): r₂₊₃, 15-17; r₄₊₅, 150; m₁₊₂, about 150; m₃₊₄, 60; cu + an, 150; squama with 2-3 setae in 1 row. Legs. Tibial scale on PI (Fig. 1D), broadly triangular, pointed apically; comb and spurs on PII-PIII as in Figs 1E-F; sensilla chaetica present on: tarsomeres ta₁-ta₅ of PI and PII, tarsomeres ta₂-ta₃ of PIII. Length (in µm) and proportions of legs (n=1, paratype) as in the following table:

	fe	ti	ta₁	ta₂	ta₃	ta₄	ta₅	LR	BV	SV	BR
PI	470	280	455	315	210	105	70	1.63	1,72	1,65	2.80
PII	545	450	225	145	95	65	55	0,50	3,39	4,42	2.20
PIII	535	380	280	165	115	80	45	0,74	2,96	3,21	2.30

“ 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.”

Abdomen. Hypopygium in dorsal and ventral view as in Figs 1H-I: dorsal (Fig. 1H); ventral view (Fig. 1I) with tergite IX and anal point omitted. Tergite IX 150 µm long, 125 µm maximum width, broadly sub-rectangular in basal and median part, posterior part semi-circular, dorsal hump absent; anal tergite bands (ATB) extended from basal angle to median area, thicker at base, tapering and abruptly interrupted at postero-median area; dorsal side with 7 typically decumbent setae located antero-medially in 2 specific transverse rows. Anal point (Figs 1H, L), dorsal (Fig. 1H), lateral (Fig. 1L), about 60 µm long, 50 µm maximum width at base; basal part enlarged, distal part linear and parallel-sided, about 35 µm long and 5 µm maximum width; lateral margins with sclerotization at base; ventrolateral margins of basal part with 18 setae including 6 lateral (3 on each side) and 12 ventral (6 on each side). Laterosternite IX with 6 setae (3 on each side). Apodemes (Fig. 1I), sternapodeme not projecting, nearly straight; phallapodeme linear, lateral expansion absent. Superior volsella (Figs 1H, J-K), 30 µm long, basal portion with 4-5 inner setae, covered with microtrichia; projection distinctly swollen medially, with 1 lateral seta located on outer median part; apical part markedly projecting orally clearly visible in Fig. 1K. Inferior volsella (Figs 1H-I, K), 125 µm long; apical part bilobed (clearly visible when viewed laterally as in Fig. 1K), with 8-9 dorsal stout curved setae; ventral side with 1 long apical seta, setiferous ventral lobe weak. Gonocoxite 55 µm long, lateral caudal expansion present, bearing 5 dorsolateral setae; basal inner margin (Fig. 1I) with 7 stout setae, caudal one stouter and longer. Gonostylus (Figs 1H-I, K) 105 µm long, swollen medially; inner distal margin with thin and needle-like setae located on dorsal and ventral sides. HR 0.52; HV 1.67.

Female adult, pupa and larva: unknown.

Polypedilum (Pentapedilum) bisetosus sp. n.

Material examined.

Holotype. New Caledonia, Pouembout stream. 1 male adult captured by swift net in some riparian habitat with wet soils and grasses surrounding the estuarine zone of the River Pouembout (Photo 2); 164°51'40.16"E / 21°08'33.42"S; altitude 5 m; 17.X.1997 (N. Mary leg.)

Paratype (leg. N. Mary). 1 male adult, same locality and date as for holotype. 1 male adult, Kwé Néco stream at Thio village, site n° 41 in MOUBAYED-BREIL et al. 2021 (Table VI); alt. 117 m, 20.XI.1999.

Holotype (mounted on one slide) is deposited in the collections of the ‘Musée cantonal de Zoologie, Palais de Rumine, 6 place de la Riponne, CH-1014 Lausanne (MZL), Switzerland’. The paratypes are deposited in the collection of the senior author.

Etymology: the name “*bisetosus*” of the new species refers to the atypical distribution pattern of the two inner stout setae on ventral basal part of gonocoxite.



Photo 2. Type-locality of *Polypedilum (Pentapedilum) bisetosus* sp. n. (photo N. Mary 02.XI.2021).

