

Life cycle stages of mites of the genus *Ctenocolletacarus* Fain (Acari: Acaridae) associated with *Ctenocolletes* bees in Australia

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Abstract

The first known life cycle stages (other than the hypopus) for the genus *Ctenocolletacarus* are described. They comprise the female, egg, larva, and protonymph of *C. longirostris*, and the tritonymph and adults (female and homomorphic and heteromorphic males) of *C. brevirostris*. They were collected from brood cells of their hosts or reared from hypopi.

Additional host records for hypopi of the two species are provided and *Ctenocolletes nigricans* is newly recorded as a host for *C. brevirostris*.

Introduction

Fain (1984) erected the genus *Ctenocolletacarus* for three new species of acarid mites then known only from heteromorphic deutonymphs (hypopi) phoretic on bees of the genus *Ctenocolletes* (Stenotritidae) in Western Australia. Houston (1984) noted that female bees carried the hypopi in specialised pouches on the abdomen and surmised that there is a mutualistic association between bees and mites. More recently, he excavated nests of *Ctenocolletes albomarginatus* Michener and *C. nicholsoni* Cockerell and obtained series of mites from the brood cells. Nests of *C. nicholsoni* yielded gravid females, eggs, larvae and protonymphs. Some of the protonymphs were reared to hypopi which were identified as mostly *C. longirostris* Fain and a few *C. grandior* Fain. Moreover, hypopi of *C. brevirostris* Fain taken from adult bees were reared to tritonymphs and adults of both sexes.

This paper describes these newly discovered life cycle stages and provides a basis for a forthcoming account of the biology of the mites.

Most of the material examined is lodged in the Western Australian Museum with duplicates in the Institut royal des Sciences naturelles de Belgique, Bruxelles, the British Museum (Natural History), London, and the Museum of Zoology, University of Michigan, Ann Arbor.

All dimensions are given in μm .

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Systematics

Genus *Ctenocolletacarus* Fain, 1984

Type species

C. longirostris Fain, 1984.

Characters of adults and immatures may now be added to the definition of this genus, originally based on hypopi only.

Female

Body of ovigerous individuals (containing about 12 eggs) strongly dilated; cuticle soft with small propodonal shield; sejugal furrow poorly developed; epimeres I fused in a short sternum, others free; vulva longitudinal (I-shaped) and situated between coxae III-IV; genital suckers normally developed; anus very close to vulva; copulatory orifice ventroterminal, close to midline; legs appearing relatively small in dilated female; all tarsi ending in claw with long straight base completely embedded in membranous pretarsus.

Chaetotaxy of body: setae *ve* very small, situated along lateral margin of shield directly behind *vi*; setae *s cx* very short and thin, not barbed; setae *sc i* short and thin; *sc e* long with thick bases; *d1*, *d2*, *l1* and *l2* very short and thin; *d3-d5* and *l3-l5* thick but in *C. longirostris* all are broken close to their bases except *l5* which is long and entire (in *brevirostris*, at least *d3*, *d5* and *l5* long); ventrally, setae *cx I*, *cx III*, *sh* and the three pairs of genitals short and thin, *h* about twice as long; three pairs of short anal setae and two pairs of chitinous ringlets represent vestigial anal setae.

Chaetotaxy of legs: tarsus I with 13 setae of which six are short apical or preapical spines, three are preapical pedunculate foliate setae (two large laterals and one smaller dorsal), and four are median setae (two spines and two spinous setae); tarsus II as in I but with one spinous median seta (*ba* seta) lacking; tarsus III with seven spines (six on apical third and one on median third) and three subapical pedunculate foliate setae; tarsus IV with eight spines and two pedunculate foliate setae (one dorsal, one anterior); tibiae I-IV with 2-2-1-1 spines; genua with 2-2-1-0 spines; femora with 1-1-0-1 thin setae; trochanters with 1-1-1-0 setae.

Solenidiotaxy: tarsus I with three solenidia, *w3* being apical; all tibiae with one solenidion; genua I with two unequal solenidia; genua II-III each with one solenidion.

