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Life histories of *Paucispinigera* Freeman, *Paraborniella* Freeman and *Paratendipes* Kieffer (Diptera: Chironomidae) with phylogenetic considerations

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Abstract

The immature stages of the New Zealand endemic *Paucispinigera* Freeman and *Paraborniella* Freeman, endemic to Australia, are described fully for the first time. A new species of *Paratendipes* Kieffer endemic to Australia is described in all life stages. Morphological support from larvae for placement in a 'Microtendipes' group in tribe Chironomini includes the 6-segmented antenna with Lauterborn organs on the 2nd and 3rd segments, and a well-demarcated, multi-toothed ventromentum. The pupa has a few-branched thoracic horn and the distribution of taeniate L-setae is informative. Significant differentiating characters of the adult male include the form of tibial apices and the structures of superior and median volsellae in the genitalia. In the wing of *Paucispinigera*, the squama lacks setae, contrary to the original description, and unusually has vein M_{1+2} setose in both sexes and also the M_{3+4} setose in the female. An apical spine on the gonostylus of *Paucispinigera* is unusual. The female genitalia are described here for the first time but lack phylogenetically informative variation. An Australian species of the widespread genus *Paratendipes* Kieffer, described here as *Paratendipes sinespina* **sp. n.**, is provided for comparison. *Paucispinigera* and *Paraborniella* each warrant independent generic rank.

Key words: new life histories, new species, Australia, New Zealand, monotypic genera

Introduction

Modern systematic research in the family Chironomidae (Diptera) emphasises holomorphological studies, with the immature stages (larva and pupa) integrated with adult morphology. Thus keys and diagnoses to the Holarctic Chironomidae (Wiederholm 1983, 1986, 1989) reconciled disparate taxonomies at the generic level across North America and Eurasia. The larvae have been revisited (Andersen *et al*. 2013) and the framework holds well for the northern hemisphere midges. The situation in the southern hemisphere and also in south-east Asia is improving, but adult-based taxa of generic rank persist for which the immature stages are undescribed or unknown. Endemic genera in the tribe Chironomini from the main islands of New Zealand and from continental Australia are among these.

Paucispinigera approximata Freeman was described from New Zealand as a monotypic new genus by Freeman (1959). Similarly monotypic is *Paraborniella tonnoiri* (Freeman 1961) from Australia. In his pioneering study of female genitalia of the Chironomidae, Sæther (1977) included *Paucispinigera* based only on Freeman's short description, keying it as close to *Paraborniella* Freeman and grouping these both with *Paratendipes* Kieffer 1911. However, specimens were not examined and female genitalic characters were not assessed. *Paucispinigera* received no attention excepting catalogues until its inclusion in a broad molecular-based phylogeny (Cranston *et al.* 2011). Based on reared associated material, the taxon was placed in the informal 'Microtendipes' group as also was *Paraborniella* that has been studied principally for larval resistance to dehydration (Jones 1975; Nakahara *et al*. 2008).

Recent inclusion of the larvae of *Paucispinigera*, *Paraborniella* and *Paratendipes* in a regional (Australia and New Zealand) generic key (Cranston 2019b) requires retrospective formal descriptions of the immature stages to evaluate the proposed generic endemism.

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Methods and materials

Taxa of phylogenetic significance were sought for molecular phylogenetic studies across the Chironomidae (Cranston *et al*. 2011). Immature stages were prioritised for relevance to aquatic biomonitoring programs and ease of collection. Those of *Paucispinigera* were sought without success in streams around the type-locality of Ohakune in New Zealand's North Island, where habitat has been impacted by activity of the nearby volcanic Mount Ruapehu and local stream conditions seem unsuited now, as also for *Riethia zeylandica* Cranston. However, subsequently *P. approximat*a was found in the Buller area of the north-west of South Island. Larvae of *Paraborniella* have been collected opportunistically in Australia in newly wetted rockpool larval habitats. However, for molecular studies (Cranston *et al*. 2011) a culture in Japan sourced originally from Merredin, Western Australia (R. Cornette, pers. comm.) was used: at that time all known eastern Australian sites were dry. *Paratendipes* was collected and reared initially during environmental impact studies of the Alligator Rivers Region of Australia's Northern Territory (Cranston 1991).

Specimens were mounted on slides in Euparal using standard procedures (Cranston 2000), with some larvae mounted initially in Hoyer's mountant for optimal clearing and optics for photography. Selected examples of such larvae have been remounted from Hoyers into Euparal. All life stages were examined using compound microscopy with phase contrast and Nomarski optics up to oil immersion (x1000). For descriptive taxonomy both line drawings and photographs are used: neither alone is satisfactory (Cranston 2019a) and the trend to photography alone is unacceptable (Zamani *et al*. 2020).

Morphological terminology follows Cranston (2013) and interpretation of the median volsella follows Pinho *et al*. (2013) as an appendage originating between the bases of the superior and inferior volsellae. Morphological measurements, unless otherwise stated, are in microns (μm) rounded to the nearest 5 μm except when measurement at maximum magnification (oil immersion, ×1000) that allows accuracy to +/- 1 μm. In keeping with our understanding of the influence of body size variation (allometry, see McKie & Cranston 2005), only summary ratios of antennal flagellomere and leg segments are provided without tabulation of actual measurements. In the adult redescription, square brackets are used for Freeman's data and parentheses ('round brackets') for mensural data ranges from examined specimens.

Ink drawings by hand used a drawing tube on film, scanned and manipulated subsequently in Adobe® Photoshop™. In line drawings of the complete pupal abdomen the posterolateral 'comb' (e.g. Fig. 6D, 9E, F) is portrayed as if on the same plane as the tergal structures (dorsal) although the 'comb' is ventral (pleural / sternal). This follows convention (e.g. Pinder & Reiss 1986) as does imprecision about the surface of origin of lateral abdominal setae. Photographs were compiled using Automontage™.

Lengths are in microns (μm) unless stated as mm. Abbreviations, adult, unless stated. *Ac*, acrostichal setae (count); *A.R*., antennal ratio = length of terminal flagellomere divided by combined preceding flagellomeres (adults) (♂ 1–12; ♀ 1–4); terminal segment / sum of preceding segments (larva); *B.l*., total body length in mm; *BV*, 'Beinverhältnis': length of Fe+Ta+Ta_1/ $Ta_{2–5}$; *Dc*, dorsocentral setae (count); *Fe*, Femur; *Fl*, flagellomere; $Fl_{1–12, 13,}$ length of antennal $flagellomeres_{1-12}$ combined (♂); *L*, larva; *Le*, larval exuviae; *Le/Pe/*♂ (♀)*,* reared adult male (female), with associated larval and pupal exuviae; *MV*, molecular voucher; n, number of specimens measured; $P_{1–3,}$ leg(s) (1 = fore; 2 = mid; 3 = hind leg); *Pa*, prealar setae; Palp, palpomere lengths; *P(e),* pupa (exuviae); *P*♂ (♀), pharate male (female) within pupa; *Scts*, scutellar setae; *sq*, squamals (count); *SV*, 'Schenkel–Schiene–Verhältnis' = combined Fe + Ti / length of Ta_1; *Ta*, tarsomere; *Ti*, Tibia; *V.R*., vein ratio = length of Cu / length of M; *Wl*, wing length (mm) (arculus to apex).

Geographical terms: *Ck*, Creek, *E*, East; *N*, North; *R*., River; *S*, South.

Specimens are conserved in the Australian National Insect Collection, CSIRO, Canberra, Australia (ANIC), The Natural History Museum, London, (dis) United Kingdom (BMNH) and Zoologische Staatssammlung München, Munich, Germany (ZSM).

Taxonomy

Paucispinigera Freeman
(Figs 1–3)

Paucispinigera Freeman 1959: 428.

Type-species: *Paucispinigera approximata* Freeman 1959: 428, by monotypy and original designation.

Generic Diagnosis. Male and female adults, described briefly by Freeman (1959), within tribe Chironomini diagnostically have unusual wing venation (Figs 1A, B) with R_{2+3} near adjacent to R_1, and with long costa and curved R_{4+5} terminating at wing tip close to the apex of M_{1+2}. Distal half of M_{1+2} (and M_{3+4} in female) with numerous uniserial setae, as on R, R_1 and R_{4+5}. Squama bare. Fore leg tibia with rounded apex (Fig. 1C); mid and hind leg tibiae apically with 2 near contiguous combs, broader (outer) with single apically curved spine (Fig. 1D), narrower (inner) without spine. Male genitalia (Fig. 1E–G) with curved gonostylus with apical spine (possible megaseta) and well developed median volsella.

Pupa. Cephalic area with neither cephalic tubules nor warts, with frontal setae (Fig. 2A). Thorax slightly crenulate dorsally (Fig. 2B), with a few-branched horn. Abdomen (Fig. 2C) with strong pedes spurii B on TII; with rectangular spinule pattern on TII–V, anteromedian patch on TVI, TVII–VIII without spinulation. Hook row of TII short, continuous. Conjunctives III and IV with transverse spinule band. Pleura of V posteriorly with spinule patch (Fig. 2D). L setae taeniate on V–VIII, 4, 4, 4, 4. 'Comb' with dominant tooth and several outer curved smaller teeth (Fig. 2E). Anal lobe with uni- biserial fringe and dorsal seta.

Larva. Dorsal head with frontoclypeus flared anteriorly with semilunar clypeus (Fig. 2F, 3B). Antenna with 6 segments with Lauterborn organs on apices of 2nd and 3rd segments (Fig. 2G, 3C). Labral SI broadly plumose, near contiguous on fused base, SII apically serrate arising from short nearly contiguous tubercles; pecten epipharyngis of three separate lobes, each with 2 –4 rounded teeth; premandible with 4 teeth and strong brush (Fig. 2H, 3D, E). Mandible with short pale dorsal tooth, larger triangular apical tooth and 2 inner teeth; seta subdentalis elongate; mola and inner margin smooth; seta interna densely plumose, more basal than usual (Fig. 2I, 3I). Ventromental component of mentum with 8 uneven-sized teeth, paler than laterals; dorsomentum with 4 darker teeth each side, each slightly diminishing in size laterad (Fig. 2J, 3H). Ventromental plate fan-shaped with evenly distributed striae.

Paucispinigera approximata Freeman
(Figs 1–3)

Paucispinigera approximata Freeman 1959: 428.

Material examined: 2♂, Pe/♂, 8Pe, NEW ZEALAND: South Island, Nelson Lakes N.P., Speargrass Stream, 41°47'01"S 172°46'28"E, 1.ii.2000 (*Cranston*); 7L, same except 41°48'24"S 172°50'46"E, 13.vi.2007 ('QUT team'); L, same except 11 –13.i.2010 (*Cranston*) MV NZ10–2.

Description. Adult Male (n=2). Body length 2.5–3.0 mm, wing length 2.2 [2–2.6] mm. Wing hyaline, plain. Slide mounted colour: thorax yellow-brown with darker postnotum, legs plain ["green with reddish thoracic markings ... head and antennal pedicel yellow, palpi darker .... thorax yellowish-green with reddish strips, postnotum and sternopleuron ... legs pale yellow ..... abdomen plain green"]

Antenna. With 13 flagellomeres; Fl_{1-12} 500–510, Fl_{13}, 560–570; Antennal ratio 1.1–1.2 [1.3].

Head. Eye bare, with dorsomedial parallel-sided extension 5 ommatidia long, separated medially by width of 8 ommatidia. Temporals 10–12 uniserial; clypeals 7–8. Frontal tubercles absent. Palp 5-segmented, segment 2 globular, segments 3 and 4 approximately equal in length, 5th long (250 μm); segment 3 apparently lacks sensilla.