Photo 2. Localité type de *Polypedilum (Pentapedilum) bisetosus* sp. n. (cliché N. Mary 02.XI.2021).

Male adult

(n = 2), Figs 2A-L

Diagnostic characters

The closest species to *P. bisetosus* sp. n. is *P. leei*, which is reported from Australia by FREEMAN (1961). However, the new species can be separated from *P. leei* and other members of the subgenus *Pentapedilum* by a combination of distinguishing characters. Head. Base of coronal triangle strongly concave; antenna 1225 µm long, last flagellomere 670 µm long, AR 1.22; clypeus rectangular, with 16 setae. Thorax. Lobes of antepronotum not gaping; acrostichals 13, located close to scutum, all decumbent including 12 thicker and 1 thinner; dorsocentrals 14 including 12 decumbent; prealars 4; scutellum with 7 setae. Wing. Only cells r_{4+5} , m_{1+2} , m_{3+4} and an covered with microtrichia; squama with 7-8 setae. Legs. Tibial scale of PI pointed apically, tibial spurs on PII-III well-developed; sensilla chaetica present on tarsomeres. Abdomen. Tergite IX with 8 dorsal setae; anal tergite band interrupted at caudal part. Anal point nearly parallel-sided in dorsal view; distal half curved downwards with truncate apex when viewed laterally; ventrolateral margins of basal part with 18 setae (8 lateral, 10 ventral). Laterosternite IX with 10 setae. Superior volsella with 5 inner setae at base, base without microtrichia; projection distinctly straight, narrowing towards apex, apical part slightly curved upwards, with 1 lateral seta on outer basal part. Inferior volsella linear, apex pointed dorsally, rounded ventrally. Gonocoxite with 3 characteristic inner setae (2 thinner, proximal; 1 stouter, caudal), inner proximal half with sclerotization. Gonostylus swollen medially, with thin needle-like setae on inner distal margin.

Description

Medium to big sized species. Total length 2.90 mm. Wing length 1.25 mm, TL/WL = 2.32. General colouration brownish in general, with contrasting brown to dark brown thorax. Antenna brownish; mesonotal stripes dark brown; wing pale brown; legs brownish. Abdomen brown to dark brown; anal segment contrasting brown to dark brown; anal tergite bands blackish.

Head (Fig. 2A). Eyes bare; frontal tubercles absent, basal margin of frontal area with a characteristic concavity; coronal triangle well-developed, V-shaped basally; temporals 10 including 6 inner and 4 outer verticals. Antenna 1225 µm long; last flagellomere 750 µm long, weakly clubbed, pre-apical sensilla chaetica weakly-developed; antennal groove beginning on segments 2/3; AR 1.22. Clypeus (Fig. 2B) rectangular 75 µm long, 65 µm wide, with 16 setae in 4 rows. Palp (paratype) 5-segmented, first and second segments fused; length (µm) of palpomeres: 25, 35, 65, 85, 145; palpomere 3 with sensilla clavata, sensilla coeloconica absent.

Thorax. Lobes of antepronotum not gaping, lateral antepronotals 3; acrostichals 13, located close to scutum, all decumbent including 12 thicker and 1 thinner; dorsocentrals 14 including 12 decumbent; prealars 4 uniserial; scutellum (Fig. 2C) with 7 setae located in caudal pattern, median seta much stouter. Wing (Fig. 2G). Brachiolum with 1 seta; subcosta overreaching fork of radius; number of setae on veins: R, 17; R₁, 11; R₄₊₅, 33; M₁₊₂, 45; M₃₊₄, 9; fork rm with 2 characteristic setae; remaining veins bare. Cells m₁₊₂, m₃₊₄ and an, covered with microtrichia (about 170); distribution pattern on: m₁₊₂, linear; squama with 7-8 setae in 2 rows. Legs. Tibial scale of PI (Fig. 2D) pointed apically, tibial spurs on PII-III (Figs 2D-E) well-developed; sensilla chaetica present on: tarsomeres ta₁-ta₅ of PI and PII, tarsomeres ta₂-ta₃ of PIII. Length (in µm) and proportions of legs (n = 1, paratype) as in the following table:

	fe	ti	ta₁	ta₂	ta₃	ta₄	ta₅	LR	BV	SV	BR
PI	520	325	515	315	210	135	90	1,58	1,81	1,64	3.0
PII	565	515	310	285	125	85	55	0,60	2,53	3,48	2.10
PIII	555	525	285	220	165	105	65	0,54	2,46	3,79	2.0

