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A new genus and species of Australian Tanypodinae (Diptera: Chironomidae) tolerant to mine waste

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Abstract

For over 25 years an undescribed Tanypodinae (Diptera: Chironomidae) has been known to dominate the lotic invertebrate assemblage associated with long-term polluting mine adits in Captains Flat, on the Molonglo River, southern New South Wales, Australia. Although known in all life stages, it has been impossible to allocate the species to any described genus. Renewed interest in the taxonomy of the Tanypodinae, particularly associated with molecular investigations and pollution indicator status warrants formal description. All stages conform to tribe Pentaneurini, but each life stage differs in morphological resemblance. *Yarrhpelopia* Cranston **gen. n.** is proposed for the taxon previously referred to under the informal code name of 'genus A'. The genus name derives from south-east Australian aboriginal word *yarrh*, in recognition of its core distribution and presence in flowing waters. A single species, *A. norrisi* Cranston **sp. n.,** is described, acknowledging the late Professor Richard Norris, an influential Australian limnologist. Larvae dominate the benthos immediately adjacent to mine adits that continue to leach heavy metals (zinc, cadmium, copper and lead) into downstream sediments. A wider distribution includes cleaner near pristine, eastern Australian rivers between 30° and 42°S, but these records are excluded from the type series pending molecular insights into species limits.

Key words: New genus, new species, Australia, tanypods, biomonitoring

Introduction

Globally there are some 54–57 genera of the subfamily Tanypodinae (Diptera: Chironomidae), depending on the status of some subgenera. Of these 22 are present in Australasia (Ashe & O'Connor, 2009). Formally described endemism at genus level in the subfamily in Australia was limited to *Coelopynia* Freeman 1961, given high rank as a tribe by Roback (1982) and *Australopelopia* Cranston 2000, a monotypic genus of Pentaneurini. Other taxa suspected of lying outside the predominantly northern-hemisphere based generic concepts (e.g. Fittkau 1962) have informal code names (e.g. Cranston 1996). Here formal names and life history descriptions are provided for the taxon for which the informal code Pentaneurini genus 'A' was applied (Cranston 1996). The description, as is desirable for all Chironomidae, derives from the larva, pupa, male and female imagines. Distinction from other taxa lie in the larval head setation and sensory pits, some aspects of the pupal thoracic horn but only few adult features, which are rather homogeneous in this tribe. The dominant larval habitat adjacent to mine adits of low pH and high in heavy metals is particularly significant, although larvae apparently are not confined to such waters. Molecular phylogenetic estimates have been derived (Cranston *et al*. 2011, Krosch *et al.* 2017) but undersampling for molecular analysis remains a problem.

Methods

Specimens were collected from running waters by kick nets for larvae, or from drift using a modified Surber sampler with mesh size of approximately 300µm exposed minimally to include night hours (18.00–6.00h). By preference, field-based sorting was done immediately after net recovery using a binocular microscope, preferably

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with natural light. Individual larval rearings were made in native water, held at ambient temperature, in separate vials stoppered with cotton wool. Specimens are prepared with at least the genitalia of pharate adults dissected out, and mounted in Euparal or some whole larvae in Hoyer's mountant. Terminology largely follows Sæther (1980) except where larval features follow Cranston (2012, 2013). Taenia (taeniate) is used for broadened thin setae. Mensural features are counts, or lengths in µm, unless stated. Localities are arranged from N to S: either GPS-derived degrees, minutes and seconds (xx°xx'xx") or decimal minutes (xx.x') are cited. Elevations, where cited, are map-derived. All specimens are deposited in the Australian National Insect Collection (ANIC). Abbreviations: AR—Antennal ratio (in Tanypodinae the sub- plus terminal flagellomere: remainder of flagellum), Ck—Creek, L(e)—larva (exuviae), LR—Leg ratio (tarsomere1: tibia), MV—proposed molecular vouchers, NP—National Park, P(e)—pupa (exuviae), R.—River, SF—State Forest.

Results

Yarrhpelopia gen. nov.

(Figs. 1–3)
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Pentaneurini genus A (Cranston 1996, Krosch *et al*. 2007)

Diagnosis. Adult male. Pedicel setose, flagellomeres with dark plumes; terminal segment of male short, darkened, with apical fine seta (Fig. 1A). Wing (Fig. 1B) translucent, veins including crossveins pale, membrane and all veins densely setose; costa (C) extending to apex of R_{4+5} prior to wing apex, and proximal to end of M_{3+4}; R_1 and R_{4+5} narrowly separated such that R_{2+3} is poorly visible, but a faint R_2 seems to connect to apex of R_1 and costa; R_{4+5} runs close to and terminates in costa. Squama setose, uniserial. Tibial spurs (Fig. 1C) 1, 2, 2: elongate with several side teeth, inner spur on t_2 and t_3 50–60% length of outer, tibial comb of 3 spines on apex of hind tibia; pulvilli absent; claws very slender, pointed. Posterior margin of TIX with 5–6 long setae. Hypopygium (Fig. 1D) with mediobasal spinose lobe, possibly representing volsella. Parameres strong, long, and dark within cleared gonocoxite (Fig. 1D left).

