Australasian *Stictocladius* Edwards (Diptera: Chironomidae) diagnosed and described

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Abstract The first formal generic diagnosis for the immature stages and females, and a more complete diagnosis of the males of *Stictocladius*, based on extensive material from the southern continents, are provided. Associated immature stages are described in detail for the previously described Australasian species, *Stictocladius lacuniferus* (Freeman), New Zealand; *S. pictus* (Freeman), New Zealand; *S. multiserialis* (Freeman), Australia; *S. uniserialis* (Freeman), Australia; *S. victoriae* (Freeman), Australia. Divergent species *Stictocladius sofour* sp. n. from eastern Australia and *Stictocladius occidentalis* sp. n. from western Australia are described. The further existence of undescribed additional diversity, notably from tropical Australia and the Neotropics, is noted: the morphology of these specimens is incorporated in the generic diagnoses. *Stictocladius* is compared with putatively related *Diplocladius* Kieffer and *Heleniella* Gowing, and the very likely sister group, *Lopescladius* Oliveira.

Key words Australia, Chironomidae, identification, New Zealand.

INTRODUCTION

In the southern summer of 1926–1927, F.W. Edwards, Dipterist at the British Museum (Natural History), collected insects in Patagonia with the stated aim of bringing evidence to bear on faunal resemblances between the southern continents (Edwards 1927). His collections of adult Chironomidae were worked up for publication (Edwards 1931) using a classification concept that was soon to be superceded by those incorporating the immature stages. Although the species were placed into broad adult-based generic concepts, including some that we recognise no longer (e.g. *Trivinho-Strixino* (Freeman 1961; Cranston & Edward 1999) and some Chironominae (Brundin 1966), certain Orthocladiinae (Freeman 1961; Cranston & Edward 1999) and some Chironominae (e.g. *Trivinho-Strixino et al.* 2009).

Among the taxa he recognised in Patagonia, Edwards (1931) described *Stictocladius* Edwards as a new subgenus of *Spaniotoma* for three Patagonian Argentine Orthocladiinae. Edwards believed these midges, although rendered distinctive by their white-ringed tibiae and conspicuous wing-markings, otherwise ‘would have to be placed with the European *Diplocladius cultriger* Kieffer, to which they do not seem to be all closely related’ (Edwards 1931, p. 280). Indeed, Brundin (1956) regarded *Stictocladius* as a subgenus of *Diplocladius* Kieffer. In his study of the New Zealand Chironomidae, Freeman (1959) recognised two new species as congeneric with those of Edwards from Patagonia. He placed both in *Diplocladius*, arguing that one (*D. lacuniferus* Freeman) resembled Edwards’ taxa, whereas the other, with plain-wings and unbanded legs (*D. pictus* Freeman), had affinities to the Palaearctic *Diplocladius* (and an African species known only from a female). When he turned to the Australian Chironomidae, Freeman (1961) distinguished three new species varying in the development of the white-ringed legs but all conforming to the Patagonian patterned-wing type (see Fig. 1), which he treated as *Stictocladius*, ranked as a subgenus of *Diplocladius*. Freeman noted that no species of *Stictocladius* had the characteristic hypopygial anal point of *Diplocladius*, but admitted that knowledge of the immature stages should be known before definitive rank could be allocated.

The discovery by Brundin (1966), of the pupa in South American streams, exhibiting a unique pupal leg sheath arrangement, encouraged him to elevate *Stictocladius* to generic rank. This status has been unchanged in subsequent publications. Although a pupa allowed estimating the rank and identified some differentiation from *Diplocladius*, the immature stages of *Stictocladius* have never been described formally, neither have they been differentiated completely from the New World genus *Lopescladius* Oliveira, especially the subgenus *Cordiella* (Coffman & Roback 1984). Roback and...
Coffman (1983) segregated pupae of _Lopescladius_ from the Andes from their pupal ‘Genus 7 sp.’, which they suspected to be _Stictocladius_ based on the straight leg sheaths and ‘general body form’. Further, unknowingly they may have discovered the larva of _Stictocladius_ in a trout stomach, illustrating it as ‘Genus near _Lopescladius_ sp.’ Across the Pacific, Australian and New Zealand researchers (e.g. Marchant _et al._ 1994; Marchant 1995; Fowler & Death 2001) recognised larval _Stictocladius_ from several informal publications (including Cranston 1994, 1996, 2000) that allowed recognition of the genus into ecological and biomonitoring studies.

Here we provide the first formal generic diagnosis for _Stictocladius_ for each life-history stage based on extensive material now available from Australia and New Zealand, and incorporate unassociated but clearly congeneric immature material from the Neotropics. We compare the genus with a putative relative _Heleniella_, and the seemingly assured sister group _Lopescladius_. We describe in more detail the associated immature stages for the previously described species, and note the existence in Australia and South America of undescribed additional species diversity (although these specimens are incorporated into the generic diagnoses).

**METHODS AND TERMINOLOGY**

Generally collections of immature stages have been made either with kick nets or with one or more intercept nets, with mesh size 300 µm, in flowing water. Attempts to rear from live larvae involved placement individually in a few ml of native (or tap) water in cotton-wool stopped 50 mm × 10 mm glass vials, and at ambient temperature, without aeration; all failed. Dead immature stages were preserved in 70% ethanol or 100% isopropanol for molecular studies. Pupae and especially their exuviae (cast skins) were collected by exposing drift nets with 643, Australia; _Diplocladius lacuniferus_ Freeman 1959: 416, New Zealand; _Diplocladius pictus_ Freeman 1959: 416, New Zealand; _Diplocladius (Stictocladius) multiserialis_ Freeman 1961: 641, Australia; _Diplocladius (Stictocladius) uniserialis_ Freeman 1961: 643, Australia; _Diplocladius (Stictocladius) victoriae_ Freeman 1961: 643, Australia.

**Differential diagnosis**

Adult _Stictocladius_ are separable from other orthoclads by having eyes that are hairy, do not protrude strongly and lack any dorsomedian extension; at most one inner vertical seta; no acrostichal setae; costa barely to slightly extended; and without pulvilli. Male genitalia (Fig. 2a–g) with double gonostylus consisting of a base with one immovable bare, curved lobe and one microtrichiose and setose lobe without megaseta, hypopygium lacking a superior volsella and virga; antenna without a subapical seta. Females have one to two subapical antennal setae; the genitalia (Fig. 2h,i) have a large dorsomeral lobe covering most of small brush-like ventrolateral lobe; the large apodeme lobes are microtrichiose and meet at mid-line; tergite IX is divided; gonocoxite with short and usually some long setae; and seminal capsule with a large neck.

Pupal _Stictocladius_ differ from all other orthoclads in all leg sheaths being directed straight backwards with free apices (Fig. 4b) and not joined along sutures. From all other ortho-
clads except Heleniella Gowin and Lopescladius Oliveira (Fig. 4a), the digitiform apical projections on the anal lobe differentiate. Stictocladius differs from Heleniella by lacking mediolateral point patches on sternite I and by having at most 1 L seta on segment VIII, from Lopescladius by having the projections of the anal lobe straight and immobile, in contrast to being curved and movable.

Larval Stictocladius differ from all other orthoclads by having very short procerci with long anal setae (Fig. 7n), and antennae (Fig. 7f–i) with the second segment basally having a short or very long unsclerotised area, and with the ultimate segment whip-like, and a long blade. A divided second antennal segment is seen in Heleniella, Lopescladius and Brillia Kieffer but all have the segment sclerotised at the base, and the hyaline area medial. The larva of Lopescladius, both the nominate subgenus and L. (Cordiella), has very similar antennae, but the mentum and submentum is flanked laterally by a hyaline area, and the setae submenti and setae maxillaris (SM3, 4) are strongly retracted.

Generic description (based on all known species)

Imago (Figs 1–3)

Minute to moderately sized species, wing length 0.8–2.3 mm.

