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On the genus *Allocladius* Kieffer, 1913 from New Caledonia. I. Description of *A. barendeunus*, *A. dumbeanus* and *A. panienus* spp. n. [Diptera, Chironomidae, Orthocladiinae]

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Recent material, composed of male adults, pupae and larvae of chironomids, collected by swift, drift and entomological nets and Malaise traps in some riparian and semiterrestrial habitats bordering wetlands delimited by the littoral ecosystem of New Caledonia (Grande Terre), revealed the presence of three new *Allocladius* species (*A. barendeunus*, *A. dumbeanus* and *A. panienus* spp. n.). *A. barendeunus* keys close to *A. wirthi* (Freeman, 1961), *A. azoricus* (Stora, 1945), *A. deborae* Ferrington & Sæther, 2011 and *A. bothnicus* (Tuiskunen, 1984), which are members of both *fortispinatus*-gr and *longicrus*-gr. However, it is distinguished from the latter species by having: - in the male adult (apical seta on antenna absent, terminal segment 85 µm long, AR 0.30; anal point triangular; virga filiform, worm shaped; pars ventralis tongue shaped; inferior volsella single, located distally, large lobe-like, swollen medially, projecting distally, median area bare; crista dorsalis pointed tooth-like); - in the pupal exuviae (transparent to pale brown; thorax with 2 lateral antepronotals and 2 median antepronotals; row of spines present anteriorly on segments III-VI and posteriorly on segments III-VIII; conjunctives with rows of spinules present on tergites III/IV to VI/VII and sternites II/III to IV/V; macrosetae lanceolate). Distinctive characters of *A. dumbeanus* sp. n. (antenna with 1 apical seta; palpomere 3 with 1 needle-like sensilla coeloconica; anal point triangular, apex sharply pointed; virga mushroom-like with 1 caudal teat-like spine; pars ventralis tongue shaped; superior volsella absent; inferior volsella double, dorsal side triangular, accessory lobe long pouch shaped; gonostylus massive distally; crista dorsalis on distal half, prominent apically) will easily distinguish it from other related members of the *longicrus*-gr, namely *A. deborae* Ferrington & Sæther, 2011. Based on some atypical characters (antenna densely covered with long setae; frontal tubercles teats shaped; palp 4-segmented, palpomere 3 with 2 spatulate sensilla coeloconica; anal lobe of wing projecting; tergite IX with a dorsal hump; virga consisting of 2 long sinuous spines; inferior volsella single, elongate long lobe-like, swollen distally, accessory lobe absent; crista dorsalis prominent apically), *A. panienus* sp. n. appears to belong to a new group: the *panienus*-group. Nevertheless, some morphological similarities are observed between the new species and other related congeners: *A. caspersi*, *A. aizaiensis* and *A. nanseni*). Accordingly, the three new species can be considered as biogeographic representative elements, which deserve greater conservation measures. Comments on their taxonomic position with key for known male adult of *Allocladius* species from the Australasian Region are given.

Sur le genre *Allocladius* Kieffer, 1913 de Nouvelle-Calédonie. I. Description d'*A. barendeunus*, *A. dumbeanus* et *A. panienus* spp. n. [Diptera, Chironomidae, Orthocladiinae]

Mots-clés: Diptera Chironomidae, Genre *Allocladius*, description de 3 spp. n, Nouvelle-Calédonie, conservation.

Un récent matériel, composé d'adultes mâles, de nymphes et de larves de Chironomidae, a été collecté au moyen de filets (de type Surber, dériveur et entomologique) et de tentes Malaise dans des habitats ripicoles et semi-terrestres délimités par l'écosystème littoral de Nouvelle-Calédonie (Grande Terre), a révélé la présence de trois nouvelles espèces appartenant au genre *Allocladius* (*A. barendeunus, A. dumbeanus* et *A. panienus* spp. n.). Les caractères distinctifs des trois espèces et leur affinité avec les 5 groupes du genre *Allocladius* se résument ainsi : *A. barendeunus* sp. n. est proche d'*A. wirthi* (Freeman, 1961), *A. azoricus* (Stora, 1945), *A. deborae* Ferrington & Sæther, 2011 et *A. bothnicus* qui font partie de l'un des deux groupes (*fortispinatus* et *longicrus*). Elle s'en distingue par les caractères suivants: - adulte mâle (antenne sans soie apicale, segment terminal court, 85 µm de long, AR 0.30; pointe anale triangulaire; virga vermiforme ; pars ventralis en forme de langue; volselle inférieure unique en forme d'un gros lobe saillant, placée dans la partie distale, partie médiane enflée et glabre ; crista dorsalis en forme de dent pointue) ; - exuvie nymphale (transparente à brun pâle; antépronotum avec 2 soies latérales et 2 soies médianes ; rangée d'épines présente antérieurement sur les segments III-VI et postérieurement sur les segments III-VIII; conjonctives avec des rangées de petites épines présentes sur les tergites III/IV à VI/VII et sternites II/III à IV/V; macro-soie lancéolée). Les caractères distinctifs d'*A. dumbeanus* sp. n. (antenne avec une soie apicale ; palpomère 3 muni d'une sensilla coeloconica en forme d'aiguille; pointe anale triangulaire, apex pointu; virga en forme de champignon muni d'une épine caudale en forme de téton; pars ventralis en forme de langue; volselle supérieure absente; volselle inférieure double, partie dorsal triangulaire, ventral en forme d'une longue poche ; gonostyle massif distalement ; crista dorsalis inséré sur la moitié distale, saillant apicalement) la séparent facilement des autres espèces apparentées du groupe *longicrus*, en l'occurrence *A. deborae* Ferrington & Sæther, 2011. Sur la base de certains caractères atypiques (antenne avec soies denses et longues, tubercules frontales en forme de tétons, palpe avec 4 segments, palpomère 3 avec 2 sensilla coeloconica spatulées, lobe anal de l'aile saillant, tergite IX muni d'une bosse dorsale, virga composé de 2 longs épines sinueuses, volselle inférieure unique, allongée et enflée dans sa partie distale, lobe ventral absent, crista dorsalis saillant apicalement), *A. panienus* sp. n. se place dans un nouveau groupe: le groupe *panienus*. Toutefois, certaines similarités morphologiques sont observées chez d'autres congénères apparentés : *A. caspersi* (Ferrington & Sæther, 2011), *A. aizaiensis* (Wang, 1990) et *A. nanseni* (Kieffer, 1926. Les trois nouvelles espèces peuvent être considérées comme des éléments biogéographiques représentatifs méritant des mesures de protection appropriées. Des commentaires sur leur position taxonomique et une clé pour les espèces connues de la région Australasienne sont fournis.