Thorax. Antepronotal lobes tapered dorsally, medially divided at notch, without lateral antepronotal setae. Scutum not overreaching antepronotum, smoothly curved in profile. Without any humeral pit. Ac (c. 12) partially biserial, starting from front, ending just anterior to scutellum; 6–7 uniserial Dc each arising from pale spot, absent from humeral area; 3 Pa; 6–8 uniserial Scts.

Wing (Fig. 1A, B). Membrane without setae or microtrichia. Anal lobe weakly developed. Costa ends at apex of

long R_{4+5} terminating at wing tip, close to apex of M_{1+2}; R_{2+3} tracking close to R_1. FCu distal to RM with VR 1.3–1.4. Brachiolum with 2 setae. R, R_1, R_{4+5} and distal half of M_{1+2} setose. Squama bare [fringed].

Leg. Apex of fore Ti with rounded scale, without spur (Fig. 1C). Mid and hind Ti apically with two nearly contiguous combs occupying about 60% circumference, one comb with curved spur (Fig. 1D), the other without spur. Only teneral LR_1 available, c. 1.2 [1.3]. Pulvilli absent [only visible in slide preparations and not divided]; empodium well formed.

Abdomen. Tergites I–VII with few irregularly scattered setae.

Hypopygium (Fig. 1E, F). Anal tergite without evident bands, mictrotrichiose to base of anal point, with median anal tergite setae represented by few small setal bases; few short basal-lateral setae on submargin of tergite IX. Anal point near continuous taper from anal tergite margin, short, bare apically, with rounded apex. Superior volsella (Fig. 1E) broadly digitiform ('fat finger'), abruptly narrowed distally to curved hook, with coarse microtrichia basally, with 2-3 stronger setae dorsally, 2 medially-directed on inner surface, bare apically. Median volsella with distinct stem, distally with 3-5 long simple narrow taeniae, directed medially (Fig. 1F). Inferior volsella fused to gonocoxite in basal 1/3, becoming subglobular, extending beyond gonocoxite apex, microtrichiose apico-ventrally, apically with medial to dorsomedial directed, simple setae, without any differentiated apical seta. Gonostylus sickle-shaped or 'allantoid', inward curving with rounded apex bearing a small 'megaseta' (i.e. seemingly with 'socket-base') or simple point. Transverse sternapodeme and phallapodeme (not illustrated) very pale, indistinct (hypopygia examined are teneral).

Adult female (described briefly by Freeman, 1959) (n=0). Distinguished by bare squama, wing veins R_{4+5} and M_{3+4} ending close at wing apex; all R veins and both M veins setose.

Pupa (n=8). Medium-sized, c. 4.5–5.0 mm long. Thorax and cephalic area pale golden brown, abdomen pale hyaline with indication of darker golden apophyses, comb and anal lobe.

Cephalothorax. Frontal apotome weakly wrinkled, without cephalic tubercles or frontal warts; frontal setae (90 μm) located on short, sometimes pointed tubercle (5 μm) (Fig. 2A). Detail of thoracic horn difficult to interpret but with plump, spinose, basal stem (c. 100 μm long), divided into few, possibly only 2, maximally 4, hyaline branches; basal ring small, oval and with modest tracheal 'bundle'. Median suture rugulose with small scales (Fig. 2B). Prealar tubercle absent. Antepronotum with 1 median, 0 lateral setae; 2 precorneals; dorsocentrals (Dc) each c. 50 μm long with Dc1 and Dc_2, approximated and well separated (250 μm) from also closely approximated Dc_3 and Dc_4.

Abdomen (Fig. 2C). Tergite I bare, II–VI each with extensive subquadrate spinule patch without stronger anterior or posterior bands; T VII–VIII and anal segment bare. Tergite II hook row continuous, comprising 20–25 hooks, 25–30% width of segment II. Narrow transverse spinule bands on conjunctives III and IV. Segment V with fine pale spinules in patch on posterolateral of pleura (Fig. 2D). Sternites III–VI with fine spinules (max. length 6 μm), extensive on III, with at least anteromedian patch on IV–VI; remainder bare. Vortex on IV. Pedes spurii B strong, on segment II only. Posterolateral corner of segment VIII ('comb') with golden–brown teeth, posteriormost tooth dominant, with 2–4 shorter, curved, pointed teeth (Fig 2E). Apophyses weak. Segment I with 2D, 3V and without L setae; II with 3D, 3V and 3 L; III with 4D, 3V and 3L; IV–VII with 5D, 3–5 V and 4 taeniate LS, VIII with 4 taeniate LS. O setae very fine, present definitively on TII–V, uncertain otherwise, but at least on SIII. Anal lobe elongate semicircular with uneven uni-biserial fringe of 22–27 taeniae, with fine dorsal seta. Genital sac of male extends beyond anal lobes, of female unknown or male-like.

Larva (4th instar) (n=5). Body (Fig. 3A) pink-red in life 4–4.5 mm long, ventral head length 350–380 μm. Head capsule yellow with golden-brown dorsomental, apical mandibular and premandibular teeth. Genae and submentum variably darkened; occipital margin broad, dark.

Dorsal surface of head (Fig. 2F, 3B) with frontoclypeus narrowing anterior prior to subterminal flare to lateral points, without frontal pit. Cephalic S3 (clypeal) setae close to anterior margin, S2 seta on narrow granulose area, S1 on delimited labrum—all 3 setae (S1–S3) forming a tight cluster.

Antenna (Figs 2G, 3C) 6-segmented, with segments 2 and 3 subequal, each longer than short 4th, 5th longer than 4th, 6th shortest; Lauterborn organs well developed, sessile, alternate on apices of 2nd and 3rd segments. Segment 1 with ring organ at basal third, seta absent. Blade subequal or extending slightly beyond antennal apex.

Labrum (Figs 2H, 3D, E). SI arise near contiguous on fused base, broadly plumose with about 20–25 apical branches; SII arise from nearly contiguous short tubercles, apically serrate on both margins; SIII simple, short; SIV moderately developed. With 7–8 plumose chaetae. Seta praemandibularis simple. Labral lamellae a broad, single plate with fine teeth. Pecten epipharyngis comprising three separate lobes each with 2–4 rounded teeth. With 7–8

apically plumose chaetulae laterales and 2 apically branched chaetulae basales. Premandible with 4 teeth, distal pair more pointed than shorter, rounded, inner pair, with strong brush.

Mandible (Figs 2I, 3F) with short pale dorsal tooth, larger triangular apical tooth and 2 modest inner teeth; darkened distal mola not tooth-like. Pecten mandibularis with 8–10 branches, strong, extending to margin of mandible. Seta subdentalis very elongate, arising from ventral surface of mola, significantly retracted on mola, somewhat dilate medially then narrowing to rounded apex, level with apical mandibular tooth. Mola and inner margin smooth. Seta interna densely plumose, located more basal than usual.

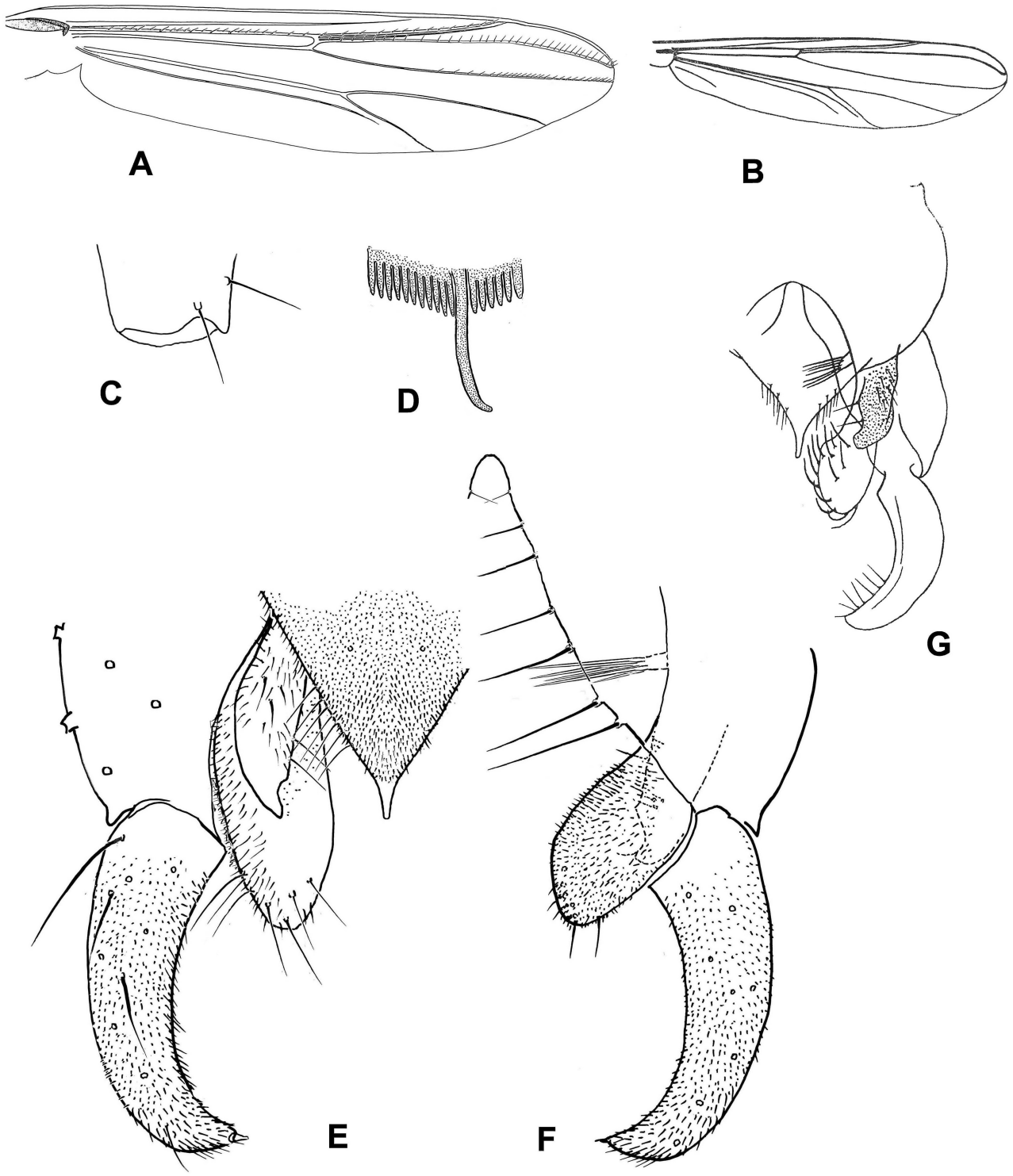

FIGURE 1. *Paucispinigera approximata* Freeman. Adult male: A, B, Wing; C. Fore-leg tibial apex; D. Hind-leg tibial apex; Hypopygium: E. left side, dorsal; F. right side, stylised ventral; G. hybrid view. B, G, from Freeman (1959).

