



## New species and a new genus of Cirolanidae (Isopoda: Cymothoidea: Crustacea) from groundwater in calcretes in the Pilbarra, northern Western Australia

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### Abstract

*Kagalana tonde* **gen. nov.**, **sp. nov.** and *Haptolana yarraloola* **sp. nov.** are described from subterranean water in calcretes in the Pilbarra region, Western Australia. *Kagalana* is characterised by haptorial dactylus on pereopod 1, short antennule and antenna peduncles, and pleonites 4 and 5 narrow, laterally overlapped by margins of pleonite 3 and pleonite 5 narrower than the pleotelson anterior margin. *Haptolana yarraloola* is the second record of the genus from Australia, both species of which are from Western Australia.

**Key words:** Cirolanidae, Isopoda, *Haptolana*, *Kagalana*, Australia; cave fauna; phreatic fauna; Western Australia; Pilbarra

### Introduction

The indigenous subterranean aquatic fauna of Western Australia is rich and diverse (Humphreys 1999, 2001) and continues to receive considerable scientific attention (see Pain, 2005 for an overview). The crustacean fauna from this region is correspondingly diverse (e.g. Bruce & Humphreys 1993; Cho *et al.* 2005; Finston & Johnston 2004; Keable & Wilson 2006; Karanovic 2006; Knott & Halse 1999; Poore & Humphreys 1992, 1998, 2003; Wilson & Ponder 1992; Wilson 2003; Wilson & Keable; 1999, 2002; Yager & Humphreys 1996). Globally, cirolanid isopods are a significant component of aquatic cave waters, now represented by 21 genera and some 86 species (Kensley *et al.* 2007 and author updates), with the regions of greatest representation being the amphi-Caribbean region and the regions surrounding the Mediterranean Sea. Australia, in contrast, had only one recorded stygian or groundwater cirolanid isopod, *Haptolana pholeta* Bruce & Humphreys, 1993, known from Barrow Island, off the central coast of Western Australia. This contribution describes two more cirolanid species from Western Australia, one necessitating a new genus.

Species descriptions were prepared in DELTA (Descriptive Language for Taxonomy, see Dallwitz *et al.* 1997) using a general Cirolanidae character set. Some *integer numeric* character states in the description may include a zero (0) rather than the more usual ‘without’ or ‘none’; minor details qualifying a coded character state are given within parentheses.

**Abbreviations:** CPS—circumplumose; RS—robust setae; PMS—plumose marginal setae; WAM—Western Australian Museum, Perth; MTQ—Museum of Tropical Queensland, Townsville.

## Taxonomy

### Suborder Cymothoida Leach

### Family Cirolanidae Dana

#### *Kagalana* gen. nov.

Type species: *Kagalana tonde* sp. nov., here designated (monotypic).

**Diagnosis.** Head with rostral point. Clypeus ventrally flat, not blade-like, not projecting. Pleonites 4 and 5 narrow, laterally overlapped by margins of pleonite 3 and pleonite 5 narrower than the pleotelson anterior margin; pleonite 1 and most of pleonite 2 not visible in dorsal view. Pereopod 1 robust, propodus expanded, dactylus haptorial; pereopods 2–7 ambulatory, slender. Pereopods 1–3 with ischium superior distal margins weakly produced, setose; merus superior distal margin weakly produced, not overriding propodus; pereopods 2 and 3 merus inferior margin RS not molariform; pereopods 5–7 basis without long PMS, ischium and merus distally without long setae. Penial processes present on sternite 7 as mutually adjacent papillae. Pleopod 1 endopod narrow, half as wide as exopod. Pleopod 2 appendix masculina basally inserted, apex sub-acute.

**Description.** Head wide, approximately 75% as wide as pereonite 1, anterior margin evenly rounded. Body surfaces unornamented; pereonite 1 about 1.7 times as long as pereonite 2 in dorsal view. Pleon unornamented, about 9% BL, with 4 visible unfused segments, pleonite 1 and most of pleonite 2 largely concealed by pereonite 7; pleonite 2 epimera not produced;. Pleotelson without longitudinal carinae, ridges or without tubercles; posterior margin with PMS and RS.

Antennule peduncle articles collinear, articles 1 and 2 fused; peduncular article 2 not at right angles to article 1; article 3 well developed, about as long as combined lengths of articles 1 and 2; flagellum shorter than peduncle; without callynophore. Antenna peduncle comprised of 5 articles, peduncular articles 1–3 shortest, articles 4 and 5 longest, 5 longer than 4; flagellum about as long as peduncle.

Frontal lamina lateral margins parallel; ventrally flat, without lateral angles, anteriorly rounded; posteriorly abutting clypeus; approximately 2 times as long as basal width, not projecting anteroventrally from posterior. Clypeus ventral surface not projecting relative to frontal lamina. Mandible incisors wide, right incisor tricuspidate; spine row with 4–5 RS. Maxillule mesial lobe with 3 CP RS. Maxilliped palp articles 3 and 4 mesial margin lobed; lateral margins of articles 2–5 with long setae; articles 3 and 4 distal margin width greater than proximal margin of article 4 and 5 respectively; endite with 1 coupling hook.

Pereopods 1–7 dactylus with small secondary unguis present. Pereopod 1 dactylus longer than palm; complex RS opposing dactylus. Pereopod 7 basis not noticeably broader in distal half compared to proximal half; margins with few discontinuous setae; ischium and merus not flattened, distal margin weakly expanded, inferior margins with few setae; inferodistal angles of ischium, merus and carpus with low cuticular nodules.

Pleopod 1 rami lamellar; endopod narrow, 3.5 times as long as wide. Pleopod 2 appendix masculina longer than endopod. Pleopods 1–5 with PMS present on all exopods and endopods of pleopods 1 and 2; endopods 3–5 without PMS, smaller (0.7–0.8) than exopods; endopod of pleopod 5 without proximomesial lobe. Uropod peduncle mesial margin strongly produced; exopod lateral margin not excised.

Females. Ovigerous and non-ovigerous females similar to males but slightly larger. Brood pouch made up of 4 pairs of oostegites arising from coxae 2–5, the posterior pair being largest, extending over most of the marsupium (anteriorly to sternite 3).

**Remarks.** *Kagalana* gen. nov. is characterised by and can be identified by the typical cirolanid body shape (see Bruce 1986; Brusca *et al.* 1995), together with the antennule peduncle and flagellum being short (extending no further than the anterior of pereonite 1), pleonites 4 and 5 narrow, laterally overlapped by margins of pleonite 3 and pleonite 5 narrower than pleotelson anterior margin, pereopod 1 being robust and haptor-

rial and the inferior margins of the merus of pereopods 2 and 3 lacking molariform setae.

**Relationships.** The most similar genus is *Speocirolana* Bolívar y Pielain, 1950, a genus of 12 species endemic to Mexico and Texas, which differs to *Kagalana* in the large size (adults 14–33 mm) of the species, pleonites 4 and 5 subequal in width and both narrower than the pleotelson anterior margin, in having haptorial and robust pereopods 2 and 3 and prominent penial processes; the palm of pereopods 1–3 typically has several large robust setae, but there is no robust seta opposing the base of the dactylus. *Speocirolana* was first established as a subgenus of *Cirolana* Leach, 1818, Bowman (1964) later elevating it to genus on the basis that pereopods 1–3 were ‘prehensile’. Bowman (1964) did not rediagnose the genus and, surprisingly given the number of described species, no revised diagnosis to the genus has since been given. Botosaneanu *et al.* (1998) offered some additional states ‘apparently demonstrating monophyly’, though the distribution and significance of the states mentioned was not discussed; some included characters such as ‘pereopods 4–7 ambulatory’, a state that is widespread in the genera close to *Cirolana*, are of little diagnostic value.