1. Introduction

Based on worldwide knowledge from the literature on the taxonomy, geographical distribution and ecology of the genus *Allocladius* Kieffer, 1913 (EDWARDS 1929, 1932, GOETGHEBUER 1940-1950, STRENZKE 1950,1960, BRUNDIN 1956, FREEMAN 1959, 1961, TOKUNAGA 1964, SASA 1979, 1985, 1998, FREEMAN & CRANSTON 1980, CASPERS & REISS 1989, CRANSTON et al. 1989, WANG 1990, LANGTON 1991, SASA & OKAZAWA 1992, SÆTHER & FERRINGTON 2003, SPIES & SÆTHER 2004, YAMAMOTO 2004, LANGTON & PINDER 2007, MAKARCHENKO & MAKARCHENKO 2007, 2008, 2011, ANDERSEN et al. 2010, FERRINGTON & SÆTHER 2011, ASHE & O'CONNOR 2012, SÆTHER & SPIES 2013, MOUBAYED-BREIL et al. 2021), there are currently about 30 known valid species of the genus, which are distributed in 5 groups as documented in FERRINGTON & SÆTHER (2011).

A recent large material of chironomids, composed of male adults, pupae and larvae, collected by swift, drift and entomological nets and Malaise traps in some lentic, riparian and semiterrestrial

habitats delimited by the littoral ecosystem of New Caledonia (Grande Terre), revealed the presence of three new species of *Allocladius* (*A. barendeunus* sp. n., *A. dumbeanus* sp. n. and *A. panienus* sp. n.). In this paper, *A. barendeunus* sp. n. is described as male adult and pupal exuviae, based on associated material composed of adults and male pharate adults, while *A. dumbeanus* sp. n. and *A. panienus* sp. n. are both described only as male adult. Comments on their taxonomic position with key for known male adults of *Allocladius* species from the Australasian Region are given.

2. Material and methods

The studied material is composed of male adults and pupae collected between 1996 and 2012 in some riparian habitats bordering wetlands and down basin of streams and rives and lakes covered by the coastal ecosystem of New Caledonia. The adults were captured using swift nets and Malaise traps, the pupae and larvae by Surber and drift nets. 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 FERRINGTON & SÆTHER (2011) for the imagines and those of SÆTHER (1980) and LANGTON (1991) for the pupae.

3. Results and descriptions

Allocladius barendeunus sp. n.

Material examined.

Holotype. New Caledonia**.** One male adult captured by swift net at the Barendeu stream, locality of Bourail (165°23'04.3354"E; 21°27'49.5832"S); riparian habitat with wet soils and grasses surrounding the rhithral of Barendeu stream (Photo 1); site N° 23 as reported in MOUBAYED-BREIL et al. 2021 (Table VI); altitude 113 m; 18.XI.2012 (N. Mary leg.)

Paratype (all leg N. Mary). New Caledonia. One male adult and 2 male pharate adults collected by Surber, drift and swift net, (166°36'47.21"E; 22°12'49.61"S); riparian habitats surrounding the River Coulée near the city of Nouméa; site N° 93 as reported in MOUBAYED-BREIL et al. 2021 (Table VI); alt. 40 m; 07.XI.2012.

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 *"barendeunus"* refers to Barendeu stream, where the type material was collected. Barendeu stream (Bourail) is located north-western to the capital Nouméa of New Caledonia.

Diagnostic characters

Male adult

The new species will be separated from other related members of the genus by the following combination of characters. Eyes bare, slightly extended dorso-medially; frontal tubercles absent, frontal margin concave, coronal triangle with 1 inwardly curved lateral expansion; temporals 7. Antenna 365 µm long, terminal segment 85 µm, apical seta absent, AR 0.30; clypeus trapezoidal; palpomere 3 ellipsoid with 1 needle-like sensilla coeloconica. Lobes of antepronotum not gaping;

acrostichals 4. Veins R_1, and R_{1+2} with 2 and 3 setae; anal lobe projecting. Sensilla chaetica present on tarsomeres ta_1-ta_5; pulvilli present. Tergite II-IV with 4 setae placed in 1-2 rows. Tergites IX semicircular, dorsal hump low. Anal point widely conical at base, triangular with pointed apex, proximal half covered with macrotrichia; basal part with about 16 setae. Virga filiform, worm shaped. Gonocoxite rounded apically, basal junction with a characteristic tongue-like pars ventralis. Superior volsella low. Inferior volsella single, large lobe shaped, swollen medially, downwardly projecting, median area bare, distal part densely setose. Gonostylus slender proximally, massive distally; crista dorsalis pointed tooth shaped, located pre-apically; megaseta occasionally forked.

Pupal exuviae

Head. Frontal apotome bare, frontal setae indistinct. Thorax. Precorneals well-developed, thoracic horn absent, precorneal tubercle reduced, comma-like shaped; dorsocentrals 4, Dc_1-Dc_2 close together, lateral antepronotals (2) and median antepronotals (2) hair-like. Abdomen. Row of spines present anteriorly on segments III-VI and posteriorly on segments III-VIII; conjunctives with rows of spinules present on tergites III/IV to VI/VII and sternites II/III to IV/V. Anal lobe slightly wider basally, rounded apically; anal macrosetae typically lanceolate, curved apically. Genital sac overreaching tip of anal lobe; lateral and caudal parts with a characteristic group of spinules.

Photo 1. Type-locality of *Allocladius barendeunus* sp. n. (photo N. Mary 18.XI.2012).
Photo 1. Localité type d'*Allocladius barendeunus* sp. n. (cliché N. Mary 18.XI.2012).

Description

Male imago

(n = 4; Figs 1A-K, 2A)

Small species. Total length 1.60 mm; wing length 0.58 mm; TL/WL = 2.76. General colouration brownish; head dark brown, antenna brownish, thorax brownish with dark mesonotal stripes, legs and abdomen brownish; anal segment contrasting pale brown to dark brown. Head (Fig. 1A),

slightly extended dorso-medially; eyes bare; frontal tubercle absent, median part of frontal margin concave, coronal triangle well developed, suture with 1 filiform lateral expansion, inwardly curved giving appearance of pair of tongs; temporals 7 including 4 inner and 3 outer verticals. Antenna 13-segmented, 365 µm long, segments 2-12 subequal (20 µm long), last flagellomere (Fig. 1B) 85 µm long, weakly clubbed, apical seta absent; with about 8-10 short setae, antennal groove reaching segments 2/3; AR 0.30. Clypeus (Fig. 1C) trapezoidal, with 10 setae in 2 rows. Palp 5-segmented, segments 1-2 fused; length (in µm) of segments: 16, 21, 35, 67, 82; palpomere 3 (Fig. 1D) nearly ellipsoid, with 1 characteristic needle-like sensilla coeloconica. Thorax. Lobes of antepronotum not gaping; lateral antepronotals 3; acrostichals 4, dorsocentrals 10 uniserial; prealars 4; scutellum with 6 setae (3 on each side of the midline). Wing. Brachiolum with 1 seta; subcosta overreaching fork of radius; costal expansion about 30 µm long, bare; anal lobe well-developed, projecting; distribution of setae on veins: R_1, 2; R_{1+2}, 3; remaining veins and squama bare. Legs. Length (in µm) of tibial spurs: PI, 45; PII-III, 35, 25. Sensilla chaetica present on tarsomeres ta_1-ta_5; pulvilli present. Length (in µm) and proportions of prothoracic (PI), mesothoracic (PII) and metathoracic (PIII) legs (n =1) as in the following table:

	fe	**ti**	**ta_1**	**ta_2**	**ta_3**	**ta_4**	**ta_5**	**LR**	**BV**	**SV**	**BR**
PI	560	615	265	150	110	75	70	0,43	3,55	4.43	2.85
PII	565	520	210	115	95	60	65	0,40	3,87	5.16	2.40
PIII	615	635	320	185	170	95	80	0,50	2,96	3.91	2.50

" 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."

