

A troglomorphic species of the centipede *Cryptops* (*Trigonocryptops*) (Chilopoda: Scolopendromorpha) from Western Australia

Gregory D. Edgecombe

Australian Museum, 6 College Street, Sydney, NSW 2010, Australia

Abstract – Among the 152 named species of the cosmopolitan centipede genus *Cryptops* Leach, 1815, a few troglomorphic species have been described from caves in Europe, the Canary Islands, and Cuba. Caves in the Roe Plains in the Nullarbor Region of Western Australia have yielded a new troglomorphic species, *C. (Trigonocryptops) roeplainsensis* sp. nov. The subgenus *Trigonocryptops*, known from Spain, North Africa, tropical West, Central and East Africa, Peru, Brazil, Cuba, India, Indonesia, and New Caledonia, has not previously been identified in Australia. Among Australian species, *Cryptops spinipes* Pocock, 1891, is most similar to *C. roeplainsensis*, is likewise a member of *C. (Trigonocryptops)*, and provides records for this subgenus in New Zealand, the Solomons and Fiji.

INTRODUCTION

The scolopendromorph centipede genus *Cryptops* has been recorded from numerous caves, but among the 152 named species of the genus (Lewis 2002) only a few are troglomorphic. They include *C. (Cryptops) jeanneli* Matic, 1960, from France, *C. (C.) vulcanicus* Zapparoli, 1990, from the Canary Islands, *C. (Trigonocryptops) longicornis* Ribaut, 1915, from Spain, and the Cuban *C. (T.) cavernicolus* Matic *et al.*, 1977, and *C. (T.) troglobius* Matic *et al.*, 1977. Other species collected in caves are troglaxenes, more typically epigeal in occurrence (see Ribaut 1915; Matic 1960; Negrea 1993; Stoev 2001, for occurrences of various species of *C. (Cryptops)* in European and North African caves). *Cryptops (Cryptops) omissus* Ribaut, 1915, *C. (C.) kempi* Silvestri, 1924, and *C. (Trigonocryptops) numidicus aelleni* Manfredi, 1956, were described from caves (in Kenya, Assam and Morocco, respectively), but none is troglomorphic. The Australasian species *C. (C.) australis* Newport, 1844, was reported from a Tanzanian cave (Ribaut 1915), though the single small specimen was considered to be of uncertain specific identity by Lewis (1999) and its morphology displays no troglomorphic characters.

Cave surveys by the Western Australian Museum have uncovered a remarkable troglomorphic species of *Cryptops* in caves in the Roe Plains in the Nullarbor Region of Western Australia (Figure 1), described herein as *Cryptops (Trigonocryptops) roeplainsensis* sp. nov. This new species is the first member of *C. (Trigonocryptops)* recorded in Australia. All cited material of the new species is deposited in the Western Australian Museum (prefix WAM), Perth. Specimens of *C. (T.) spinipes* in the Australian Museum are prefixed AM KS.

Scanning electron micrographs were captured digitally with a LEO VP435 using a Robinson backscatter collector. Morphological terminology follows Lewis *et al.* (2005).

SYSTEMATICS

Family Cryptopidae Kohlrausch, 1881

Subfamily Cryptopinae Kohlrausch, 1881

Genus *Cryptops* Leach, 1815

Type species

Scolopendra hortensis Donovan, 1810, by monotypy.

Remarks

Cryptops was divided by Attems (1930) into the nominate subgenus, *C. (Trigonocryptops)* Verhoeff, 1906, and *C. (Chromatanops)* Verhoeff, 1906. Subsequently, three additional subgenera have been referred to *Cryptops*: *C. (Haplocryptops)* Verhoeff, 1934, *C. (Trichocryptops)* Verhoeff, 1937a, and *C. (Paratrigonocryptops)* Demange, 1963.

Subgenus *Trigonocryptops* Verhoeff, 1906

Type species

Cryptops gigas Kraeplin, 1903, by subsequent designation of Attems (1930).