*Kagalana* shows few obvious affinities to other genera. The form of pleonites 4 and 5 and pereopod 1 is similar to but not the same as that of *Speocirolana*, but convergence can be supposed. The morphology of the antennule, antenna, mouthparts and uropods are most similar to that of *Cirolana* while the complex robust seta opposing the base of the dactylus of pereopod 1 could be interpreted as similar to genera related to *Metacirolana* Kussakin, 1979 (see Bruce 1986; Brusca *et al.* 1995). At present I regard the genus as of uncertain affinities, but probably derived from a *Cirolana*-like ancestor.

Many cave-dwelling cirolanids have long antennules and antennae, including relatively long flagellae, and *Kagalana* is distinctive in having a very short antennule peduncle and flagellum.

**Etymology.** Kaga is an Aboriginal word for a water hole; combined with –lana to indicate the family affinity; gender female.

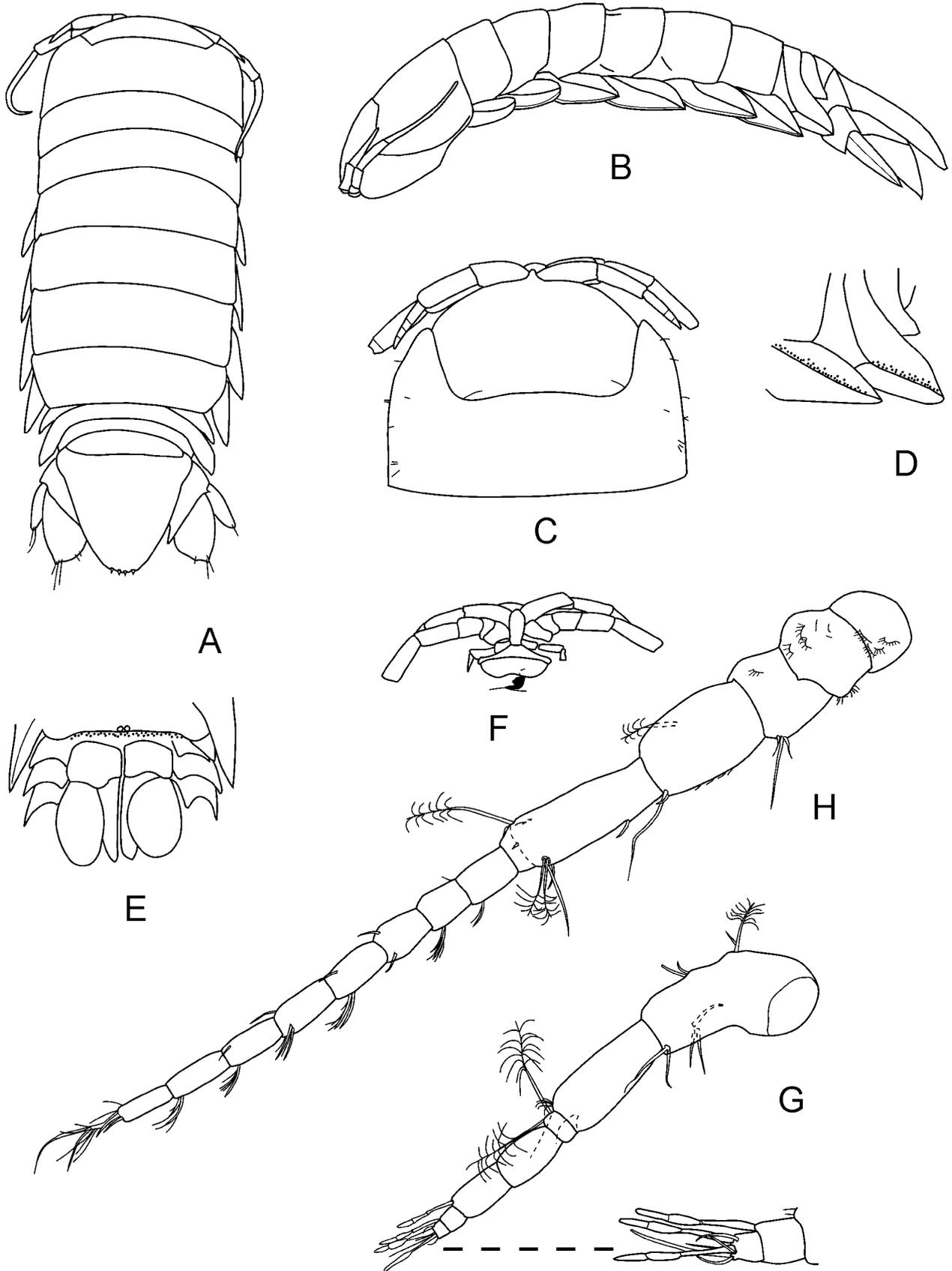
### *Kagalana tonde* sp. nov.

**Material examined** (all Pilbarra region, Western Australia).

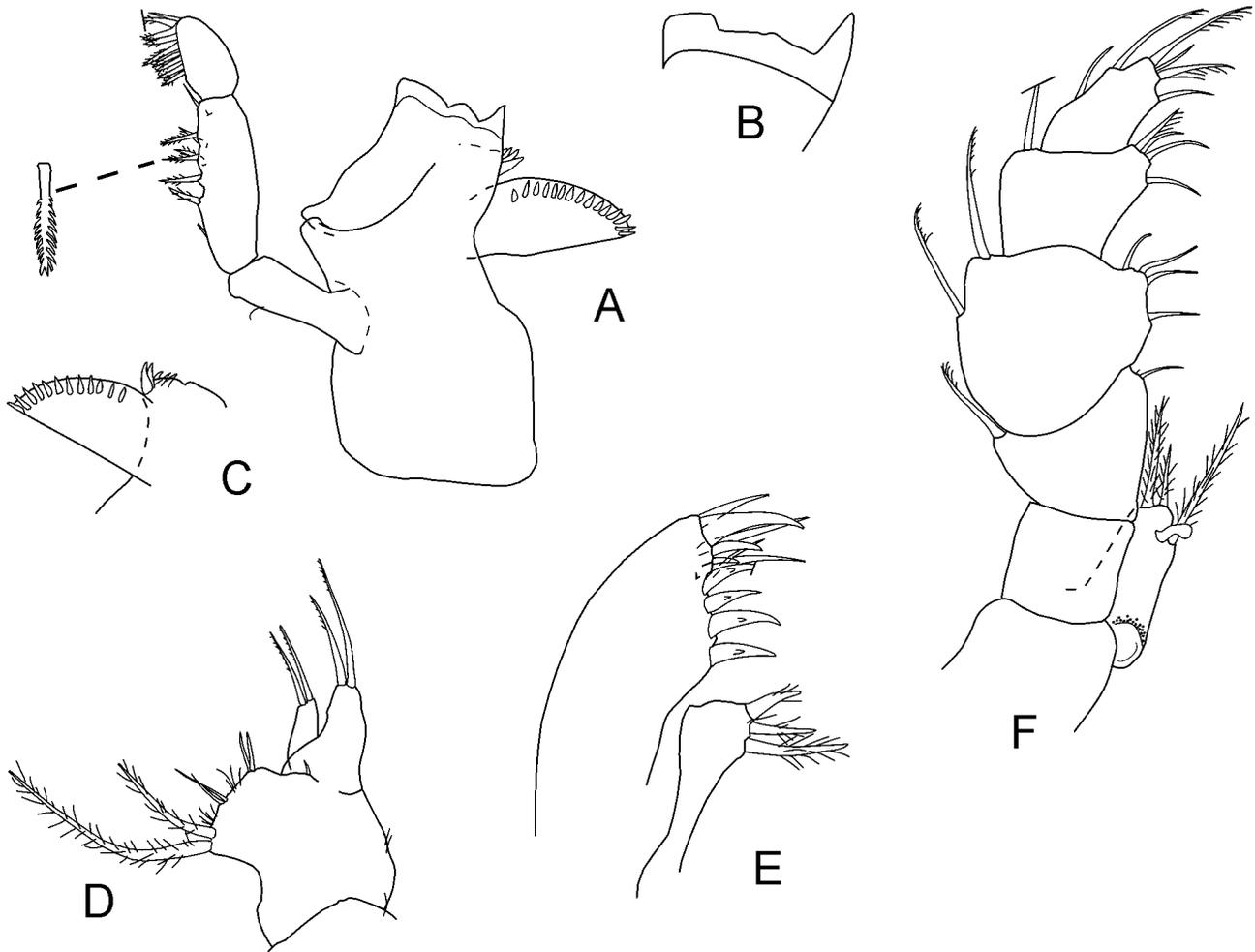
**Holotype.** ♂ (2.7 mm) ‘House Creek’, Ashburton, 22°27′52.5″S, 116°02′10.8″E, 8 August 2005, site PSS172, altitude 150 or 162 m (depending on method of measurement), salinity 0.67 ppm (WAM C39308).