Abdomen. Tergites I-IV (Fig. 2A), tergite I with about 10 setae (5 on each side), tergites II-IV, each with 4 setae, tergite II with 4 setae on 1 transverse anterior row, those on tergites III-IV are located otherwise. Hypopygium in dorsal and ventral view as in figures 1F-G (ventral view, Fig. 1G, with tergite IX and anal point omitted). Tergite IX broadly semi-circular, dorsal hump low; without dorsal setae (Fig. 1F). Laterosternite IX with 6 setae (3 on each side). Anal point 17-20 µm long, 10-12 µm maximum width at base, clearly visible in both lateral (Fig. 1E) and dorsal view (Fig. 1F); basal part (proximal half) cup-like, distinctly enlarged; distal half triangular, sharply pointed apically, apex not reaching tip of inferior volsella; blackish macrotrichia extended from base to median area; sclerotized band at basal margin absent. Apodemes (Fig. 1G); transverse sternapodeme semi-circular, slightly projecting orally; phallapodeme saw-like shaped. Virga (Figs 1F-G, J) filiform, giving appearance of a sinuous worm. Gonocoxite 65 µm long, 45 µm maximum width including inferior volsella, rounded apically; basal junction circular ventrally (Fig. 1G), bearing a characteristic tongue-like pars ventralis; ventral margin with 9 stout inner setae. Superior volsella (Fig. 1H) weakly bulged. Inferior volsella (Figs. 1F,H) 25-30 µm long, 10-15 µm maximum width, single, located distally, markedly swollen medially, expanded distally, inwardly and downwardly projecting; outer proximal part with 3 stout setae, median area bare, distal half covered with short and fine setae, almost free apically; ventral accessory lobe absent. Gonostylus (Figs 1I, K: Fig. 1I, acute angle; Fig. 1K, right angle), about 40 µm long, 12-15 µm maximum width at distal part; posterior part more massive, upwardly projecting; anterior side with orally directed fine setae, pre-apical part concave giving appearance of a broken hollow; crista dorsalis, small pointed tooth shaped, located pre-apically; megaseta well-developed, occasionally bifid, located apically. HR 1.63; HV 4.0.

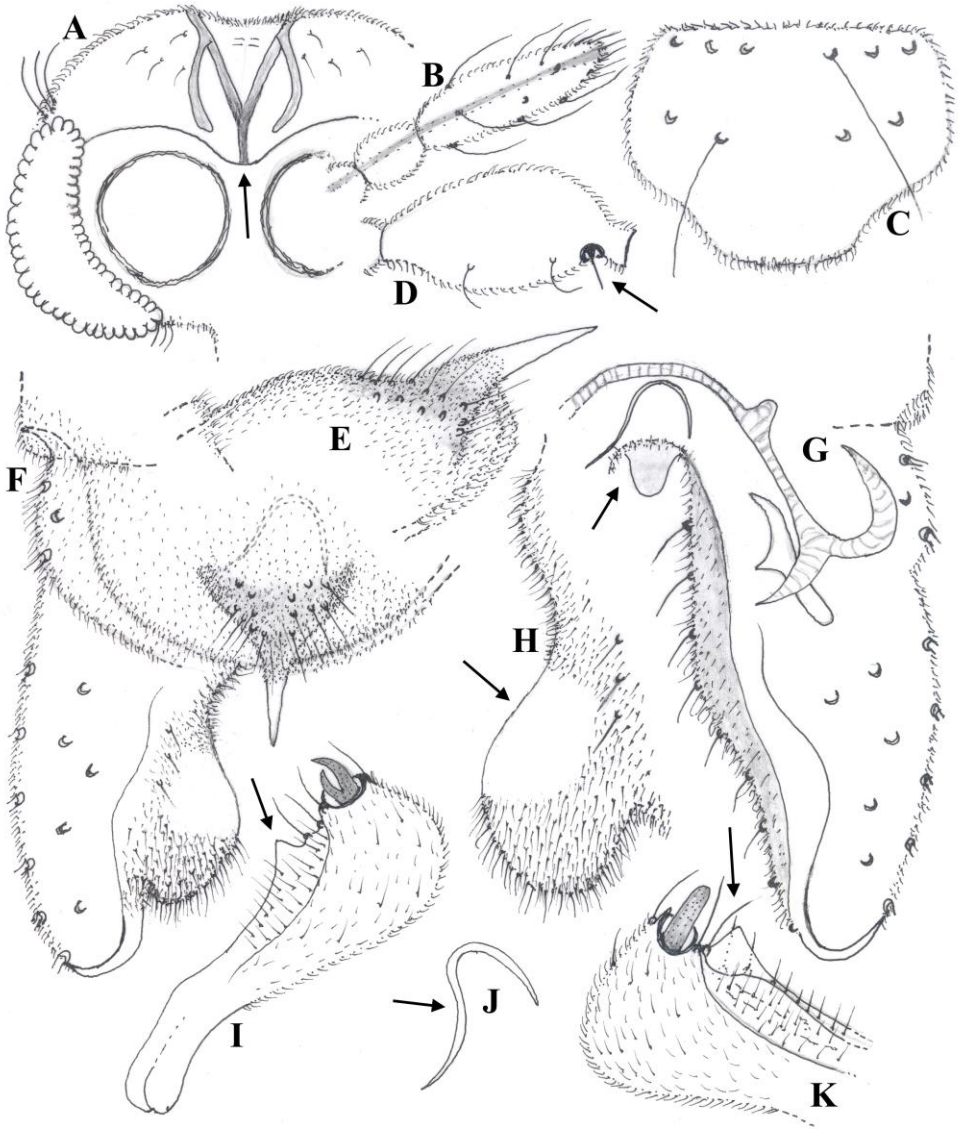

Figure 1. Male imago of *Allocladius barendeunus* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); antenna, two last segments (B); clypeus (C); palpomere 3 (D); tergite IX and anal point in lateral view (E); hypopygium in dorsal (F) and ventral view (G), with virga and pars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