Abdomen. Hypopygium in dorsal and ventral view as in Figs 2H-I: dorsal (Fig. 2H); ventral view (Fig. 2I) with tergite IX and anal point omitted. Tergite IX about 80 µm as long as wide, proximal half broadly sub-rectangular, distal half narrowing, dorsal hump absent; anal tergite bands (ATB) extended from basal angle to caudal area, much thicker at base, abruptly interrupted posteriorly; dorsal side with 8 not decumbent setae, located antero-medially between the ATB. Anal point (Figs 2H, K-L), dorsal (Fig. 2H), lateral (Fig. 2K-L), about 40 µm long, about 5 µm maximum width; parallel-sided; distal half distinctly curved downwards with truncate apex when viewed laterally as in Figs 2K-L; ventrolateral margins of basal part with 18 setae including 8 lateral (4 on each side) and 10 ventral. Laterosternite IX with 10 setae (5 on each side). Apodemes (Fig. 2I), sternapodeme linear, nearly straight, lateral expansion absent; phallapodeme linearly elongate. Superior volsella (Figs 2H, J), 55 µm long; basal portion with 5 inner setae, without microtrichia; projection 25 µm long 5 µm maximum width medially, distinctly straight and narrowing distally, with 1 lateral seta (20 µm long) located on outer basal part; apical part markedly projecting orally clearly visible in Figs 2H, J. Inferior volsella (Figs 2H-I), 70 µm long; apical part rounded, with 6-7 dorsal stout curved setae, caudal one distinctly projecting outwards; ventral side (Fig. 2I), setiferous ventral lobe with 2 short apical bristle-like setae. Gonocoxite 40 µm long, lateral caudal expansion well-developed, bearing 5 dorsolateral setae on each side; basal inner margin (Fig. 2I) atypically with 3 stout setae including 2 thinner (proximal) and 1 much stouter and longer (caudal), inner proximal half with sclerotization. Gonostylus (Figs 1H-I) 85 µm long, swollen medially; inner distal margin with about 10 thin and needle-like setae located on dorsal and ventral sides. HR 0.50; HV 3.41.

Female adult, pupa and larva: unknown.