Male

General characters as in female and sexual dimorphism little developed. Males are of two kinds: a homomorphic male with legs III normal, and a heteromorphic

male with legs III modified (leg thicker than normal and tarsus prolonged into a very strong conical ventrally recurved process). Both kinds of males with adanal suckers absent and replaced by pair of chitinous ringlets; tarsus IV with two small suckers.

Tritonymph

Only one free tritonymph was observed (the others being enclosed by the hypopial skin). Legs reduced, claws smaller and setae shorter than in adults. Setae *d3-d5* much shorter than in adults; *d5* curved with a tooth on basal third. Some of the enclosed tritonymphs contained a fully developed male or female. Thus, it appears that the tritonymph is a non-motile stage that remains within the hypopial exuvium. Our one free specimen probably was expelled accidentally.

Protonymph

Dorsal setae mostly spinous and subequal in length. Some protonymphs contained a fully developed hypopus.

Larva

Chaetotaxy as for protonymph but genitals, anals, *l4* and *l5* lacking. Coxa I with pair of long Claparéde organs. Some larvae contain a protonymph.

Remarks

The genus *Ctenocolletacarus* differs from other genera of Acaridae by characters of the hypopi (Fain 1984) and the following: male lacking adanal suckers; female with anus situated anteriorly close to vulva and anal chaetotaxy reduced to three pairs instead of usual five or six pairs; both sexes with strong development of setae *d5* and *l5* which are very long and have very thick bases.