Pupa. With elongate flat-tubular thoracic horn, about 3–4× as long as broad with horn sac near filling lumen, contracted strongly in distal 1/4 with narrow neck connecting to laterally orientated ovoid plastron plate, filling half of surrounding corona; corona oval, faintly defined, occupying c. 25% of length of horn. Thoracic horn (except corona) with complete dense cover of pointed scales. Thoracic comb modestly developed, uniserial row of 5–7 short, apically rounded tubercles. Basal lobe dome-shaped. Thorax smooth. Tergite I with pigmented scar. Shagreen of small tubercle /spinules, dense and aligned in rows of 2–4; L(ateral) setae taeniate on VII (4) and VIII (5), anal lobe outer margin with very fine spines, inner bare, anal setae adhesive.

Larva. Head index c. 0.5; ligula 5-toothed with weakly concave tooth row, inner teeth weakly curved outward and mid-tooth slightly recessed; 2nd antennal segment smooth, AR c. 3, ring organ at c. 60% from base. Lauterborn organs short and apex does not resemble 'tuning fork'. Basal palp segment undivided, ring organ at 75% from base; b sensillum of two sections, basal section about 3 times length of apical section. Mandible with seta subdentalis arising on strong distal molar 'tooth', posterior to well-defined, rounded inner tooth. SSm retracted, V9, VP and V10 near aligned 45° to longitudinal axis, with ventral pit (VP) slightly posterior to V9–V10; dorsal pit (DP) present, S7 separated from S8. Body without swim hairs. Parapod claws simple, pale.

Type species. *Yarrhpelopia norrisi* **sp.n.**

Etymology. *Yarrh* (pronounced with silent 'h) derives from the southern New South Wales Aboriginal Ngunnawal language meaning 'running water', recognising the ecology of the genus and its centre of distribution, and—*pelopia,* a common suffix in Tanypodinae, the suppressed *Pelopia.*

Distribution. Australian endemic, probably monotypic, distributed along the eastern margin of Australia, from 30°S to 42°S. Apparently absent from northern and western Australia.

Remarks. All stages of *Yarrhpelopia* conform to diagnoses of the tribe Pentaneurini, but each differs in generic identity according to respective stage keyed. In the key to larval Tanypodinae of the Holarctic region (Cranston & Epler, 2013) the simple palpal base, slightly recessed central ligula tooth, body lacking fringe, antennal peg sensilla absent, strong molar tooth, conventionally short posterior parapods, and smooth head and antennal length 3.5× mandible and medially located ring organ leads to couplet 33. The presence of a dorsal pit and simple small posterior parapod claws conform to *Larsia* whereas the ligula shape and A.R. of less than 3.5 suggest *Zavrelimyia*. In Cranston (1996), the larva is keyed as 'genus A' as distinct from other Australian genera on the basis of the distribution of cephalic setae and pits, and on the sculpturing ('creasing') of the postmentum and gula. However Cranston's (loc. cit.) interpretation of the inner teeth of the ligula as directed anteriorly is erroneous as unworn teeth have an outwardly directed apex.

Regarding the pupa, in the key of Fittkau & Murray (1986) the unfringed, narrow anal lobe indicates Pentaneurini, within which the dense simple spines of the abdominal shagreen preclude the Thienemannimyia group of genera. The presence of 4 LS on segment VII and adhesive sheaths on anal macrosetae, distinct thoracic comb, corona on thoracic horn and male genital sacs extending to 70% of length of the anal lobe that lacks spines on the inner margin leads to couplet 39. *Yarrhpelopia* has both transverse serial spinule (shagreen) groups of *Larsia* and simple spinules of *Zavrelimyia* (*Zavrelimyia*): the thoracic horn lacks the characteristically lobate respiratory atrium of *Larsia*. Keyed as 'genus A' (Cranston, 1996) it is close to *Paramerina (*now *Zavrelimyia*) based largely on the thoracic horn (tubular, non-lobate atrium, corona present, plastron plate apical with coarse surface), but differs from *Zavrelimyia* (*Paramerina*) in the horn being spinose distally as far as the corona.

In the adult male if the setose lobe on the basal median gonocoxite is considered to be a volsella (in the sense of the volsella of the Thienemannimyia group in Murray & Fittkau, 1989) it would be the least developed volsella in the group. Treating *Yarrhpelopia* as excluded from the Thienemannimyia group, the tapering gonostylus, plain wing, bare eye, costa ending clearly before M_{1+2}, absence of scutal tubercle and paired spurs present with outer half length of inner, leads to a cluster of genera in which wing venation is critical in further keying. The anterior wing venation is difficult to interpret due to weakly-indicated veins and dense setosity. However R_1 and R_{4+5} are approximated especially in the male, and with R_{2+3} compacted between them and with R_2 faintly detectable. Although these keys do not strongly follow phylogeny, and each stage differs in morphological proximity, adjacency to *Zavrelimyia* (*Paramerina*) recurs.