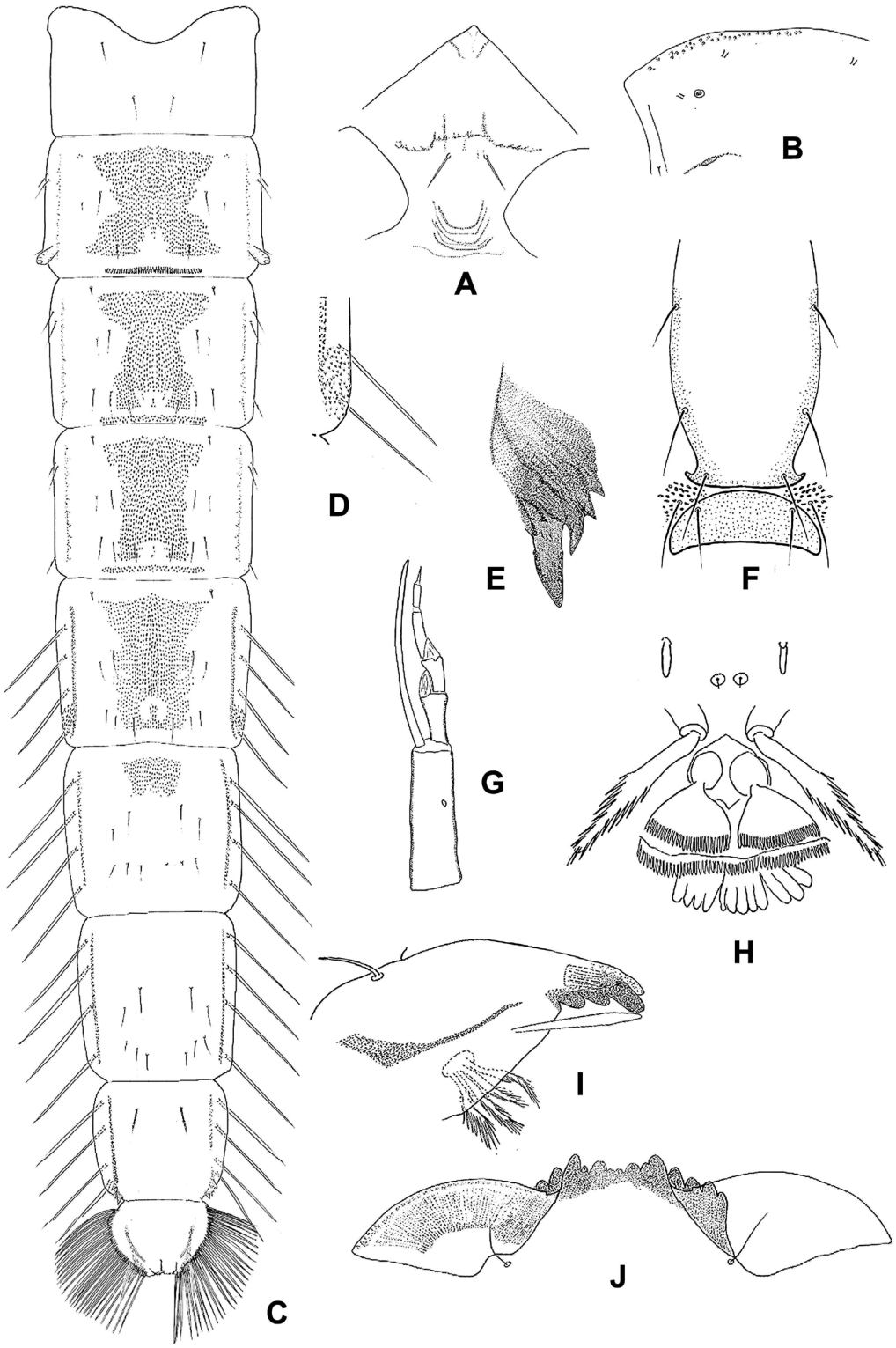

FIGURE 2. *Paucispinigera approximata* Freeman. Pupa: A. Cephalic area; B. Anterior thorax, lateral; C. Abdominal tergites; D. Pleura of segment V; E. Posterolateral corner of VIII ('comb'). Larva. F. Anterior dorsal head; G. Antenna; H. Labrum-epipharynx; I. Mandible; J. Mentum, ventromental plates.

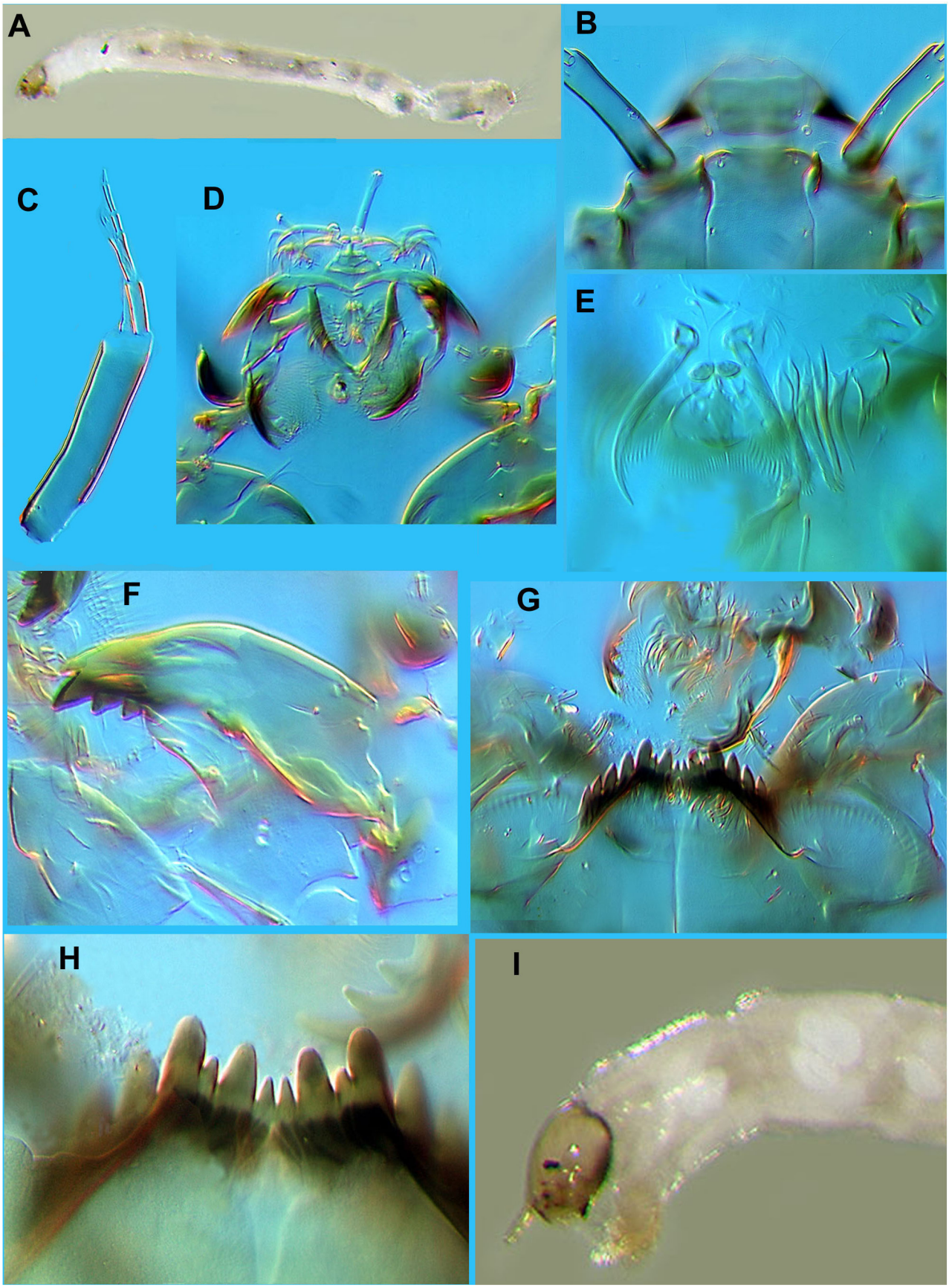

FIGURE 3. *Paucispinigera approximata* Freeman, larva. A. Habitus (ethanol-preserved); B. Anterior dorsal head; C. Antenna; D. Labrum-epipharynx; E. S setae, detail; F. Mandible; G. Mentum, ventromental plates, labrum-epipharynx; H. Dorsomentum, detail; I. Anterior body.

Mentum (Figs 2J, 3G, H) with fully delimited ventromental component of 8, uneven-sized, slightly paler median teeth; dorsomentum on each side with 4 darker teeth each diminishing slightly in size laterad. Ventromental plate fan-shaped with curved anterior margin, with notch at level of dorsomental teeth, striae numerous, almost straight, fine. Setae submenti simple.

Body (Figs 3A, I). Without lateral or ventral tubules. Anterior parapod claws dense, fine, simple, pale; posterior parapods claws pale, simple. Procercus pale, small, as high as wide, bearing 7–8 anal setae.

Discussion. The adults of *Paucispinigera* were described by Freeman (1959) from New Zealand from a small fauna lacking many genera with which to make comparisons. The Australian Chironomidae were under revision and to be described shortly thereafter (Freeman 1961), and must have been known to him. In this context, Sæther's (1977) provisional key to female adults, using non-genitalic features for both sexes derived from Freeman (1959, 1961) to distinguish *Paucispinigera* and *Paraborniella* remains valid: squama bare, pulvilli near absent, non-extended scutum, anterior tibia with rounded scale and without spine. The distinctive wing venation of *Paucispinigera*, with R_{4+5} and costa extending to wing apex near an upturned apex of M_{1+2}, and setosity of M veins continues to allow differentiation, as does the unusual 'megaseta' on the apex of the male gonostylus. These wing characters could be considered as autapomophic (providing no ranking information) and no additional evidence is provided by the female genitalia. As discussed below, *Paucispinigera* and *Paraborniella* key in Cranston *et al*. (1989) with *Apedilum* and *Paralauterborniella*, but neither are convincing given substantial differences in the male genitalia.

Differentiation in pupae at the generic level, in contrast to the efficacy at species level, is plagued by lack of autapomorphies within excessive variation. In Pinder & Reiss (1986) the pupa of *Paucispinigera* can be keyed to *Paratendipes*, including with the large pedes spurii B, but differing from most in lacking cephalic tubules and warts, and in the distribution of taeniate L setae.

In the regional key of Cranston (2019b) the larva of *Paucispinigera* is separated from similar genera with a 6 segmented antenna and displaced Lauterborn organs, including *Microtendipes*, *Paratendipes and Paraskusella* (Cranston 2018) by differences in the pigmentation and teeth number and relative height of the median (ventro-) mentum structure. The paired low (small) teeth in a mid-ventromentum of 8 delimited teeth appear diagnostic.

Paraborniella Freeman

(Figs 4–6)

Paraborniella Freeman 1961: 717.

Type species: *Paraborniella tonnoiri* Freeman, 1961: 717, by original designation and monotypy.

Generic diagnosis. Male and female adults, as keyed by Freeman (1961), with unarmed fore-tibial apex, acrostichals in near double row starting from the front, mid- and hind-tibial combs separated, pulvilli absent and male genitalia with median volsella [as appendage 2a] (Fig. 4E). Freeman (1961) added this to the solitary spur on the posterior tibia to distinguish from similar genera (*Paucispinigera* was not included).

Pupa (Fig. 6A–E). Cephalic area with frontal setae on well-developed tubercles. Thorax with 4 or 6 branched thoracic horn. Abdomen with large pedes spurii B on TII; with well-developed rectangular spinule areas on TII-V, somewhat hourglass–shaped spinule patch on TVI; no separated distinct band of stronger spinules on any segment; T1, VII, VIII with weak anterior spinulation. Hook row of TII with short median division by median hook–free discontinuity. Conjunctives IV with broad transverse spinule band narrowly separated from more anterior spinule area. All pleurae bare. L setae taeniate on V–VIII, 4, 4, 4, 4. Anal lobe with uni- biserial fringe and dorsal seta. Posterolateral corner of VIII with 8–12 modestly-developed spines forming diffuse 'comb'.