Ctenocolletacarus longirostris Fain, 1984

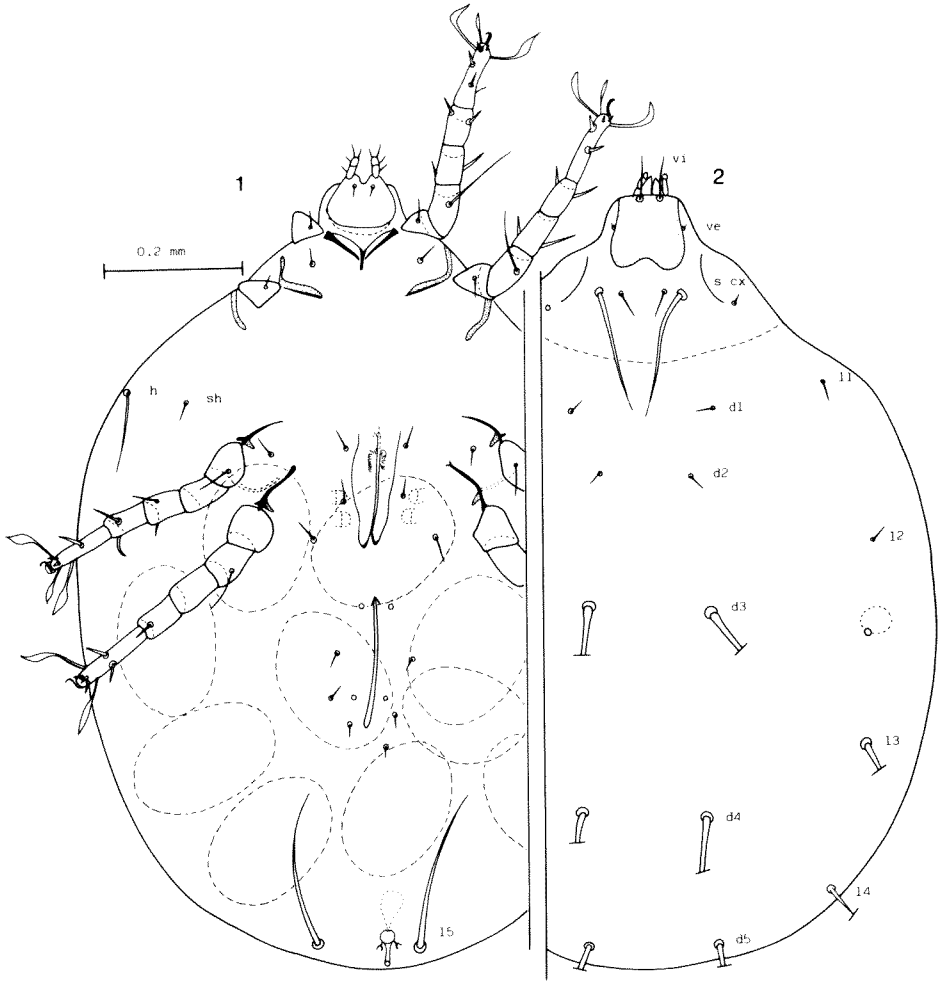
Figures 1-6, 11-17

Although we are using the above name for the females, eggs, larvae and protonymphs obtained from brood cells of *Ctenocolletes nicholsoni*, it is possible that some of them are really *C. grandior*. This is because both species are represented amongst 22 hypopi reared from one cell (17 *longirostris*, 5 *grandior*). Presumably some of the protonymphs from that cell (and perhaps individuals from other cells) are *grandior*. However, we could not distinguish two kinds in any stage other than the hypopus and, because all hypopi carried by female bees occupying the nests were *longirostris*, we elect to use this name for all individuals. We may be dealing with sibling species distinguishable only by their hypopi.

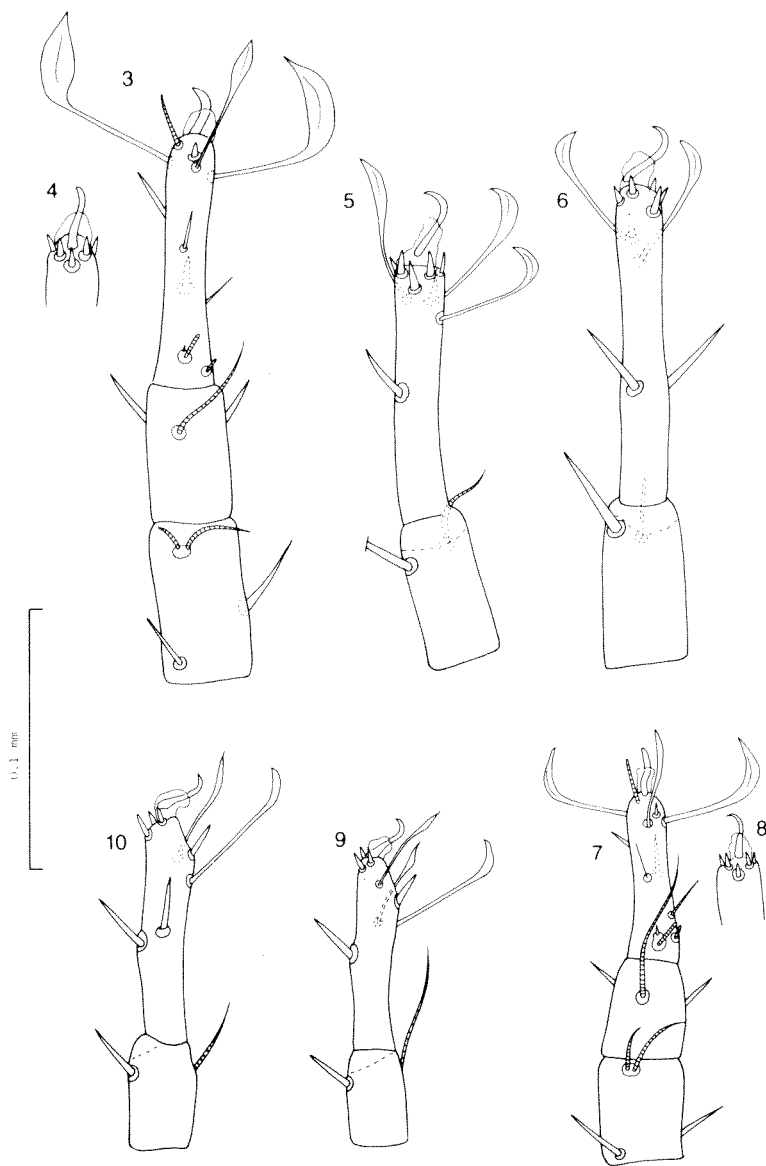
Female (Figures 1-6)

Our two females are broadly ovoid and contain 12 and 14 eggs; cuticle broken in posterior third so dimensions of idiosoma are estimated as (length x width) 1260 x 960 and 1200 x 800.