Eye hairy, often slightly protruding, without dorsomedian elongation. Antenna with 13 flagellomeres in male, 5 in female; fully plumed; groove in male beginning on flagellomere 2–3; sensilla chaetica present on flagellomere 2–4 or 2–5 and ultimate; apex without subapical seta in male, with 1–2 setae in female; Male Antennal Ratio 0.3–0.9. Palpomeres 4 (in 1 species) or 5, 3rd with 1–2 short lanceolate sensilla clavata. Temporals less than 11, usually 2–5, inner verticals nearly always absent. Coronal suture of female absent, reduced or complete. Tentorium may be narrow basally, or throughout in female. Cibarial pump with anterior margin more or less deeply concave. Clypeus with 2–26 setae.

Antepronotal lobes broad and collar-like, or reduced and narrowed medially, deeply separated medially, with 2–21 weak lateral antepronots. Humeral pit simple and oval, inconspicuous or conspicuous, sometimes with several smaller circular areas posterior of pit (Fig. 3a–g). Acrostichals absent, dorsocentrals uni- to multiserial, 1–14 prealars, supraalar absent. Scutellum with 2–9 transversely uniserial, about 14 biserial, or 36–64 multiserial setae. Postnotum with 0 occasionally 7 median setae.

Wing membrane without setae, with well-developed punctuation, hyaline, pale or patterned with 1–3 broad dark bands, broken up by pale areas in some species (Fig. 1a–f). Anal lobe well developed, projecting or weak. Costa barely to slightly extended; R2+3 running in the middle between R1 and R4+5 and ending midway between R1 and R4+5 or closer to R4+5; R4+5 in 1 species ending well proximal to end of M3+4; usually ending slightly proximal, above or slightly distal to end of M3+4; Cu1 nearly straight, slightly curved throughout, or sinuous; FCu well distal to RM; postcubitus ending far distal to cubital fork; An1 ending slightly distal to slightly proximal to cubital fork; An2 well developed, often reaching almost as far as An1. Brachiolium with 1–2 setae; R with 0–13 setae in male, 3–32 in female; R1, with 0–13 setae in female, usually bare in male; R4+5 usually bare in male, with 0–24 setae in female; C extension with 0–4 non-marginal setae; other veins bare. Squama bare or with up to 12 setae. Sensilla campaniformia about 7–10 basally on brachiolum as well as apically on brachiolum, 3 below setae on brachiolum; other veins bare. Squama bare or with up to 12 setae. Sensilla campaniformia about 7–10 basally on brachiolum as well as apically on brachiolum, 3 below setae on brachiolum; 1 present on RM or basally on R1.

Front leg ratio (LR1) 0.45–0.90, LR2 0.35–0.54, LR3 0.37–0.62. Legs unicoloured, or with whitish to yellowish rings on tibiae and more indistinct rings basally on femora. Tibial spurs (Fig. 3h–l) often strongly developed with distinct lateral denticles, inner spur of hind tibia more than half as long as outer spur, in 1 species mid and hind tibiae both with only one spur; hind tibial comb well developed with 10–11 spiniform setae, in 2 species with only 4–8 short setae.

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Fig. 2. *Stictocladius* spp. Male genitalia. (a) *S. lacuniferus*, (b) *S. pictus*, (c) *S. multiserialis*, (d) *S. occidentalis*, (e) *S. sofour*, (f) *S. uniserialis*, (g) *S. victoriensis*. Female genitalia. (h) *Stictocladius lacuniferus*, (i) *S. occidentalis*. 

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Sensilla chaeticae and pulvilli absent. Pseudospurs absent, or when present on ta₁ of mid and hind leg and ta₂ of mid leg, 23–30 μm long.

Abdomen unicoloured, with anterior segments and genitalia paler than posterior segments, or with segment IV and genitalia whitish and remaining segments dark. Middle tergites with broad band of median setae, few marginal setae and several lateral setae with basal setae absent, in several females very few tergal setae. Sternite VIII of female with 6–42 setae.

Hypopygium (Fig. 2a–g) with anal point either absent or short, triangular to parallel-sided with blunt apex, transparent, at most with few weak microtrichiae. no setae; tergite IX with 6–26 weak setae. Laterosternite IX with 2–11 setae, all weak or some much stronger than others, often additional anterior

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**Fig. 3.** *Stictocladius* spp. Thoracic pits. (a) *Stictocladius lacuniferus*, (b) *S. pictus*, (c) *S. multiserialis*, (d) *S. occidentalis*, (e) *S. sofour*, (f) *S. uniserialis*, (g) *S. victoriensis*. Tibial spurs. (h) *Stictocladius lacuniferus*, (i) *S. pictus*, (j) *S. multiserialis*, (k) *S. sofour*, (l) *S. uniserialis*. © 2010 The Authors

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spur. Transverse sternapodeme slightly concave, straight or slightly convex. Oral projections small and triangular; broad, low and apically truncate or rounded; or conspicuous, higher than wide, digitiform, rectangular or rounded. Phallapodeme well sclerotised, aedeagal lobe well developed sometimes with sclerotised apicomedian margin. Virga absent. Gonocoxite well developed; superior volsella absent; inferior volsella medially and bluntly triangular, long and low with posterior apex ending free, double with both anterior triangular part and long and low more posterior part, or pediform. Gonostylus double with microtrichiose base, long, bare immovable appendage and mostly oblong movable appendage with several setae and microtrichiae; in 1 species base fused with appendages, both appendages immovable, and bare appendage small. HR 1.2–3.8. Crista dorsalis and megaseta absent.

Female genitalia (Fig. 2h,i) with evenly curved gonocoxapodeme ending well before base of gonapophysis VIII. Sternite VIII forming small floor under anterolateral parts of vagina. Gonocoxite well developed usually with long and short setae, or few short setae. Tergite IX divided, with numerous setae. Segment X normal. Postgenital plate weak, bluntly triangular, sometimes very indistinct. Cercus mostly pediform. Dorsolesal lobe large and covering most of partly brush-like ventrolateral lobe. Apodeme lobe large, often with well-sclerotised apodeme, lobes meeting at mid-line, with microtrichiae at least at mid-line and usually very weak straight microtrichiae also on surface of lobe. Labia normal, bare. Coxosternapodeme strongly to very weakly sclerotised. Seminal capsules larger than cerci, ovoid and pale to smaller, rounded and well sclerotised; neck large and triangular. Spermathecal ducts with loop or bend, or (in 1 species) straight, wider posteriorly, with separate openings.

Pupa (Figs 4–6)

Small to moderately sized pupae, 2–5.5 mm long. Exuvial colour ranging from nearly transparent with yellowish tint, or pale golden brown to dark brown.

Cephalic tubercles, frontal warts and frontal setae absent; frontal apotome wrinkled or smooth (Fig. 6a). Thoracic horn absent or present, if present (Fig. 6c,d) widest near base and tapering to pointed apex, spinulose. Eye sheath with 2 postorbitals, very conspicuous in S. lacuniferus. Thorax smooth, wrinkled or tuberculate (Fig. 6b). Setae of cephalothorax hair-like or, in S. lacuniferus, bristle-like with anterior precorneal occasionally taeniate. Three precorneals; 2 median and 2 lateral antepronotals of which one reduced to setal mark; 4 dorsocentrals, 3 posterior close together, 2 anterior and 2 posterior close together, or in 1 Neotropical species Dc2 in the middle between Dc1 and Dc3; dorsocentrals except Dc2 all very short. Wing sheath with variably crenulate anterior margin, without pearls or nose. Leg sheaths all directed straight backwards with free apices not joined along sutures; leg sheaths ending at mid-abdomen (Fig. 4b).