Larva (Fig. 6E–I). Dorsal head with anteriorly-flared frontoclypeus with S3 seta on sclerite posterior to convex margin, labral sclerites highly fragmentary bearing S2 seta, labrum distinct with SI seta lying at midlateral margin. Antenna 6-segmented with Lauterborn organs located on apices of 2nd and 3rd segments. Labral SI on separated bases, broadly plumose; SII serrate on inner subapical margin, arising from well separated short tubercles. Pecten epipharyngis of three lobes each with 4–5 rounded teeth. Premandible with 2 teeth, with strong brush. Mandible with short pale dorsal tooth, larger rounded apical tooth and 2 inner teeth. Pecten mandibularis with 6–7 branches. Seta subdentalis well developed, reaching 2nd inner tooth. Mola smooth, inner margin with 1 weak spine. Seta interna densely plumose. Mentum with distinct ventromental component either with midmentum of 4, uneven-sized,

slightly paler teeth and dorsomentum with first compound pair of large and small tooth and 4 darker teeth, or with 8 middle teeth of midmentum delimited as a ventromentum including part or all of the compound-paired teeth, with 4 dorsomental teeth. Ventromental plate fan-shaped, striae straight, narrow, numerous uniformly across plate.

Paraborniella tonnoiri Freeman
(Figs 4–7)

Paraborniella tonnoiri Freeman 1961: 717; Cranston 1996, 2000

Material examined (collected Cranston, deposited ANIC unless stated). AUSTRALIA: New South Wales: 2L, Pe/♂, ♀, Beardy Waters, 6 ml n.e. Glen Innes, 29º06'S 151º46'E, 24.i.1969 (*Martin*), from egg mass; 2L, Le/Pe/♂, 2 km n.e. Nerriga, roadside drain, 35º06'S 150º07'E 2.ix.1988; 2L(3i), Morton N.P., 5–8 km. s. Sassafras, 35º08'S 150º16'E, 1.ii.1988; 4♂, Oallen, 'Neverdie', 35º07'40"S 150º00'44"E, .ix.2016.

South Australia: Le/Pe/♂, Pildappa Rocks, 22º32'S 134º21'E, 27.ii.1969 (*R.E. Jones*) det. D.H.D. Edward.

Western Australia, 5L, Mt. Lesueur, site 10, 24.viii.1990 (*Edward*), 'VML1', det. D.H.D. Edward; 4L, Yorkrakine Rock, 31º42'S 117º30'E, 19.viii.1985 (*Edward*) det. D.H.D. Edward.

Northern Territory: 2Pe, West MacDonnell Ranges, Serpentine Gorge (inner), 22º35'S 132º31'E, 8.iii.1995; 6L, Kata Tjuta, Valley of the Winds, 25º20'S 130º43'E, 5.vi.1992.

Description (genus and species). Adult Male (n=5–8). Body length 1.9–2.4 mm, wing length 1.7–2.1 mm. Wing hyaline, plain. Alcohol-preserved and slide-mounted dark brown.

Antenna. With 13 flagellomeres; $Fl_{1\text{-}12}$ 350–450, Fl_{13} 650–820; A.R.1.6–2.0. Apex squared off (Fig. 4B).

Head. Eye bare, with dorsomedial parallel-sided extension 5–6 ommatidia long, separated medially by width of 10 ommatidia. Temporals 9–14; clypeals 12–13. Frontal tubercles absent. Palp 5-segmented, segment 2 globular, segments 3 and 5 subequal in length, 4th shorter (210–340 μm); segment 3 lacks sensilla.

Thorax. Antepronotal lobes tapering dorsally, slightly divided medially at notch, without lateral antepronotal setae. Scutum curved in profile without tubercle, not overreaching antepronotum. Without humeral pit. Ac 12–16, uni-biserial starting from front, ending mid-thorax; Dc 8–15 uniserial, each arising from small pale spot; Pa 3–5; Scts 8–13, uniserial.

Wing (Fig. 4A). Membrane without setae or microtrichia. Anal lobe moderately developed. Costa ends at apex of R_{4+5} both terminating just prior to wing tip. R_{2+3} distinct and ending 1/3 distance apex of R_1 and R_{4+5}, FCu distal to RM, VR 1.1–1.2. Brachiolum with 2 setae. R, R_1, setose, R_{4+5} bare. Squama with 5–6 setae.

Leg. Apex of fore leg tibia with rounded scale, without spur (Fig. 4C). Mid and hind Ti apically with two slightly separated combs, combined occupying about 50% circumference, shorter comb with curved spur (Fig. 4D), the wider comb lacking spur. Leg ratios: LR_1 1.42–1.60, BV_1 1.58–1.85, SV_1 1.46–1.56; LR_2 0.56–0.57, BV_2 2.56–2.67, SV_2 3.48–3.69; LR_3 0.79–0.82, BV_3 1.9–2.0, SV_3 2.5–2.6. Pulvilli absent, empodium weak.

Abdomen. Tergites I–VII with dense irregularly-distributed setae.

Hypopygium (Fig. 4E–I). Anal tergite with neither bands nor setae, microtrichia extending onto base of anal point, with many setae baso-laterally along submargin of tergite IX. Anal point relatively short, bare apically, near parallel–sided with rounded apex (Fig. 4F). Superior volsella (Fig. 4H) 70–80 long, swollen almost bi-lobed, basal dorsal area with 2–3 longer curved setae towards outer margin, arising from paler ovoid-rectangular microtrichiose area, becoming darker and curved medially to taper to weak point or hook. Median volsella (Fig. 4I) 65–70 long with distinct stem (15 long), distally with 2–3 longer and several shorter taeniate setae. Inferior volsella free from gonocoxite from its base, elongate with dorsal longitudinal ridge bearing numerous long simple setae mostly directed antero-medially, without long setae in macrotrichiose lateral and part dorsal surface, extending to mid-gonostylus, without distinct apical seta. Transverse sternapodeme dark, squared-arched; phallapodeme weak (Fig. 4G).

Adult Female (n=1) (unknown to Freeman, 1959)

As male except: Body length 3.2 mm, wing length 5.5 mm.

Head. Antenna (Fig. 5A): 5-segmented, lengths: 105; 65; 70; 80; 165; A.R. 0.5. Temporals 9–10, clypeals 18. Palp 2–5: 50, 150, 165, 215.

Thorax. Ac uniserial, c. 10, Dc 12 uniserial, including 2 isolated humerals, 3 Pa; 8 Scts.

Wing. VR 1.3. Setation: R 17, R_1 22, R_{4+5} 33; sq 9–10.

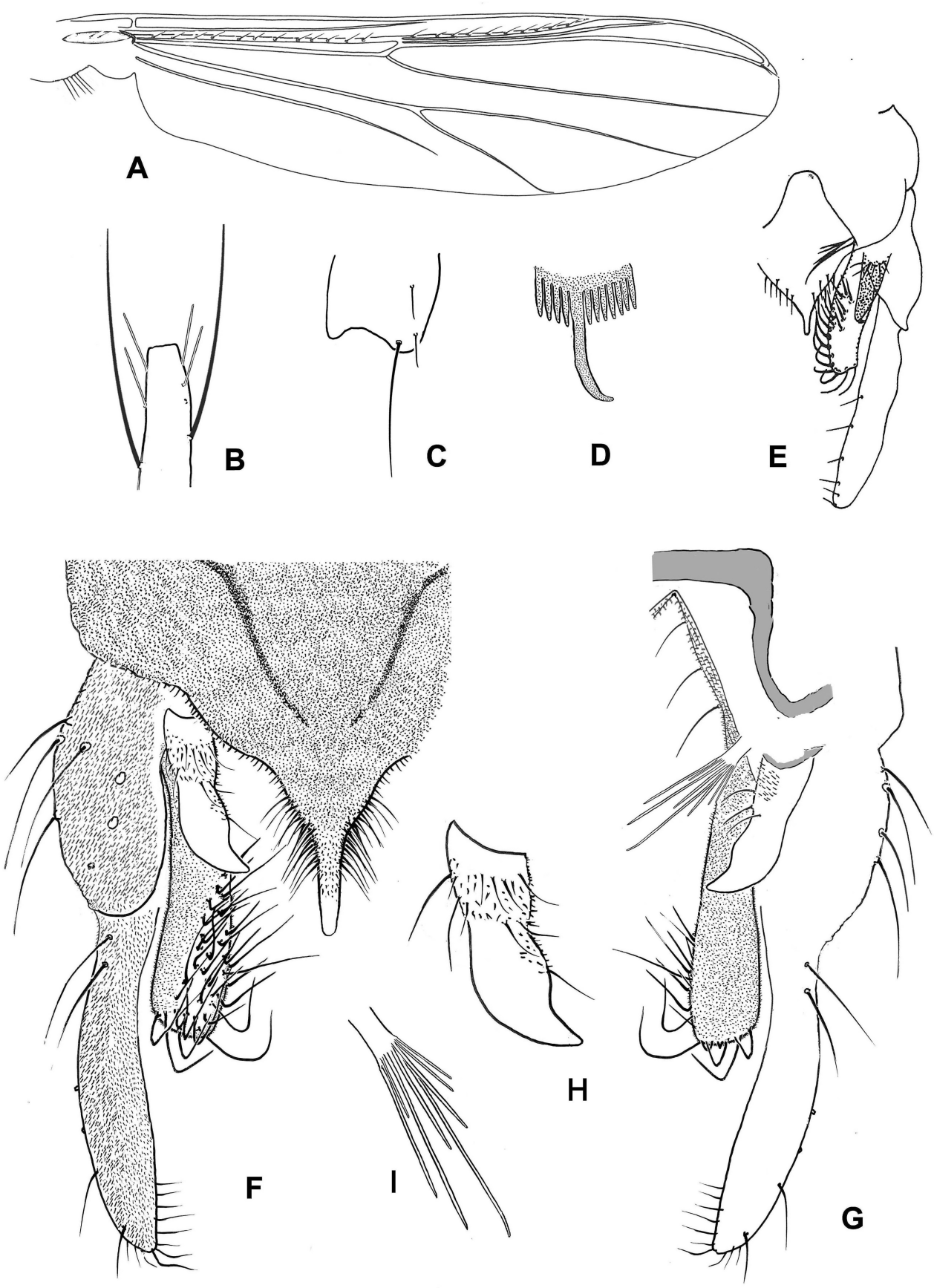

FIGURE 4. *Paraborniella tonnoiri* Freeman, male. A. Wing; B. Antennal apex; C. Foretibial apex; D. Hind tibial inner comb; E. Male hypopygium (from Freeman 1961); F. Left side hypopygium, dorsal view; G. ventral view, right side (stylised); H. Superior volsella (dorsal); I. Median volsella.