**Paratypes.** 2♂ (2.4, 2.5 [dissected] mm), 3♀ (non-ovig. 2.8, 2.9, 3.1 mm), same data as holotype (WAM C39309). 2♂ (2.2 mm, 1.9 mm), manca (1.5 mm), Hardey River, 22°55′35.2″S, 117°23′03.8″ E, 21 November 2003, altitude of 400 m, site code PSS173, field bore code, NWSLK220A, coll. Mike Scanlon (MTQ W13692). ♂ (2.6 mm), Hardey River, 22°55′35.2″S, 117°23′03.8″ E, 21 November 2003, altitude of 400 m, site code PSS173, field bore code, NWSLK220A, coll. Mike Scanlon (WAM C39311). ♂ (2.7 mm, pereopods 1 both incomplete), 26 July 2003, PSS173 (WAM C39310). ♀ (ovig. 3.5 mm), Calgara Bore, 22°58′31.8″S, 116°58′07.3″ E, 21 May 2004, altitude of 400 m, site code PSS209, field bore code, NWSLK176, coll. Jim Cocking (WAM C39312). ♂ (2.2 mm), Wyloo Station, 22°39′55.0″S, 116°14′20.2″E, 3 August 2003, altitude of 175 m, site code PSS206, field bore code, NWSLK88, coll. Mike Scanlon (WAM C39313).

**Additional material:** 5 mancas (1.3–1.6 mm) Robe River 6A, 21°31′53.4″S, 115°512′0.0″E, 11 Nov 2004, PSS075 (WAM C39314). ♀ (ovig 3.0 mm; non-ovig, 2.2 mm), Robe River 2A, 21°34′52.6″S, 115°52′7.0″E, 11 Nov 2004, site code PSS016 (WAM C39315). 2 mancas (1.8, 1.5 mm), Robe River 2A, 21°34′52.6″S, 115°52′7.0″E, 6 Aug 2005, site code PSS016 (WAM C39316). Manca (1.6 mm), Robe River 2A, 21°34′52.6″S, 115°52′7.0″E, 11 Nov 2004, site code PSS016 (WAM C39317). Manca (1.6), Robe River 2A, 21°34′52.6″S, 115°52′7.0″E, 15 May 2005, site code PSS016 (WAM C39318). ♀ (non-ovig. 2.0 mm), Yarraloola Station, 21°37′58.8″S, 115°57′40.8″E, 5 April 2003, altitude of 70 m, site code PSS089, field bore code PANNASLK089, coll. Jane Mcrae (WAM C39319). ♂ (2.0 mm, damaged), 21°37′58.8″S, 115°57′40.8″E, 3 April 2003, site code PSS089, PANNASLK4, coll. Jane Mcrae (WAM C39320).



**FIGURE 1.** *Kagalana tonde* sp. nov. A–F, holotype, G, H, male paratype, 2.5 mm, WAM C39309. A, dorsal view; B, lateral view; C, dorsal view, head and pereonite 1; D, pleonites lateral margins; E, sternite 7, showing penial openings; F, frons; G, antennule; H, antenna.



**FIGURE 2.** *Kagalana tonde* sp. nov. Male paratype, 2.5 mm, WAM C39309. A right mandible; B, left mandible incisor; C, molar process; D, maxilla; E, maxillule; F, maxilliped.

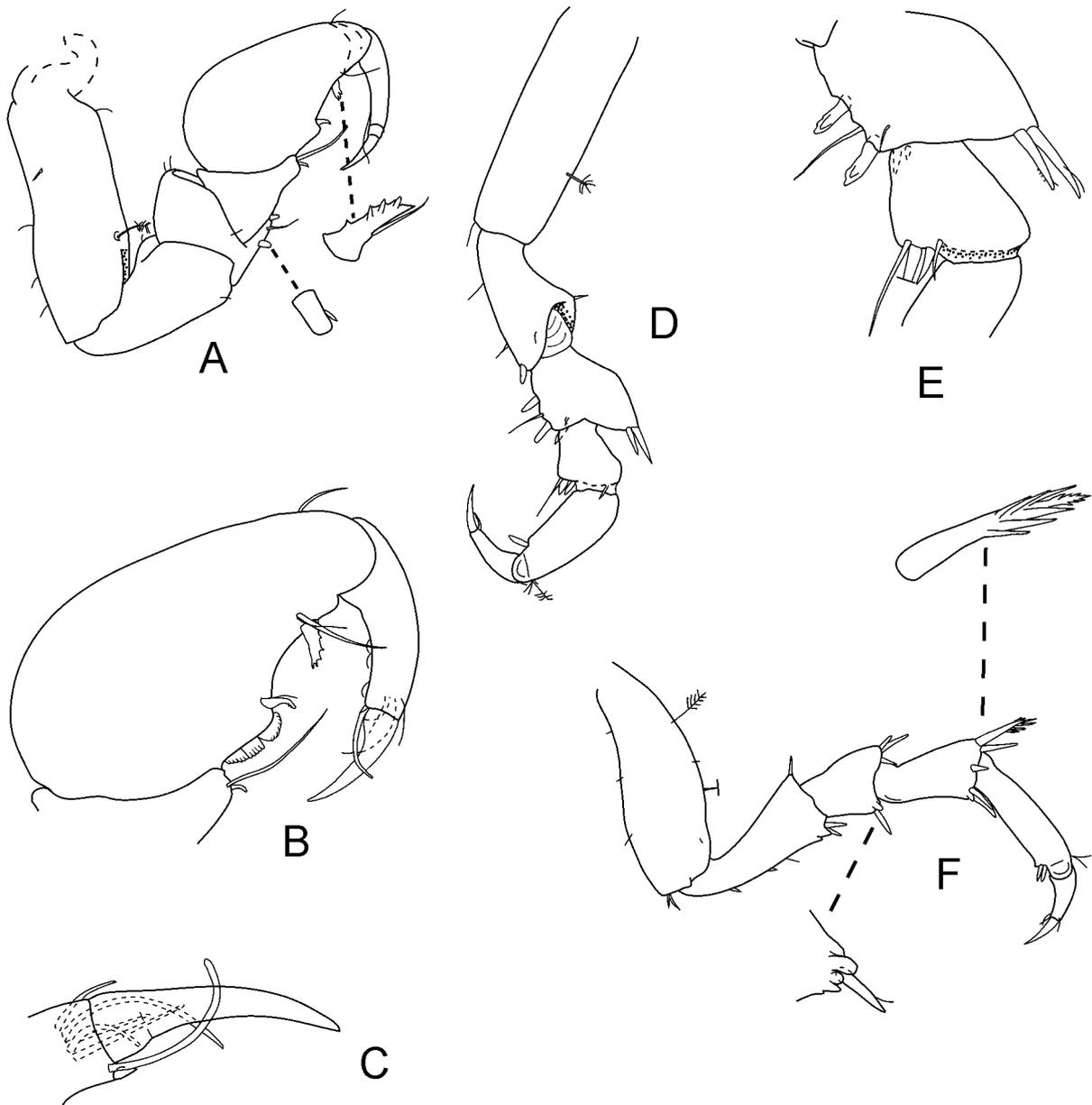
**Description.** *Body* 2.8 times as long as greatest width, widest at pereonite 6, lateral margins subparallel. Eyes absent. *Pereonite 1* and *coxae* 2–3 each with posteroventral angle rounded; *coxae* 5–7 with entire oblique carina. *Pleon* with posterolateral angles of pleonite 2 forming obtuse point; pleonite 3 epimeral margins, narrowly rounded; posterolateral margin of pleonite 4 rounded; pleonite 5 0.86 as wide as anterior margin of pleotelson. *Pleotelson* 0.9 times as long as anterior width; lateral margins weakly convex, smooth, posterior margin evenly rounded, without median point, with 4 RS.