The following description includes features of taxonomic significance at generic level. Until further species are collected, the description of *Yarrhpelopia norrisi* sp.n. summarises features of a new genus.

***Yarrhpelopia norrisi* sp. nov.**
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Type material. **Holotype** Le/Pe/♂, slide mounted in Euparal, ANIC, AUSTRALIA: New South Wales (NSW), Captains Flat, Molonglo R., 35°35.29”S 149°26.46’E, 21.ix.2016, P.S. Cranston, MV NSWCF-10. **Paratypes** (proposed molecular vouchers (MV) all ANIC): as Holotype, Le/Pe/♂, MV NSWCF-8; Le/Pe/♀, MV NSWCF-6; Pe/♂, MV NSWCF-5; Pe/♀, MV NSWCF-4; 3L MV NSWCF-1-3; non-MV, as Holotype except 2L, Pe; as Holotype, 11L, 'C1Q1', 12.v.1988, B. Atkins, 5L, 'C1Q2', 28.v.1988, B. Atkins; Le/Pe/♀, as Holotype except 12.ii,1988; Le/Pe,/♂, NSW, Foxlow, nr. Captains Flat, 35°30'S 149°20'E, 12.ii.1988, Cranston.

Other material [all AUSTRALIA, in ANIC]: NSW: 2Pe, P♂, Warrumbungles, Timor Rock, Shawn's Ck., 31°16'S 149°09'E, 15.ix.1989, Cranston; P/♀, Bugong Rd, Kangaroo V., xi.1990, Edward; Pe, 6 km n.e. Nerriga, Endrick R., 35°05'S 150°08'E, 1.ix.1998, Cranston; Pe, Morton N.P., Corang R., 35°15'S 150°06'E, 25.v.1994, Cranston; Pe, Molonglo R., above Captains Flat, 35°35'S 149°28'E, 6.iii.1993, Cranston; Le/Pe/m, Le/Pe/f, Pe, Brown Mt, Rutherford Ck., 36°36'S 149°47'E, 16.x.1990, Cranston & Edward; 3Pe, Kosciuszko N.P., Spencers Ck., 1730m asl, 36°26'S 148°22'E, 2.i.1988, Cranston; Pe, Tantawangalo S.F., Wog R., 37°05'S 149°35'E, 13.iii.1993, Cranston. ACT (Australian Capital Territory): Pe, Brindabella Ranges, L. Blundells Ck., 35°22'S 148°50'E, 21.xii.1977, Willis; Le/P, Lees Ck., 35°22'S 148°50'E, 24–25.ii.1998; 3Pe, Mt Gingera, 35°34'S 148°48'E, 18.xii.1992, Cranston. Victoria, Pe, Tambo R., Currawong Ck., 36°58'S 147°54'E, 11.xi.1990, Hortle; 3Pe, , East Gippsland, Bonang Hwy/Gap Rd., 37°14.5'S 148°45.5'E, .ii.1992, Cranston. Tasmania, 2Pe, Peters Link Rd., 41°09'S 148°07'E, 24.ii.1993, Cranston; Le/Pm, nr St Helens, Rattrays Marsh, 41°12'S 148°09'E, 24.ii.1993, Cranston; 4Pe, King Solomon's Jewels, pond #2, 41°47.8'S 146°16.5'E,17.iii.1997, 1185 m asl., Wright; Pe, Cradle Mt.- L. St Clair, N.P., Frog Flat, 41°50'S 146°00'E, 25.i.1990, Cranston; Pe, Strahan S.F., Lake Ashwood, 26.iii.1997, 42°06'S 145°17.5'E, Wright; 3Pe, Central Plateau, small lake nr. L. Ada, 42°52'S 146°28'E, 15.iii.1997, 1160 m. asl., Wright. South Australia, Pe, Ewens Ponds, 38°01'S 140°49.5'E, 19.xii.1996, Wright.

Description. Adult male (n=6) total length 2.2–3.6 mm, wing length 2.0–2.6 mm. Yellow-brown, scutal vittae mid-brown, scutellum darker brown-black. Wings unmarked. Legs light brown. Abdomen basically pale yellow with ovate to dumbbell-shaped, darker brown area anteriorly on each segment, area slightly larger posteriorly until pale segment VIII. Genitalia pale brown.

Head. AR c. 1.7, terminal flagellomere tapering, 4.5× as long as broad, terminating in strong seta (Fig. 1A); penultimate flagellomere 7× terminal flagellomere. Eye with 7–8 ommatidia long dorsomedial extension. Temporal setae 10–12 closely aligned medially, sparser dorsally. Clypeal setae 14. Palp well developed, total length 750, each segment longer than preceding, seemingly lacking sensilla clavata (neither single or aggregated). Scape bare, pedicel with 2 lateral setae.