Tergites (Fig. 5a–c): I without spinulation or in a few species with anterolateral or anteromedian spinulation, in 2 species covered by low tubercles posteromedially; II–VI usually bare or with some anterior spinulation, occasionally covered with coarse spinulation, VII and VIII sometimes bare, usually with anterolateral spinulation, in 1 species covered with coarse spinulation; IX bare or with median spinulation. Sternites: I without spinulation except in 1 species where it is covered with coarse spinulation; II–VIII bare or usually with some anterior or median spinulation on anterior sternites (Figs 5c,6f,g) and anterolateral spinulation on posterior sternites; IX without spinulation.

Posterior margin of tergites II–VIII, or occasionally I–VIII, with transverse posterior row of pointed triangular spines and often 1–4 rows of smaller spines anterior to these. Sternites (Figs 5c,6e) V–VII nearly always, II and VIII often, III–IV sometimes and I occasionally with posterior spines. Sternite II with or without anteromedian dense cluster of translucent spines, sometimes also on sternite III, seldom on IV, sternite II may also have anterolateral spine groups (Fig. 6f). Pedes spurii A, if present, on sternite VI (Fig. 6h), if on IV, not in whorl. Pedes spurii B and caudal hooklets of tergite II absent. Conjunctives of tergites and sternites bare, with 3–5 rows of tubercles (Fig. 5c), or (1 species) spinulose.

Fig. 4. Stictocladius spp. Pupa, (a) Lopescladius sp. (as Cordites) redrawn from Brundin (1966: fig. 622), (b) Stictocladius sp. redrawn from Brundin (1966: fig. 621).
on conjunctives II/III to IV/V. Anterior margins of tergites and sternites III–VI or conjunctives II/III to V/VI may have dark bands.

Segment I with 1 L setae; II–VII each with 4 L setae, L₁ and L₂, and L₃ and L₄ close together, L₁ fine, hair-like, other L setae bristle-like to narrowly taeniate, length highly variable; VIII probably without L setae, but dorsal setae may be situated far lateral appearing as L₂ and/or L₄. Segment I with 4 D and 3 V setae, II–VII each with 5 D and 4 V setae, VIII with 4 D and 3 V setae. Abdominal setae hair-like, bristle-like or narrowly taeniate. O setae absent.

Anal lobe with long, digitiform, straight apical projections, each carrying 2 (Fig. 6j) or 3 equally long, strong macrosetae (Fig. 6i) shorter than anal lobe, 3–10 μm, mostly more than 5 μm, wide at base. Macrosetae may arise from spined tubercles. Genital sac of male much shorter than, or extending slightly past, apex of projection.

**Larva (Fig. 7)**

Minute to moderately sized larvae, fourth instar 2–6 mm long. Head capsule elongate and nearly parallel-sided, or less elongate and tapering. Head capsule c. 300 μm, postmentum 100–160 μm long. Setal pits and sensillae distinct (Fig. 7a)

Antenna (Fig. 7f–i) 5-segmented, 1/3 to subequal to head capsule length; basal segment ranging from slightly longer than short flagellum to shorter than very long flagellum; basal setal mark and ring organ close to base, second setal mark variable, from close to ring organ to about 2/3; second antennal segment 2 to 4–5× as long as combined lengths of 3–5, unsclerotised either only extreme base (Fig. 7f) or for >basal 50% (Fig. 7g,h); segment 3 variable lengthed, 4 always short; segment 5 elongate, tapering, thread-like; segment 4 may merge with long apical segment giving 4-segmented appearance (Fig. 7i). Lauterborn organs and

**Fig. 5. Stictocladius** spp. Pupa, abdomens (a) tergites, *S. uniserialis*, (b) tergites, *S. sofour*, (c) lateral, *S. lacuniferus*. © 2010 The Authors Journal compilation © 2010 Australian Entomological Society
Fig. 7. *Stictocladius* spp., Larva. (a) Dorsal head *S.* sp. indet.; (b–d) mentums of (b) *S. uniserialis*, (c) *S. sofour*, (d) *S. lacuniferus* (insert – worn apex), (e) *S. pictus*; (f–i) antennae of (f) *S. sofour*, (g) *S. uniserialis*, (h) *S. lacuniferus*, (i) apex of *S. lacuniferus*, (j) mandible of *S. sofour*, (k) labrum of *S. occidentalis*, (l) maxilla of *S. occidentalis*, (m) premental lobes of *S. occidentalis*, (n) posterior abdomen of *S. uniserialis*. © 2010 The Authors

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style distinct, subequal in length. Base of blade sclerotised (Fig. 7f,g), blade may extend beyond flagellum in species with segment 2 mostly sclerotised (Fig. 7e), long, but shorter than second segment in species with unsclerotised basal half of segment 2 (Fig. 7g). AR 0.4–0.8 if antennal segment 2 mostly unsclerotised (Fig. 7g), 0.7–1.0 if 2 is largely sclerotised (Fig. 7f).

Mentum (Fig. 7b–e) with 1 or 2 broad median teeth and 3 or 4 pairs of lateral teeth, evenly decreasing or with 3rd tooth displaced off line and lower than neighbouring teeth (Fig. 7b). Ventromental plates not recognisable in most species, thin in S. pictus (Fig. 7e). Setae submenti wide, simple, situated from just posterior to base of outer lateral mental tooth or at same level, but more median, or somewhat retracted (Fig. 7d).

Mandible (Fig. 7j) with 3 inner teeth or with a 4th variably delimited from mola; apical tooth shorter than combined width of innermost 2 teeth, seta interna with about 6 strongly branched branches; seta subdentalis strong. Proximal dorsal seta thick and long, equal to mandible in length, distal about half the thickness and length.

Labrum (Fig. 7k) with SI simple, bifid or with a few apical teeth, other S setae simple; with no labral lamellae, 2–3 chaetae and 2–3 spinulae. Pecten epipharyngis of 3 simple scales. Chaetulae laterales 4–6 pairs, median pair strong, other fine and apically plumose with long points; chaetulae basales apically simple. Premandible broad, simple, but sometimes with inner hump, which may appear as second tooth; without brush.

Maxilla (Fig. 7l) broad and square with galea sensilla distinct; 4 outer lacinal chaetae simple, petiolate, innermost pair longer, apically branched sometimes deeply so, simple in Stictocladius sofor.

Premeno-hypopharyngeal apparatus robust, with paired 3-part digitiform lobes and a bipartite sensillum, the longest digitiform lobe prominent, apically rounded and protruding anterior to mentum (Fig. 7m)

Body elongate, abdominal segments longer than wide. Anterior parapods short, separate, smooth or indistinctly to highly serrate claws. Posterior abdominal segment with several distinct setae. Pro cercus (Fig. 7n) at most 10 μm high and wide; with 2 (Australian) or 3–5/6 (some New Zealand and Neotropical species) anal setae; lateral pro cercal setae long, placed at or beside base of pro cercus on abdominal segment. Procerci may be placed apically on projection. Supraanal seta well developed. Posterior parapods narrow, digitiform, mostly parallel-sided, ventrally oriented, with 12–16 smooth apical claws (Fig. 7n). Anal tubes shorter than posterior parapods, bluntly triangular to digitiform, more or less constricted at extreme base.

Systematic position of the genus Stictocladius

Edwards (1931) erected Stictocladius as a subgenus of Spaniotoma Philippi, primarily for the white-ringed tibiae and the conspicuous wing-markings, in a genus otherwise resembling the European D. cultriger Kieffer. Brundin concurred in regarding Stictocladius as a subgenus of Diplocladius Kieffer, but raised the rank in described the pupa, especially mentioning the unique leg sheath arrangement. As observed by Freeman (1959), Edwards’ differences do not hold, as some species lack leg and wing coloration. In fact, the only differences between male imagines of Stictocladius and Diplocladius appear to be the presence of acrostichals (although these are difficult to observe) and of weak setae on the base of the anal point in Diplocladius.

In contrast to the undoubted similarity of adult males, the female imago and the immature stages are very different from those of Diplocladius. Excepting the gonocoxite and anterior placement of the spermathecal ducts on the seminal capsule, the female genitalia are very similar to those of Lopescladius (Sæther 2004).