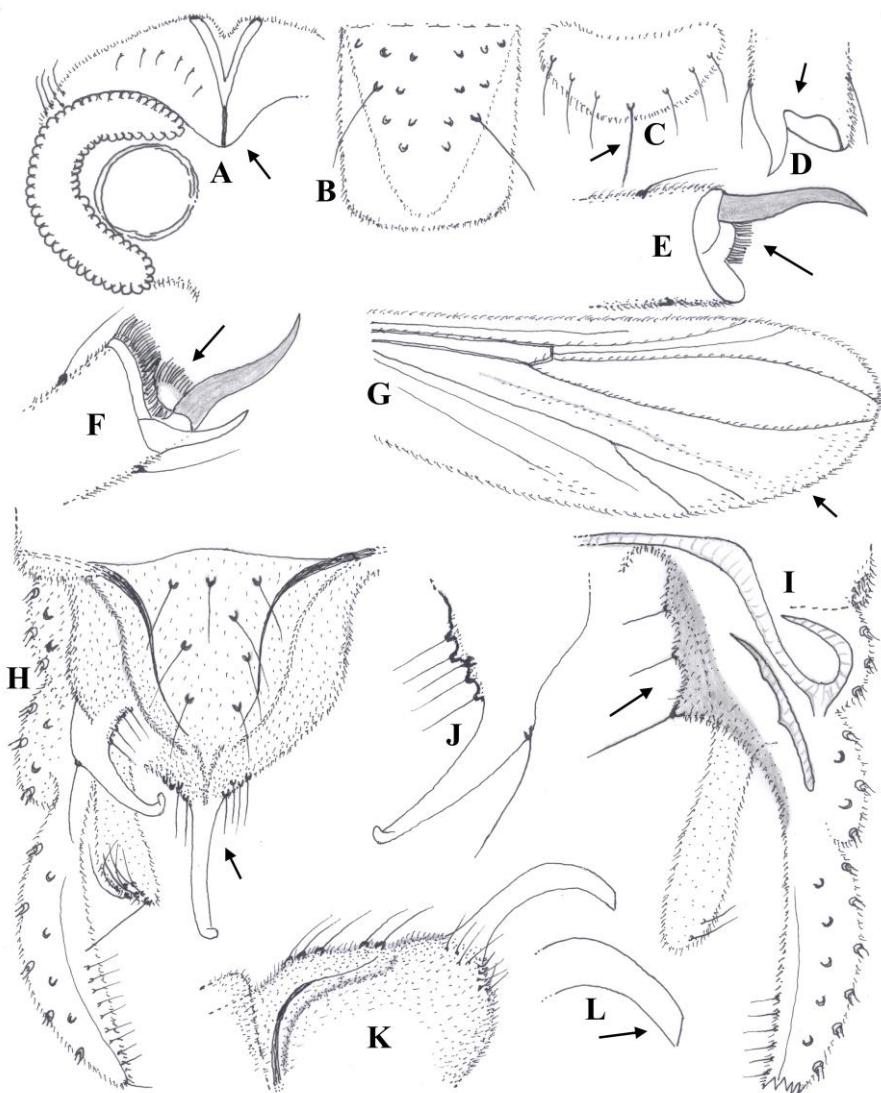


Figure 2. Male imago of *Polypedilum (Pe.) bisetosus* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); clypeus (B); scutellum (C); tibial scale of PI (D), PII (E) and PIII (F); wing, distal half (G); hypopygium in dorsal (H) and ventral view (I); superior volsella, right side (J); tergite IX and anal point, lateral (K); distal part of anal point, lateral (L). The arrows indicate some distinctive characters.

Figure 2. Imago mâle de *Polypedilum (Pe.) bisetosus* sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex, et soies temporales (A) ; clupéus (B) ; scutellum (C) ; éperon tibial de PI (D), PII (E) et PIII (F) ; aile, moitié distale (G) ; hypopyge en vues dorsale (H) et ventrale (I) ; volselle supérieure, côté droit (J) ; tergite IX et pointe anale, vue latérale (K) ; pointe anale, partie distale en vue latérale (L). Les flèches indiquent quelques caractères distinctifs.

Polypedilum (Pentapedilum) neocaledonicus sp. n.

Material examined

Holotype. New Caledonia. 1 male adult captured by swift net around Saraméa stream, at Saraméa Captage ($165^{\circ}51'52.20"E$; $21^{\circ}38'14.64"S$); lotic and lentic habitats with riparian aquatic plants surrounding the down basin of Saraméa stream (Photo 3); site 39 as reported in MOUBAYED-BREIL et al. 2021 (table VI); alt. 144 m; 09.XI.2012 (N. Mary leg.).

Paratype (leg. N. Mary). 1 male pharate adult, same locality and date as for holotype.

Holotype (mounted on one slide) is deposited in the collections of the ‘Musée cantonal de Zoologie, Palais de Rumine, 6 place de la Riponne, CH-1014 Lausanne (MZL), Switzerland’. The paratype is deposited in the collection of the senior author.

Etymology: the name “*neocaledonicus*” of the new species refers to the Island of New Caledonia.