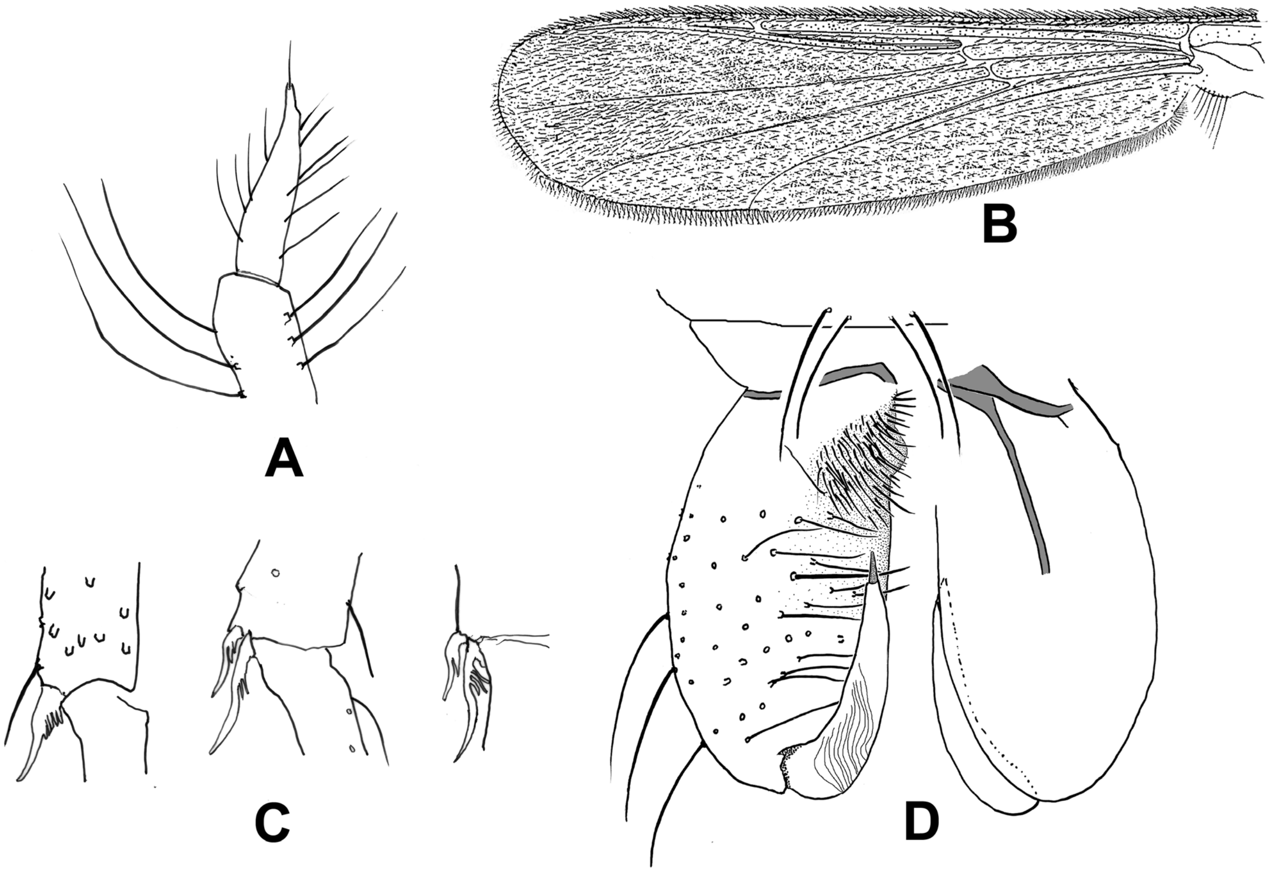

FIGURE 1. *Yarrhpelopia norrisi* **gen. n. sp. n.** Adult male. A. Antennal apex; B. Wing; C. Tibial apices, TI–TIII L to R; D. Hypopygium, left side dorsal, right side stylised ventral/internal.

Thorax. Scutal tubercle absent. Antepronotal setae 1–2, fine; acrostichals 28, uni-biserial between the vittae ending in anterior prescutellar field; dorsocentrals 28, arising anteriorly in humeral field, multiserial in humeral area, uniserial between vittae, expanded posteriorly; supraalars 0; prealars 10–11; scutellars 16. Preepisternum bare.

Wing (Fig. 1B). Costa extending to apex of R_{4+5}, ending subapically, proximal to end of M_{1+2}; R_{2+3} weak, running midway between approximated R_1 and $R_{4+5;}$ R_2 faint, terminating in costa near apex of R_1. MCu above FCu, VR c. 1.0. Membrane unpatterned, densely setose in all cells and all veins. Anal lobe rounded. Squamal setae 24–28.