The pupa resembles that of Lopescladius and Helleniella Gowin. Both Helleniella and Lopescladius have posterior spines on tergites and sternites, and digitiform extensions on the pupal anal lobe. Helleniella also has anterior spine groups on sternites II and III as in some Stictocladius. The leg sheaths of Lopescladius extend beyond the wing sheath as in Stictocladius, but in contrast to the free leg sheaths in Stictocladius, the sheaths of Lopescladius are fused along sutures.

The larvae differ from Diplocladius in virtually all details (mentum shape, beard, SI setae, labral lamellae, procerci), essentially precluding a close relationship. Brillia, Helleniella and Stictocladius all have larvae with the second antennal segment variably divided by a hyaline section. Brillia otherwise differs as much as does Diplocladius, and this feature must be homoplasious. The second segment is partly sclerotised in Lopescladius and Stictocladius whereas it is the basal part that is more weakly sclerotised in Helleniella.

Freeman (1959) noted the similarity between the wing of S. pictus (Freeman) and that of species placed formerly in Smittia Holmgren (including Pseudosmittia Goetghbeuer). Indeed the wing of Smittia maculipennis Goetghbeuer from D. R. Congo and Kenya, known only from the female, is very similar to that of S. pictus. Freeman used this similarity to suggest that Stictocladius could be intermediate between Diplocladius and Smittia. However, S. pictus differs from all the remaining species of Stictocladius in having a sinuous Cu, combined with retracted Rs and extended costa.

The double gonostylus, which has been given great weight in postulated relationships in previous commentary, actually is quite homoplasious against any orthocladi phylogeny: details of the structure show substantial differences between, for example, Cricotopus (Pseudocricotopus Nishida), Chaetocladius (Amblycladius Kieffer) and Diplocladius Sæther. The structure appears also in genera of the Brillia Kieffer group, including Phudsonia Sæther and EuryclONUS v. d. Wulp, but no existing phylogenetic estimate suggests a close relationship.

Morphological matrices constructed for assessment of Orthocladiinae phylogeny fail to provide robust estimation for the position of Stictocladius (O.A. Sæther pers. obs. 2000–2001). Problems arise with homology of, for example, leg sheath and anal lobe projections of the pupa, and the antennal terminal flagellomere. Although much evidence suggests that
Lopescladius forms the sister group of Stictocladius, an alternative placement with Heleniella as sister group cannot be refuted. We await molecular sequence data to assess which, if either, relationship is supported.

Key to male imagines of named Australasian Stictocladius species

1. Wing clear ...........................................  S. sofour sp. n.
   – Wing pigmented (Fig. 1) ........................................... 2
2. Squama setose; pseudospurs present .................................................. Neotropical species
   – Squama bare; pseudospurs absent (Australia, New Zealand) .................. 3
3. Dorsoceentrals in 3–4 rows posteriorly, >35; >10 antepronotals; >35 scutellars ................................. 4
   – Dorsoceentrals uniserial, at most 12; <8 antepronotals; <8 scutellars ....................... 5
4. Wing with 3 dark bands, median band transverse at base of Cu fork, apical band transverse near apex of M3+4 (Fig. 1d) microtrichiose appendix of gonostylus evenly oval, HR >1.9 ...............  S. multiserialis (Freeman)
   – Wing with 2 dark bands, apical band broadly transverse from base of Cu fork to near apex of M3+4 (Fig. 1f).............................. S. victoriensis (Freeman)
5. Anal point present (Fig. 2a); New Zealand ........................................  S. lacuniferus (Freeman)
   – Anal point absent ............................................................................. 6
6. R4+5 retracted, ending well proximal of apex of M3+4; wing length <0.9 mm; AR about 0.35; New Zealand ........................................ S. pictus (Freeman)
   – R4+5 not retracted, ending from slightly proximal to slightly distal to apex of M3+4; wing length >1.1 mm; AR >0.5. Australia ........................................ 7
7. Wing nearly completely dark with 2 nearly fused broad bands (Fig. 1c); inferior volsella low, adpressed to gonocoxite, with short microtrichiae (Fig. 2d) ......  S. uniserialis (Freeman)
   – Wing with fully separated bands (Fig. 1e); inferior volsella distinct, often pediform, with distinct microtrichiae (Fig. 2f) ..................... S. occidentalis (Freeman)

Key to female imagines of named Australasian Stictocladius species

1. Wing clear ...........................................  S. sofour sp. n.
   – Wing pigmented (Fig. 1a–f) ........................................... 2
2. Squama setose, pseudospurs present ..................................................... Neotropical species
   – Squama bare, pseudospurs absent .................................................. 3
3. R4+5 retracted, ending well proximal of apex of M3+4; wing length <0.9 mm; New Zealand ........................................ S. pictus (Freeman)
   – R4+5 not retracted, ending from slightly proximal to slightly distal to apex of M3+4; wing length >1.1 mm ........................................... 4
4. Dorsoceentrals in 3–4 rows posteriorly, >18; about 20 antepronotals, scutellars >30 ................. 5
   – Dorsoceentrals uniserial, <12; <9 antepronotals, <9 scutellars ....................... 6
5. Wing with 3 dark bands, median band transverse at base of Cu fork, apical band transverse near apex of M3+4 (Fig. 1d) ............... S. multiserialis (Freeman)
   – Wing with 2 dark bands, apical band broadly transverse from base of Cu fork to near apex of M3+4 (Fig. 1f).............................. S. victoriensis (Freeman)
6. Tibiae unicolorous to yellowish ringed .................................................. S. uniserialis (Freeman)
   – Tibiae whitish ringed ...................................................................... 7
7. Wing with 2 broad, separate transverse bands, distal band with 3 clear areas (Fig. 1a). New Zealand ........................................ S. similis (Freeman)
   – Wing nearly completely dark, with broad transverse bands partly fused and distal band without clear areas (Fig. 1c). Australia ................. S. occidentalis sp. n.

Key to pupae of named Australasian Stictocladius species

1. Thoracic horn present (Fig. 6c,d) ........................................ 2
   – Thoracic horn absent (Fig. 6b) .................................................. 3
2. Two anal macrosetae (Fig. 6j); pedes spurii A on sternite VI; New Zealand ................ S. pictus (Freeman)
   – Three anal macrosetae (Fig. 6i); pedes spurii A absent; Australia .................. S. sofour sp. n.
3. Each conjunctive with 5–7 rows of pale tubercles (Fig. 5c). New Zealand ....... S. lacuniferus (Freeman)
   – Conjunctives bare (Fig. 5a,b) or most with fine spinules ........................................ 4
4. Sternites II and III with posterior spines, sternite II (III) with median spine groups (Fig. 6f) ................. S. uniserialis sp. n.
   – Sternites II and III with neither posterior or median spine groups .................................. 5
5. Sternite VI without pedes spurii A .................................................. S. uniserialis (Freeman)
   – Sternite VI with pedes spurii A (Fig. 6h) ...................................... 6
6. Posterior spines of tergites III shorter and broader than those of IV; anal lobe projection >230 µm, >0.59 lobe length; male genital sac reaching midpoint of projection ............... S. victoriensis (Freeman)
   – Posterior spines of tergites III subequal to those of IV; anal lobe projection <180 µm, <0.58 lobe length, male genital sac ending approximately at apex of projection .......... S. multiserialis (Freeman)

Key to larvae of named Australasian Stictocladius species

(Does not include the incomplete larva of S. uniserialis)