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

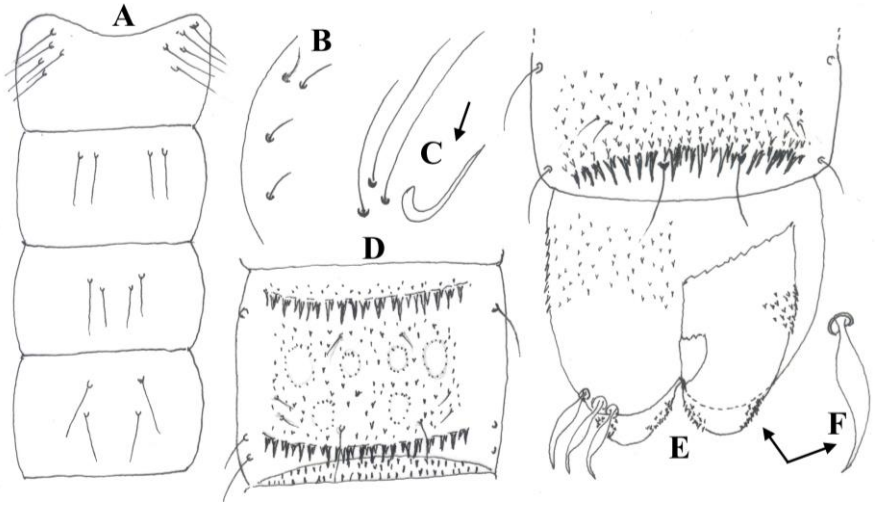

Figure 2. Male adult and pupal exuviae of *Allocladius barendeunus* sp. n. Male adult: tergites I-IV (A). Pupal exuviae: dorsocentrals (B); precorneals (C); tergite IV (D); tergite VIII (distal half, dorsal) and anal segment in dorsal and ventral view (E); macrosetae (F). The arrows indicate some distinguishing characters.

Figure 2. Adulte mâle et exuvie nymphale d'*Allocladius barendeunus* sp. n. Adulte mâle: tergites I-IV (A). Exuvie nymphale : soies dorso-centrales (B) ; soies précornéales (C) ; tergite IV (D) ; tergite VIII (moitié distale, dorsale) et segment anal en vues dorsale et ventrale (E) ; macro-soie (F). Les flèches indiquent quelques caractères distinctifs.

Pupal exuviae

(n = 2; Figs 2B-F)

Total length 1.65 mm. General colouration nearly colourless, is *Allocladius*-type, resembling to some other semiterrestrial pupal exuviae including that of: *Hydrosmittia*, *Limnophyes*, *Pseudosmittia*, *Smittia*, etc. Frontal apotome, cephalothorax and wing sheath nearly transparent; abdomen with anterior and posterior rows of spines pale brown with slight yellowish tinge; anal segment and genital sac white to pale brown. Cephalothorax (Figs 2B-C). Frontal apotome broadly triangular, frontal setae apparently absent. Antepronotals 4 hair-like setae including 2 subequal lateral antepronotals (about 30 µm long) and 2 median antepronotals (50 µm long). Dorsocentrals (Fig. 2B) consist of 4 subequal setae 10 µm long, inserted in 2 groups (32 proximal, 2 median); Dc_1 and Dc_2 located close together almost in 1 transverse row, Dc_3 and Dc_4 dispersed; distance (in µm) between Dc_1-Dc_2 5, Dc_2 -Dc_3 15 and Dc_3 -Dc_4 20. Thoracic horn absent; precorneal tubercle modified into a comma-like tubercle as illustrated in Fig. 2C; precorneals smaller than lateral antepronotals, 20 and 25 µm long. Abdomen. Tergite I with a group of short spinules located in 3 rows on postero-lateral part. Large transverse row of spines (Figs 2D-E) present anteriorly on segments III-VI and posteriorly on segments III-VIII; conjunctives (Fig. 2D) with rows of orally and caudally directed spinules present on tergites III/IV to VI/VII and sternites II/III to IV/V, are absent on tergite VIII as in Fig. 2E. Anal segment and genital sacs in dorsal and ventral view (Fig. 2E); anal lobe slightly wider at base, rounded apically, antero-median area with spinules; anal macrosetae typically lanceolate, curved apically. Genital sac overreaching tip of anal lobe; group of spinules on lateral and caudal sides represents a characteristic specific character.

Female adult and larva: unknown.

Allocladius dumbeanus sp. n.

Material examined.

Holotype. New Caledonia. 1 male adult captured by swift net at the Dumbéa stream, close to the village of Dumbéa (166°30'02.7662"E; 22°07'30.7340"S); riparian habitat with wet soils and grasses surrounding the down basin of the Dumbéa stream (Photo 2); site N° 50 as reported in MOUBAYED-BREIL et al. 2021 (Table VI)); altitude 29 m; 04.XI.2012 (leg. N. Mary).

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 *"dumbeanus"* of the species refers to the village of Dumbéa in New Caledonia, where the type material of *Allocladius dumbeanus* sp. n. was captured.

Photo 2. Type-locality of *Allocladius dumbeanus* sp. n. (photo N. Mary 04.XI.2012).

Photo 2. Localité type d'*Allocladius dumbeanus* sp. n. (cliché N. Mary 04.XI.2012).

Diagnostic characters

The following combination of characters will separate the new species from other related congeners. Eyes bare, not-extended dorso-medially; frontal margin concave; frontal tubercle and temporals absent. Antenna 510 µm long; terminal segment 95 µm, with 1 stout apical seta; segments slender, barely covered with medium sized setae (250 to 100 long); AR 0.23. Clypeus cup-like with 8 setae; palp 5-segmented, palpomere 3 with 1 needle-like sensilla coeloconica. Lobes of antepronotum weakly gaping; acrostichals 3. Anal lobe of wing well developed, projecting, veins and squama bare. Pulvilli present on tarsus, sensilla chaetica present on tarsomeres ta_1-ta_5. Tergites IX weakly humped. Anal point triangular, widely enlarged at base, apex sharply pointed, basal part with 4 lateral setae (2 on each side), macrotrichia only on proximal half. Virga spheroid, with 1 caudal teat-like spine. Gonocoxite with truncate apex. Pars ventralis tongue shaped. Superior volsella absent. Inferior volsella double, dorsal lobe broadly triangular, accessory lobe elongate pouch shaped, free apically. Gonostylus massive distally; crista dorsalis prominent apically, located apically.