Remarks

Following Attems (1930), the subgenus *Trigonocryptops* is identified by trigonal sutures in

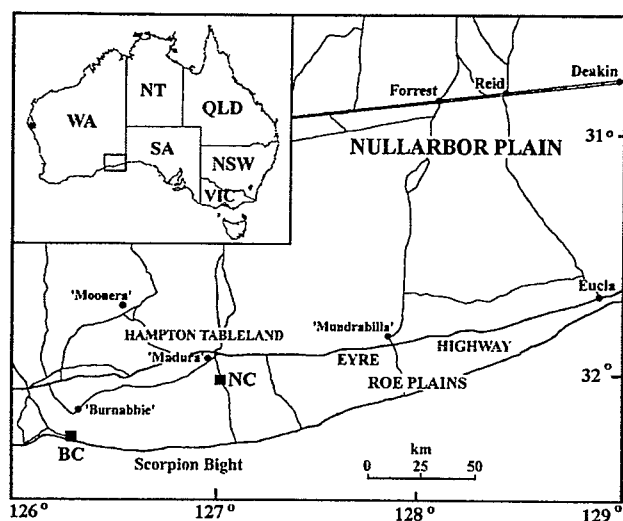


Figure 1 Location of the Roe Plains (inset in map of Australia), with the two localities for *Cryptops* (*Trigonocryptops*) *roeplainsensis* indicated by black squares in more detailed map. BC, Burnabbie Cave; NC, Nurina Cave.

front of the endosternite (Figure 19), a transverse ridge on the sternites between the coxae, generally bipartite tarsi, the head overlying tergite 1, a transverse suture on tergite 1, a divided katopleure, and mostly yellow or brown colour. These characters are all possessed by *C. (Trigonocryptops) roeplainsensis* sp. nov. Other characters shared by members of *C. (Trigonocryptops)* and seen in *C. (T.) roeplainsensis* are an anterior setose area on the clypeus delimited by sutures (Figure 4), a projection at the anterolateral corner of the endosternite (Figure 19), and slit-like spiracles (all cited in Verhoeff's original diagnosis of *Trigonocryptops*). Paired distal spinose processes on the ultimate leg (Figure 9) are also shared by many species of *C. (Trigonocryptops)*.

Attems (1930) reviewed records of *Cryptops* (*Trigonocryptops*) from Spain, North Africa (Morocco, Algeria), tropical West and East Africa, Brazil and New Caledonia. Subsequently described species have extended the distribution of this subgenus to India (Jangi 1955), Peru (Bücherl 1950; Kraus 1957), Sumba, Indonesia (Würmli 1972) and Cuba (Matic *et al.* 1977), and expanded its diversity and distribution in tropical West and Central Africa (Kraus 1958; Demange 1965, 1968).

Cryptops (Trigonocryptops) roeplainsensis sp. nov.
Figures 2–34

Material Examined

Holotype

Australia: Western Australia: Roe Plains, Nurina Cave 6N-46, 32°01'S 127°01'E, 19 September 1999, N. Poulter, on guano-covered rock (WAM 99/3011: Figures 3–5, 7–12, 16).

Paratypes

Australia: Western Australia: Roe Plains: Burnabbie Cave, vicinity of Eyre Bird Observatory, 32°14'S 126°18'E, 18 May 2004, P. Hosie, on small rock above water in chamber, 100 m into cave (WAM T60506, T60507); cave 6N-1327, c. 32°01'S 127°01'E, 31 December 1998, S.M. Eberhard, deep zone (WAM 99/1374).

Diagnosis

Antenna 9 times length of head plate; paramedian sutures continuous on head plate; continuous paramedian sutures on tergites 4–19; complete oblique sutures on tergites 2–5; 9–15 setae on each margin of maxillipede coxosternum; tergites, sternites and legs relatively elongate; ultimate leg with pair of distal spinose processes on prefemur, femur and tibia; 20–25 saw teeth on tibia, 10–18 saw teeth on tarsus 1.