*Antennule* peduncle peduncle articles 3 and 4 0.9 times as long as combined lengths of articles 1 and 2, 2.3 times as long as wide; flagellum with 4 articles, extending to anterior of pereonite 1. *Antenna* peduncle article 4 1.6 times as long as wide, 2.3 times as long as article 3, inferior margin with 1 plumose seta, and 0 short simple setae; article 5 1.3 times as long as article 4, 2.7 times as long as wide (widest sub-distally), inferior margin without pappose setae, superior distal angle with cluster of 2 short simple setae (and 2 plumose setae); flagellum with 9 articles, extending to posterior of pereonite 1.

*Frontal lamina* 2.1 as long as greatest width, lateral margins diverging slightly towards anterior.

*Mandible* molar process anterior margin with 12 flat teeth; without proximal cluster of long simple setae; right mandible spine row composed of 4 spines, left with 5 spines; palp article 2 with 7 distolateral setae, palp article 3 with 9 biserrate RS. *Maxillule* mesial lobe with 3 large CPS RS; lateral lobe with 11 RS. *Maxilla* lateral lobe with 2 long simple setae (finely serrate); middle lobe with 2 long simple setae (finely serrate); mesial lobe with 2 distal simple setae, with 4 proximal simple and plumose setae. *Maxilliped* palp article 2 mesial

margin with 1 slender seta, lateral margin distally with 1 slender seta (distally serrate); article 3 mesial margin with 4 slender setae, lateral margin with 2 slender setae (distally serrate); article 4 mesial margin with 4 slender setae (1 serrate), lateral margin with 1 slender seta; article 5 distal margin 4 setae (2 serrate), lateral margin with 2 setae (1 serrate); endite with 3 long CPS setae, and 1 coupling seta.



**FIGURE 3.** *Kagalana tonde* sp. nov. Male paratype, 2.5 mm, WAM C39309. A, pereopod 1; B, pereopod 1, propodus; C, pereopod 1, dactylus tip, detail; D, pereopod 2; E, pereopod 2, merus and carpus; F, pereopod 7.

*Pereopod 1* basis 2.7 times as long as greatest width, superior distal angle with cluster of 2 acute setae; ischium 0.7 times as long as basis, inferior margin without setae, superior distal margin without RS; merus inferior margin with 2 molariform RS, set as two groups, superior distal angle with 2 setae; carpus inferior margin with 1 RS (and 1 long simple seta); propodus 1.7 times as long as wide, inferior margin with 1 RS (spine opposing dactylus with 4 cusps); dactylus 0.7 as long as propodus (slender, 5.0 times as long as basal width). *Pereopod 2* ischium inferior margin with 1 stout, bluntly rounded RS, superior distal margin with 1 acute RS; merus inferior margin with 4 stout RS, set as two groups (of 2 and 2), superior distal margin with 2 acute RS; carpus inferodistal angle with 2 RS; propodus 2.5 times as long as wide, palm without RS. *Pereopod 7*

*pod 3* similar to pereopod 2. *Pereopod 6* similar to pereopod 7. *Pereopod 7* basis 2.8 times as long as greatest width, superior margin convex, inferior margin with 2 palmate setae; ischium 0.6 as long as basis, inferior margin with 1 RS, superior distal angle with 1 RS (acute), inferior distal angle with 2 RS; merus 0.6 as long as ischium, 1.8 times as long as wide, inferior margin without RS, superior distal angle with 3 RS, inferior distal angle with 1 RS; carpus 0.7 as long as ischium, 1.7 times as long as wide, inferior margin without RS, superior distal angle with 2 RS (1 strongly serrate; plus 1 mid-distal margin), inferior distal angle with 1 RS; propodus 0.9 as long as ischium, 3.4 times as long as wide, inferior margin without RS, superior distal angle with 2 slender setae, inferior distal angle with 2 RS. *Pereopods 6* and *7*, inferior distal angles of ischium to carpus with rounded blunt spines.

*Pleopod 1* exopod 1.5 times as long as wide, distally broadly rounded, lateral margin weakly convex, mesial margin weakly convex, with PMS from distal one-third, with 9 PMS; endopod distally subtruncate, lateral margin straight, with 4 PMS on distal margin only; peduncle 1.4 times as wide as long, mesial margin with 3 coupling hooks. *Pleopod 2* exopod with 10 PMS, endopod with 1 PMS; *appendix masculina* with parallel margins, 1.2 times as long as endopod, distally bluntly rounded. *Pleopod 3* exopod with 8 PMS. *Pleopod 4* exopod with 10 PMS. *Pleopod 5* exopod with 12 PMS. Pleopods 2–5 peduncle distolateral margin with prominent acute RS, 3–5 endopods without distomesial serrate scales.

*Uropod peduncle* ventrolateral margin with 2 RS; lateral margin without medial short acute RS, uropod peduncle posterior lobe about three-quarters as long as endopod. *Uropod rami* extending to pleotelson apex, marginal setae in single tier, apices narrowly rounded. *Endopod* apically not bifid; lateral margin sinuate, proximal lateral margin without RS; distal lateral margin with 1 RS, mesial margin straight (serrate), with 3 RS. *Exopod* not extending to end of endopod, 3.2 times as long as greatest width, apically not bifid; lateral margin weakly convex, without RS; mesial margin weakly convex, with 1–3 RS.

**Variation.** Details of type specimens. Pleotelson ( $n=13$ ) 2–4 RS, with 4 most frequent (64%), 2 occurring three times and 3 twice. Uropod endopod ( $n = 25$ ) mesial margin with 2–5 RS, with 2 (40%) and 3 (56%) most frequent (5 once), lateral margin ( $n = 23$ ) with 0 (39%) or 1 (61%) RS; exopod mesial margin ( $n = 25$ ) with 1–3 RS, with 1 (40%), or 2 (57%) most frequent (3 once), lateral margin ( $n = 25$ ) with 1 (88%) or 2 (12%) RS.

**Etymology.** Tonde is an Aboriginal word meaning blind (noun in apposition).

### *Haptolana* Bowman, 1966

*Haptolana* Bowman, 1966: 105.– Messana & Chelazzi, 1984: 296.– Bruce, 1986: 222.– Kensley & Schotte, 1989: 137.– Bruce & Humphreys, 1993: 876.– Bruce, Lew Ton & Poore, 2002: 147.