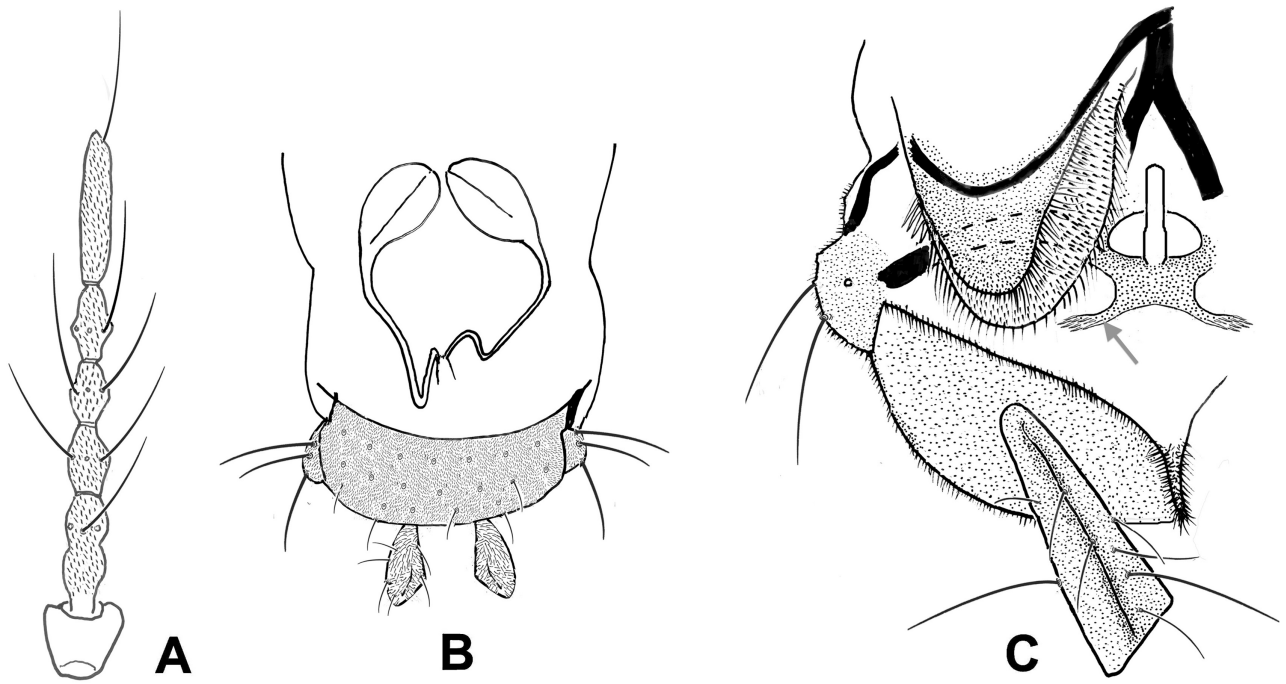

FIGURE 5. *Paraborniella tonnoiri* Freeman, female. A. Antenna; B. Abdomen, dorsal; C. somewhat stylised ventral genitalia.

Legs. P_1: 255, 185, 195, 110, 95, 60, 40; LR_1 1.05, BV_1 2.28, SV_1 2.08; P_2: 250, 235, 130, 65, 60, 35; LR_2 0.55, BV_2 3.7, SV_2 2.56; P_3: 1129, 1120, 760, 480, 400; 160; LR_3 0.67, BV_3 3.0, SV_3 2.94.

Genitalia (Fig. 5B, C). Notum robust 225 long, with strong rami making 300 total. Dark, strong gonocoxapodeme curved 'under' (dorsal to) gonapophysis VIII and fused medially via weakly sclerotised section. Coxosternapodeme IX strongly sclerotized, anteriorly curved to traverse notum. Labia well developed, with hyaline scales.

Seminal vesicles ovoid, large, 175 long, maximum width 100, with tapering dark brown neck before curved (maybe forming one loop) spermathecal ducts ending separately. Gonocoxite IX protruding, with 4–5 long setae. Cerci 125 long by 50 wide. Gonapophysis VIII with large microtrichiose dorsomesal lobe, continuous with inner contour of vagina; ventrolateral lobe either lacking or perhaps represented by few short scales. Postgenital plate elongate, densely setose.

Pupa. Medium-sized, c. 4.0–5.0 mm long. Cephalic area and thorax pale gold with brown tinged margins to appendages, abdomen pale hyaline with little indication of darker apophyses, comb and anal lobe.

Cephalothorax. Frontal apotome weakly wrinkled, without frontal warts; frontal setae (c. 50 μm) located on conical cephalic tubercles (50–60 μm), apex blunt or pointed sclerotised 'nipple' (Fig. 6A). Thoracic horn comprising 6 stout smooth hyaline branches, longest 600 μm; basal ring oval and with well-developed tracheal 'bundle'. Median suture smooth anteriorly, tuberculose medially. Prealar tubercle absent. Antepronotal and thoracic setae uncertain; 2 precorneals, others including dorsocentrals not determinable in specimens available.

Abdomen (Fig. 6B–D). Tergite I bare, II–V each with broad anterior band of slightly stronger spinules merging posteriorly in more-or-less subquadrate pattern; TVI spinulation stronger anteriorly, weaker posteriorly, TVII with only anterior fine spinulation, TVIII and anal lobe bare (Fig. 6B). Tergite II hook row discontinuous, comprising 17–20 hooks each side, c. 40% width of segment II, narrowly but clearly separated medially. Broad transverse spinule bands on conjunctive IV is scarcely separated from more anterior spinule area. Pleurae of III and IV with few scattered spinules. Sternites bare except for SIV with fine laterally-directed spinules of < 4 μm (Fig. 6C). Vortex on IV larger and more anteriorly located than usual. Pedes spurii B developed, on segment II only. Posterolateral corner of segment VIII ('comb') with 8-11 brown sharp teeth, none dominant (Fig. 6D). Apophyses weak.

Segment I with 2D, 3V and without L setae; II with 3D, 3V and 3 L; III with 4D, 3V and 3L; IV–VII with 5D, 3–5 V and 4 taeniate LS, VIII with 1D, 1V and 4 taeniate LS. O setae very fine, present on TII–VII, uncertain ventrally, but present on sternite IV.

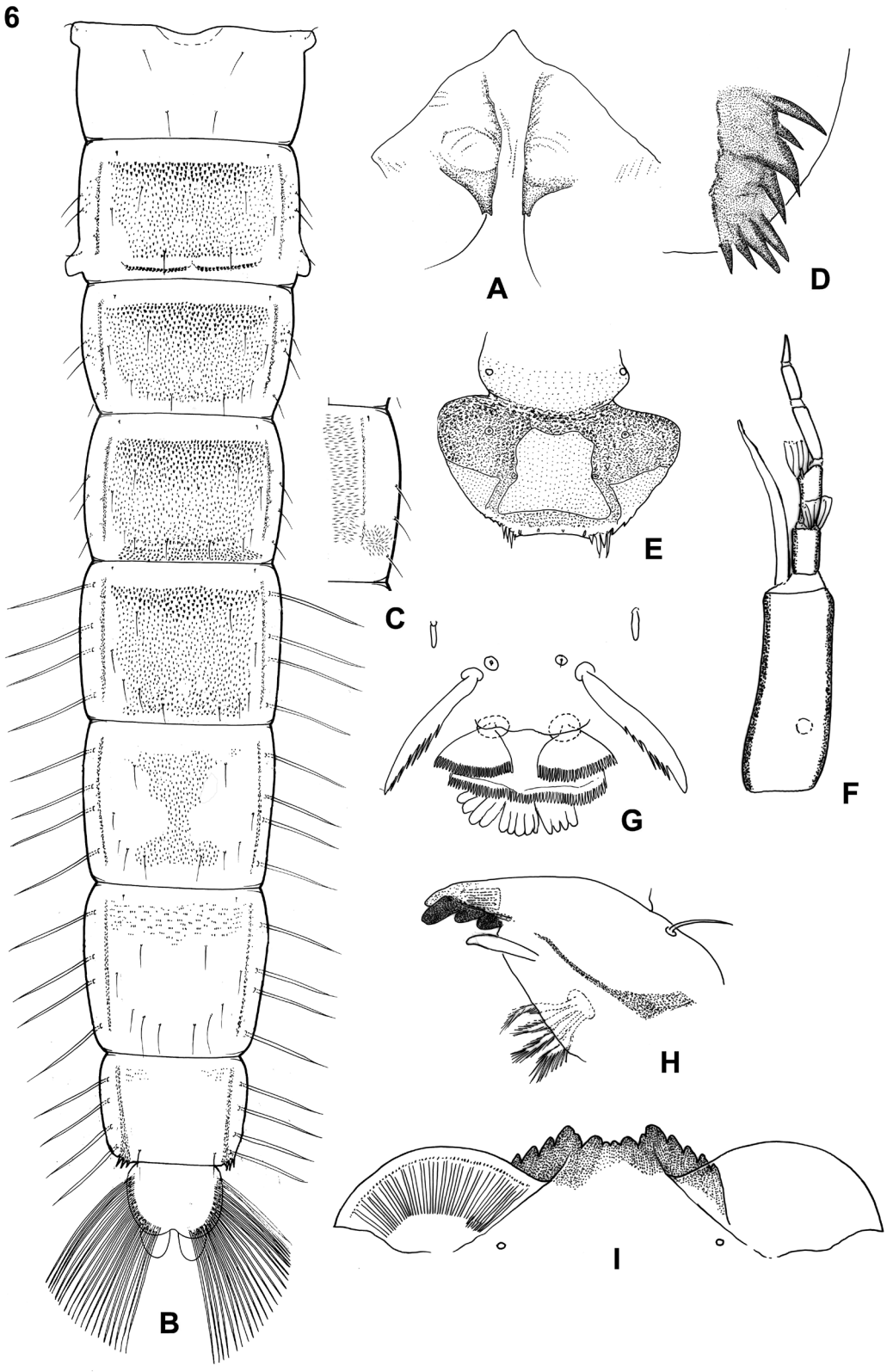

FIGURE 6. *Paraborniella tonnoiri* Freeman, pupa. A. Cephalic area; B. Abdomen, tergites; C. Sternite IV; D. Posterior of VIII ('comb'). Larva: E. Anterior dorsal head; F. Antenna; G. Labrum; H. Mandible; I. Mentum and ventromental plates.

Anal lobe elongate semicircular with fringe of 30–40 taeniae, uniserial anteriorly, unevenly biserial posteriorly, with dorsal seta. Genital sac of male extends beyond anal lobes; of female unknown or male-like.

Larva (4th instar) (n=10). Body (Fig. 7E) bright red in life, up to 10 mm long. Ventral head length c. 500 µm. Head capsule pale yellow with golden-brown dorsomental, apical mandibular and premandibular teeth. Genae and submentum pale to slightly darkened; occipital margin narrow, dark.

Dorsal head (Fig 6E) with frontoclypeus narrowed anterior prior to subterminal flare to lateral points, without frontal pit. Cephalic S3 (clypeal) setae close to anterior margin, S2 seta on broad granulose area, S1 outside of labrum.

Antenna (Fig. 6F, 7A) 6-segmented, with segments 2, 3, 4 subequal, each longer than shorter 5th and short 6th; 62–75; 15–17; 15–20; 14–20; 8–12; 5–7; A.R. 0.95–1.25; Lauterborn organs well developed (12–15 long), sessile, alternate on apices of 2nd and 3rd segments. Ring organ in basal 1/4 of segment 1, lying distal to extended weakly-sclerotised, elongate-ovoid region ('pouch'?), seta absent. Blade extends to mid-4th segment, much shorter than antennal flagellum, accessory blade short.

Labrum (Figs 6G, 7D). Labral SI on separated bases, broadly plumose; SII serrate apically, widely separated at origin. SIII simple, short; SIV moderately developed. With 7–8 plumose chaetae. Seta premandibularis simple. Lamellae finely-toothed, broad, undivided plate. Pecten epipharyngis comprising three separate lobes each with 5–7 rounded teeth, variably sized in some specimens. With 7–8 apically plumose chaetulae laterales, 2 apically branched chaetulae basales. Premandible with 2 teeth, with strong brush.

Mandible (Fig. 6H, 7B) with short pale dorsal tooth, darker larger apical tooth and 2 modest inner teeth; distal mola darkened not tooth-like. Pecten mandibularis weak, but extending to margin of mandible. Seta subdentalis squat, retracted on mola arising from ventral surface, parallel-sided to rounded apex, ending level with 2nd inner mandibular tooth. Mola and inner margin smooth. Seta interna quite densely plumose.

Mentum (Fig. 6I, 7C) with delimited ventromentum of 8, uneven-sized, teeth; dorsomentum on each side with 4 teeth rather darker than ventromentum, each diminishing slightly in size laterad. Ventromental plates fan-shaped, widely separated medially, about 2 times as wide as high, subequal in width to mentum, curved and moderately striate. Striae dense, narrow, almost straight, arrayed across the plate. Setae submenti simple.