Description

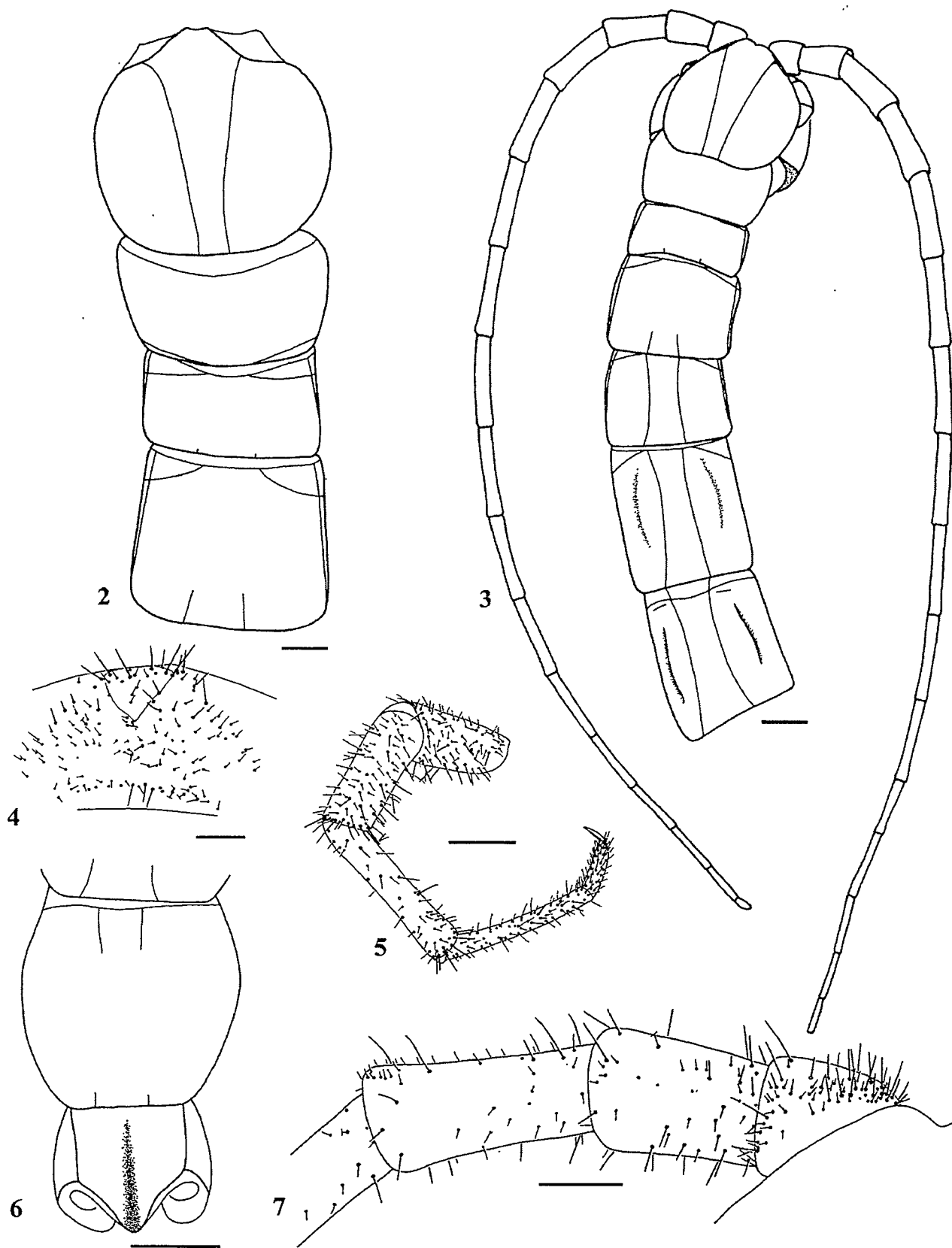
Length (anterior margin of head plate to posterior margin of telson) 46–78 mm. Holotype (largest specimen) with head plate 3.0 mm long, antenna 26.7 mm long.

Head, proximal part of antenna, and anterior trunk segments pale orange; distal part of antenna and posterior trunk segments yellowish-orange; deeper orange band across posterior margin of head plate and trunk tergites.