Dorsum: well developed tegmen covers base of gnathosoma; lengths of setae are *ve* and *s cx* 6-10; *vi* 50, *sc i* 50, *sc e* 200, *d1*, *d2*, *l1* and *l2* 20-30; *l4* at least 50 long.



Figures 1, 2 *Ctenocolletacarus longirostris*. Gravid female, ventral and dorsal views, respectively.



Figures 3-10 Legs of *Ctenocolletacar* females. (3-6) *C. longirostris*: (3) leg I, dorsal view; (4) apex of tarsus I, ventral view; (5) tibia and tarsus III; (6) tibia and tarsus IV. (7-10) *C. brevisrostris*: (7) leg I, dorsal view; (8) apex of tarsus I, ventral view; (9) tibia and tarsus III; (10) tibia and tarsus IV.

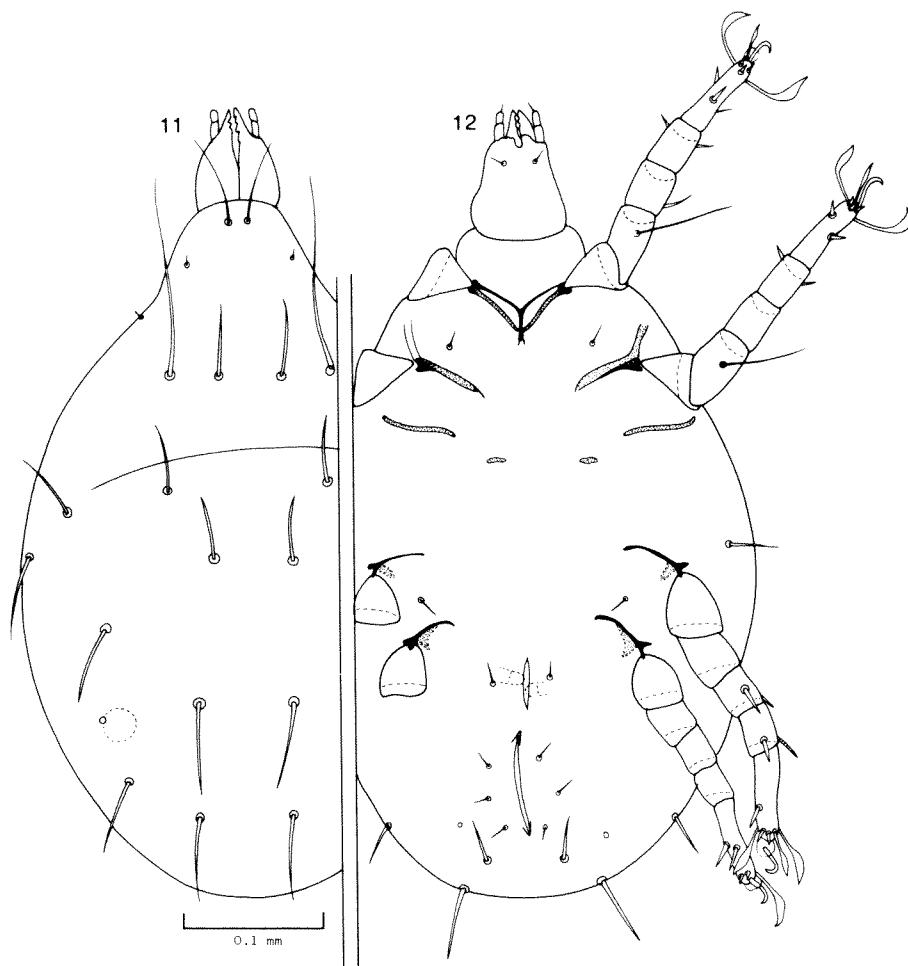
Life cycle stages of mites

Venter: setal lengths are *h* 135, *sh* 30, *l5* 250, *cx I*, *cx III* and genitals 30-40, anals (very thin) 12-15.