1. Mentum with 2 median teeth (Fig. 7c,e); hyaline base to antennal segment 2 occupying no more than 10% of segment length (Fig. 7f) ................................... 2
   – Mentum with single median tooth (Fig. 7b,d); hyaline base to antennal segment 2 occupying more than 30% of segment length (Fig. 7g) ......................... 3
2. Outermost tooth of mentum lower than adjacent (Fig. 7c). Australia .................. S. sofour sp. n.  
   – Outermost tooth of mentum elevated (Fig. 7h). New Zealand ......................................................  
   ............ S. pectoralis (+ Neotropical species: not keyed)  
3. Antennal segment I with apical 20% hyaline (Fig. 7h). New Zealand .................. lacuniferus (Freeman)  
   – Antennal segment I with very modest hyaline apex, no more than 5% length. Australian species ............ 4  
4. Posterior parapods with weak claws. Postmentum <133 μm long. Western Australia ........................................  
   – Posterior parapods with relatively strong claws. Postmentum >140 μm. Eastern Australia ...................... 5  
   5 Anal setae >290 μm long; postmentum about 140 μm long .......................................................... S. multiserialis sp. n.  
   – Anal setae <190 μm long; postmentum 145–160 μm long ................................................ S.? victoriensis (Freeman)

NEW ZEALAND SPECIES

Stictocladius lacuniferus (Freeman)  
(Figs 1a,2a,3a,h,5c,6f,7d,h,i)

Diplocladius lacuniferus Freeman 1959: 416.  
Stictocladius lacuniferus (Freeman), Brundin 1966: 428.


Diagnosis. The imagines are separable from other Stictocladius by the combination of having banded wings with paler areas in the outer band, bare squama, no pseudospurs and tibiae ringed with white. The male has an anal point and the female straight spermathecal ducts.

The pupa is characterised by lacking thoracic horn; by the conjunctives with five to seven rows of pale tubercles; anterior margins of tergites and sternites with dark bands; pedes spurii A on sternite VI; thoracic and abdominal setae long, strong and bristle-like; and male sternite VIII without posterior spines.

The larval ventrum has a single broad median pointed tooth with appressed small first laterals, with the outermost three teeth clustered, a hyaline apex to the basal antennal segment and slightly more than half the second antennal segment sclerotised, and with four anal setae on a squar procercus placed posterodorsally on the segment.

Male imago (n = 2–4)

Thorax, legs and abdomen all nearly fully dark, only humeral area, and scutellum medially more yellowish. Tibiae ringed with white.

Thorax (Fig. 3a). Antepronotum collar-like. Humeral pit oval or nearly circular.

Wing (Fig. 1a). Anal lobe not protruding. Wing with 2 bands, with large lacunae in apical band.

Legs (Fig. 3h). Pseudospurs absent.

Hypopygium (Fig. 2a). Anal point present. Oral projections of transverse sternapodeme triangular, wide but low. Inferior volsella with 4–5 setae and strong microtrichia. Microtrichiose appendix of gonostyly with about 7–9 setae.

Mensural features (n = 2–4). TL 2.7 mm, WL 1.38–1.40 mm. Head: AR 0.60–0.66, CI 4–8, IV 0, IV 1, Po 2–3; Thorax: Ap 6–7, Dc 6–7, Pa 3, Sc 4–6, Legs: LR, 0.75, BV 2.34–2.48, SV 2.43–2.45, BR 2.4; LR, 0.44–0.46, BV 2.86–3.19, SV 4.12–4.20, BR 2.6; LR, 0.55–0.60, BV 2.97–3.04, SV 3.38–3.4.

Female imago (n = 1–2)

Coloration patterns as in male, but slightly more pale and scutum more yellowish mediare.

Wing. Anal lobe rounded. Dark areas more extensive than in male.

Genitalia (Fig. 2h). Gonocoxite with 8 setae of which 3 are longer. Microtrichiae of gonapophysis VIII conspicuous. Seminal capsules pale.

Mensural features (n = 0–2). Body and wing lengths unmeasured. Head: Fl 63–75, AR 0.49–0.52, CI 8–10, IV 0, OV 2, Po 2; Thorax: Ap 4–6, Dc 6–7, Pa 2–3, Sc 7–8; Legs: LR, 0.67, BV 2.58, SV 2.59, BR –; LR, 0.45–0.47, BV 2.88–2.91, SV 3.85–4.05, BR –; LR, 0.50–0.52, BV 3.05–3.10, SV 3.62–3.71, BR –.

Pupa (n = 10)

Coloration of exuviae pale brown with scutum, wing sheath margin tergites II–IV slightly darker.

Cephalothorax. Thorax slightly wrinkled, not tuberculose. Wing sheath finely crenulate, nearly smooth on anterior margin.

Abdomen (Figs 5c,6f). Tergites I bare; T II–IV bare, but spotted with dark dots; T VII–VIII with anterior spinulation and spots, T IX bare. Sternite I–V bare, S VI–VIII with anterotateral spinulation. Each conjunctives with 5–7 rows of large pale tubercles. Anterior margins of tergites and sternites II–VII with dark bands. Spines present posterior on T II–VIII, few,
widely spaced and without row(s) of smaller spines anterior to posterior row; spines present posterior on S II–VII, median and anterolateral on II and sometimes median on III. Pedes spurii A present on S VI.

**Larva (n = 8)**

Total length 6.2 mm (n = 1), head capsule 285–310 μm, postimentum 125–130, mentum (Fig. 7d,e) with single median tooth, flanked by small pair of 1st laterals, which appear fused after wear (Fig. 7d), larger 2nd laterals and partially clustered triplet of outer teeth, mentum width 75–87, mid-tooth width 26–34, mandible 100–105. Antennal segments 63–68 (hyaline apex c. 20%); 55–65 (hyaline base c. 45–50%), 5–7, 2–3, 26–30; AR 0.62–0.72. Ring organ 12–15 from base, apical setal mark at 38–45. Blade 75–80, sclerotised base 5–7. Pro cercus 8–10 wide by 10 high, anal setae 175–235. Anal tubules 50–82 long.

**Stictocladius pictus** (Freeman) (Figs 1b,3b,3j)

*Diplocladius pictus* Freeman 1959: 416.

*Stictocladius pictus* (Freeman), Brundin 1966: 428.


**Diagnosis.** The imagines are separable by the combination of one transverse band on wing, retracted R 4+5, sinuous Cu 1, rare squama, no pseudospurs and yellow legs.

The pupa is characterised by having a thoracic horn, two anal macrosetae with spines at base, pedes spurii A on sternite VI, and posterior spines on sternites V–VII or VIII.

The putative larva (the only ‘different’ *Stictocladius* in NZ streams not belonging to *S. lacuniferus* and with *pictus* present as pupae) resembles a small *S. sofour*, with a broad double median mental tooth and three pairs of laterals, but with the outermost tooth elevated and stronger ventromental plate in *S. pictus*.

**Male imago (n = 1)**

Thorax, dark brown, legs yellow.

Thorax (Fig. 3b). Antepronotal lobes narrowed medially. Humeral pit ovoid.

Wing (Fig. 1b). Anal lobe reduced. Wing with 1 broad band, with clear space below FCu.

Legs (Fig. 3i). Pseudospurs absent.

Hypopygium (Fig. 2b). Oral projections of transverse sternapodeme well developed, rounded, higher than broad. Microtrichiose appendix of gonostylus with about 7 setae.

Mensural features (n = 0–1). TL 1.58, WL 0.81. Head: AR 0.35, CI 4, IV 0–2, OV 1, Po 1; Thorax: Ap 2–4, Dc 3–4, Pa 1, Sct 4. Leg 1 missing; LR 0.48, BV 3.21, BR 4.08; LR 0.59, BV 3.41, SV 3.41.

**Female imago (n = 1–3 mature pupae)**

Colour as in male.

Wing. Anal lobe reduced. Dark areas probably as in male.

Genitalia. Seminal capsules pale.