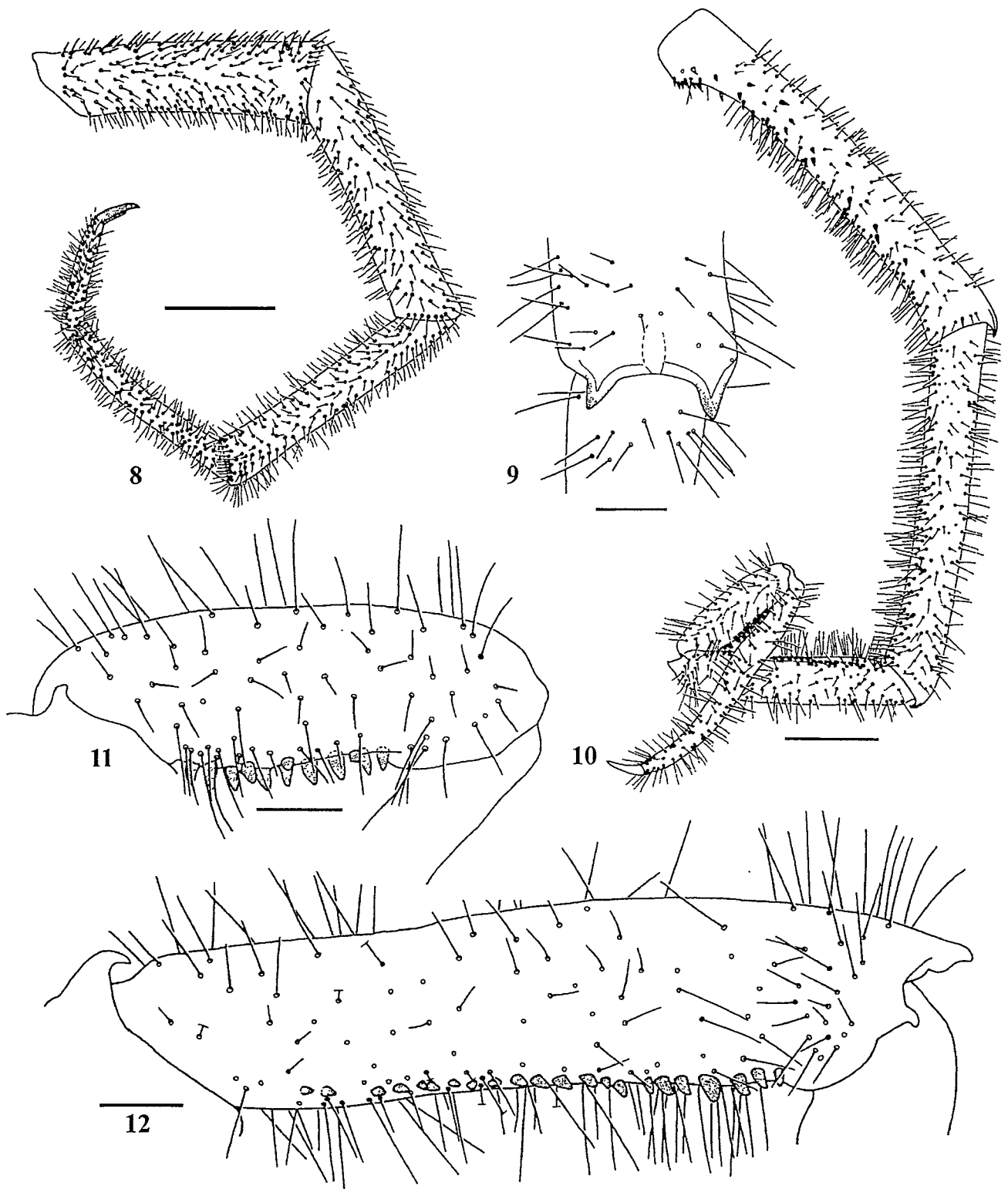
Head plate overlaps tergite 1; length and width of head plate nearly equal, posterior corners strongly rounded, sides convex outwards, anterior apex indented, bisected by longitudinal median furrow; paramedian sutures diverging anteriorly on head plate (Figures 2, 3); head punctate, densely covered with fine setae.

Antenna composed of 17 articles (Figure 3); basal two articles relatively stout, articles then increase in length to a maximum at articles 7–10, then gradually shortening except that article 17 is less than half length of article 16; articles 4–16 all much longer than wide, length up to 6.5 times width. All surfaces of antennal articles 1–3 with scattered long setae, densest on article 1 (Figure 7); short, fine setae abundant on all articles except for dorsomedial side of articles 1 and 2, becoming more densely concentrated up to article 4, then of even density to form a fur-like covering (Figures 29, 30); from article 4, long setae (Figure 28) confined to an irregular ring (variably two-deep) around proximal end of each article and occasional seta more distally.

Anterior setose area on clypeus diamond shaped (Figure 4), with its anterior convergent sutures meeting at a point. Longer setae on anterior setose area arranged 2.2.4.1 (WAM T60506), 2.4.2.2.1 (WAM T60507) or less regular (Figure 4), with a large seta just outside suture at widest point of setose area. Prelabral setae in two rows of 13–14;



Figures 2-7 *Cryptops (Trigonocryptops) roeplainsensis* sp. nov.: 2, 6, WAM T60507, scales 1 mm. 2, head plate and tergites 1-3; 6, tergites 19-21 and coxopleuron of ultimate leg. 3-5, 7, holotype WAM 99/3011. 3, head and tergites 1-6, scale 1 mm; 4, clypeus, scale 0.25 mm; 5, leg 1, scale 0.5 mm; 7, proximal part of antenna, scale 0.5 mm.