Description

Male imago

(n = 2; Figs 3A-L)

Large species. Total length 2.15 mm; wing length 0.87 mm; TL/WL = 2.47. General colouration contrasting pale brown to dark brown; head darkened; antenna brownish; thorax with contrasting brown to blackened mesonotal stripes; legs and abdomen brownish; anal segment brownish. Head (Fig. 3A) not-extended dorso-medially; eyes bare; frontal margin convex; frontal tubercles and temporals absent. Antenna 13-segmented, 510 µm long, segments 3-12 subequal of 30-35 µm long; last flagellomere (Fig. 3B) 95 µm long, weakly clubbed; all segments slender; with about 55 setae (4-5 on segments 2 to 6, 2 on 7 to 12, and about 5-6 on terminal segment); length (in µm) of setae decreasing from 250 on proximal segments to 200-100 µm on distal ones; last flagellomere with dense sensilla chaetica apically, with 1 stout apical seta; antennal groove reaching segments 2/3; AR 0.23. Clypeus (Fig. 3C) 45 µm long, 35 µm maximum width, cup shaped, with 8 setae in 2 rows. Palp 5-segmented, segments 1-2 fused; length (in µm) of segments: 10, 15, 30, 40, 55; palpomere 3 (Fig. 3D) ellipsoid, with 1 needle-like characteristic sensilla coeloconica; palpomere 5 with 1apical stout seta. Thorax. Lobes of antepronotum weakly gaping; lateral antepronotals 3; acrostichals 3, dorsocentrals consisting of 9 not decumbent setae; 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 about 35 µm long, bare; anal lobe well-developed, projecting; veins and squama bare. Legs. Length (in µm) of tibial spurs: PI, 60; PII-III, 40, 25. Sensilla chaetica present on tarsomeres ta_1-ta_5; pulvilli present. Length (in µm) and proportions of prothoracic (PI), mesothoracic (PII) and metathoracic (PIII) legs (n =1) as in the following table:

	fe		**ti**	**ta_1**	**ta_2**	**ta_3**	**ta_4**	**ta_5**	**LR**	**BV**	**SV**	**BR**
PI	340		355	195	150	100	55	50	0,55	2,51	3,56	2.75
PII	355		345	175	125	105	50	50	0,51	2.65	4.0	2.25
PIII	370		375	205	115	95	50	45	0,55	3.11	3,63	2.50

Abdomen. Hypopygium in dorsal and ventral view as in figures 3E-G (ventral view, Fig. 3G, with tergite IX and anal point omitted). Tergite IX about 65 µm long, 105 maximum wide, broadly semi-circular, dorsal hump (Fig. 3E) low; posterior part with 8 setae. Laterosternite IX with 4 setae (2 on each side). Anal point (Fig. 3E, lateral; Figs 2F, 2J dorsal) 30 µm long, 20 µm maximum width, broadly triangular, widely enlarged at base, narrowing distally, apex sharply pointed; not reaching tip of inferior volsella; proximal half with macrotrichia; with 4 lateral setae, located at base (2 on each side), visible in lateral (Fig. 3E) and dorsal view (Figs 3F, J). Apodemes (Fig. 3G); transverse sternapodeme rounded; phallapodeme saw-like shaped. Virga (Figs 3F-H) spheroid, mushroom shaped, with 1 caudal teat-like spine. Gonocoxite 75 µm long, basal junction semicircular in ventral view (Fig. 3G), pars ventralis well-developed, tongue shaped; ventral margin with 9 stout inner setae. Superior volsella absent. Inferior volsella (Figs. 3F, I), 75 µm long, 20-25 µm maximum width, double, dorsal lobe triangular with right angled apex, located medially, covered with short and fine setae; accessory lobe 70 µm long, about 15 µm maximum width, elongate pouch-like shaped, free apically, distal part giving appearance of a typical marsupial pouch-like. Gonostylus (Figs 3K-L; Fig. 3K, acute angle; Fig. 3L, right angle), 50 µm long, 15-20 µm maximum width at distal part; more massive distally, upwardly projecting posteriorly; anterior side with orally directed fine setae; crista dorsalis well-developed, located on distal half, distinctly prominent apically, occupying 80% of the anterior side; megaseta well-developed. HR 1.5; HV 4.30.

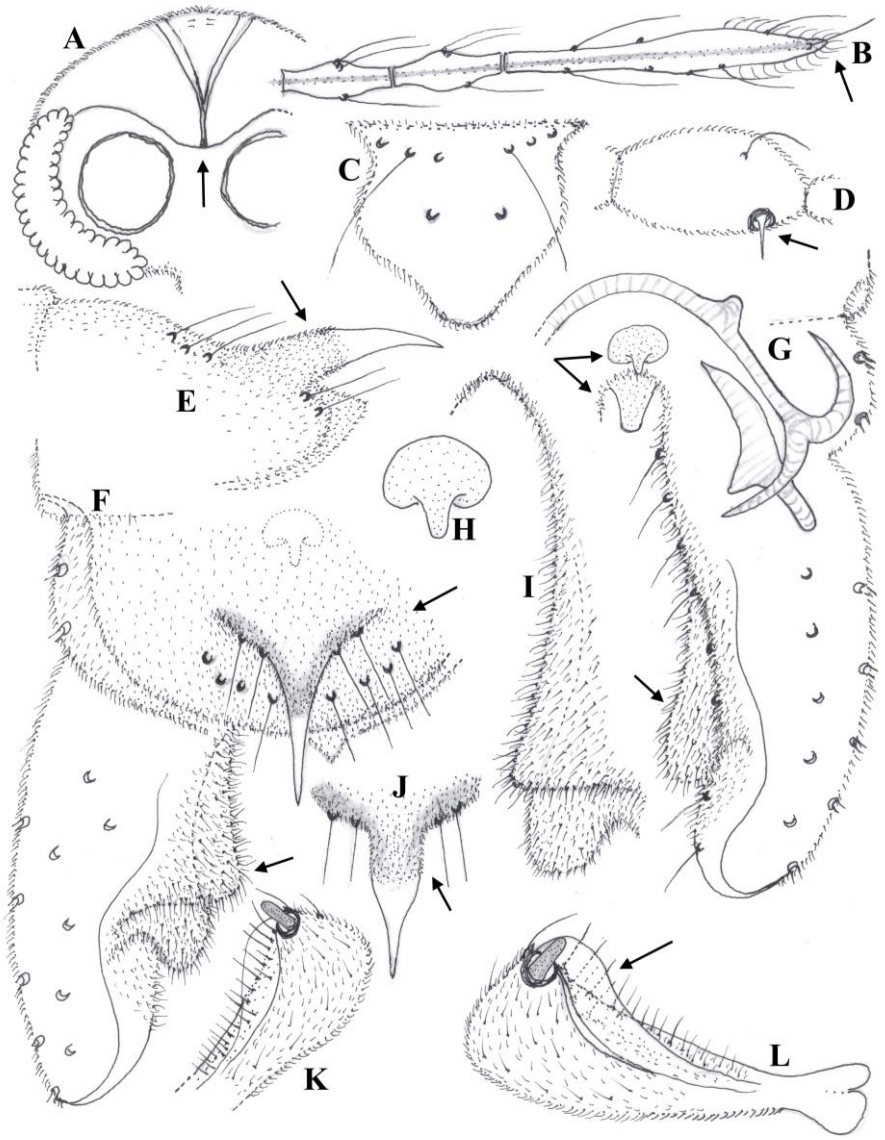

Figure 3. Male imago of *Allocladius dumbeanus* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); antenna, 3 last segments (B); clypeus (C); palpomere 3 (D); tergite IX and anal point in lateral view (E); hypopygium in dorsal (F) and ventral view (G); virga (H); inferior volsella, right side (I); anal point, dorsal (J); gonostylus (K-L) at acute angle (K), and right angle (L). The arrows indicate some distinguishing characters.