Legs: lengths of tarsi I-IV are 102, 105, 108 and 130, respectively.

Protonymph (Figures 11-16)

Idiosoma of freshly emerged specimens measure (length x width) from 390 x 240 to 420 x 255 (n 5) and of fully fed specimens from 450 x 280 to 600 x 420 (n 5); one pair of genital suckers, one pair of genital setae and three pairs of anal

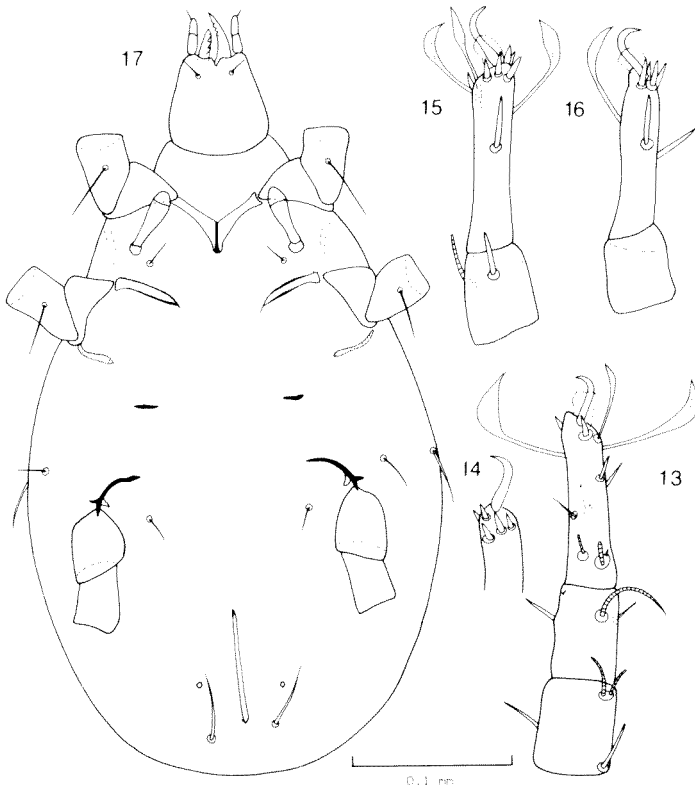


Figures 11, 12 *Ctenocolletacarus longirostris*. Protonymph, dorsal and ventral views, respectively.

setae present; hysteronotal setae 45-60 long; lengths of other setae are *vi* 55, *ve* 10, *s cx* 6, *sc i* 70, *sc e* 140, and (on venter) *d5* 35 and *l5* 40; legs well developed each ending in large claw; tarsi I-IV with 13-12-10-7 setae; tarsus IV bearing six spines and one dorsal foliate seta; tibiae I-IV with 2-2-1-0 setae, genua with 2-2-1-0 and femora with 1-1-0-0; trochanters bare; tarsus I with only two solenidia (*w1* and *w2*).

Larva (Figure 17)

Length and width of idiosoma of four specimens are 420 x 270, 390 x 245, 360 x 240 and 344 x 225; body shape as in protonymph; ventrally, genital suckers and genital and anal setae absent; coxae I bear setae *cx I* 35 long; setae *sh*, *cx III* and *d5* present; chaetotaxy of legs I-II as for protonymph; leg III as in protonymph but with one foliate seta of tarsus replaced by spine.



Figures 13-17 *Ctenocolletacarus longirostris*. (13-16) protonymph: (13) leg I in dorsal view; (14) apex of tarsus I viewed ventrolaterally; (15) tibia and tarsus III; (16) tibia and tarsus IV. (17) Larva, ventral view.