Figures 8–12 *Cryptops (Trigonocryptops) roeplainsensis* sp. nov.: holotype WAM 99/3011. 8, leg 20, scale 1 mm; 9–12, leg 21. 9, spinose processes at distal end of femur, scale 0.25 mm; 10, leg 21, scale 1 mm; 11, tarsus 1, scale 0.25 mm; 12, tibia, scale 0.25 mm.

numerous short setae between apical cluster and prelabral rows, variably arranged into a medial cluster and lateral bands (Figure 4) or more evenly scattered. Labrum with shallow incision against rounded sclerotised bulge in sidepiece, not strongly tridentate; margin densely fimbriate; a translabral ruga just behind anterior margin.

Maxillipede with anterior edge of coxosternum slightly convex on each side, fringed by row of 9–15 marginal setae (13+15, 13+14 in larger specimens, 10+9 in smallest specimen, WAM 99/1374) (Figure 17); median incision weak. Surface of coxosternum and trochanteroprefemur (Figure 15) evenly covered with abundant short setae, relatively longer setae concentrated on anterior third of coxosternum. Single band of short setae on each femur and tibia. Tarsungulum articulated with trochanteroprefemur along wide hinge.

Apical claw of second maxilla with slender hook distally, lacking a flange along its inner edge (Figure 16). Dorsal brush dense, running along distal three-quarters of article 3.

First maxillary coxal process isolated by a narrow desclerotised band.

Mandible with 11 comb lamellae (Figures 20, 21), each composed of up to 16 distally pointed spines (Figure 25). Fringe of branching bristles of even width against comb lamellae and ventral two pairs of teeth, abruptly narrowing against third tooth pair (Figure 22), narrow against fourth tooth pair; branches confined to 3–6 spine-like projections at distal end (Figure 24). Abundant blunt accessory denticles on two dorsal paired teeth (Figure 26). Haarpolster (=pulvillus) a small, dense pad of bristles, some with spine-like marginal and distal branches (Figure 27).

Tergite 1 with complete anterior transverse suture; posterolateral sutures directed backwards medially, extending to posterior margin of tergite (Figure 2). Lateral longitudinal sutures on tergites 2–19, becoming submarginal by about tergite 5. Complete oblique sutures on tergites 2–5 (Figure 3); incomplete oblique sutures on tergites 6 and 7. Paramedian sutures on posterior 25% of tergite 3, complete on tergites 4–19, including anteriorly-divergent sutures on pretergites; paramedian sutures confined to anterior 25% and posterior margin of tergite 20 (Figure 6). Shallow crescentic sulci on tergites 5–19. Tergites 1 and 2 with dense, mostly fine, short setae, a few moderately long setae; remaining tergites evenly scattered with mostly short setae and numerous longer setae. Tergite 21 slightly longer than wide, posterior margin triangular with rounded apex; shallow longitudinal median depression along posterior two-thirds of tergite (Figure 6).

Sternites 2–19 with median longitudinal and curved transverse sulci equally developed (Figure 19). Mostly short setae densely scattered over most