Legs. LR_1 0.89–0.91, LR_2 0.68–0.70, LR_3 0.72–0.78; all legs densely setose, with beard ratio on all legs maximally 4, lacking any tarsal brush on tarsomere 3 of mid legs. Tibial spurs (Fig. 1C), lengths: P_1 35; P_2 30, 50; P_3 30, 53; tibial comb of P_3 with 3 subequal setae. Claws very slender, slightly curved, distally pointed, simple. Pulvilli absent.

Hypopygium (Fig. 1D). Tergite IX posteriorly with irregularly aligned 6 setae; "anal point" obscure, broad and rounded, microtrichiose. Gonocoxite 190 long, 2× as long as broad, cylindrical, microtrichiose mediobasally, with evidence of mediobasal swelling, interpretable as volsella in some orientations, weak otherwise, a weakly developed anal point extending from tergite IX which bears 5–8 setae along its posterior submargin (Fig. 1D). Gonostylus 120 long, well developed, swollen at base, tapering in apical 2/3, terminal spur 15 long. Phallapodeme long, sternapodeme inverted V-shape (Fig. 1D).

Adult female (n=3), as male in colour and non-dimorphic features. Total length 1.8 mm, wing length 1.9 mm. AR 0.24, terminal flagellomere 115 long, tapering, apex with strong seta. Dorsomedial extension of eye 4–5 ommatidia wide. Temporal setae 10–12, linear uniserial. Clypeal setae 29. Palp as male. Scape bare, pedicel with 7 setae forming semicircle. Many thoracic setae bimodal in length (and size of pit): antepronotal seta 1; acrostichals 30; dorsocentrals 29; supraalars 0; prealars 14; scutellars 26. Squama 18. LR_1 0.79, LR_2 0.73, LR_3 0.74–0.78; Tibial spur lengths: P_1 38, P_2 35, 50, P_3 35, 50.

Genitalia. Gonocoxapodeme VIII mid-brown, gently curved, tapering medially. Gonapophysis VIII triangular. Gonotergite IX without setae. Notum well developed, twice length of seminal capsule, free part of rami pale. Tergite IX thin, non-setose. Postgenital plate large bearing small pediform cerci. Three ovoid to globular seminal capsules, 75 long, spermathecal ducts bare, straight, ending separately

Pupa (n=10). Length 5.2 mm. Cephalothorax grey including wing sheaths; abdomen TI grey, remainder pale to mid-yellow, each with antero-median grey patch; apophyses golden.

Cephalothorax. Thoracic horn (Fig. 2A) cylindrical, flattened in antero-ventral plane, slightly curved, near parallel-side in lateral view, terminally rounded; 275 long, 5× maximum width, external membrane with spines nearly united into irregular mesh. Horn sac tubular, occupying full lumen, with short angled connection to plastron at about 90% length from base. Corona wide, occupying about 20% length of thoracic horn, plastron plate ovoid, angled to long axis. Basal lobe tubercular c 35 long. Thoracic comb comprising 12–20 short tubercles, longest 10 long and dorsad, biserial medially. Thorax weakly spinulose; without scutal or postnotal tubercle. Single antepronotal seta retracted from margin, other thoracic setae difficult to discern: only 1 weak precorneal seta; dorsal setae 1 and 2 present, simple, 2 displaced laterally close to anterior wing sheath base, dcs_4 taeniate, in supraalar position.

Abdomen (Fig. 2B). Tergite I with scar, lateral muscle marks very weak. Abdominal spinulation (shagreen) (Fig, 2C) fine, aggregated form short rows, spinules larger and denser and in triplets medially or aligned laterally especially on more posterior segments. L setae taeniate only on segments VII (4, clustered in posterior half) and segment VIII (all 5, evenly spaced). D setae: 3 on I, 4 on II, 5 on III–VII, absent on VIII; O-setae: 1 pair dorsal, 1 ventral, situated mid-curve of apophyses. Anal lobe (Fig. 2D) about 1.5× as long as broad, microspinulose, outer borders with spinules, inner border convex, outer border curved. Anal macrosetae adhesive. Gonopodial sheath of female short, spinulose; of male smooth, extending c. 70% length of anal lobe,

Larva (n=10). Body length 5.4–5.8 mm, head capsule length 550–580, golden-yellow with narrow cephalic margin slightly darker golden-brown; mandible golden, tip brown, ligula golden brown grading to dark brown distal half, anterior parapod claws fine and pale, posterior claws broader, simple, golden-yellow. Capsule longish-oval, cephalic index 0.7–0.75. Cephalic setation (Fig. 3A): S10, VP and S9 aligned at 45° to longitudinal axis, SSm retracted, posterior to S10 and more median than S9, dorsal pit present, S7 close to S8, S5 only slightly proximal to DP.