**Type species.** *Haptolana trichostoma* Bowman, 1966; by monotypy. Types held at USNM.

**Species included.** *Haptolana trichostoma* Bowman, 1966, Cuba; *H. somala* Messana & Chelazzi, 1984, Somalia; *H. pholeta* Bruce & Humphreys, 1993, Western Australia; *H. bowmani* Botosaneanu & Iliffe, 1997, Yucatan Peninsula, Mexico; and *H. yarraloola* **sp. nov.**, Western Australia.

**Exclusions.** *Haptolana belizana* Botosaneanu & Iliffe, 1997, Belize, is regarded as *incerta sedis*. *Haptolana yunca* Botosaneanu & Iliffe, 2000, from the Yucatan, is excluded from the genus, and is here transferred to *Cirolana* (see ‘Remarks’).

**Remarks.** *Haptolana* has been most recently diagnosed by Bruce & Humphreys (1993). Critical to the original genus diagnosis (Bowman 1996) was that pereopods 1–7 are all ‘prehensile’ (or haptorial, *sensu* Bruce & Humphreys 1993). The second described species, *H. somala* from Somalia, conformed to Bowman’s concept, but *Haptolana pholeta* from Western Australia, has an ambulatory pereopod 1, although pereopods 2–7 are otherwise very similar to those of the Somali and Cuban species, each with a haptorial dactylus.

More recently, several Caribbean species have been placed in *Haptolana* by Botosaneanu & Iliffe (1997, 2000), two of which differ with regard to the diagnostic pereopodal morphology. *Haptolana belizana* Botosa-

neanu & Iliffe, 1997 has an ambulatory pereopod 1, and slender propodi and dactyli on pereopods 2–7; it is here regarded as *incerta sedis*. *Haptolana yunca* Botosaneanu & Iliffe, 2000 has all pereopods ambulatory, essentially similar to those of *Cirolana* Leach (see Bruce 1986; Brusca *et al.* 1995) other than in lacking

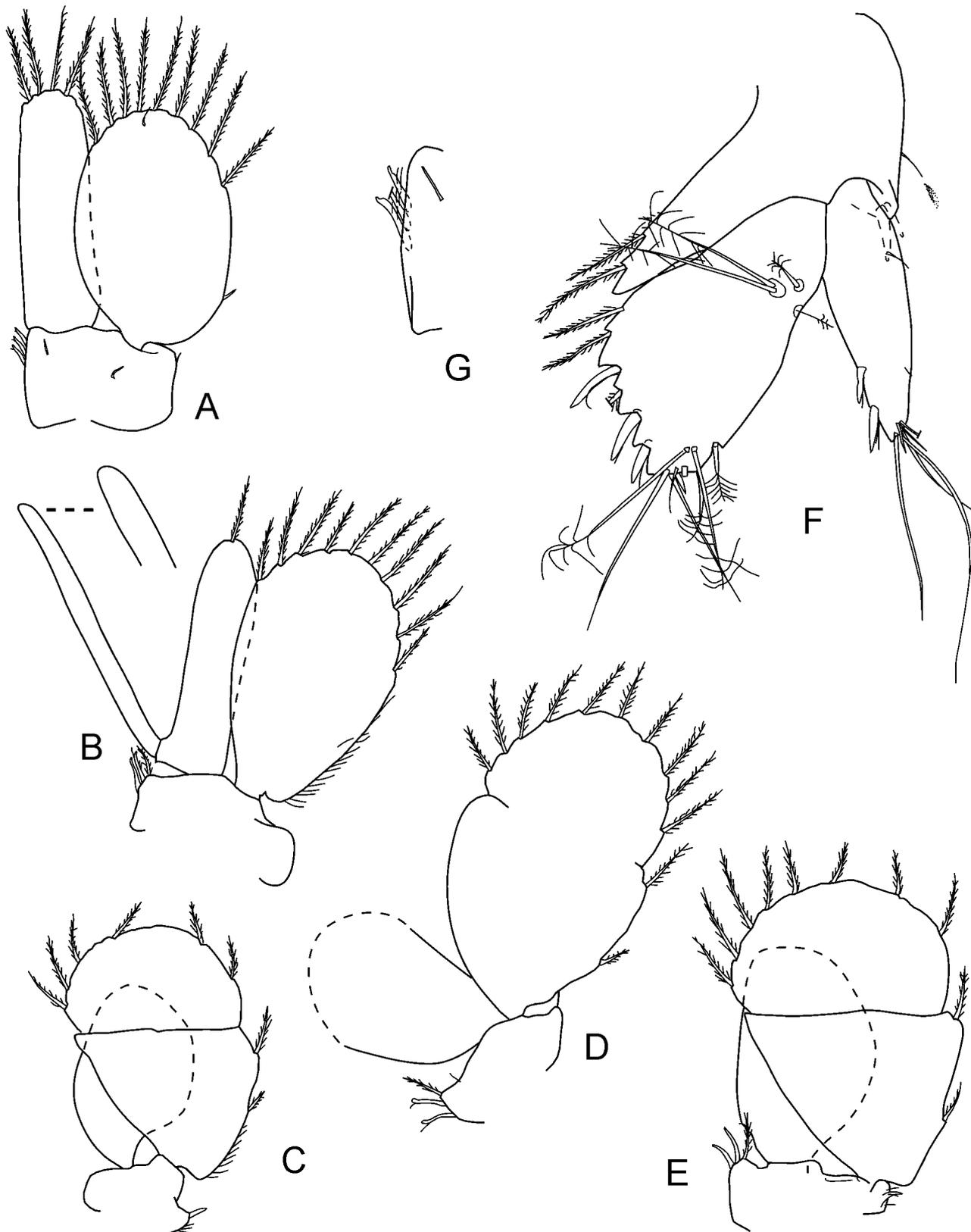


FIGURE 4. *Kagalana tonde* sp. nov. Male paratype, 2.5 mm, WAM C39309. A–E, pleopods 1–5 respectively; F, uropod; G, pleopod 2, peduncle mesial margin.

molariform robust setae on the inferior margin of the merus of pereopods 1–3, and the robust setae of the superior distal angles of the ischium and merus of pereopods 1–3 being comparatively longer. I regard *H. yunca* as being better placed in the combination *Cirolana yunca* (Botosaneanu & Iliffe, 2000) **comb. nov.**, but agreeing with the characters of the subgenus *Anopsilana* Paulian & Delamare Deboutteville, 1956 [as discussed by Botosaneanu & Iliffe (1997) who reduced *Anopsilana* to a subgenus of *Cirolana*].

### *Haptolana yarraloola* sp. nov.

**Material examined.** All material from Western Australia.

**Holotype:** ♂ (5.3 mm), Yarraloola Station, 21°37'58.8"S, 115°57'40.8" E, 17 June 2003, altitude of 70 m, site code PSS089, field bore code, PANASLK4, coll. Jane Mcrae (WAM C39321).