Egg

Ellipsoidal; eggs still enclosed in female measured from 225 x 150 to 235 x 159 (dimensions possibly exaggerated through compression), those deposited on cell wall from 180 x 110 to 190 x 120; chorion smooth, glossy and colourless.

Material examined

In alcohol unless indicated otherwise. All from Western Australia.

Associated with *Ctenocolletes nicholsoni*, from 13 km S of Wannoo (26°49'S, 114°37'E), 24-28 August 1984, collected by T.F. Houston and B.P. Hanich. *Ex* brood cells: WAM 85/426-427, 2 ovigerous ♀; WAM 85/428, eggs attached to cell wall; WAM 85/429, 200-300 larvae and protonymphs (c. 70 on 8 slides); WAM 85/430, c. 200 protonymphs and few larvae (25 protonymphs on 4 slides); WAM 85/431, 250-300 larvae and protonymphs (c. 60 on 8 slides); WAM 85/432-433, c. 30 protonymphs containing hypopi (22 on 7 slides); WAM 85/434, 6 hypopi reared from protonymphs with 5 hypopi of *C. grandior* (on slide); WAM 85/435, 11 hypopi reared from protonymphs (2 slides). *Ex* tergal pouches of two female bees (WAM 85/411-412) collected at nests: WAM 85/436-437, c. 60 hypopi (23 on 3 slides).

Associated with *Ctenocolletes centralis* Houston, from 21 km ENE of Beyondie HS (24°47'S, 120°02'E), collected 17 and 20 August 1984 by T.F. Houston and B.P. Hanich. *Ex* tergal pouches of four female bees (WAM 85/405-408): WAM 85/422-425, c. 200 hypopi (c. 50 on 12 slides).

***Ctenocolletacarus brevirostris* Fain, 1984**

(Figures 7-10, 18-27)

Female (Figures 7-10, 18-19)

Our three specimens were freshly emerged, non-gravid, and poorly sclerotised; lengths and widths of idiosomas 400 x 225, 420 x 240 and 435 x 250; dorsal shield very weakly punctate; chaetotaxy as in *C. longirostris* female; lengths of some setae are *vi* 25, *sci* 20, *sc e* 200, *d3* 230 (*d4* incomplete, at least 75), *d5* 280-300 and *h* 110; venter as in *longirostris* but setae *l5* 300 long and legs shorter, lengths of tarsi I-IV being 63-66-72-93.

Male (homomorphic) (Figures 20-23)