Body (Figs 7D, E). Without lateral or ventral tubules. Anterior parapod claws dense, fine, simple, pale; posterior parapods claws pale, simple. Procercus weakly pigmented, small, as high as wide, bearing 7–8 anal setae. Anal tubules short, rounded.

Discussion. The adult male of *Paraborniella* was described by Freeman as having genitalia very similar to *Paratendipes*. In the Holarctic key to males of subfamily Chironominae (Cranston *et al*. 1989) *Paraborniella* with 13 flagellomeres and foretibae lacking scale and spur would group with *Microtendipes* with fringed squama, whereas the bare squama would arrive at *Apedilum* and *Paralauterborniella*. However the key errs in that the *Paratendipes albimanus* group has squamal setae. *Microtendipes* is denied by *Paraborniella* lacking the diagnostic apicomedian patch of posteriorly-directed setae on the fore-femora.

As recognised by Sæther (1977) the female adult of *Paraborniella* would key with *Parvitergum* and *Paratendipes* based solely on non-genitalic features. Using the Holarctic key to pupae, *Paraborniella* would head towards *Microtendipes* and *Paralauterborniella* but the latter has 4L on II–IV, and a 'nose' on the wing. Other genera in the 'Microtendipes' group are eliminated by permutations of the number and distribution of taeniate LS setae, the presence of frontal setae and developed pedes spurii B. The somewhat similar *Kribiodorum* Kieffer (=*Stelechomyia*) also differs in the distribution of LS setae. The key did not purport to be phylogenetic, lacks many austral genera and as such, multivariate diagnostic features are ineffective here.

Concerning the larva, *Paraborniella* keys in Cranston (1996, 2000) with cluster of genera with alternate Lauterborn organs, and in the regional key of Cranston (2019b) it is separated from *Paraskusella* (Cranston 2018) by a different median mentum structure.

Molecular data suggested that *Paraborniella* was proximate (but without support) to *Paucispinigera* the sister taxon to *Microtendipes* amongst the genera sampled (Cranston 2011). Other putatively related genera sampled for molecular data, namely *Apedilum* Townes, and *Zavreliella* Kieffer + *Lauterborniella* Thienemann & Bause form a well-supported cluster as sister to *Skusella* Freeman + *Conochironomus* Freeman, in turn sister to *Paratendipes* Kieffer + *Paralauterborniella* Lenz. This inclusive clade, informally termed the 'Microtendipes group', finds subsequent support including from an expanded molecular analysis by Han *et al*. (2020), although it was not recovered in the large and densely sampled morphological analysis of Andersen *et al*. (2017).

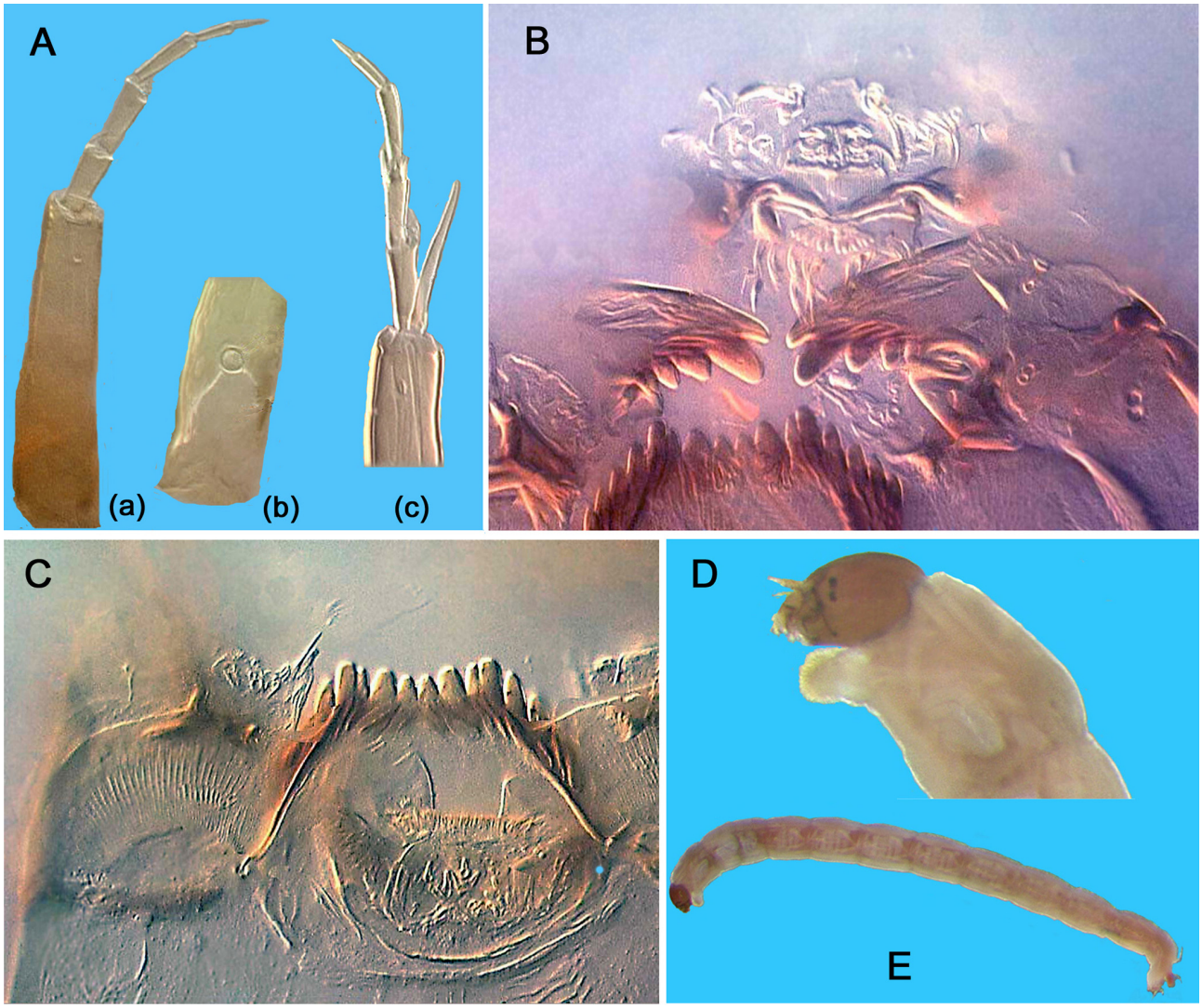

FIGURE 7. *Paraborniella tonnoiri* Freeman, larva. A. Antenna (b. 'pouch' on segment 1, c. with flagellum); B. Labrum, epipharynx, mandible; C. Mentum and ventromental plate; D. Head, anterior body; E. Habitus.

***Paratendipes sinespina* sp. n.**
(Figs 8–10)
urn:lsid:zoobank.org:act:0908E66F-415D-4307-8FF1-A249D687D94C

Paratendipes 'K1' Cranston 1991, 1996.

Material examined. Holotype, here designated: Le/Pe/♂, AUSTRALIA, Northern Territory, Kakadu N.P., Radon Springs [headwater Gulungul Ck.], 12°45'S 132°55'E, 13/14.iv.1989 (*Cranston*)(ANIC).

Paratypes (collected Cranston, deposited ANIC, unless otherwise stated). 4♂, as holotype; P♂, Magela Ck, 12°35'S 132°52'E, iv–v.1992 (*Hardwick*); ♂, Magela Ck, Ranger outfall, 12°41'S 132°55'E, 20.v.1988 (*Wells & Suter*); 4♂, 14Pe, P/♂, 9P/♀, 'Treehouse', Magela Ck, below Bowerbird Billabong, 12°47'S 133°03'E, 28.v.1988 (3 BMNH, 3 ZSM); Pe, Hickey Ck, 12°55'S 132°50'E, 29.v.1988; Le/Pe/♀, Wildman R. @ Arnhem Hwy X., 12°50'S 132°01'E, 2.vi.1988; Pe, Barramundie Ck, below falls, 13°22'S 132°28'E, 28.v.1988; 6Pe, P♂, P♀, 13°30'S 132°30'E, Rockhole Mine Ck, RMC site A, 25.iv.1992 (*Hardwick*); Pe, Koolpin Ck , 13°29'S 132°35'E, 25.v.1988, Pe, same except 15/16.1992; Pe, S. Alligator R., Fisher Ck, 13°33'S 132°33'E, 24.v.1988; 5♂, Pe, Le/Pe/♂, 13°34'S 132°35'E, S. Alligator R., Gimbat spillway, Coronation Hill, 13°34'S 32°35'E, 19/20.iv.1989.

Other material. Queensland: Pe, U. Brisbane R., 26°48'S 152°16'E, 20.ix.1989.

Western Australia: ♂, Kimberley, Vynnot Ck, 16°31'S 125°16'E, 17–20.vi.1998 (*Weir*).

Etymology. sine spina ('without' 'spine' L.), refers to the simple anterior tibial apex lacking the fine spine that characterises nearly all *Paratendipes*.

Description. Male (n=10). Body length 4.0–4.4 mm, wing length 2.0–2.3 mm. Wing hyaline with weak pattern as in Fig. 8A, when on slide, seen best under semi-dark field. Pale brown with darker vittae. Legs with faint pattern of dark femora and 'knee', tibiae pale until apex, and darker on distal tarsomeres (as with wing, best seen under dark field).

Antenna. With 13 flagellomeres; $Fl_{1\text{-}12}$, 380–410, Fl_{13} 340–370. A.R. 0.9–1.1

Head. Eye bare, with dorsomedial parallel-sided extension 5–6 ommatidia long, separated medially by c. 10 ommatidia. Temporals 5–10 uniserial; clypeals 8–12. Frontal tubercles absent. Palp 5-segmented, segment 2 globular, segments 3, 4 and 5 quite similar in length, variably contracted; segment 3 lacks sensilla.

Thorax (Fig. 8C). Antepronotal lobes taper dorsally, medially slightly divided at notch, without lateral antepronotal setae. Scutum, smoothly curved in profile without tubercle, not overreaching antepronotum. Ac c. 6 –14 uni-biserial starting from front, ending mid-thorax; 8–15 uniserial Dc each arising from pale spot; Pa 3; Scts 5–9 uniserial or if >6, with 2 in more posterior position.

Wing (Fig. 8A). Membrane with neither setae nor microtrichia. Consistently patterned with faint pale brown clouds in mid cell r_{4+5}, mid and subapical in $m_{1+2,}$ mid $m_{3+4,}$ distal cu and bordering An vein. Anal lobe shallow. Costa ends at apex of R_{4+5} just proximal to wing apex. R_{2+3} distinct, ending midway between apices of R_1 and $R_{4+5,}$ FCu distal to RM, VR 1.2–1.3. Anal vein distinct with associated darkening. Brachiolum with 2 setae. R setose (9–11), $R_{1,}$ R_{4+5} bare. Squama bare.

Leg. Apex of fore tibia with rounded scale, without spur (Fig. 8D). Mid and hind tibiae apically with two slightly separated combs, combined occupying about 60% circumference, each comb with short straight spur (Fig. 8E). Leg ratios: LR_1 1.14–1.31, BV_1 1.74–1.82, SV_1 1.62–1.82; LR_2 0.52–0.58, BV_2 3.4–3.7, SV_2 3.5–4.1; LR_3 0.63–0.68, BV_3 2.7–2.8, SV_3 2.8–3.1. Pulvilli absent, empodium small.

Abdomen. Tergites I–VII with sparse irregular setae.