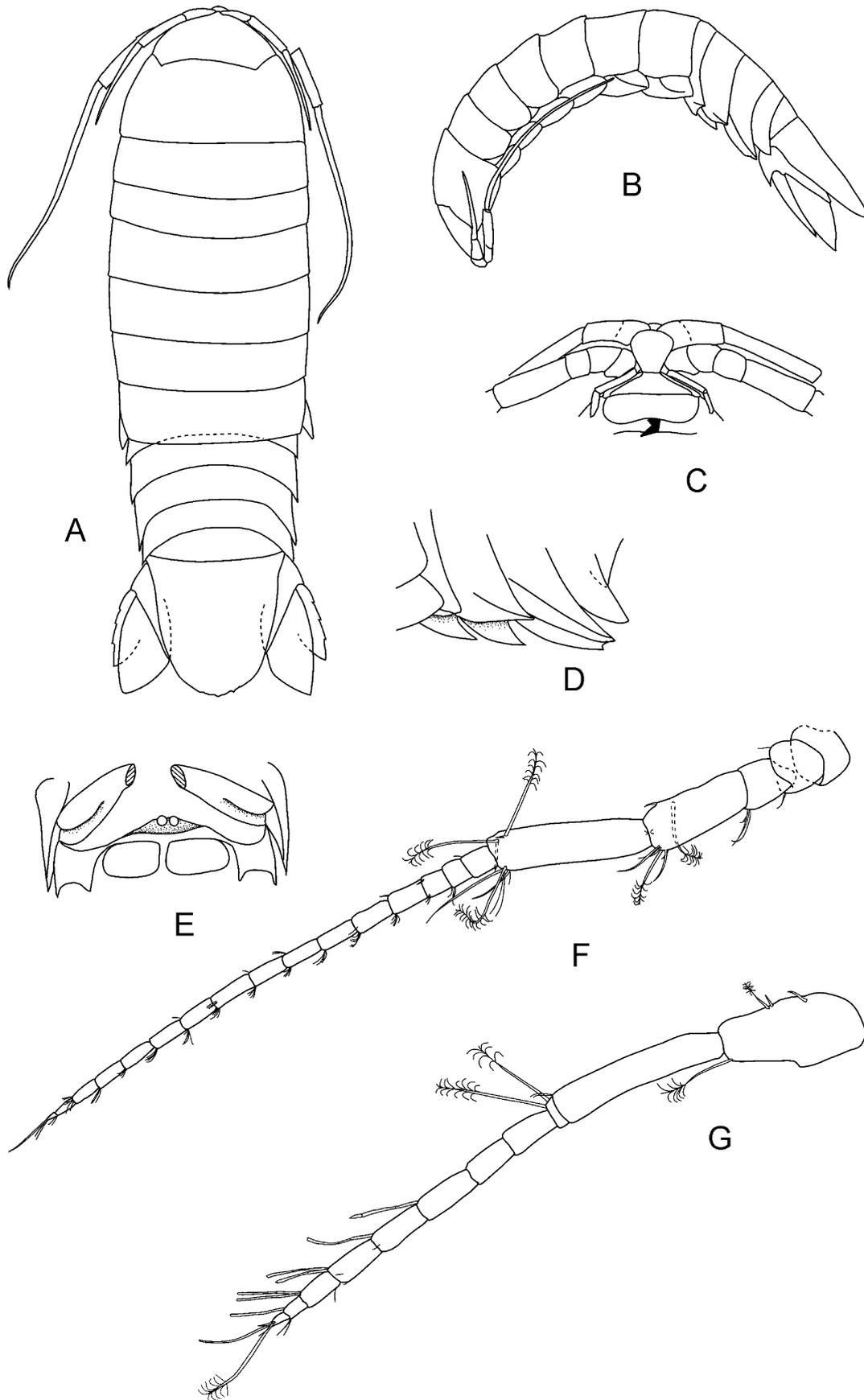
**Paratypes:** ♀ (non-ovig. 5.6 mm, pleon in two pieces), same data as holotype (WAM C39322). ♀ (non-ovig. 5.0 mm), 21°37'58.8"S, 115°57'8.0"E, 17 June 2003, site code PSS089, field bore code PANNASLK4, coll. Jim S. Cocking (WAM C39323). ♂ (4.6 mm, dissected), Robe 6A, 21°31'53.4"S, 115°51'21.0" E, 4 April 2003, altitude of 60 m, site code PSS075, field bore code G7073010P, coll. Mike Scanlon (WAM C39324). ♀ (non-ovig. 5.5 mm), Robe River, 21°37'58.8"S, 115°57'8.0"E, 5 April 2003, site code PSS089, field bore code PANASLK4 (MTQ W13693).

**Description.** *Body* 3.6 times as long as greatest width, dorsal surfaces smooth, widest at pereonite 4, lateral margins subparallel. *Rostral point* present, minute. Eyes absent *Pereonite 1 and coxae* 2–3 each with posteroventral angle rounded; coxae 5–7 with incomplete oblique carina; posterior margins of pereonites 5–7 smooth. *Pleon* with pleonite 1 largely concealed by pereonite 7; 3–5 posterior margin smooth; posterolateral angles of pleonite 2 forming acute point, not posteriorly produced; pleonite 3 with posterolateral margins extending to but not beyond posterior margin of pleonite 5, expanded, posteriorly produced; clearly extending beyond posterior margin of pleonite 5, posterolateral margin of pleonite 4 acute. *Pleotelson* 1.1 times as long as anterior width; lateral margins convex, margins smooth, posterior margin converging to caudomedial point, with small distinct median point, with 4 robust setae.

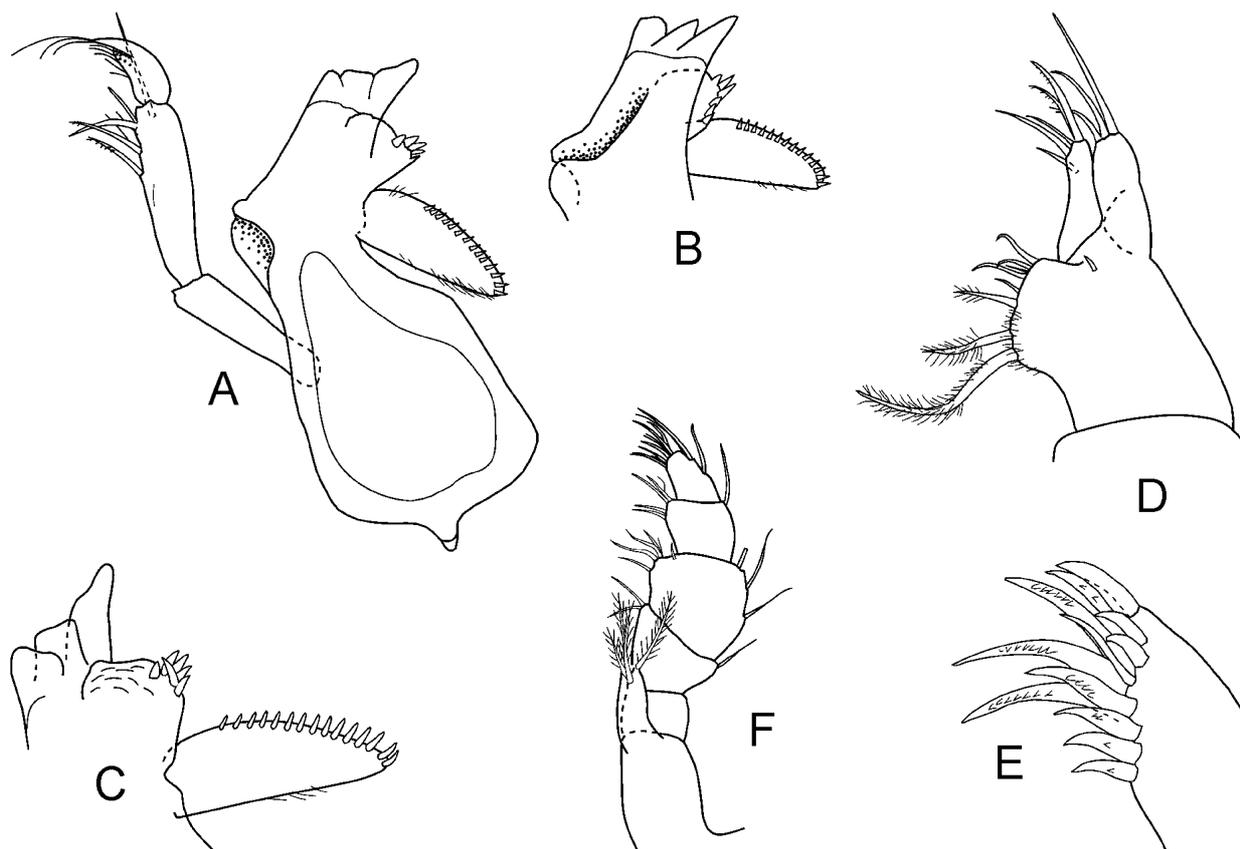
*Antennule* peduncle articles 1 and 2 entirely fused; articles 4 and 5 1.3 times as long as combined lengths of articles 1 and 2, article 3 5.3 times as long as wide; flagellum with 8 articles, extending to posterior of pereonite 1. *Antenna* peduncle article 4 2.2 times as long as wide, 2.2 times as long as article 3, inferior margin with 1 plumose seta, and 1 short simple seta; article 5 1.5 times as long as article 4, 3.8 times as long as wide, inferior margin with 2 pappose setae, superior distal angle with cluster of 4 short simple setae (and 1 plumose); flagellum with 18 articles, extending to pereonite 6.