Mensural features (n = 0–3). Body and wing lengths unmeasured. Head: Fl 48–65, AR 0.46–0.62, CI 2–4, IV 0, OV 0, Po 1; Thorax: Ap 3, Dc 3–4, Pa 1–2, Sct 4; Legs: LR 0.52–0.53, BV 3.26–3.27, SV 16–3.18, BR 1.3; LR 0.41–0.47, BV 3.51–3.55, SV 3.96–4.00, BR 1.8; LR 0.44–0.50, BV 3.54, SV 3.68–3.93, BR 2.2.

**Pupa (n = 10–12)**

Coloration of exuviae pale brown with scutum, wing sheath margin and tergites II–IV slightly darker.

Cephalothorax. Thoracic horn 165–210, 190 μm long; spinose, tapering to point; 20–28, 24 μm wide; 7.5–12.7, 8.7× as long as wide; 1.48–1.77, 1.58× as long as anal macrosetae. Thorax smooth, not tuberculose. Wing sheath finely crenulate, nearly smooth on anterior margin.

Abdomen (Fig. 6j). Tergites I–IX bare. Sternite I–VI bare, S VII–VIII with anterolateral spinulation. Conjunctives bare. Spines present posterior on T II–VIII; posterior on S II–VII or VIII, sometimes absent also in males. Pedes spurii A present on S VI. Two anal macrosetae; 3–5, 4 μm wide at base; bases with spines to each side.

**Larva (presumptive; n = 1)**

Total length undetermined, head capsule 210 μm, postimentum 70, mentum (Fig. 7e) with paired broad median teeth and 3 laterals of which the outer is taller; mentum width 46, mid-teeth width 19, mandible 55. Antennal segments 27 (hyaline apex c. 15%); 38 (hyaline base c. 50%), 3, 1, 6; AR 0.56. Ring organ 8 from base, apical setal mark not visible. Blade 54, sclerotised base very short. Posterior body sacrificed for DNA.

**AUSTRALIAN SPECIES**

**Stictocladius multiserialis** Freeman (Figs 1d,2c,3j)

*Diplocladius (Stictocladius) multiserialis* Freeman 1961: 641.

*Stictocladius multiserialis* (Freeman); Brundin 1966: 428.

**Material. Queensland.** Carnarvon NP, Carnarvon Ck, 1 km W camp, 25°04′S, 148°14′E, 1 Pe, 4–5.vi.1991, Black.

**Diagnosis.** The imagines are separable from other members of the genus by the combination of having multiserial dorsocentraIs, and wing with three transverse bands. The male has an evenly oval microtrichiose appendix of gonostylus, and an HR of 2.0–2.4.

The pupa differs from related species by having posterior spines of tergites III subequal to those of IV; anal lobe projection 140–180 μm long and 0.46–0.55 as long anal lobe length, and male genital sac ending approximately at apex of projection.

The larva has relatively strong claws on posterior parapods; second antennal segment sclerotised for about 40% of its length, postmentum about 140 μm long, and anal setae about 300–313 μm long.

**Male imago (n = 5)**

Thorax, abdomen and legs blackish brown.

Thorax (Fig. 3c). Antepronotum collar-like. Humeral pit distinct, large, oval. DorsocentraIs in 3–4 rows posteriorly. Scutellum with setae in 3–4 transverse rows. Postnotum apparently with a few weak setae in 2 specimens.

Wing (Fig. 1d). Anal lobe weak, not protruding. Wing with 3 brownish bands, apical 2 really formed by breaking of 1 broad band by 3 translucent areas.

Legs (Fig. 3j). Pseudospurs absent.

Hypopygium (Fig. 2c). Oral projections of transverse sternapodeme broad, but low, apically truncate. Inferior volsella with about 2–3 strong basal setae; 4–5 additional setae and strong microtrichiae. Microtrichiose appendix of gonostylus with about 10 weak setae, apical 2 stronger.

**Mensural features (n = 4–5).** TL 3.1–3.4, WL 1.8–2.1. Head: AR 0.75–0.93. Cl 8–12, IV 0, OV 1–2, Po 3–4; Thorax: Ap 11–21, Dc 36–44, Pa 9–11, Sct 36–44. Legs: LR1 0.72–0.76, BV 2.56–2.82, SV 2.02–2.39, BR 2.3–3.3; LR2 0.48–0.51, BV 3.46–3.73, SV 3.89–4.04, BR 2.6–3.1; LR3 0.52–0.57, BV 3.51–3.72, SV 3.28–3.56, BR 3.4–4.1.

**Female imago (n = 1–3)**

Coloration patterns as in male, but with pale shoulders.

Thorax. Scutellum with setae in up to 6 transverse rows.

Genitalia. Seminal capsules brown, well sclerotised.

Mensural features (n = 1). TL 3.0, WL 2.3. Head: Fl 115, AR 0.40, CI 0, IV 5, OV 5, Po 0; Thorax: Ap 19–21, Dc 33–56, Pa 8–19, Sct 40–64; Legs: LR; 0.69, BV 3.06, SV 2.52, BR 2.2; LR; 0.46, BV 4.17, SV 4.20, BR 2.1; LR; 0.49, BV 4.17, SV 3.89, BR 2.7.

**Pupa (n = 10)**

Exuviae yellowish brown.

Cephalothorax. Thorax with low tubercles. Wing sheath crenulate on anterior margin.

Abdomen. Tergite I with anteromedian spinulation, T II with anteromedian spinulation, T III–V bare, T VI bare or with anterolateral spinulation, T VII–VIII with anterolateral spinulation, T IX bare. Sternite I bare; S II with anteromedian and sometimes also postmedian spinulation, anteromedian spinulation often strong and nearly forming spine patch; S III–V bare; S VI–VIII with weak anterolateral spinulation; S IX bare. Spines present posterior on T II–VIII, and posterior on S V–VII. Pedes spurii A on S VI. Conjunctives bare.

**Fourth-instar larva (n = 1–3)**


**Stictocladius occidentalis sp. n.**

(Figs 1c,2d,3d)

**Types. Western Australia.** Holotype: ♂P, slide mounted (Euaral), Shannon N.P., Fish Creek, 34°40’S, 116°23’E, 24.xi.1994, Cranston.

Paratypes: 1♂♂P, 1♀P reared from Pe, 1 prepupal L, 2 L, as holotype.

**Diagnosis.** The imagines are separable from other members of the genus by the combination of having wings nearly fully dark with two broad bands partly fused, bare squama, uniserial dorsocentraIs, one prealar, no pseudospurs, and tibiae ringed with white (at least in female). The male has a low adpressed inferior volsella and a slender bare appendix of the gonostylus. The seminal capsule of the female is shorter than the cercus and much shorter than the notum, with the neck about one-fourth as long as the capsule.

The presence of posterior spines on sternites II–VII or VIII combined with the lack of tubercles on tergites or conjunctives separate the pupa from other members of the group.

The larva has weak claws on posterior parapods; mentum at least slightly darker than head capsule, with single, more or
less triangular median tooth, with distinct ventral tooth posterior to the first lateral tooth, and indication of a ventral tooth lateral to median tooth; antennal ratio 0.52–0.54; and postmentum 110–113 μm long.

**Male imago (n = 1–2 mature male pupae)**

Thorax and abdomen apparently blackish brown with gonostyly pale. Legs brown, tibiae ringed with white.

Thorax (Fig. 3d). Antepronotum collar-like. Humeral pit oval.

Wing (Fig. 1c). Wing vein with 2 bands.

Legs. Pseudospurs absent.

Hypopygium (Fig. 2d). Oral projections of transverse sternapodeme rounded, broad but low. Inferior volsella low, adpressed, with about 6 basal setae. Microrchiotheca appendix of gonostylus with about 6 weak setae, apical 2 stronger; bare appendix conspicuously slender.

Mensural features (n = 1–2, tenar). TL 2.4. Head: AR 0.68–0.8. CI 6–11, IV 0, OV 1, Po 2; Thorax: Ap 4, Dc 5, Pa 1, Sct 6. No measurable legs.