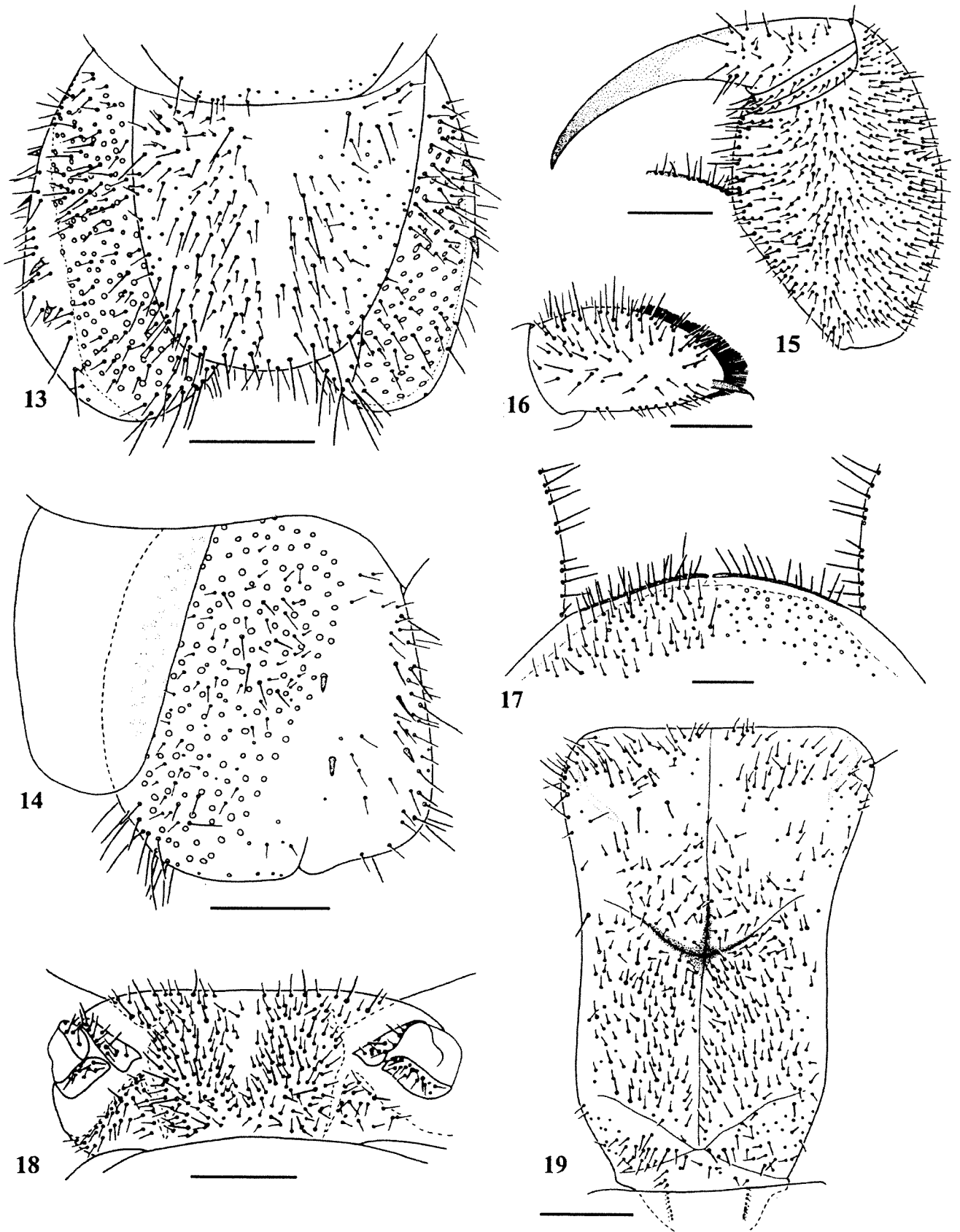
of sternite; setation variably sparser laterally. Anterior branch of trigonal suture complete on sternite 2, incomplete from sternite 3, terminating at about half width of sternum by sternite 10, indistinct from sternite 15. Endosternite with several moderately long setae near anterior margin, two parallel rows of short setae along length of endosternite (Figure 19).

Spiracles elongate, slit-like.