*Mandible* molar process anterior margin with 14 flat teeth; without proximal cluster of long simple setae; right mandible spine row composed of 5 spines, left with 7 spines; palp article 2 with 6 distolateral setae, palp article 3 with 10 robust biserrate setae. *Maxillule* mesial lobe with 3 large CPS RS; lateral lobe with 13 RS. *Maxilla* lateral lobe with 3 long simple setae; middle lobe with 5 long simple setae (2 finely serrate); mesial lobe with 5 distal simple setae, with 3 proximal CPS. *Maxilliped palp* article 2 mesial margin with 2 slender setae, lateral margin distally with 1 slender setae; article 3 mesial margin with 4 slender setae, lateral margin with 3 slender setae; article 4 mesial margin with 6 slender setae, lateral margin with 1 slender seta; article 5 distal margin 6 setae, lateral margin with 2 setae; endite with 4 long CPS, and 1 coupling seta.

*Pereopod 1* basis 2.0 times as long as greatest width, superior distal angle with 1 acute seta; ischium 0.7 times as long as basis, inferior margin with 1 seta, superior distal margin with 1 RS; merus inferior margin with 2 molariform RS, set as two groups, superior distal angle with 3 setae; carpus inferior margin with 1 RS (and 2 slender setae); propodus 2.2 times as long as wide, inferior margin with 2 RS (and 4 distal setae); dactylus 0.6 as long as propodus. *Pereopod 2* ischium inferior margin with 1 stout, bluntly rounded RS, superior distal margin with 1 RS; merus inferior margin with 3 stout RS (acute), set as two groups, superior distal margin with 2 acute RS; carpus inferodistal angle with 2 RS (acute); propodus 1.8 as long as wide, with 5 clusters



**FIGURE 5.** *Haptolana yarraloola* **sp. nov.** A–E, holotype; F–H, male paratype 4.6 mm, WAM C39324. A, dorsal view; B, lateral view; C, frons; D, pleonites lateral margins; E, sternite 7, showing penial openings; F, antenna; G, antennule.



**FIGURE 6.** *Haptolana yarraloola* sp. nov. Male paratype 4.6 mm, WAM C39324. A left mandible; B, right mandible, distal part; C, molar process; D, maxilla; E, maxillule; F, maxilliped.

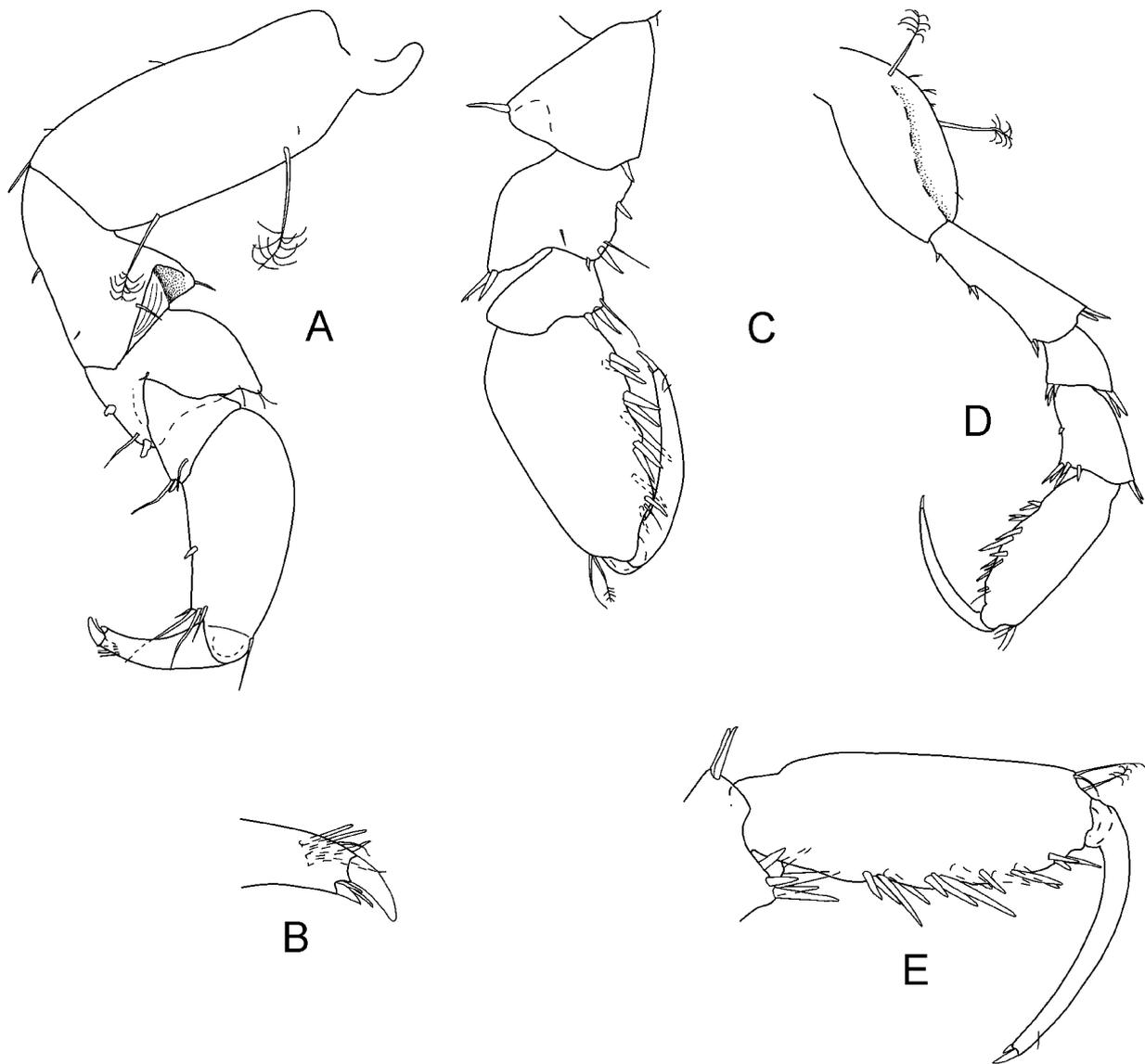
of acute RS (as 3, 3, 4, 3 and 1, arranged in a V-orientation); dactylus 0.9 as long as propodus. *Pereopod 3* similar to *pereopod 2*. *Pereopod 6* similar to *pereopod 7*. *Pereopod 7* basis 2.1 times as long as greatest width, superior margin convex, inferior margin with 2 palmate setae; ischium 0.8 as long as basis, inferior margin with 3 RS (set as 1 and 2), superior distal angle with 2 RS, inferior distal angle with 3 RS; merus 0.3 as long as ischium, 0.9 times as long as wide, inferior margin without RS, superior distal angle with 3 RS, inferior distal angle with 3 RS; carpus 0.6 as long as ischium, inferior margin with 1 RS, superior distal angle with 2 RS, inferior distal angle with 6 RS; propodus 1.1 as long as ischium, 2.6 times as long as wide, inferior margin with 4 clusters of RS (as 4, 4, 2 and 2), superior distal angle with 3 slender setae (1 palmate), inferior distal angle with 3 RS; dactylus 0.8 as long as propodus.