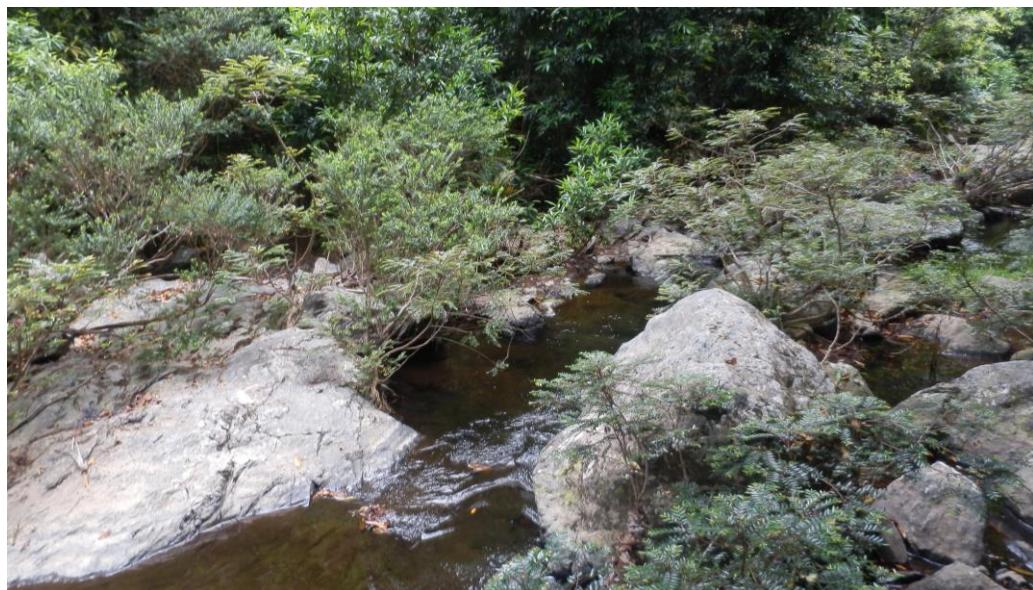


Photo 3. Type-locality of *Polypedilum (Pentapedilum) neocaledonicus* sp. n. (photo N. Mary 09.XI.2012).

Photo 3. Localité type de *Polypedilum (Pentapedilum) neocaledonicus* sp. n. (cliché N. Mary 09.XI.2012).

Male adult

(n = 2), Figs 3A-M

Diagnostic characters

Based on common morphological characters (tergite IX with V-shaped ridges, anal point very large, etc.), *P. neocaledonicus* sp. n. is placed close to some known species from the Afrotropical, Oriental and Australasian Regions, namely: *P. analis*, *P. convexum*, *P. fanjingensis* and *P. paraconvexum*. However, the unusual group of setae on outer basal part of superior volsella, combined to the following distinguishing characters will separate the new species from all other congeners. Head. Coronal triangle thick, U-shaped; temporals 10; antenna 965 µm long, last flagellomere 495 µm long, AR 1.05; clypeus rectangular, with 14 setae. Thorax. Acrostichals 14; dorsocentrals 11 not decumbent; scutellum with 6 setae. Wing. Microtrichia restricted

only to distal part of cells r_{4+5} and m_{1+2} ; squama with 7-8 setae. Legs. Tibial scale of PI pointed apically. Abdomen. Tergite IX sub-rectangular with semicircular distal half, with 11 dorsal not decumbent setae; anal tergite band interrupted on median part; posterior part with 4-5 typical V-shaped ridges. Anal point broadly large and cylindrical, dorsal plate with rounded apex, bearing 2 distinct basal V-shaped ridges; distal half slightly curved downwards, with truncate apex when viewed laterally; ventrolateral margins of basal part with 16 setae (8 lateral, 4 on each side; 6 ventral). Laterosternite IX with 4 setae. Superior volsella with lateral setae atypically located on outer side of basal part; projection distinctly sickle shaped, lacking lateral seta, apical part pointed. Inferior volsella with 1 apical long seta. Gonocoxite with 5 inner setae at basal part (4 thin, proximal; 1 stouter, caudal), lateral expansion well-developed. Gonostylus slightly swollen medially, with 10 thin needle-like setae on inner distal margin.

Description

Medium to big sized species. Total length 3.10 mm. Wing length 1.52 mm, TL/WL = 2.04. General colouration brownish in general, with contrasting brown to dark brown thorax. Antenna brownish; mesonotal stripes dark brown; wing pale brown; legs brownish. Abdomen brown to dark brown; anal segment contrasting brown to dark brown.