Antenna (Figs. 3B, C) slightly longer than head length, segment lengths: 255–300: 74–84: 6: 5–6, AR: 3.0; basal segment c12× as long as basal width, ring organ distal to mid-point (60%); Blade bifid, broad outer branch 82–90, slightly longer than thin inner branch. Lauterborn organs (peg sensilla, Sæther 1980) very short, 2–3, style c. 15 extending to near apex of antenna (Fig. 3C).

Mandible (Fig. 3D) gently curved, with bluntly tapering apical tooth, 95 long; short, rounded inner tooth not projecting, long seta subdentalis arises from projecting tooth-like distal mola. Ventrolateral setae close on outer margin, separated from sensillum minusculum by less than distance from posterior most seta 3.

Ligula (Fig. 3E) with 5 teeth, row concave, with outer teeth directed anteriorly, point of inner teeth curved outward; ligula weakly constricted medially; narrow rectangular area of muscle attachment occupying basal 8–10%. Paraligula bifid, with outer branch near half length of ligula, inner much shorter. Pecten hypopharyngis with 12–13 teeth, quite homogenous in size or diminishing slightly laterad.

Maxillary palp (Fig. 3F) with basal segment 40 long; faint ring organ situated subapically at 75% length; crown with well-developed setae and sensilla including 2-segmented b-sensillum with basal section about 3x length of apical section.

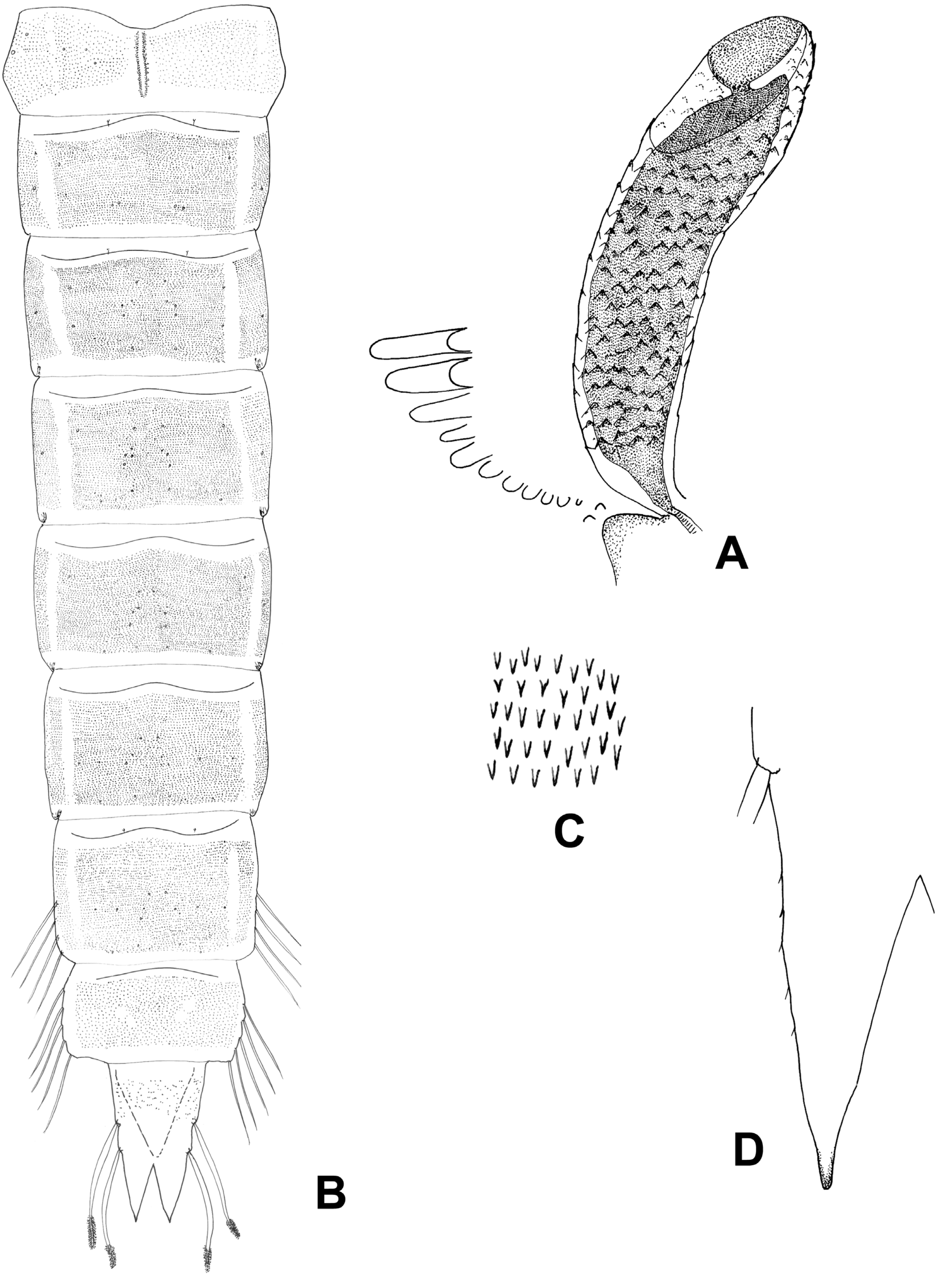

FIGURE 2. *Yarrhpelopia norrisi* **gen. n. sp. n.** Pupa. A. Thoracic horn and thoracic comb; B. Dorsal abdomen; C. Tergite IV spinulation ('shagreen'), detail; D. Anal lobe,left half.