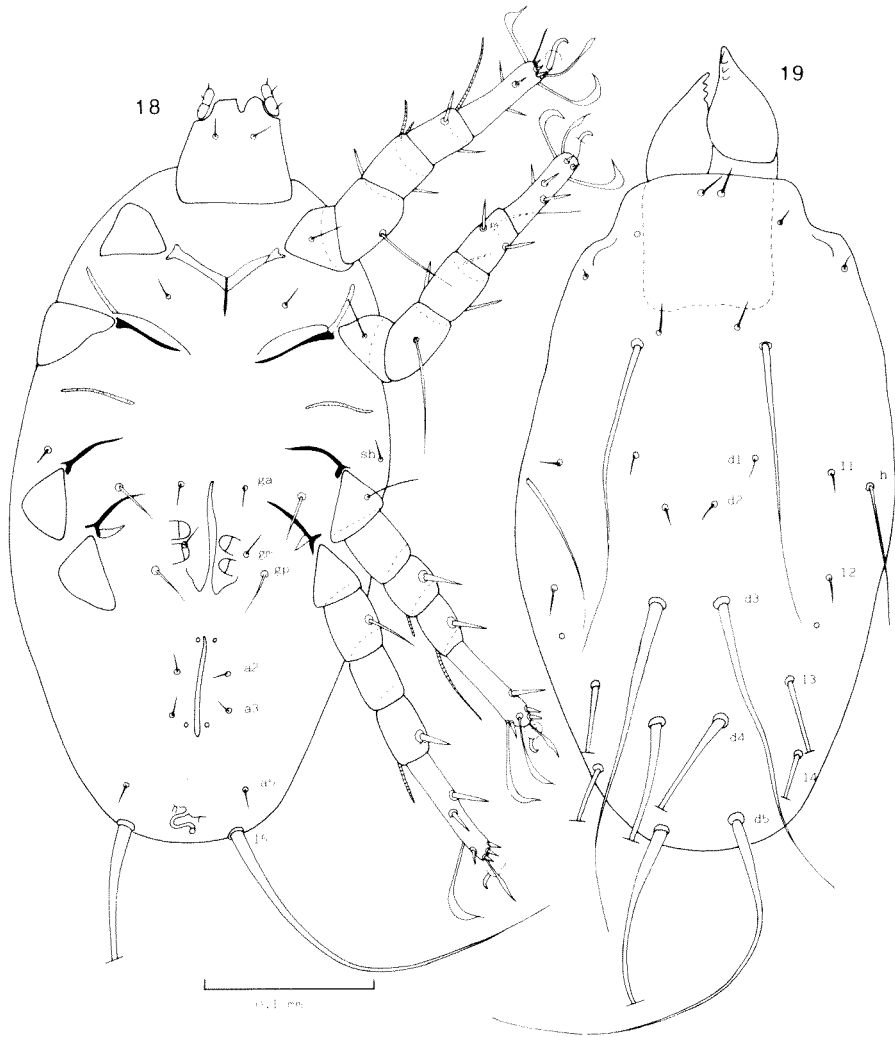
Idiosoma length 420, width 240; dorsum as in female; genital slit between coxae IV; anus close to genital slit; penis triangular, attenuated anteriorly; three pairs of anal setae present; legs I-III as in female; tarsi IV with seven spines and one pedunculate foliate seta.

Male (heteromorphic) (Figure 24)

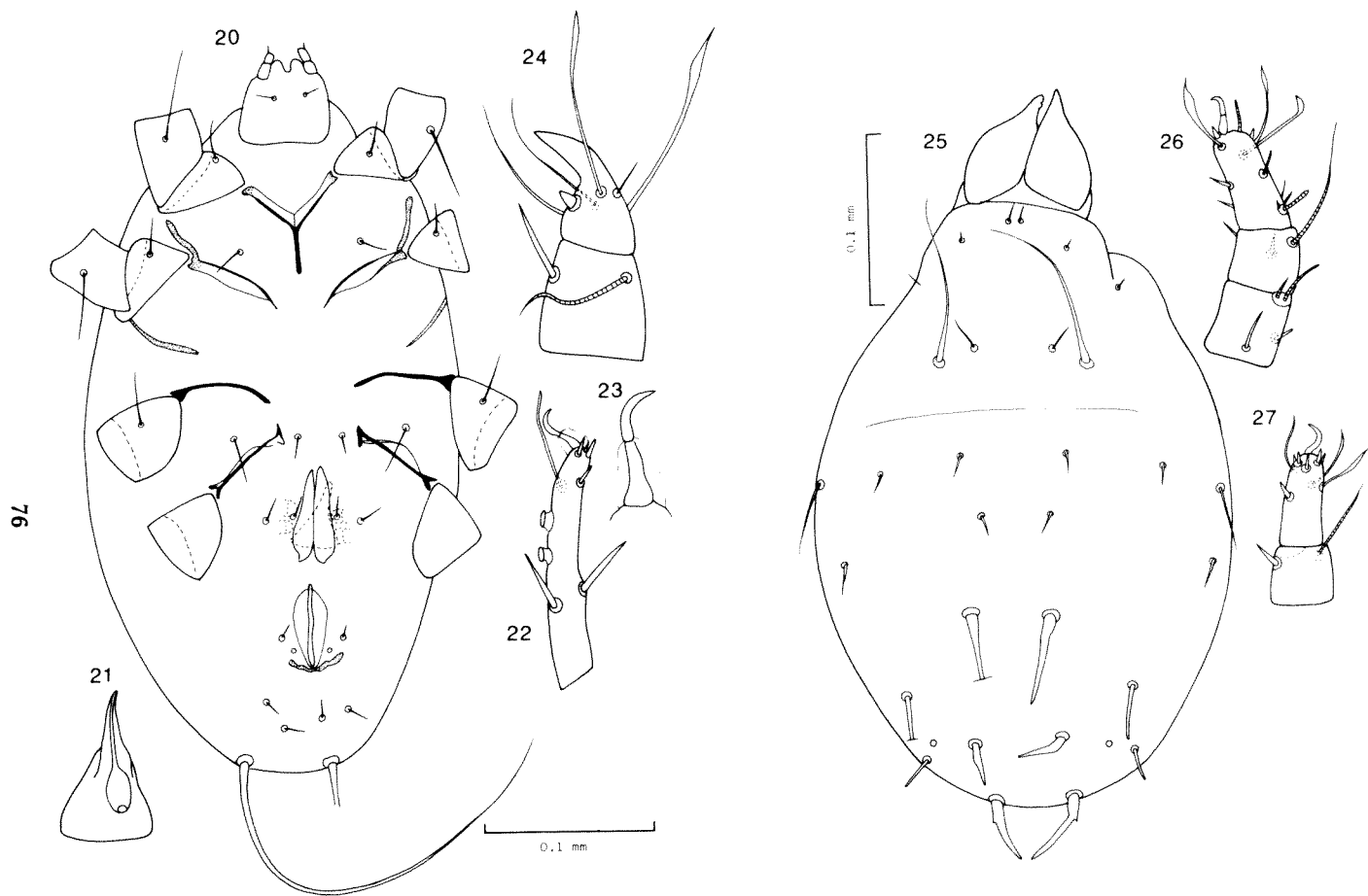
Idiosoma length 435, width 225; tarsus III bearing one blunt preapical spine, three long pedunculate foliate setae, one long thin ventral seta, and one short thin dorsal seta.