Head (Fig. 3A). Eyes bare; frontal area without tubercles, basal margin rounded; coronal triangle U-shaped, markedly thick; temporals 10 including 7 inner and 3 outer verticals. Antenna (paratype) 965 µm long; last flagellomere 495 µm long, weakly clubbed; antennal groove beginning on segments 2/3; AR 1.05. Clypeus (Fig. 3B) rectangular 85 µm long, 75 µm wide, with 14 setae in 2 rows. Palp (paratype) with first and second segments fused; length (µm) of palpomeres: 35, 45, 85, 115, 185; palpomere 3 with sensilla clavata, sensilla coeloconica absent. Thorax. Lobes of antepronotum not gaping, thinner basally, lateral antepronotals 3; acrostichals 10, all decumbent, located close to scutum; dorsocentrals 11, not decumbent in 1-2 rows; prealars 5 uniserial; scutellum with 6 setae uniserial. Wing (Fig. 3F). Brachiolum with 1 seta; subcosta overreaching fork of radius; number of setae on veins: R, about 40; R_{1+2} , about 80; R_{4+5} , up to 100; remaining veins bare. Microtrichia (about 120) present only on distal part of cells r_{4+5} and m_{1+2} ; squama with 7-8 setae. Legs. Tibial scale of PI (Fig. 3C) rounded apically, tibial spurs on PII-III (Figs 3D-E) well-developed; sensilla chaetica present on tarsomeres. Length (in µm) and proportions of legs ($n = 1$, paratype) as in the following table:

	fe	ti	ta₁	ta₂	ta₃	ta₄	ta₅	LR	BV	SV	BR
PI	790	920	1225	70	545	330	145	1,33	2,69	1,40	3.20
PII	845	760	475	360	285	215	85	0,63	2,20	3,38	4.10
PIII	820	625	435	425	355	240	80	0,70	1,71	3,32	3.00

Abdomen. Hypopygium in dorsal and ventral view as in Figs 3I-J: dorsal (Fig. 3I); ventral view (Fig. 3J) with tergite IX and anal point omitted. Tergite IX broadly sub-rectangular, distal half nearly semi-circular; dorsal hump (Fig. 3G) present on proximal dorsal part; anal tergite bands (ATB, Figs 3G-H) extended from basal angle to anteromedian area, much thicker at base, abruptly interrupted towards caudal part; dorsal side with 11 not decumbent setae, located antero-medially between the ATB. Anal point (Figs 3G-I, L), lateral (Figs 3G-H), dorsal (Fig. 3I), ventral (Fig. 3L), 75 µm long, 45-50 µm maximum width; broadly cylindrical; dorsal plate rounded apically; distal half distinctly curved downwards with truncate apex, when viewed laterally as in Figs 3G-H; ventrolateral margins of basal part with 20 setae including 8 lateral (4 on each side) and 12 ventral.