Hypopygium (Fig. 8H–K). Anal tergite with bands delineating 6-8 median anal tergal setae, band petering out prior to base of anal point, microtrichiose to near anal point origin, tergite IX with submarginal short and longer setae. Gonocoxite 60–65 long; gonostylus 70–75 with straight inner margin tapering to rounded apex, strongly microtrichiose and conventionally setose. Anal point relatively short (30–32), bare, near parallel-sided to slightly broadened in mid-section, with rounded apex. Superior volsella 50–52 long (Fig. 8H–J), swollen digitiform with downcurved (ventrally-directed) apex, on dorsal surface with 3 linear aligned setae close to base, without more distal setae; ventrally with setose lobe without microtrichia. Median volsella 35–38 long with short stem (10–12), distally with > 10 taeniate setae tightly clustered, curving to terminate posteriorly-directed (Fig. 8K). Inferior volsella 50–55 long, free from gonocoxite from base, microtrichiose and with long simple setae mostly orientated antero-medially, lacking distinct apical seta. Transverse sternapodeme dark, square-arch shaped, phallapodeme narrow.

Female (n=2) (teneral, some partially dissected from pupa, allowing limited description).

As male, except: Antenna: 55–78, 40–55, 50–75, 40–55, 82–101; A.R. 0.38–0.40. Temporals 15-17, clypeals 15–18. Palpomeres: 50,134,140,170. Thorax (Fig. 8B) more setose than male; Ac 10–12, Dc 18–19 with 4–5 in humeral area, each arising from small pale spot; Pa 3; Scts 13–16. Wing crumpled, teneral, seemingly as in illustrated male, with pigmentation no stronger; setation: R 15–16, R_1 8–12 and R_{4+5} 18–20. Legs (n=1): LR_1 0.60, BV_1 1.85, SV_1 1.88; LR_2 0.51, BV_2 2.26, SV_2 4.14; LR_3 0.59, BV_3 2.8, SV_3 3.2. Pulvilli absent, empodium weak.

Genitalia as in Saether (1977). Ovoid seminal capsules (110–140 x 75–100) are located more caudal in abdomen with relatively straight seminal ducts abruptly narrowed and connecting immediately prior to common opening. GpVIII comprises only modest dorsomesal lobe. Cerci squat, 75 x 75-80.

Pupa. Medium-sized, ca 4.5–5.5 mm long. Thorax and cephalic area golden brown, abdomen pale hyaline with little indication of darker apophyses; comb and anal lobe golden-brown.

Cephalothorax. Frontal apotome smooth without cephalic tubercles or frontal warts; frontal setae (55–60 µm) arising direct from frons (Fig. 9A). Thoracic horn with apically bluntly-spinose, basal branch (c. 120 µm long) (Fig. 9B), divided into 5–6 intertwined hyaline branches; basal ring small, oval and with small tracheal 'bundle '. Anterior thorax and median suture rugulose with small tubercular scales, strongest at mid-scutum. Prealar tubercle absent. Antepronotum with 1 median, 1 lateral setae; 2 precorneals; dorsocentrals (Dc) each c. 25–35 µm long with Dc1 and Dc_2, near contiguous to each other and well separated (200 µm) from the also near adjoining paired Dc_3 and Dc_4.

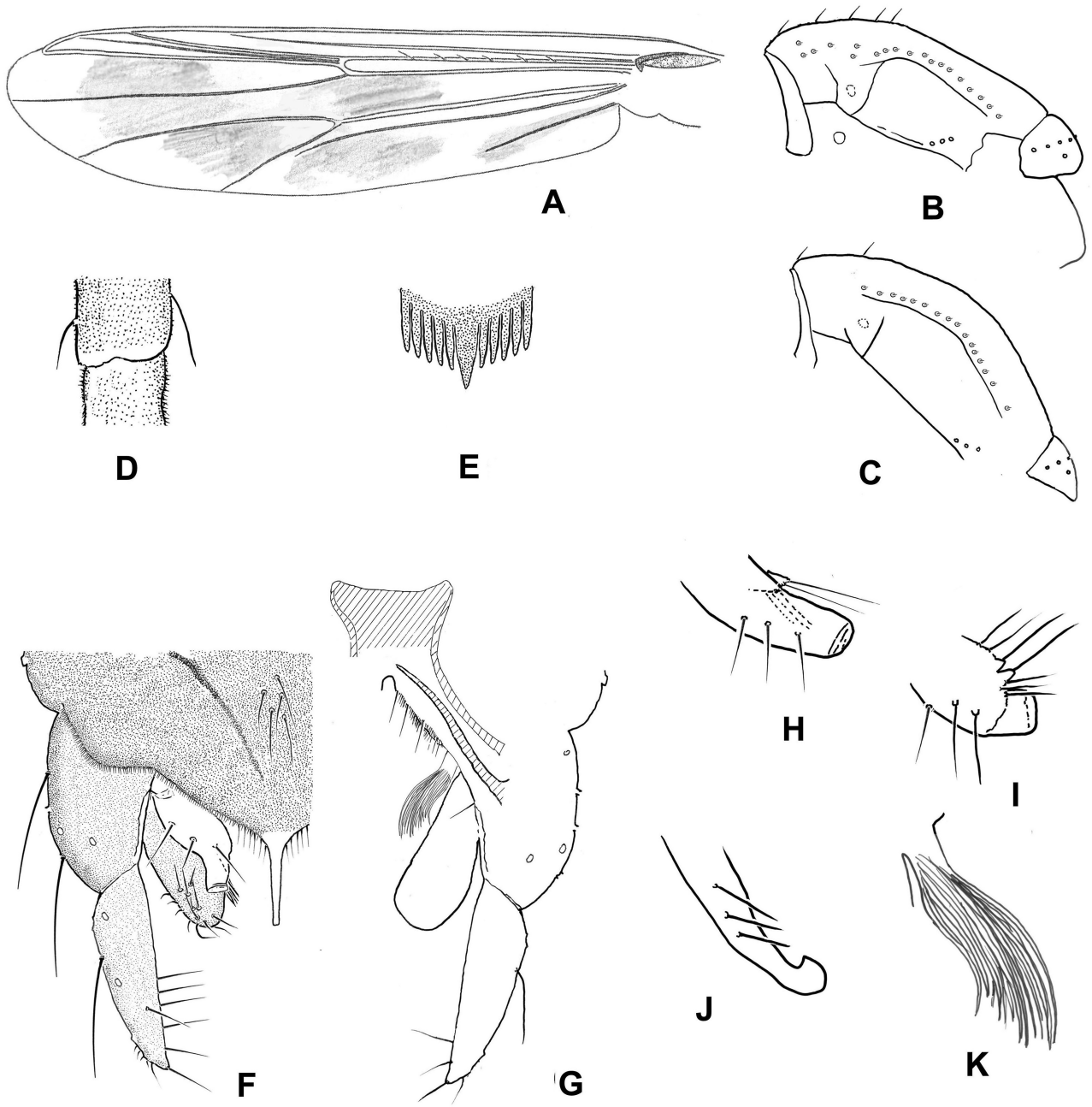

FIGURE 8. *Paratendipes sinespina* **sp. n.** male (except B). A. Wing; B. Thorax lateral (♀), C. Thorax lateral (♂); D. Fore-tibial apex; E. Inner spur and comb of hind tibia; F. Hypopygium, left side hypopygium, dorsal view; G. ventral view, right side (stylised); H–J. Superior volsella: H, dorsal, I. ventral, J. dorso-lateral view of apex; K. Median volsella.

Abdomen (Fig. 9C). Tergite I bare, II–VI each with extensive subquadrate spinule patch, not differentiated into transverse bands of stronger anterior or posterior spinules; pleurae bare except for small posterolateral area of fine spinules on V. Tergites VII–VIII with small patches anterolateral spinules, anal segment bare. Tergite II hook row continuous, comprising 20–25 hooks, 35–46% width of segment II. Narrow transverse bands of spinules on conjunctives of III and IV. Vortex only on IV. Only sternal armament a small patch of fine spinules of max. length 6 µm, near base of L_4 on V. Pedes spurii B strongly developed only on segment II. Posterolateral corner of segment VIII ('comb') with golden-brown teeth, posteriormost tooth dominant, with 2–3 shorter, curved pointed teeth (Fig, 9D). Apophyses weak / indistinct. Segment I with 3D, 1V and 1L setae; II with 4D, 3V and 3L; III with 5D, 4V and 3L; IV with 5D, 4V and 3L setae of which L_1 and L_3 taeniate (LS), V with 5D, 4V and 3LS, VI, VII with 5D, 4V, 4LS unevenly spaced, $L_{1\,\&\,2}$ well separated from approximated posteriorly located $LS_{3\,\&\,4}$. VIII with 1D, 1V and 4LS evenly spaced in posterior 2/3 segment. 'O' setae very fine, definitely on TII–VIII, uncertain / absent on sternites.

Anal lobe elongates semicircular with uniseriate fringe of 19-30 long taeniae, with fine, slender 25–30 long, dorsal seta. Genital sac of male extends beyond anal lobes, female shorter.

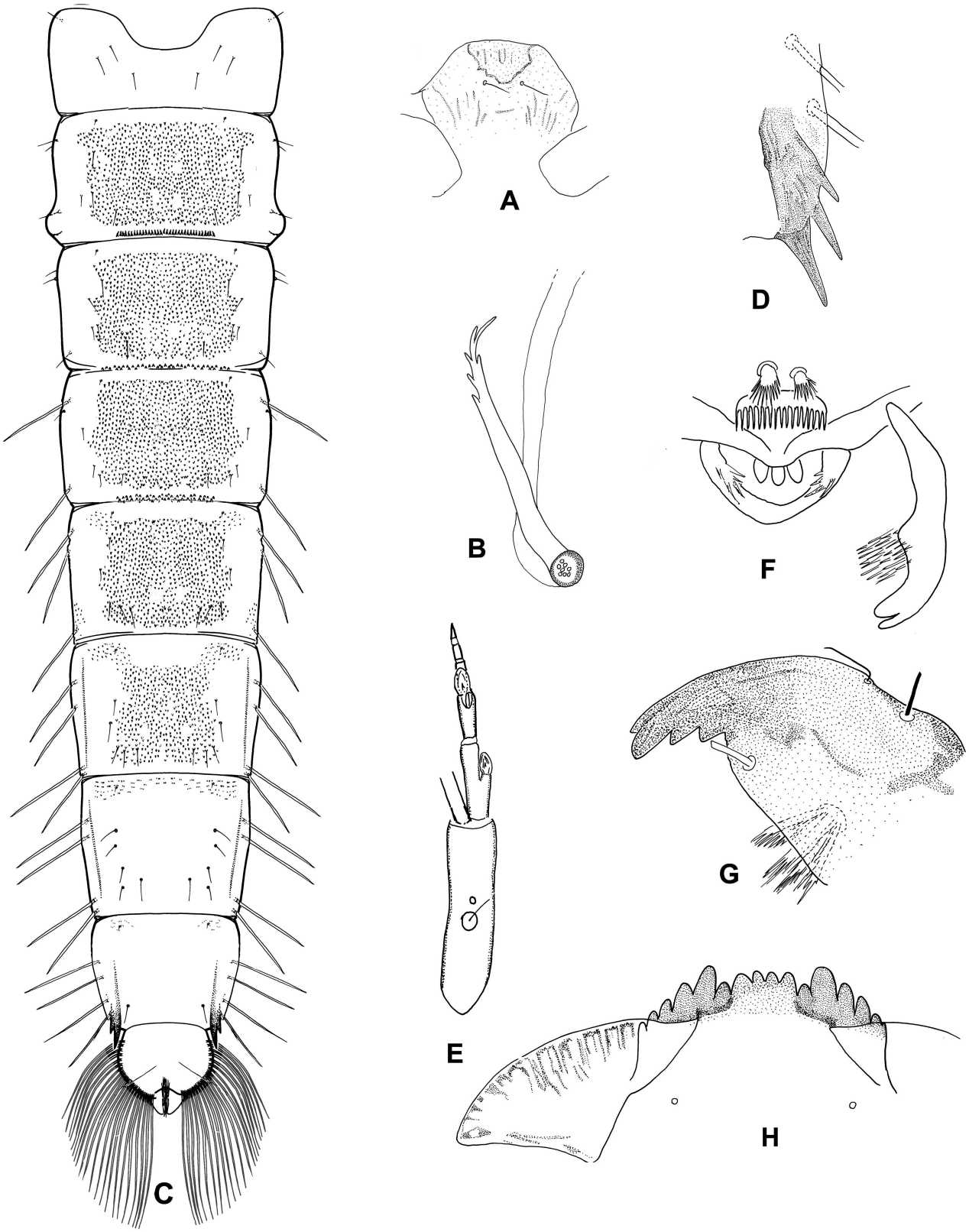

FIGURE 9. *Paratendipes sinespina* **sp. n.** Pupa. A-D: A. Cephalic area; B. base of thoracic horn; C. Abdomen; D. Posterior of VIII ('comb'). Larva: E. Antenna; F. Labrum-epipharynx; G. Mandible; H. Mentum and ventromental plate.