**Female imago (n = 1)**

Thorax and abdomen brown, margins of abdominal segments more pale. Legs brown, femora slightly more pale in basal half, front tibiae ringed with white at 0.23–0.70, mid tibia at 0.29–0.71 and hind tibia at 0.24–0.46.

Wing. Nearly fully dark with small area just distal of arculus, anal lobe, oval area at and below FR; oval area just distal to FCu below Cu, apex of cell r2r3, apex of cell m1, and 2 small areas in cell m3 clear. Anal lobe rounded.

Genitalia (Fig. 2i). Seminal capsules dark, sclerotised.

Mensural features (n = 1). TL 2.0, WL 1.1. Head: Fl 70, AR 0.48, CI 10, IV 0, OV 1, Po 3; Thorax: Ap 3, Dc 4, Pa 1, Sct 6; 0.71, BV 2.75, SV 2.56, BR 2.3; LR 0.51, BV 3.46, SV 4.00, BR 2.1; LR 0.51, BV 3.26, SV 3.81, BR 3.4.

**Pupa (n = 10)**

Exuviae yellowish to greyish brown.

Cephalothorax. Thorax tuberculose but tubercles often low. Wing sheath nearly smooth on anterior margin.


**Fourth-instar larva (n = 2–3)**

Total length 4.0–5.4 mm, head capsule 230–240 μm, postmentum 110–113, mentum width 50–60, with distinct ventral tooth posterior to first lateral tooth, and indication of a ventral tooth lateral of median tooth; mid-tooth width 15, mandible 65. Antennal segments 65–70; 95–100 (hyaline base c. 70–75%), 8–9, 4–5,18–24; AR 0.50–0.54. Ring organ 8 from base, apical setal mark at 30–43. Blade 88, sclerotised base 10–13. Posterior parapods with about 12 weak claws. Procerus 13 wide by 5 high, anal setae 450–465. Anal tubes 48–55 long.

**Etymology.** From Latin, occidentalis, western, referring to the type locality in Western Australia.

**Stictocladius sofour** sp. n.

(Figs 2e,3b,i,5b,6a,c,e,7c,f,i)


**Types.** Holotype: ♂ reared from L, slide mounted (Euparal):


Paratypes. Australia. New South Wales. Brindabellas; Bramina Ck, 35°16′S, 148°45′E, 2 Pe, 29.viii.1988; ENDrick R. 6 km NE Nerrida, 35°05′S, 150°08′E, 1 Pe, 1.ix.1988; Brown Mt., Rutherford Ck, 36°36′S, 149°47′E, 1♂ reared from P, 2♂, 1♀, 1♂ reared from L, 2 Pe reared from L, as holotype, 1 L, as holotype except viii.1997, Willis; Brindabella, Lees Creek, 35°21′S, 148°52′E, 2.x.1989 (ANIC).

**Diagnosis.** The imagines are separable from other members of the genus by the combination of having clear wings, slightly sinuous Cu1, no pseudospurs, male anal point, and zero to one seta on squama. Examined females have one to two setae on squama.

The pupa has thoracic horn, essentially smooth cephalothorax, no spinulation on median tergites, pedes spurii A absent, at least some specimens with posterior spines on each of sternites II–IV and medially on sternite II and III, posterior spines on V–VIII, and anal macrosetae with spines at base.

The larva is characterised having a mentum with double median tooth, three lateral teeth, two teeth ventral of lateral teeth and second antennal segment unsclerotised at extreme base only.

**Male imago (n = 9–10)**

Thorax, legs and abdomen brown, with antepronotum, humeral area, ground colour of scutum, scutellum and trochanter yellowish, and gonostyly whitish.

Thorax (Fig. 3e). Humeral pit barely indicated, oval.

Wing. Wing clear. Anal lobe not protruding, Cu1 apically sinuous.

Legs (Fig. 3k). Pseudospurs absent.

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Hypopygium (Fig. 2e). Anal point present. Oral projections of transverse sternapodeme mostly rectangular, conspicuous. Inferior volsella low, sometimes not discernible, with about 8 setae. Microtrichioid appendix of gonostylus with about 8 setae.

Mensural features \( (n = 9\text{–}10) \). TL 1.88–2.64, WL 1.1–1.4. Head: AR 0.48–0.63, Cl 6–8, IV 0–1, OV 1–2, Po 2–4; Thorax: Ap 3–6, Dc 4–9, Pa 2–3, Sct 4–6. Legs: LR1 2.32–2.73, SV 2.49–2.87, BR 2.3–2.5; LR3 0.46–0.54, BV 3.59–3.76, SV 3.69–4.55, BR 2.4–3.6; LR3 0.52–0.62, BV 3.25–3.61, SV 2.98–3.66, BR 2.9–4.7.

**Female imago** \( (n = 3–4) \)

Colour as in male, but paler.

Head. Ultimate flagellomere with 2 setae.

Wing. Anal lobe rounded.

Genitalia. Seminal capsules pale.

Mensural features \( (n = 2–4) \). TL 1.6, WL 1.1–1.2. Head: Fl1 48–73, AR 0.35–0.48, Cl 6–8, IV 0–1, OV 1–2, Po 2; Thorax: Ap 3–6, Dc 6–8, Pa 3, Sct 5–6; Legs: LR1 0.66–0.70, BV 2.55–2.73, SV 2.60–2.85, BR 2.8; LR3 0.48–0.50, BV 3.60–3.71, SV 3.86–4.08, BR 2.3–2.5; LR3 0.52–0.56, BV 3.44–3.82, SV 3.38–3.50, BR 2.5–3.5.

**Pupa** \( (n = 10) \)

Exuviae transparent with pale yellowish tint.

Cephalothorax. Thorax nearly smooth. Thoracic horn 175–250, 217 mm long; spinous, tapering to point; 23–28, 26 mm wide; 7.9–9.6, 8.5× as long as wide; 1.79–2.27× as long as anal macrosetae. Wing sheath very finely crenulate on anterior margin.

Abdomen (Figs 5b,6e). Tergites I–IX bare. Sternite I–II with anterolateral spinulation, S III–VIII with lateral spinulation, S II–V also usually with anteromedian spinulation. Spines present posterior on T II–VIII, posterior on S V–VII (\( \varphi \)) or VIII (\( \sigma \)), occasionally a few posterior spines on II–IV, median and lateral spinulation on II and median spinulation on III sometimes developed as spine patch. Pedes spuri A absent. Conjunctives bare. Macrosetae 3–5, 4 mm wide at base; bases with 4–6, 4 spines.

**Fourth-instar larva** \( (n = 6) \)


**Etymology.** Referring the code number (‘SOx’ = Sydney Orthocladiidae) used in Cranston (1994, 1996). To be treated as a noun in apposition.

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**Diagnosis.** The imagines are separable from an undescribed species by having the wings marked by brown, front leg ratio 0.63–0.69 in male, 0.69–0.70 in female, midleg ratio of female 0.50–0.54, and costal extension in female 13–25 μm long (male extension 25–45 μm long). The neck of the seminal capsule one-fourth to nearly one-third as long as the capsule.

The pupa differs from others by the conjunctives lacking any spinulation; with row of posterior spines on sternite IV absent, or if present, medially interrupted, and the spinulation is mostly coarse on T IX.

The larva is characterised having weak claws on posterior parapods; mentum at least slightly darker than head capsule, with single, more or less triangular median tooth, with indistinct ventral tooth posterior to first lateral tooth, and no indication of a ventral tooth laterally of median tooth; antennal ratio about 0.55; and postmentum 113–120 μm long.

**Male imago (n = 8–10)**

Thorax and abdomen blackish brown. Legs brown, tibiae pale in basal half, occasionally ringed with white.

Thorax (Fig. 3f). Antepronotum collar-like, but median lobes not reaching apex of scutum. Humeral pit distinct, large, oval.

Wing (Fig. 1e). Anallobe not protruding. Wing with 2 broad brownish bands, apex of wing more or less darkened.