*Penes* low tubercles.

*Pleopod 1* exopod 1.5 times as long as wide, lateral margin strongly convex, distally broadly rounded, mesial margin strongly convex, with PMS from distal one-third, with 29 PMS; endopod 1.5 times as long as wide, distally subtruncate, lateral margin straight, with PMS on distal margin only, endopod with 12 PMS; peduncle 1.7 times as wide as long; mesial margin with 4 coupling setae. *Pleopod 2* exopod with 34 PMS, endopod with 16 PMS; *appendix masculina* with parallel margins, 1.3 times as long as endopod, distally bluntly rounded. *Pleopod 3* exopod with 36 PMS. *Pleopod 4* exopod with 36 PMS. *Pleopod 5* exopod with 25 PMS. *Pleopods 2–5* peduncle distolateral margin with prominent acute RS, 3–5 endopods without distomesial serrate scales.

*Uropod* peduncle ventrolateral margin with 2 RS, lateral margin with medial short acute RS, posterior lobe about three-quarters as long as endopod; rami extending to pleotelson apex, marginal setae in single tier, apices acute. *Endopod* apically shallowly bifid; lateral margin weakly convex, proximal lateral margin with 1 RS; distal lateral margin with 1 RS, mesial margin weakly convex, with 5 RS. *Exopod* not extending to end of

endopod, 3.2 times as long as greatest width, apically not bifid; lateral margin convex, with 5 RS; mesial margin convex, with 3 RS.



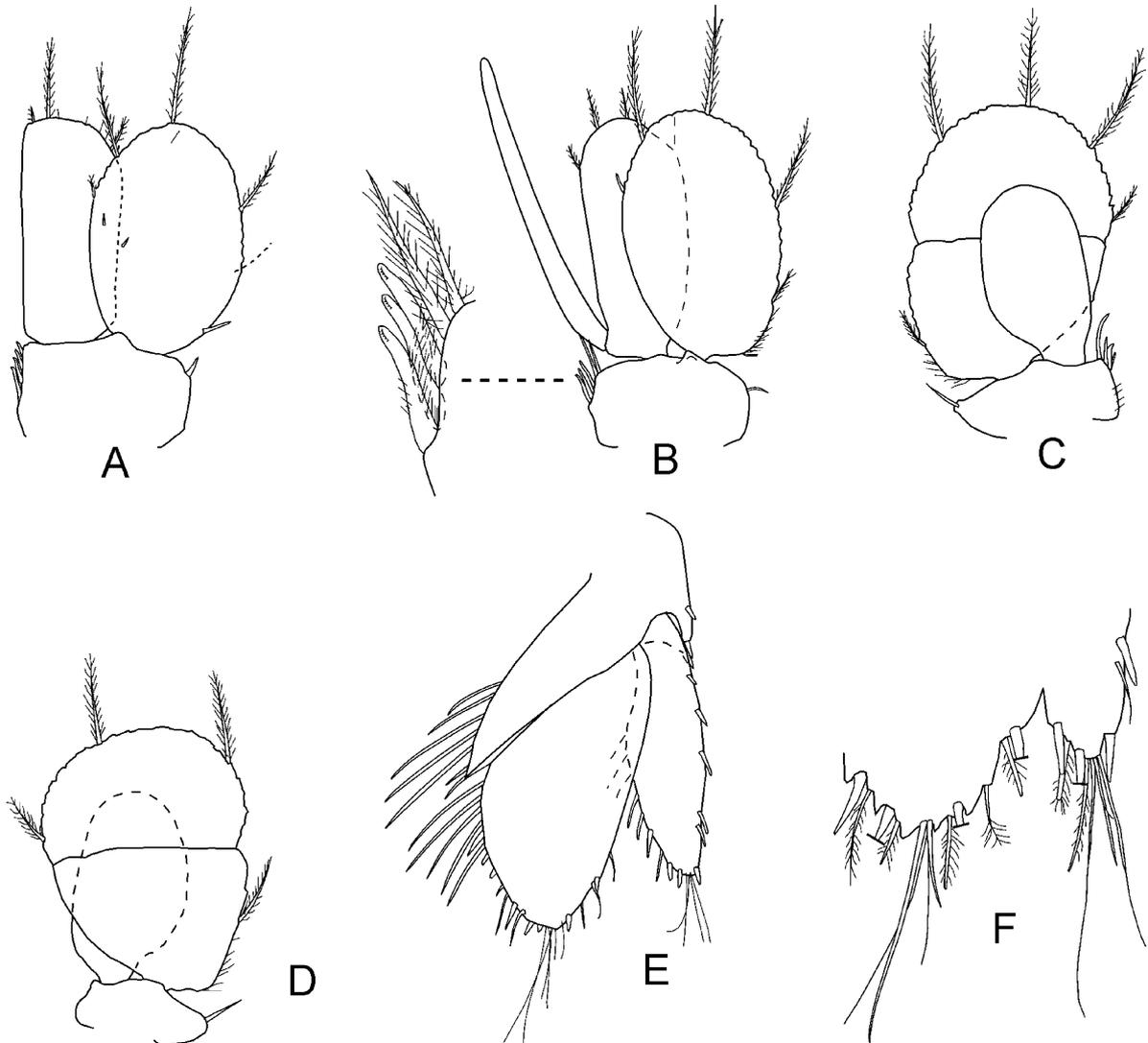
**FIGURE 7.** *Haptolana yarraloola* sp. nov. Male paratype 4.6 mm, WAM C39324. A, pereopod 1; B, pereopod 1, dactylus tip, detail; C, pereopod 2, distal articles; D, pereopod 7; E, pereopod 7, propodus.

**Variation.** Pleotelson RS (4 specimens) from 4 (3 times); one apparently aberrant female with 12 RS (as 3+9). Uropod endopod ( $n = 8$ ) mesial margin with 4–7 RS, with 4 (50%), lateral margin all with 1+1; exopod mesial margin ( $n = 10$ ) with 2–4 RS, with 7 (70%) most frequent, lateral margin ( $n = 9$ ) with 4 (33.3%) or 5 (66.7%) RS.

**Remarks.** *Haptolana yarraloola* sp. nov., together with *Haptolana pholeta* Bruce and Humphreys, 1993, can be immediately separated from all other congeners, none of which occur on the Australian continent, by the broadly rounded frontal lamina that is visible in dorsal view and the straight appendix masculina. *Haptolana yarraloola* is identified by the posterior margins of the pleotelson being distinctly angled (vs smoothly curved in *H. pholeta*) and the posterior margin having four robust setae (vs eight). Other differences are that *H. yarraloola* has a longer antennal flagellum (extending to pereonite 6 vs pereonite 5), smaller endopods on pleopods 3–5 and more robust setae on pereopod 2, 6 and 7 than does *H. pholeta*.

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**FIGURE 8.** *Haptolana yarraloola* sp. nov. Male paratype 4.6 mm, WAM C39324. A–D, pleopods 1–3, 5 respectively; E, uropod; F, uropodal rami apices.

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