Figure 3. Imago mâle d'*Allocladius dumbeanus* sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex et soies temporales (A) ; antenne, 3 derniers segments (B) ; clypéus (C) ; palpomère 3 (D) ; tergite IX et pointe anal, vue latérale (E); hypopyge en vues dorsale (F) et ventrale (G); virga (H) ; volselle inférieure, côté droit (I) ; gonostyle (K-L) à angles aigu (K) et droit (L). Les flèches indiquent quelques caractères distinctifs.

Female adult, pupal exuviae and larva: unknown

Allocladius panienus sp. n.

Material examined.

Holotype. New Caledonia, Mont Panié. 1 male adult captured by swift net at the Tao stream (164°48'22.6530"E; 20°33'42.3151"S); riparian habitats with aquatic vegetation and dense carpet of bryophytes (Photo 3); site N° 15 as reported in MOUBAYED-BREIL et al. 2021 (Table VI); altitude 84 m; 14.XI.2012 (leg. N. Mary).

Paratypes. 2 male adults, 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 paratypes are deposited in the collection of the senior author.

Etymology: the name *"panienus"* of the new species refers to the well known Mont Panié, which is located in northern New Caledonia.

Photo 3. Type-locality of *Allocladius panienus* sp. n. (photo N. Mary 14.XI.2012).

Photo 3. Localité type d'*Allocladius panienus* sp. n. (cliché N. Mary 14.XI.2012).

Diagnostic characters

The following combination of differentiating characters will easily separate the new species from other related members of the genus. Eyes bare, not-extended dorso-medially; frontal margin concave; frontal tubercles large, teats shaped; temporals 6. Antenna 540 µm long, terminal segment 300 µm, apical seta absent, segments densely covered with long setae, AR 1.25; clypeus cup-like shaped; palp 4-segmented, palpomere 3 with 2 spatulate sensilla coeloconica. Lobes of antepronotum weakly gaping; acrostichals 8-10. Wing. Anal lobe projecting, coastal expansion, veins and squama bare. Sensilla chaetica present on tarsomeres ta_1-ta_5. Tergites IX with a distinct dorsal hump. Anal point widely enlarged at base, parallel-sided distally; basal part with 17-18 setae, densely covered with small stout setae. Virga composed of 2 sinuous long spines. Gonocoxite with rounded basal junction. Superior volsella low. Inferior volsella single, slender, elongate pouch shaped, projecting downwards, enlarged distally, free apically. Gonostylus massive distally; crista dorsalis well-developed, prominent apically.

Description - Male imago

(n = 3; Figs 4A-M)

Large sized species. Total length 2.10 mm; wing length 0.58 mm; TL/WL = 2.47. General colouration contrasting pale brown to dark brown; head dark brown; antenna brownish; thorax with contrasting brown to dark brown mesonotal stripes; legs and abdomen brownish; anal segment contrasting brown to dark brown. Head (Fig. 4A) not-extended dorso-medially; eyes bare, frontal margin convex; frontal tubercles larges, teats shaped, distinctly projecting outwards; temporals 6 including 54 inner and 2 outer verticals, postorbitals 3. Antenna 13-segmented, 540 µm long, segments 2-12 subequal of 30-35 µm long; last flagellomere (Fig. 4B) 300 µm long, weakly clubbed, densely covered with up to 200 long setae (about 450-500 µm long), apical seta absent; antennal groove reaching segments 2; AR 1.25. Clypeus (Fig. 4C) 70 µm long, 85 µm maximum width, cup shaped, with 12 setae in 3 rows. Palp unusually 4-segmented, segments 1-2 fused; length (in µm) of segments: 20, 30, 45, 45; segments 3 and 4 nearly subequal; palpomere 3 (Fig. 4D) ellipsoidal, with 2 spatulate characteristic sensilla coeloconica. Thorax. Lobes of antepronotum barely gaping; lateral antepronotals 3; acrostichals 8-10, dorsocentrals consisting of 12-13 decumbent including 2 not decumbent; prealars 4 uniserial; scutellum with 6 setae (3 on each side of the midline), 2 median seta much longer than laterals. Wing. Brachiolum with 1 seta; subcosta overreaching fork of radius; costal expansion about 45 µm long, bare; anal lobe well-developed, projecting; veins and squama bare. Legs. Length (in µm) of tibial spurs: PI, 55; PII, 45, 35; PIII, 45, 25. Sensilla chaetica present on tarsomeres ta_1-ta_5; pulvilli present. Length (in µm) and proportions of prothoracic (PI), mesothoracic (PII) and metathoracic (PIII) legs (n =1) as in the following table:

	fe		**ti**	**ta_1**	**ta_2**	**ta_3**	**ta_4**	**ta_5**	**LR**	**BV**	**SV**	**BR**
PI	325		290	155	115	70	45	45	0.53	2.80	3.97	2.55
PII	260		325	185	105	95	50	50	0.57	2.57	3.17	2.20
PIII	285		315	175	110	90	50	45	0.56	2.63	3.43	2.40

Abdomen. Hypopygium in dorsal and ventral view as in figures 4F-G (ventral view, Fig. 4G, with tergite IX and anal point omitted). Tergite IX about 95 µm long, 115 maximum wide, broadly semi-circular, lateral margin sinuous medially, dorsal hump well-developed (Fig. 4E, lateral). Laterosternite IX with 6 setae (3 on each side). Anal point (Fig. 4E, lateral; Figs 4F, I-J dorsal) 25 µm long, 20 µm maximum width (nearly as wide as long); cup-like at base, linearly elongate distally, apex rounded, not reaching tip of inferior volsella; with 16-17 setae located at base, densely covered with short stout setae (Figs 4I-J). Apodemes (Fig. 4G); transverse sternapodeme rounded; phallapodeme racket-like shaped. Virga (Figs 4F-H) about 15 µm long, composed of 2 long sinuous spines. Gonocoxite 120 µm long, rounded apically; basal junction semi-circular in dorsal (Fig. 4K) and ventral view (Fig. 4G); pars ventralis absent; ventral margin with 10 stout inner setae. Superior volsella (Fig. 4K) low. Inferior volsella (Figs. 4F, K), 45 µm long, 15 µm maximum width, single (dorsal), slender, elongate lobe-like shaped, located medially, projecting downwards, covered with short and fine setae, distal part markedly swollen, giving appearance of a typical marsupial pouch-like, free apically; accessory lobe absent. Gonostylus (Figs. 4L-M; Fig. 4L, acute angle; Fig. 4M, right angle), 40 µm long, 15 µm maximum width; more massive distally and upwardly projecting; anterior side with orally directed fine setae; crista dorsalis (Figs 4l-M) well-developed, distinctly prominent apically, occupying about 60% of the anterior side; megaseta well-developed. HR 3.0; HV 5.25.