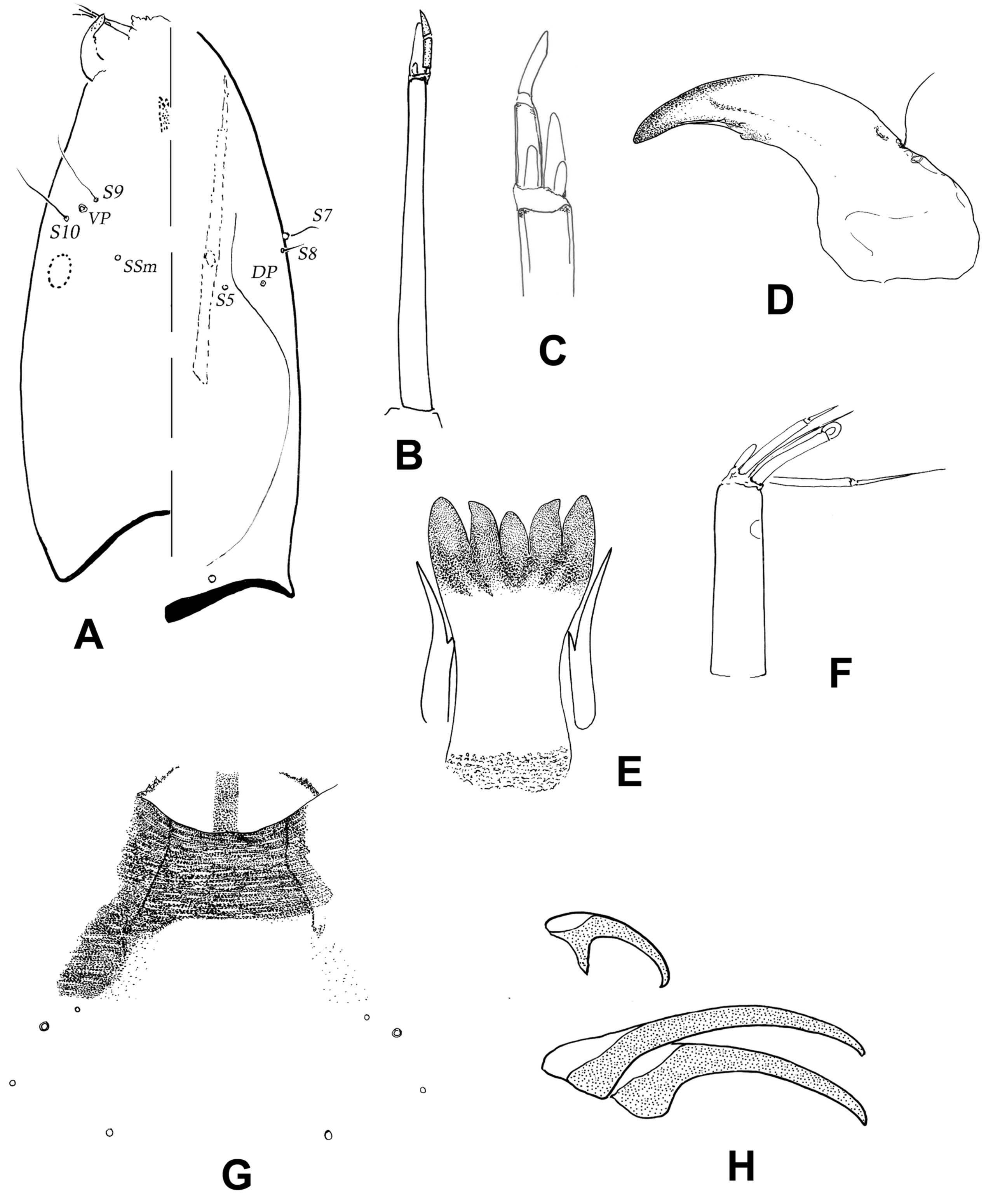

FIGURE 3. *Yarrhpelopia norrisi* **gen. n. sp. n.** Larva. A. Head, left ventral, right dorsal: Abbreviations: S5-S10 cephalic setae, DP—dorsal pit, VP—ventral pit: B. Segments 2–4 of antenna; C. Antennal apex; D. Mandible; E. Ligula; F. Palp; G. Submentum; H. Posterior parapod claws (selected).