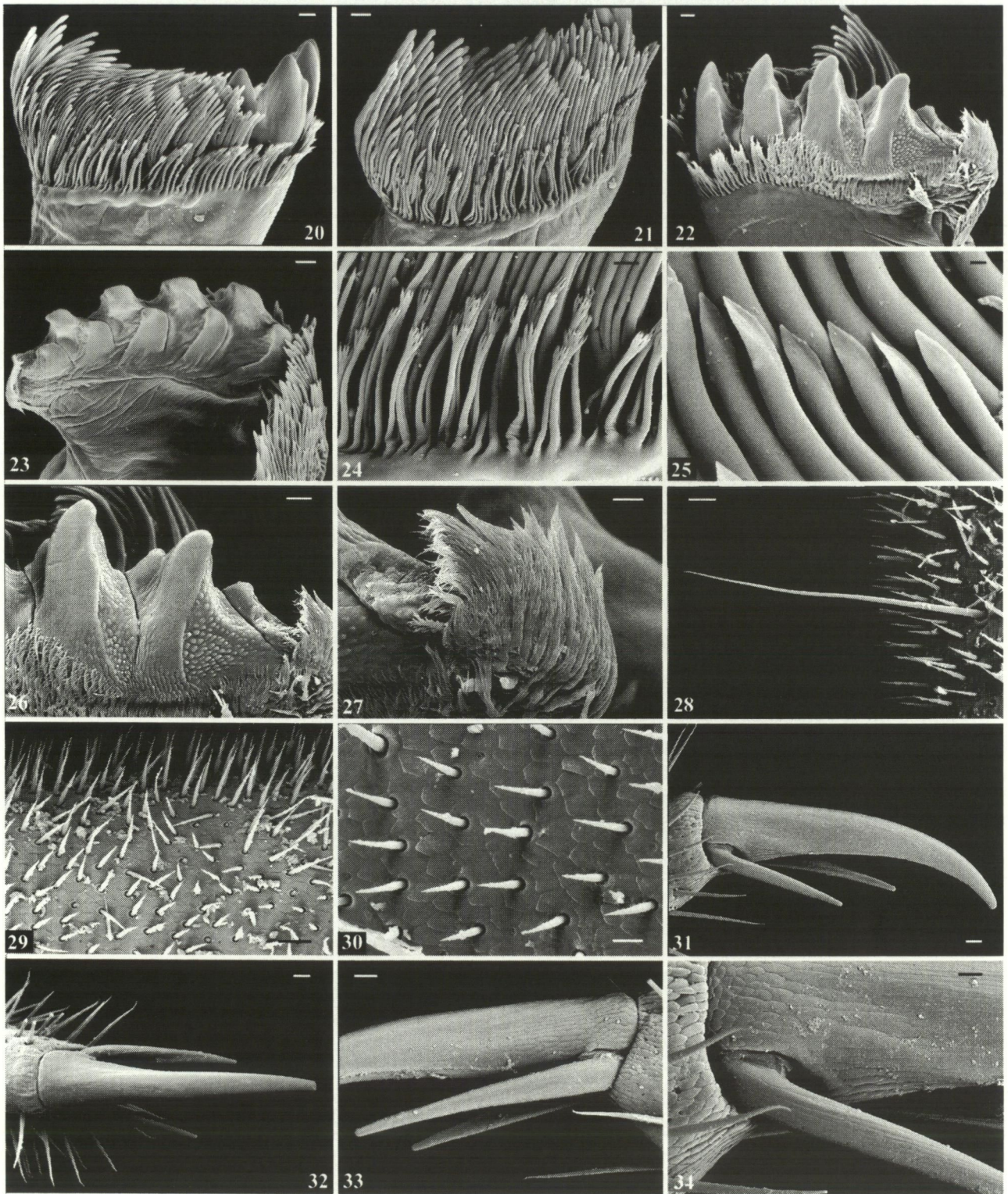
Legs long and thin, e.g., leg 10 with prefemur 1.9 mm long, femur 2.2 mm, tibia 2.6 mm, tarsus 1 2.4 mm, tarsus 2 0.7 mm compared to tergal width of 3.6 mm. All tarsi strongly bipartite. Leg 1 (Figure 5) with strong, nearly subspiniform setae on all surfaces of prefemur and femur, on all but dorsal surface of tibia; from leg 2, mix of strong setae and short, fine setae on prefemur and femur, mostly fine setae on tibia, and shorter, denser, fine setae on tarsus; legs 19–20 with more consistently strong setae on prefemur and femur. Leg 20 prefemur and femur about equally long; tarsus 2 50% length of tarsus 1 (Figure 8); no specimen with dense tufts of setae ventrally. Ultimate leg: prefemur slightly longer than femur; tarsus 2 1.8 times length of tarsus 1; prefemur seven times longer than its maximal width at distal end; femur six times longer than its maximal width at distal end (Figure 10); numerous robust spiniform setae along anterior and posterior sides of prefemur, cluster of spiniform setae on proximal ventral part of prefemur; a few spiniform setae on posterior side of femur; all segments with abundant fine, slender setae of mostly uniform length; number of saw teeth on tibia (Figure 12) and tarsus 1 (Figure 11), respectively, as follows: 22/24, 13/18 (WAM 99/3011), 23/20, 13/12 (WAM T60506), 25/23, 10/11 (WAM T60507); saw teeth on tarsus 1 variably arranged in two rows; proximal part of tarsus 2 swollen, inner margin a crest.

Pair of accessory spurs usually slightly more than 50% length of pretarsus on legs 1–20 (Figures 31–34); anterior accessory spur slightly longer than posterior spur; accessory spurs lacking on ultimate leg. Accessory spurs oriented subparallel to main claw or gently divergent (Figure 32).

Sternite 21 with sides gently convex and converging posteriorly; posterior corners rounded, hind edge moderately convex backward (Figure 13). Coxopleural pore field elliptical, extending nearly to posterior margin of coxopleuron, with 169 pores in only specimen with fully visible pore field (Figure 14). Short and moderately long setae in pore field less numerous than pores. One or two robust spiniform setae variably present above pore field, approximately aligned with cleft in posterolateral margin of coxa (Figure 14). Long setae grouped at posterior margin of coxopleuron and along entire dorsal margin, the latter with up to two spiniform setae amidst the simple setae.