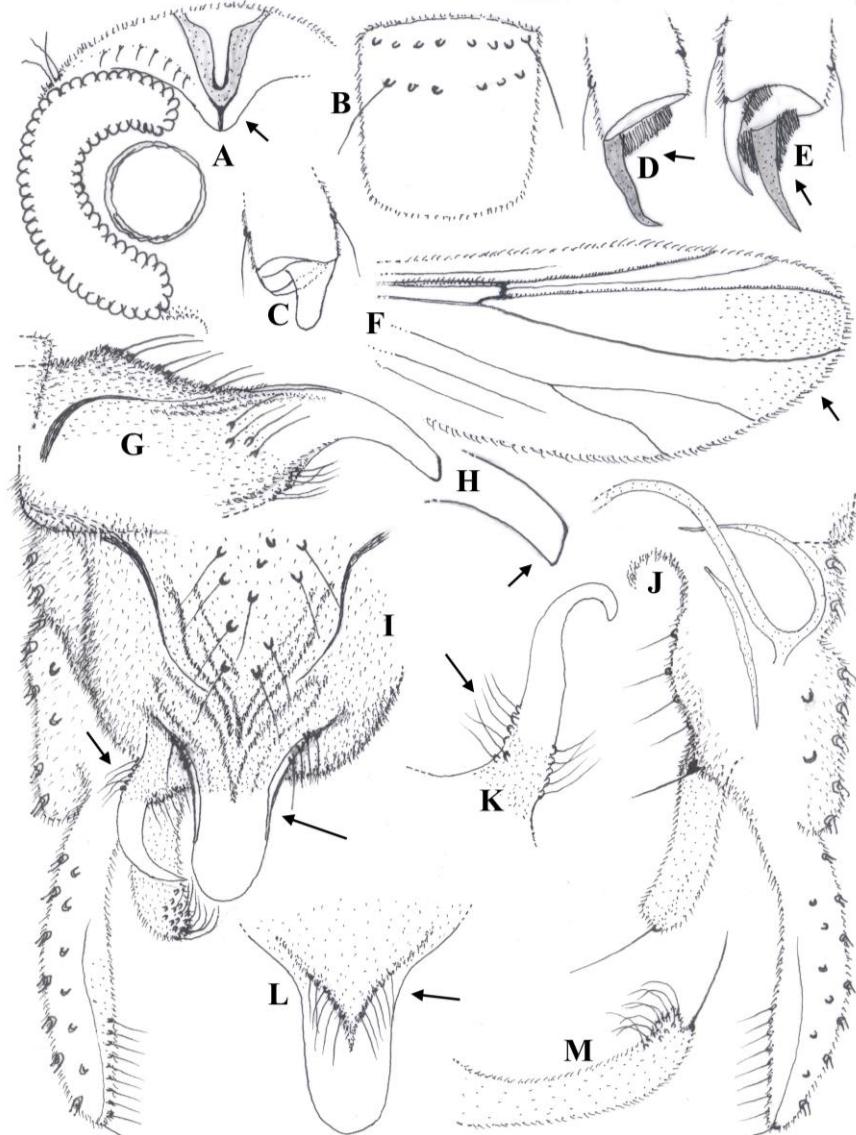


Figure 3. Male imago of *Polypedilum (Pe.) neocaledonicus* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); clypeus (B); tibial scale of PI (C), of PII (D) and PIII (E); wing, distal half (F); tergite IX and anal point, lateral (G); anal point, distal part (H); hypopygium in dorsal (I) and ventral view (J); superior volsella, lateral (K); anal point, ventral view (L); inferior volsella, lateral (M). The arrows indicate some distinctive characters.

Figure 3. Imago mâle de *Polypedilum (Pe.) neocaledonicus* sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex, et soies temporales (A); clypéus (B); éperon tibial de PI (C), PII (D) et PIII (E) ; aile, moitié distale (F) ; tergite IX et pointe anale, vue latérale (G) ; pointe anale, partie distale en vue latérale (H) ; hypopyge en vue dorsale (I) et ventrale (J) ; volselle supérieure, vue latérale (K) ; pointe anale, vue ventrale (L) ; volselle inférieure, vue latérale (M). Les flèches indiquent quelques caractères distinctifs.

Laterosternite IX with 4 setae (2 on each side). Apodemes (Fig. 3J), sternapodeme rounded, orally projecting, lateral expansion absent; phallapodeme linear. Superior volsella (Figs 3I, K; 3I, dorsal; 3K lateral); basal portion covered with microtrichia, outer side atypically with a cluster of 6 setae, inner side with 5 setae; projection distinctly sickle shaped, bare and sharply pointed apically. Inferior volsella (Figs 3I-j, M), 90 µm long; apical part rounded dorsally, bilobed laterally, with 14-15 dorsal stout curved setae, all distinctly projecting inwards; ventral side (Fig. 3J), setiferous ventral lobe with 1 long apical seta. Gonocoxite 75 µm long, basal inner margin (Fig. 3J) with 5 stout setae including 4 thinner (proximal) and 1 much stouter and longer (caudal), dorsolateral part with 6 setae on each side, lateral caudal expansion well-developed. Gonostylus (Figs 3I-J) 95 µm long, 35 µm maximum width, swollen medially; inner distal margin with about 9 thin and needle-like setae located on dorsal and ventral sides. HR 0.42; HV 3.26.