Legs (Fig. 3i). Pseudospurs absent.

Hyponygium (Fig. 2f). Oral projections of transverse sternapodeme moderately well developed with apex mostly inward curved. Inferior volsella pediform with about 4–6 basal setae and strong microtrichiae. Microtrichiose appendix of gonostylus with about 6 weak setae, apical 2 stronger.

Mensural features (n = 6–10). TL 2.1–3.3, WL 1.1–2.0. Head: AR 0.66–0.91. CI 2–10, IV 0, OV 0–2, Po 1–3; Thorax: Ap 4–5, Dc 6–12, Pa 1–3, Sc 2–7. Legs: LR: 0.63–0.69, BV 2.51–3.18, SV 2.49–2.67, BR 2.5–3.3; LR: 0.50–0.54, BV 3.51–3.83, SV 3.56–4.00, BR 2.7–3.6; LR: 0.53–0.56, BV 3.38–3.70, 3.54, SV 3.19–3.65, BR 3.3–5.0.

**Female imago (n = 4–5)**

Colour as in male, but paler.

Wing. Anal lobe rounded.

Genitalia. Gonocoxite with anterior spur. Seminal capsules pale, or not or little sclerotised. Spermathecal ducts with prominent loop. Coxosternapodeme broad, well sclerotised.

Mensural features (n = 3–5). TL 2.2–2.5, WL 1.3–1.5. Head: Fl, 75–95, AR 0.42–0.54, CI 6–10, IV 0, OV 0–1, Po 1–3; Thorax: Ap 5–8, Dc 6–10, Pa 2–3, Sc 4–8; Legs: LR: 0.69–0.71, BV 2.70–3.82, SV 2.36–2.58, BR 1.6–2.9; LR: 0.50–0.54, BV 3.34–3.97, SV 3.70–3.92, BR 2.1–2.4; LR: 0.53–0.56, BV 3.42–3.79, SV 3.27–3.61, BR 2.3–2.8.

**Pupa (n = 10–12)**

Exuviae yellowish to greyish brown.

Cephalothorax. Thorax weakly to strongly tuberculose. Wing sheath crenulate on anterior margin.

Abdomen (Fig. 5a). Tergite I bare; T II bare or with weak anterolateral spinulation plus a few scattered median spines; T III bare to faint anterolateral and median group spinulation, sometimes with spines situated on transverse lines; T IV–IX more extensive and more coarse, sometimes nearly spine-like on IX, transverse lines often more distinct. Stermites as tergites, but large anteromedian areas bare. Spines present posterior on T II–VIII, posterior on T V–VII (♀) or –VIII (♂) and usually medially interrupted band of few spines on S IV. Pedes spurii A absent. Conjunctives bare.

**Fourth-instar larva (n = 2)**

Head. Mentum with no clear ventral tooth.

**Remarks.** The pupae examined vary substantially, particularly in the strength of the tubercles on the thorax, in the extent and strength of the spinulation, and in the shape and numbers of the posterior spines on tergites and sternites. For instance, the number of posterior spines on tergite IX ranges from four posterior larger spines with six smaller in front of row to 21 larger posterior and 25 smaller spines in front of row. Also, when the number is small, the spines often are large and triangular, whereas they narrow when numerous. Typical pupae are easily identifiable by the interrupted row of posterior spines on sternite IV. However, many specimens do not have posterior spines on S IV. The often nearly spine-like spinulation on T IX is characteristic for most specimens.

Males vary especially in the colour of the legs, ranging from having tibiae nearly unicolorous to ringed with white. The inferior volsella probably always is pediform, but this may be difficult to observe in some preparations.

**Stictocladius victoriensis Freeman** (Figs 1f,2g,3g,6h)


Type. Victoria. Paratype ♂, slide mounted (Canada balsam): Sassafras, 15.x.1922, Tonnoir.
Other material. **Australian Capital Territory.** Brindabellas, Blundells Creek, 35°22’S, 148°50’E, 1♂, no date, Colless.

**Diagnosis.** The male imago is separable from other members of the genus by the combination of having multiserial dorso-centrals, and wing with 2 transverse bands. The male has an apical point and lateral creases on the microtrichiose appendix of gonostylus, and an HR of about 1.7.

**Male imago** (*n* = 1–2)

Thorax, abdomen and legs blackish brown.

Thorax (Fig. 3g). Antepronotum collar-like. Humeral pit distinct, large, oval. Postnotum apparently with a few weak setae.

Wing (Fig. 1f). Anal lobe weak, not protruding. Wing with 2 brownish bands.

Legs. Pseudospurs absent. Hypopygium (Fig. 2g). Oral projections of transverse sternapodeme apically truncate, broad, but not very high. Inferior volsella with about 6 setae and strong microtrichiae. Microtrichiose appendix of gonostylus with about 9 weak setae.

**Mensural features** (*n* = 1–2). TL 3.4, WL 1.9. Head: AR 0.72, CI 14, IV 0, OV 1, Po 4; Thorax: Ap 15, De 40–42, Pa 13–14, Sct 42. Legs: LR: 0.74, BV 2.85, SV 2.36, BR 2.0; LR: 0.49, BV 3.11, BR 4.05, BR 2.9; LR: 0.53, BV 3.77, SV 3.56, BR 3.0.

**Stictocladius sp. multiserialis group** (=? **victoriensis**)


**Fourth-instar larva** (putative)


**Remarks.** Based on the similarity to the larvae of *S. multiserialis* these larvae may belong to, or be close to, *S. multiserialis* or *S. victoriensis*.

**ECOLOGY AND DISTRIBUTION**

Larval *Stictocladius* are far less abundant in benthic lotic sampling than the density of intercepted drifting pupal exuviae indicate. Furthermore, living larvae proved impossible to rear under conditions that usually encourage late fourth instars to metamorphose. The infrequency of encounters with these stenotopic larvae may relate to their near restriction to deeper benthic habitats, down into the hyporheic. Thus in South Island, New Zealand, *Stictocladius* larvae were important epigean – hyporheic invertebrate taxa (those that occur also in benthic habitats) in the Selwyn River (Datry *et al.* 2007) and Cass-Cragieburn (Fowler & Death 2001). In the Acheron River, in south-east Australia, Marchant (1995) found *Stictocladius*, identified as *uniserialis*, to be equally abundant in samples from the immediate benthos to the hyporheic at 30 cm depth. Whether this behaviour extends to the western Australian species is uncertain – more larvae have been collected from this area, although at least the type locality of *S. occidentalis* is a sandy-bedded small river.

*Stictocladius* has been reported from pupal exuviae collected from Australian lakes, notably one morphotype from several Tasmanian lakes, and both this and another type from several lakes of south-eastern continental Australia (Wright & Burgin 2007). Since larval head capsules of a *Stictocladius* formed a modest component (c. 15%) of the paleo-head capsules recovered from the sediments of sampled Tasmanian lakes (Rees *et al.* 2008), it can be assumed that they were not washed in (as exuviae might be) from surrounding creeks. *Stictocladius* were not found in intensive survey of Lake McKenzie in south-central NSW (Wright & Cranston 2000) or in Lakes Barrine and EACHAM in tropical Queensland (Dimitriadis & Cranston 2001) suggesting the lacustrine (lentic) habitat is restricted to the cooler south-east of Australia.

According to a monthly survey of floating pupal exuviae in streams of the Brindabella Hills east of Canberra, *S. sofour* commenced to emerge in early spring, followed by *S. uniserialis*, both of which continued to emerge through summer until onset of winter. In an hourly diel sampling in December (austral midsummer), *S. uniserialis* showed little emergence after dark, but peaked in the first hours of light following dawn. Numbers of *S. sofour* were lower, but showed a more nocturnal emergence (Willis 1998). Whether these observations apply elsewhere in the range, or to congeneric species, is quite unclear.

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REFERENCES


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