Submentum (Fig 3G) anteriorly with transverse 'creases' of lighter sclerotisation, extending laterally and posteriorly to near occipital margin, less far ventrally Dorsomentum with 3 small lateral teeth; M appendage uncertain, vesicles not distinguishable. Pseudoradula 14–15 wide, essentially parallel-sided, densely granulose without clear alignment, posteriorly without contact to ventral hypopharyngeal apodemes.

Abdomen. Body without a fringe of swim setae. Anterior parapod claws simple, pale. Anal tubules slender, shorter than half length of posterior parapod, tapering apically, about 4× as long as basally wide. Procercus evenly darkened about 3× as long as wide (100 × 35), with 7 anal setae of length 500. Subbasal seta of posterior parapod simple. Posterior parapods simple, yellow with 12–14 short and triangular to long and narrow claws; with at least 1 small and 1 medium-length claw having an hyaline outer crescent (Fig. 3H). Claws subtended on parapod by subapical area of few fine spinules.

Etymology. The specific epithet *norrisi* recognises the late Professor Richard Norris, eminent freshwater biologist, whose interests in the pollution of the Molonglo River by the Captain's Flat mine extended over several decades. To be treated as a noun in apposition.

Discussion

Taxonomy. *Yarrhpelopia* is essentially the only chironomid in a highly polluted site (see below, Ecology and pollution tolerance) but immature stages of the same morphology also occur at a range of unimpacted sites. For this reason the type series is selected from specimens only from the Captain's Flat site, pending the possibility that a cryptic less-tolerant congeneric species exists. This is where molecular data linked to population genetics will be invaluable. Thus far genetic data has been obtained from only 1 larva, from a clean site in Victoria (Cranston *et al*. 2011) and none from elsewhere in the range. Material is being sought for molecular study, but the breadth of the range must be sampled for clarification.

Phylogeny. *Yarrhpelopia* was included as Pentaneurini genus A in the molecular phylogeny estimate for Chironomidae by Cranston *et al*. (2011) based in the single larva noted above. The position within a strongly supported Pentaneurini, but with weak relationships to *Conchapelopia* (the only Thienemannimyia group taxon sampled) plus *Australopelopia* and *Pentaneura* is not profound. In a subsequent assessment, with denser sampling (Krosch *et al*. 2017, in press) a supported position as sister to a slightly better sampled Thienemannimyia group is proposed.

The genus is not included (lacking formal description) in the major morphological analysis of the subfamily by Silva & Ekrem (2016) but if scored into their data matrix and analysed under maximum parsimony, a position in Pentaneurini close to their Thienemannimyia group can be construed, but without support. The same applies to *Australopelopia* which was included in Silva & Ekrem's (2016) analysis and appears to lie close to or within Thienemannimyia complex on morphology, as argued by Cranston (2000), but this finds little or no support on molecular data (Krosch *et al*. 2017).

In reviewing the morphological discussion by Silva & Ekrem (2016) concerning the Thienemannimyia group, both *Australopelopia* and *Yarrhpelopia* lack the diagnostic complex dorsomedial lobes of the male hypopygium and the pupal abdominal shagreen is simple, not comprising longish, upright, mostly multi-branched or bifid spinules. Although the pseudoradula is separated from the basal sclerotised zone, the diagnostic significance of this for the Thienemannimyia group, or the distribution of a radula connected to sclerotized base in Pentaneurini, is uncertain as it does not form part of the morphological matrix nor is the feature discussed further. In conclusion, morphology seems unlikely to be able to provide a robust estimate of the relationships of these two taxa, and ongoing molecular analysis of a well-sampled Pentaneurini will be needed.

Ecology and pollution tolerance. *Yarrhpelopia norrisi* **sp. nov.** was discovered originally and remains abundant in a reach of the Molonglo River in Captains Flat, south eastern New South Wales impacted by inflow from mine adits. In an unpublished thesis concerning biological monitoring of heavy metals, Atkins (1981) investigated the pollution ecology of freshwater mussels (*Velesunio* sp.) in the Molonglo River. These molluscs were exposed in situ to heavy metals, namely zinc, cadmium, copper and lead leaching from the abandoned mines. From polluted stretches, Atkins collected Chironomidae identified in 1988 by the author as an undetermined pentaneurine Tanypodinae. Previously Norris (1986) had reported only *Procladius* in the subfamily from the area, but subsequent collections at the same sites in and around Captains Flat confirm the dominance of the pentaneurine and the much lesser presence of a *Procladius* species. Despite attempts at remediation of the mines, Norris (1986) reported little or no change in the sediments. Concentrations in sediments at sites downstream of the mines have been recorded recently (in µg/g dry mass) as Zn: 697–6818, Pb: 23–1796, Cu: 10–628, Cd: 0.13–8.7 (Marasinghe Wadige, 2014). Highest recorded sediment metal concentrations were Zn 81×, Pb 240×, Cu 45× and Cd 48× higher than the river background metal concentrations (Marasinghe Wadige, 2014).

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