Female adult, pupal exuviae and larva: unknown.

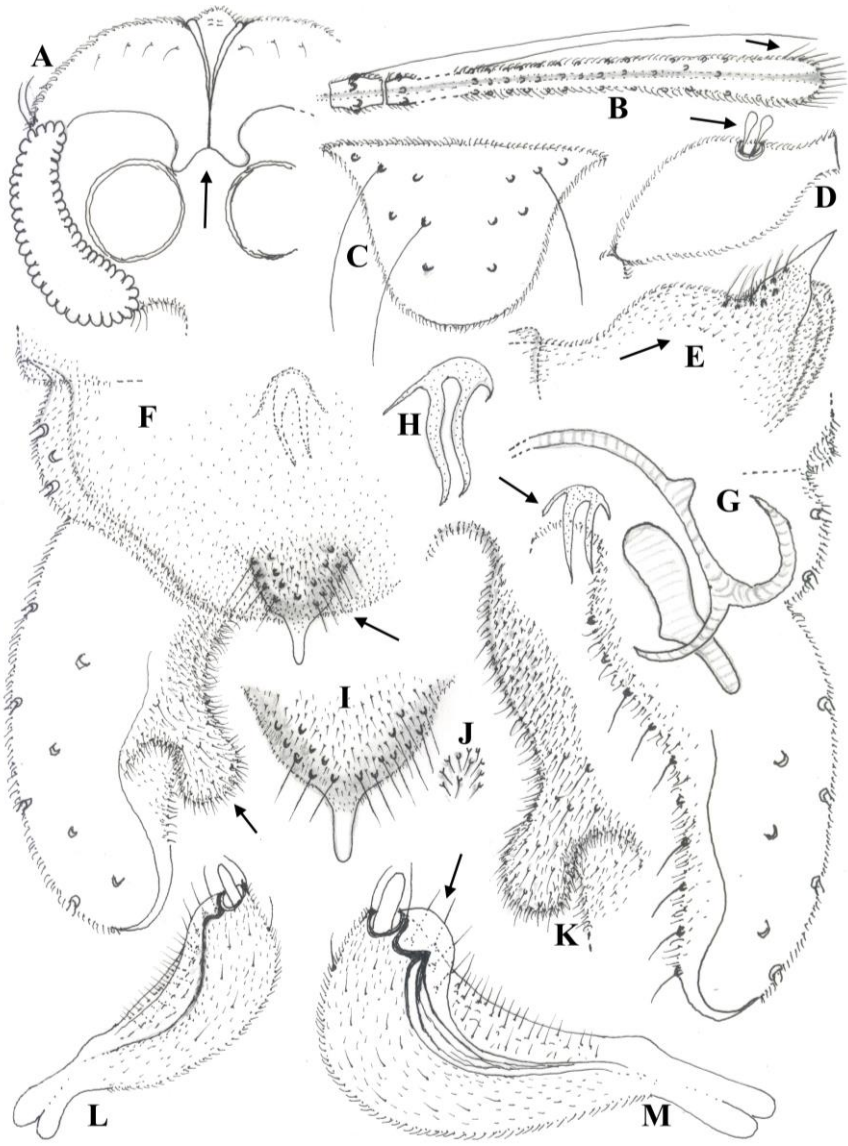

Figure 4. Male imago of *Allocladius panienus* sp. n. Head (left side, dorsal), frontal area, vertex and temporal setae (A); antenna, two last segments (B); clypeus (C); palpomere 3 (D); tergite IX and anal point, lateral (E); hypopygium in dorsal (F) and ventral view (G, with virga); virga (H); anal point in dorsal view (I); detail of setae on basal part of anal point (J); inferior volsella, right side (K); gonostylus (L-M), at acute (L) and right angle (M). The arrows indicate some distinguishing characters.

Figure 4. Imago mâle d'*Allocladius panienus* sp. n. Tête (côté gauche, vue dorsale), aire frontale, vertex et soies temporales (A) ; antenne, deux derniers segments (B) ; clypéus (C) ; palpomère 3 (D) ; tergite IX et pointe anale en vue latérale ; hypopyge en vues dorsale (F) et ventrale (G, avec virga) ; virga (H) ; pointe anale en vue dorsale (I) ; détails des soies à la base de la pointe anale (J) ; volselle inférieure, côté droit (K) ; gonostyle (L-M), angles aigu (L) et droit (M). Les flèches indiquent quelques caractères distinctifs.

4. Remarks and discussions

Actually, the genus *Allocladius* has a wide distribution in the major zoogeographical Regions since the recent publication of the largest paper on the genus by FERRINGTON & SÆTHER (2011). Currently, there are about 30 known valid species worldwide, which are distributed in 5 emended groups: *fortispinatus*-gr, *soemmei*-gr, *nanseni*-gr, *niger*-gr and *longicrus*-gr. The richest group in number of species is *longicrus*-gr, which includes 11 species. At present, the genus *Allocladius* still little known and poorly studied in New Caledonia, where only the genus level was reported by MOUBAYED-BREIL et al. (2021).

On the basis of the highlighted atypical morphological characters found in the male adult of *A. barendeunus* sp. n., *A. dumbeanus* sp. n. and *A. panienus* sp. n., the 3 latter new species can be considered as biogeographic representative elements of New Caledonia.

Accordingly, a combination of both distinguishing characters and morphological affinities with key to known male adult from the Australasian Region are briefly summarized in the following differential diagnosis. The key includes, beside the three described new species from New Caledonia, the single recorded *Allocladius* species from Australia: *A. wirthi*.

***A. barendeunus* sp. n.**

A. barendeunus keys in both *fortispinatus*-gr and *longicrus*-gr, which includes its closest related species: *A. wirthi*, *A. azoricus*, *A. deborae* and *A. bothnicus*.