Tritonymph (Figures 25-27)

Our one free tritonymph has an idiosoma 370 long and 265 wide; dorsal chaetotaxy as in adult; 15 strong spines, 30 long; legs short with tarsi I-IV 45-45-36-45 long.



Figures 18, 19 *Ctenocolletacarus breviostris*. Newly emerged female, ventral and dorsal views, respectively.



Figures 20-24 *Ctenocolletacarus brevirostris*. (20-23) Homomorphic male: (20) ventral view; (21) penis; (22) tarsus IV; (23) claw of tarsus IV. (24) Tibia and tarsus III of heteromorphic male.

Figures 25-27 *Ctenocolletacarus brevirostris* tritonymph: (25) body, dorsal view; (26) leg I; (27) leg III.

Remarks

Females of *brevirostris* differ from those of *longirostris* as follows: legs shorter (cf. tarsal lengths); some setae shorter (e.g. *vi* and *sc i*) but *l5* longer; solenidion *w2* more apical than *w1* (more basal in *longirostris*); solenidia of tibiae relatively longer.

Material examined

In alcohol unless indicated otherwise. All from Western Australia.

Associated with *Ctenocolletes albomarginatus*, from East Yuna Nature Reserve, 34 km WNW of Mullewa. *Ex* brood cells (excavated on 13-16 September 1984 by T.F. Houston): WAM 85/438, hypopus containing completely developed tritonymph moulting to male (slide). Reared from hypopi *ex* tergal pouches of female bee (WAM 85/413) (collected 13-16 September 1984 by T.F. Houston): WAM 85/439, 2♀, 2♂ (homomorphic and heteromorphic), one free tritonymph, hypopi in moulting stage (9 slides).

Associated with *Ctenocolletes nigricans* Houston, from East Yuna Nature Reserve, 34 km WNW of Mullewa, 23-24 September 1983, collected by C.A. and T.F. Houston. *Ex* tergal pouches of four female bees (WAM 83/552, 83/561-563): WAM 85/418-421, c. 250 hypopi (c. 50 on 11 slides).

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References

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