Female adult, pupa and larva: unknown.

4. Differential diagnosis

Based on some common morphological characters found in the male adult, *P. aramanus* sp. n. and *P. bisetosus* sp. n. show some resemblance with other known species from the Afrotropical, Australasian and Oriental Regions, namely: *P. leei* Freeman, 1961; *P. sordens* (van der Wulp, 1874); *P. uncinatum* (Goetghebuer, 1921); *P. vittatum* (Freeman, 1958); *P. wittei* (Freeman, 1958). Nevertheless, *P. neocaledonicus* sp. n. appears to belong to a separate group of species.

Some characters present in *P. neocaledonicus* sp. n. (tergite IX with V-shaped ridges, anal point very large, etc.) will key it beside some known species from the above-cited three zoogeographical Regions, namely: *P. anale* (Freeman, 1954), *P. convexum* (Johansen, 1932), *P. fangjingsensis* Zhang & Wang, 2005; *P. paraconvexum* Zhang & Wang, 2005. Moreover, the presence of unusual cluster of setae on outer lateral side of basal portion of superior volsella is considered as a strong distinctive character to separate the new species from all other congeners.

The knowledge and revisions worldwide from the literature of the subgenus *Pentapedilum* including the recent descriptions, show that there are about 60 known valid species of which *P. convexum*, *P. leei* and *P. nodosum* are currently reported from Australia. Consequently, the description of *P. aramanus* sp. n., *P. bisetosus* sp. n. and *P. neocaledonicus* sp. n. increases the total number of species to 6 from the Australasian Region.

Accordingly, the three new species appear to belong to local biogeographic representatives of New Caledonia and the Australasian Region. Nevertheless, a combination of the relevant distinguishing characters are also highlighted in the following key to known male adult of *Pentapedilum* species from New Caledonia.

Key to known male adult of *Polypedilum*, subgenus *Pentapedilum* from New Caledonia

1. Superior volsella with a cluster of lateral setae on both inner and outer sides of basal portion (Fig. 3H, J); anal point broadly large, ellipsoid shaped (Fig. 3H, K), ridges distinctly V-shaped at proximal and basal parts; apex rounded in dorsal and ventral view (Figs 3I, L), truncate laterally (Figs 3G-H); macrotrichia restricted to the distal part of cells r_{4+5} and m_{1+2} *P. (Pe.) neocaledonicus* sp. n.

- Superior volsella with lateral setae only on inner side of basal portion (Figs 1H, J; 2H, J); anal point slender, parallel-sided (Figs 1H; 2H); macrotrichia distributed otherwise 2

2. Tergite IX with 7 decumbent setae in 2 transverse rows (Fig. 1H); basal part of anal point with sclerotization (Figs 1H, L); macrotrichia present on all cells (Fig. 1G); superior volsella swelling medially (Figs 1H, J-K); basal inner margin of gonocoxite with 7 setae including 1 stoutest located caudally (Fig. 1I) *P. (Pe.) aramanus* sp. n.
- Tergite IX with 7 not decumbent setae (Fig. 2H); basal part of anal point without sclerotization; macrotrichia present distally on cells r_{4+5} , m_{1+2} , m_{3+4} and a_n (Fig. 2G); superior volsella not swelling medially (Figs 2H, J); basal inner margin of gonocoxite with only 3 setae including 1 stoutest located caudally (Fig. 2I) *P. (Pe.) bisetosus* sp. n.

5. Ecology and geographical distribution

Type material of *P. aramanus* sp. n., *P. bisetosus* sp. n. and *P. neocalledonius* sp. n. was collected along the middle and down basins of three streams located in northern areas of New Caledonia: Arama Captage, Pouembout and Saraméa Captage. Pristine aquatic habitats enriched in organic matters (Photos 1-3), include emerged and submerged plants, stones and gravelly substrata covered with bryophytes and microalgae, which represent the most favourite microhabitats for the larval populations. Emergence of adults is recorded from October to November. Although the three new described species are currently known only from their type localities, their geographical distribution is likely believed to be more widespread in similar aquatic habitats over the coastal ecosystem of New Caledonia.

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