Distinctive characters are:

- Antenna lacking apical seta, terminal segment 85 µm long, AR 0.30;

- Palpomere 3 (Fig. 1D) with 1 needle-like sensilla coeloconica;

- Anal lobe of wing well-developed and projecting, R_1 and R_{1+2} with 2 and 3 setae;

- Pars ventralis present (Fig. 1G), tongue shaped;

- Virga filiform, (Figs 1F-H), worm shaped;

- Inferior volsella single (Figs 1F, H), large lobe-like, inwardly and downwardly projecting, free apically, outer proximal part with 3 stout setae, median area bare; accessory lobe absent;

- Gonostylus (Figs 1I, K), massive distally; crista dorsalis pointed tooth shaped.

***A. dumbeanus* sp. n.**

This new species keys in the *longicrus*-gr close to *A. deborae*, from which it can be separated by the following distinctive characters:

- Antenna with 1 apical seta (Fig. 3B), AR 0.23; while is apparently lacking apical setae with a much higher antennal ratio (AR 1.44) in *A. deborae* (in FERRINGTON & SÆTHER 2011);

- Palpomere 3 with 1 needle-like sensilla coeloconica (Fig. 3D), is bearing 2 lanceolate sensilla clavata in *A. deborae* (in FERRINGTON & SÆTHER 2011);

- Anal point triangular (Figs 3 E-F, J), apex sharply pointed with 4 lateral setae located at base, are otherwise figured in *A. deborae* (Figs 31E-F IN FERRINGTON & SÆTHER 2011);

- Virga (Figs F-H) mushroom-like with 1 caudal teat-like spine;

- Pars ventralis tongue shaped (Fig. 3G), is broadly spheroid in *A. deborae* (Fig. 31E in FERRINGTON & SÆTHER 2011);

- Inferior volsella (Figs 3F, I) double, dorsal lobe broadly triangular, accessory lobe elongate pouch shaped, free apically; are differently shaped in *A. deborae* (Figs 31E-F in FERRINGTON & SÆTHER 2011);

- Gonostylus (Figs 3K-L) massive distally, is linearly elongate in *A. deborae* (Fig. 31F in FERRINGTON & SÆTHER 2011);

- Crista dorsalis large, distinctly prominent apically, is much weaker in *A. deborae* (Fig. 31F in FERRINGTON & SÆTHER 2011);

***A. panienus* sp. n.**

Though some morphological similarities are seemingly observed between *A. panienus* sp. n. and other related congeners (namely: *A. caspersi*, *A. aizaiensis* and *A. nanseni*), the new species appears to belong to a separate group of species: the *panienus*-gr.

Distinctive characters are:

- Antenna densely covered with long setae (450-500 µm long), including up to 200 long setae are only inserted on last flagellomere (Fig. 1B), such characters are differently figured in all other members of the genus;

- High value of the antennal ratio (AR 1.25), is similarly observed in *A. aizaiensis*, and *A. nanseni* (AR 1.32 and 1.21), while is much lower (AR 0.30) in *A. caspersi* (in FERRINGTON & SÆTHER 2011);

- Frontal tubercles large, outwardly projecting and teats shaped (Fig. 1A), are absent in *A. caspersi* and *A. aizaiensis*, or vestigial in *A. nanseni* as illustrated in FERRINGTON & SÆTHER 2011 (Figs 8B, 14B, 15B);

- Palp 4-segmented, palpomere 3 with 2 spatulate sensilla coeloconica (Fig. 1D), are not similarly figured in other members of the genus (in FERRINGTON & SÆTHER 2011);

- Anal lobe of wing well-developed and projecting, is absent or weak and not projecting in *A. caspersi*, *A. aizaiensis*, and *A. nanseni* as illustrated in FERRINGTON & SÆTHER 2011 (Figs 8A, 14A, 15A);

- Virga consisting of 2 long sinuous spines (Figs 1F-H), is differently shaped in *A. caspersi*, *A. aizaiensis*, and *A. nanseni* as illustrated in FERRINGTON & SÆTHER 2011 (Figs 8F, 14E, Fig. 15E);

- Inferior volsella single (Figs 1F, K), long pouch shaped, enlarged distally, projecting downwards and free apically, seams to represent a relevant distinguishing specific character of *A. panienus* sp. n.;

- Accessory lobe of inferior volsella absent (Figs 1F, K), while is present in *A. caspersi*, *A. aizaiensis*, and *A. nanseni* as illustrated in FERRINGTON & SÆTHER 2011 (Figs 8G, 14F, 15F);

- Gonostylus (Figs 1L-M), crista dorsalis distinctly prominent apically, are otherwise shaped in *A. caspersi*, *A. aizaiensis*, and *A. nanseni* (Figs 8G, 14F, 15F in FERRINGTON & SÆTHER 2011).

Key to known male adult of *Allocladius* species from the Australasian Region

1. Inferior volsella single; accessory lobe absent; antenna without apical seta **2**

- Inferior volsella double; accessory lobe present; antenna with apical seta **4**

2. Virga filiform to worm shaped (Figs 1G, J); pars ventralis present (Fig. 1G); last flagellomere 85 µm long; AR 0.30; crista dorsalis pointed tooth shaped.....***A. barendeunus* sp. n.**

- Virga otherwise shaped; pars ventralis absent **3**

3. Virga consisting of 2 long curved spines (Figs 3F-H); last flagellomere 300 µm long; AR 1.25; crista dorsalis lobe shaped, prominent apically .....***A. panienus* sp. n.**

4. Anal point triangular (Figs 3E-G), apex sharply pointed, with 2 lateral setae; pars ventralis tongue shaped (Fig. 3G); AR 0.23; crista dorsalis prominent apically .....***A. dumbeanus* sp. n.**

- Anal point conical (Fig. 9F in FERRINGTON & SÆTHER 2011), apex broadly rounded, with numerous lateral setae; pars ventralis absent; AR 0.79-1.19; crista dorsalis absent .....***A. wirthi***

5. Ecology and geographical distribution

Larvae of the genus *Allocladius* appear to be encountered in streams and rivers, as well in semiterrestrial and riparian habitats surrounding wetlands or bordering lentic hydro-systems. Male adults of *A. barendeunus* sp. n., *A. dumbeanus* sp. n. and *A. panienus* sp. n. were captured in the down basin of some streams and rivers, where surrounding semiterrestrial and riparian habitats enriched with aquatic and subaquatic plants and bryophytes represent the most favourable micro-habitats for larval populations. Emergence is observed between September and October. Typology of the 3 type-localities where the new species were collected are: potamal of Barendeu stream (alt. 113 m, Photo 1) for *A. barendeunus* sp. n.; potamal of the River Dumbéa (alt. 29 m, Photo 2) for *A. dumbeanus* sp. n.; rhithral of Tao stream (Mont Panié, alt. 84 m**,** Photo 3).

A. barendeunus sp. n., *A. dumbeanus* sp. n. and *A. panienus* sp. n. could be more widely distributed over the littoral wetlands or, even in other sites located at higher altitude including middle and high mountainous basins of New Caledonia. Seemingly, the 3 new species can be considered as biogeographic local representatives, which deserve greater consideration and conservation measure.

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