Figures 13–19 *Cryptops (Trigonocryptops) roeplainsensis* sp. nov.: scales 0.5 mm except 16, 17, 0.25 mm. 13–15, 17–19, WAM T60507. 13, 14, ventral and ventrolateral views of sternite and coxopleuron of segment 21; 15, forciphule; 17, margin of maxillipede coxosternum; 18, sternite 1; 19, sternite 4. 16, holotype WAM 99/3011. Tarsus and claw of second maxilla.



Figures 20–34 *Cryptops* (*Trigonocryptops*) *roeplainsensis* sp. nov.: 20–27, WAM T60506, mandibular gnathal edge. 20–22, anterior views, scales 20 μm ; 23, medial view, scale 30 μm ; 24, fringe of branching bristles, scale 10 μm ; 25, comb lamellae, scale 2 μm ; 26, paired teeth, scale 20 μm ; 27, Haarpolster, scale 10 μm . 28–34, WAM T60507. 28–30, sensilla on antennal articles 5 and 6, scales 20 μm except 30, 10 μm ; 31–34, pretarsus of leg from middle of trunk, scales 20 μm except 34, 10 μm . 31, posterior view; 32, dorsal view; 33, anterior view; 34, posterior accessory spur.

DISCUSSION

Like the highly troglomorphic congeners, *Cryptops* (*Trigonocryptops*) *longicornis* Ribaut, 1915, and *C. (T.) troglobius* Matic *et al.*, 1977, *C. roeplainsensis* is distinguished from other members of *C. (Trigonocryptops)* by its very long antennae and legs, and elongate body (relatively long tergites and sternites). The Spanish *Cryptops longicornis* was transferred to *C. (Trigonocryptops)* by Attems (1930). Verhoeff (1937b) instead considered it a member of *C. (Cryptops)*, but it has been more recently reinstated as *C. (Trigonocryptops)* (Serra 1981). The extreme elongation of the legs in *C. (T.) roeplainsensis*, as in *C. (T.) troglobius*, is associated with a greater number of saw teeth than in non-troglomorphic species. *Cryptops roeplainsensis* differs from *C. (T.) longicornis* in its continuous paramedian sutures on the head plate, more numerous setae on the maxillipede coxosternal margin, more saw teeth (12–13 on the tibia, 5 on tarsus 1 in *C. (T.) longicornis*) (Serra 1981), and much more abundant pores on the coxopleuron of the ultimate leg (about 60 in *C. longicornis* versus 170 in *C. roeplainsensis*). Compared with the Cuban *C. (T.) troglobius*, the new species lacks paramedian sutures on tergite 1 and has incomplete paramedian sutures on tergite 20, has more numerous setae on the head plate, maxillipede, trunk tergites and sternites, has a narrower non-cribriform area on the dorsal part of the ultimate leg coxopleuron, and a shorter posteromedian projection of tergite 21.

Among named Australian species, *Cryptops spinipes* Pocock, 1891, known from New South Wales and Queensland (Kraepelin 1916; Chamberlin 1920), is most similar to *C. (T.) roeplainsensis*. The two species share the anteriorly-divergent paramedian sutures on the head plate, anterior transverse suture on tergite 1, and trigonal sutures on anterior sternites (segments 2–6 in *C. spinipes*). *Cryptops spinipes* was treated as a member of *C. (Cryptops)* by Attems (1930) but the trigonal sutures on the sternites, a diamond-shaped anterior setose area on the clypeus, and pair of distal spinose projections on the tibia of the ultimate leg instead indicate membership in *C. (Trigonocryptops)*. As such, *C. spinipes* provides records of *C. (Trigonocryptops)* in New Zealand (Archev 1924), the Solomon Islands and Fiji (Chamberlin 1920), as well as eastern Australia. Material of *C. (T.) spinipes* used to confirm the presence of the trigonal sutures and anterior setose area on the clypeus is from New Zealand (AM KS 90634) and north Queensland (AM KS 58457). In addition to its troglomorphic characters involving elongation of the antennae, legs and trunk sclerites, *C. (T.) roeplainsensis* is distinguished from *C. (T.) spinipes* by the following: much denser setation on the clypeus (only three large setae on the anterior setose area in *C. (T.) spinipes* plus up to three small setae), maxillipede

(e.g., coxosternum and trochanteroprefemur), and sternites; trigonal sutures on the sternites developed further posteriorly on the body; distal spinose projections on the ultimate leg prefemur and femur, not just the tibia; and greater number of coxopleural pores.

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