Larva (n=2). As generic diagnoses with specific and mensural characters as follows: Body colour, length and morphology unknown (only exuviae); head length 500µm, postmentum length 180. Head capsule pale yellow with darker yellow to brown teeth of the dorsomentum, inner mandible and premandible. Genae / postmentum pale; occipital margin narrow, darker yellow-brown than postmentum.

Antenna (Figs 9E, 10A). 6-segmented, lengths 52–55, 20–24, 12–15, 7–8, 4–5, 3–4; A.R. 1.2-1.3. Lauterborn organs well developed on pedestal in mid-2nd and sessile on apex of 3rd segment. Style subapical on 3rd segment. Blade 56, extending slightly beyond antennal apex.

Labrum (Figs 9F, 10D). SI and SII setae plumose, SI on common base, not fused. Labral lamellae c. 20 even-sized spines on single plate. Pecten epipharyngis 3 simple lobes. Chaetulae of ungula short, squat, not differentiated into laterales and basales. Premandible with 2 teeth, beard of stubbly spinules.

Mandible (Figs 9G, 10E) 70–90, with pale dorsal tooth, larger darker triangular apical tooth and 2 darker inner teeth; darkened distal mola rounded. Seta subdentalis 12, slender, short.

Mentum (Figs 9H, 10B, C). Ventromentum delimited, comprising 8 teeth; pale median 4 subequal teeth flanked by 2 darker teeth, the inner smaller than next lateral tooth; 4 darker dorsomental teeth each diminishing slightly in size laterad. Ventromental plate fan-shaped with micro-crenulate anterior margin, internally with 5–6 broad coarse striae restricted to the lateral 3/4 of plate, each terminating anteriorly in a prominent triangular spine, associated with one crenulation of the plate margin.

Abdomen (n=1, exuviae), with small pale (almost hyaline) simple parapod claws. Body setae 24–30 long, simple. Procercus minute, squat, 5 high x 10 wide, bearing 6 apical setae of length 300–350; 2 procercal setae displaced to cuticle a short distance from procercus, 110–130 long. Posterior parapod c. 350–400 long, with anal seta 110–130 long.

Comments. The associated larva and pupa of *Paratendipes sinespina* conform substantially to the Holarctic diagnoses of Pinder & Reiss (1983, larva, 1986, pupa) including after expansion by recognition of the life stages of *Paratendipes basidens* Townes (Epler & Ferrington 1994) and *Paratendipes nubilus* Meigen (Biro & Klink 2005) as incorporated into Epler *et al*. (2013) for larvae. The flat foretibial apex lacking any spine in both sexes of *P. sinespina* appears significant. Never-the-less, *Paratendipes inarmatus* Freeman from Batu Caves, Malaysia, also has a simple apex on the foretibia, and here Freeman's (1962) comments are relevant "Even though the presence of this spur is an important character of the genus, *inarmatus* resembles other species so closely in hypopygial and thoracic structure that I have not thought it wise to place it in a new genus. The African *P. seydeli* Freeman [1957] also lacks this spur, but that is not such an otherwise typical species as *inarmatus*" (Freeman 1962: p.131). With the allocation of *P. seydeli* to the recently described *Paraskusella* Cranston (2018), we can see that Freeman also surely was correct about *P. inarmatus*.

The immature stages and male genitalia locate *P. sinespina* within *Paratendipes*, as with Malaysian *P. inarmatus* Freeman, albeit both as slightly atypical species. Essentially the expansion needed for the generic diagnosis is inclusion of the flat apex on the foretibia without a spine in both sexes of the adult, and the unusual distribution of taeniate L setae on abdominal segments IV and V, seen otherwise only in modified form in *P. subaequalis* and an unidentified species from Singapore.

For reasons given above, the Australian species is treated as an endemic and new to science. However, northern Australian tropical species of several Chironomini are distributed also in Asia and extra-limital taxa need consideration. Excepting the plain winged *P. inarmatus*, none elsewhere are reported to lack the fore-tibial spine. Disregarding this, amongst species with bare squama and tapering anal point (the *nudisquama* group), the wing patterning resembles two others, namely the Asian *P. nigrofasciatus* Kieffer 1916 (Yamamoto & Yamamoto 2012) and *P. nubilipennis* Freeman 1957 from Africa and Saudi Arabia (Cranston 1989). Neither species agrees exactly with the leg and/ or wing pattern of *P. sinespina* although pigmentation is weak and the pattern must be determined on a microscope slide with slightly 'out of phase' optics, or 'pseudo-dark' field. Pale pigmentation may be consequence of rapid development in warm tropical waters as seen in other tropical taxa such as *Polypedilum johannseni* Sublette & Sublette (Tang & Cranston 2019). The median volsella of *P. sinespina* differs from all illustrated male genitalia of *Paratendipes*, being 'bushier' with dense taeniae significantly overlapping with those opposite then curved to orientate and terminate more distally. The superior volsella with a ventral setose lobe also may differ, but existing illustrations are inconsistent regarding this feature. The distribution of taeniate lateral setae on the pupa of *P. sinespina* **sp. n.** might be unique in the genus but this cannot be verified due to the paucity of published evidence from rearings, especially lacking in Chinese material (e.g. Qi *et al*. 2009). The larva is typical for *Paratendipes*, including

with the proximal Lauterborn organ pedicellate, originating prior to the apex of the segment, rather than sessile on the apex as the distal. This pedicellate proximal Lauterborn organ occurs in several larvae allocated to *Paratendipes*, although on a very short segment it is nearer the apex. This structure seems not to occur in other genera with alternate Lauterborn organs on a 6 segmented antenna. This condition needs to be examined at oil immersion magnification, with phase contrast to allow interpretation: illustrations may not represent accurate observations.

Paratendipes sinespina is restricted to the northern monsoonal seasonal tropics associated with sandy-bedded but perennial creeks. Although a suite of congeners from more temperate Australia are yet to be differentiated, *P. sinespina* is the dominant Australian tropical species of the genus, but larvae are rare in contrast to the abundant pupal exuviae.

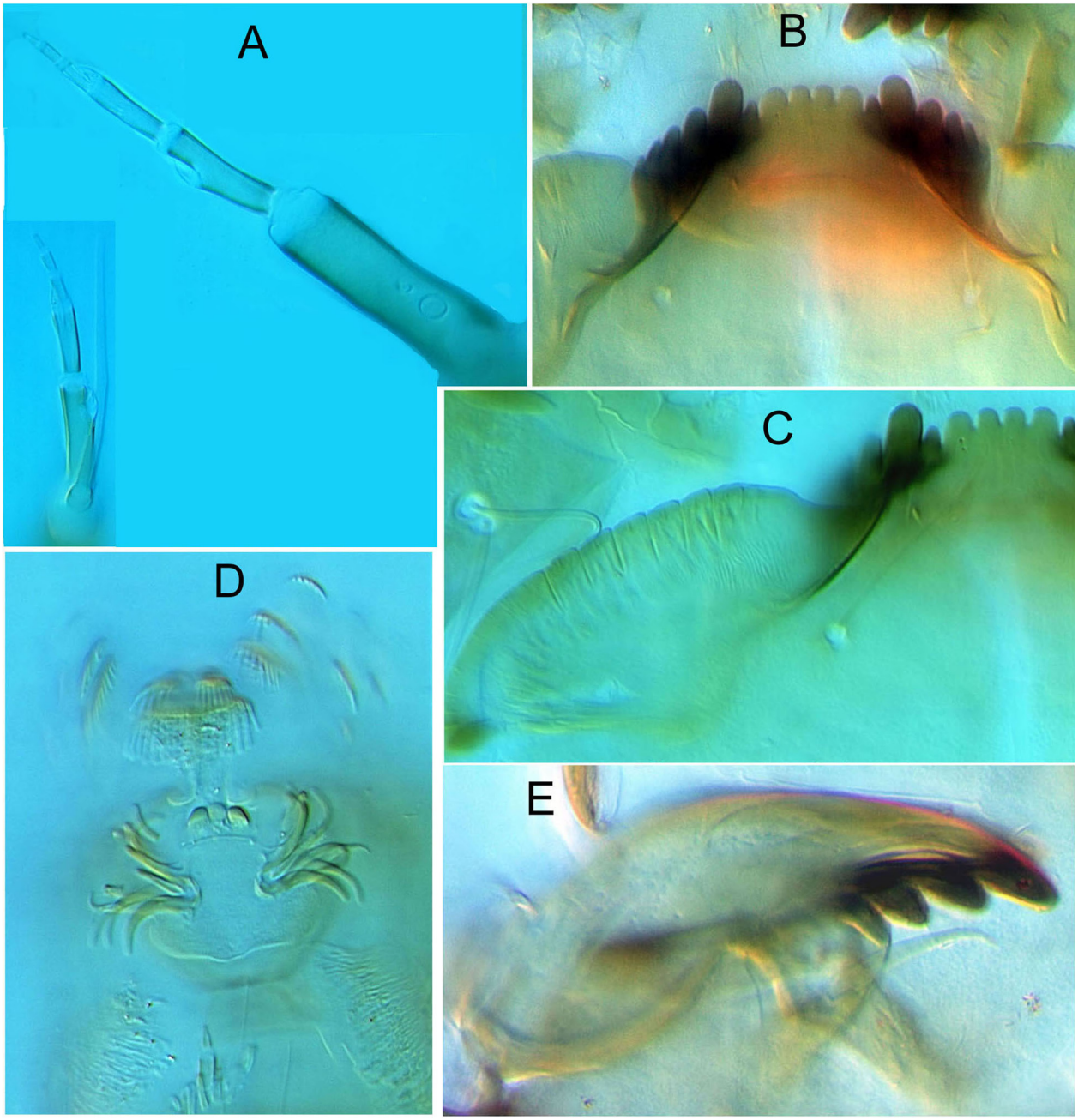

FIGURE 10. *Paratendipes sinespina* **sp. n.** Larva. A. Antenna (inset, apical segments); B. Mentum; C. Ventromental plate; D. Labrum-epipharynx; E. Mandible.

Discussion. Detailed examination of the morphology of all life stages of the monotypic genera *Parvitergum* and *Paraborniella* shows both similarity and distinction from each other, and each from *Paratendipes*. Nothing refutes the molecular evidence, albeit derived from limited taxon sampling. The morphology of these genera sup-

port the current status and any synonymy would be premature without global study inclusive of all taxa related to *Paratendipes*. Interestingly, *Imparipecten* a genus of Chironomini described on the adult by Freeman (1961), after remaining monotypic for over 50 years, has larvae in south-east Asia (Cranston *et al*. 2011) and recently was found in South America (Fusari *et al*. 2018). Fears of taxonomic redundancy inherent in description of monotypic higher taxa are tempered by such examples.

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