

THE GENERA *CAMPYLOCHIRUS* TROUESSART AND  
*CAMPYLOCHIOPSIS* FAIN (ACARI: ATOPOMELIDAE),  
 PARASITES OF PHALANGEROID MARSUPIALS IN AUSTRALASIA

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*Synopsis*

The little known type-species of *Campylochirus* Trouessart, *Campylochirus chelopus* Trouessart from *Pseudocheirus peregrinus* (Boddaert) in Tasmania, is re-examined. Material from the same host and locality subsequently assigned to this species is shown to be composite, comprising *Campylochirus* (*Campylochirus*) *brevipenis*, n. sp., and *Campylochiopsis micrura* Fain and Domrow. *Schoinobates volans* (Kerr) is listed as a new (and more likely) host for *Campylochirus* (*Campylochiroides*) *antechinus* Fain, originally described from museum specimens of various Australian dasyurid marsupials. *Campylochirus* (*Campylochiroides*) *sthenophallus*, n. sp., is described from *S. volans* in Victoria. New morphological data are given for *Campylochiopsis dolichurus* (Fain), also from *S. volans*, and for *Campylochiopsis misonnei* Fain from *Pseudocheirus* sp. in Irian Jaya. No new data are available for the three other known *Campylochirus* (*Campylochiroides*) spp.: *C. pseudocheirus* Fain (*Pseudocheirus forbesi* Thomas, New Guinea), *C. petauricola* Fain (*Petaurus breviceps* Waterhouse, Victoria and Irian Jaya), and *C. caparti* Fain (*Pseudocheirus* sp., Irian Jaya). The necessary illustrations and descriptions are given, thereby affording a revision of the closely related genera *Campylochirus* and *Campylochiopsis* all species of which parasitise petaurid marsupials in Australasia.

The Australian phalangeroid marsupials carry several atopomelid genus-group taxa characterised in part by a relatively full complement of dorsal shields (see Fain and Domrow, 1974, for terminology), the migration of the normally basal solenidion of tibiotarsi III to a distal position (Fain, 1972), and, in the ♂, by adanal organs and incrassate legs IV.

The first to be described was *Campylochirus* Trouessart, the history of which is complex enough to bear summary. Its type-species, *Campylochirus chelopus* Trouessart, was briefly described without illustrations by Trouessart (1893, 1917) from *Pseudocheirus peregrinus* (Boddaert) (= *Pseudocheirus convolutor* (Oken) = *Phalangista cooki* Desmarest), the only representative of this genus in Tasmania.

In August 1956, Lawrence described *Cricetomysia andrei*, n. g., n. sp., from specimens in the Trouessart collection labelled as from *Cricetomys gambianus*, West Africa. Earlier, in April of the same year, Domrow (1956b) described the ♂, ♀, and nymph of a species he identified as *Campylochirus chelopus* from specimens collected on the type-host in Tasmania. In 1958, Domrow noted that his description and figures corresponded well with those of *Cricetomysia andrei* and concluded that the specimens described by Lawrence could only be the lost syntypes of *Campylochirus chelopus*, but that they had become mislabelled since Trouessart's time.

Fain (1971, 1972), in his revision of the Listrophoroidea of Australia and New Guinea, reproduced the illustrations of the ♂ and ♀ given by Domrow (1956b), because enquiry at likely institutions had failed to locate the specimens on which they were based.

This seemed satisfactory until Domrow recently obtained both sexes of two atopomelid species from *Pseudocheirus peregrinus* in Tasmania and Victoria and concluded that the species he had earlier described as *Campylochirus chelopus* was

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composite, the ♂ representing his conception of *Campylochirus chelopus*, and the ♀ and nymph representing a new species briefly described as *Campyloch'opsis micrura* by Fain and Domrow (Fain, 1974). The examination of six of Domrow's original specimens (on a slide since located in the Natal Museum, Pietermaritzburg, by Mr B. Lamoral) confirmed this finding.

A re-examination of Trouessart's types seemed essential and this was kindly facilitated by Mr M. Naudo, Muséum National d'Histoire Naturelle, Paris. In brief, *Campylochirus chelopus* Trouessart is closely related to, but distinct from, *Campylochirus chelopus* Domrow.

It is the purpose of this paper to record the corrections involving the three species and two closely related atopomelid genera mentioned above, to describe another new species of *Campylochirus*, and to provide further data on three of the other six known species in the complex. All species are from members of the family Petauridae (Laurie and Hill, 1954; Ride, 1970).

All measurements are in  $\mu\text{m}$ .

The material listed is deposited in various institutions abbreviated:

Australian National Insect Collection, CSIRO, Canberra	ANIC
British Museum (Natural History), London	BMNH
Institut de Médecine Tropicale Prince Léopold, Antwerp	IMTPL
Institut Royal des Sciences Naturelles de Belgique, Brussels	IRSNB
Muséum National d'Histoire Naturelle, Paris	MNHN
Natal Museum, Pietermaritzburg	NM
Queensland Institute of Medical Research, Brisbane	QIMR
Queensland Museum, Brisbane	QM

#### Genus CAMPYLOCHIRUS Trouessart

*Campylochirus* Trouessart, 1893 : 698. Type-species *Campylochirus chelopus* Trouessart.

*Cricetomysia* Lawrence, 1956 : 355. Type-species *Cricetomysia andrei* Lawrence.

*Definition.* Both sexes with four dorsal shields of which the postscapular is devoid of strongly sclerotised transverse bands posteriorly; coxae III and IV normally placed. Female without any external copulatory tube. Male with genitalia set between trochanters IV; legs IV moderately to strongly swollen, with suckers on tibiotarsi IV reduced in latter case.

#### Subgenus CAMPYLOCHIRUS Trouessart

*Definition.* Male with penis cylindrical, long to very long, and describing at least one curve; body provided with complex transparent membrane posteriorly; legs IV strongly swollen, with shortened tibiotarsi IV bearing reduced suckers. Female with two lateral shields on opisthogaster; opisthonotal shield in shape of T, flanked on either side by an elongate depressed zone that is neither punctate nor scaly.

#### *Campylochirus (Campylochirus) chelopus* Trouessart

(Figs 1-4)

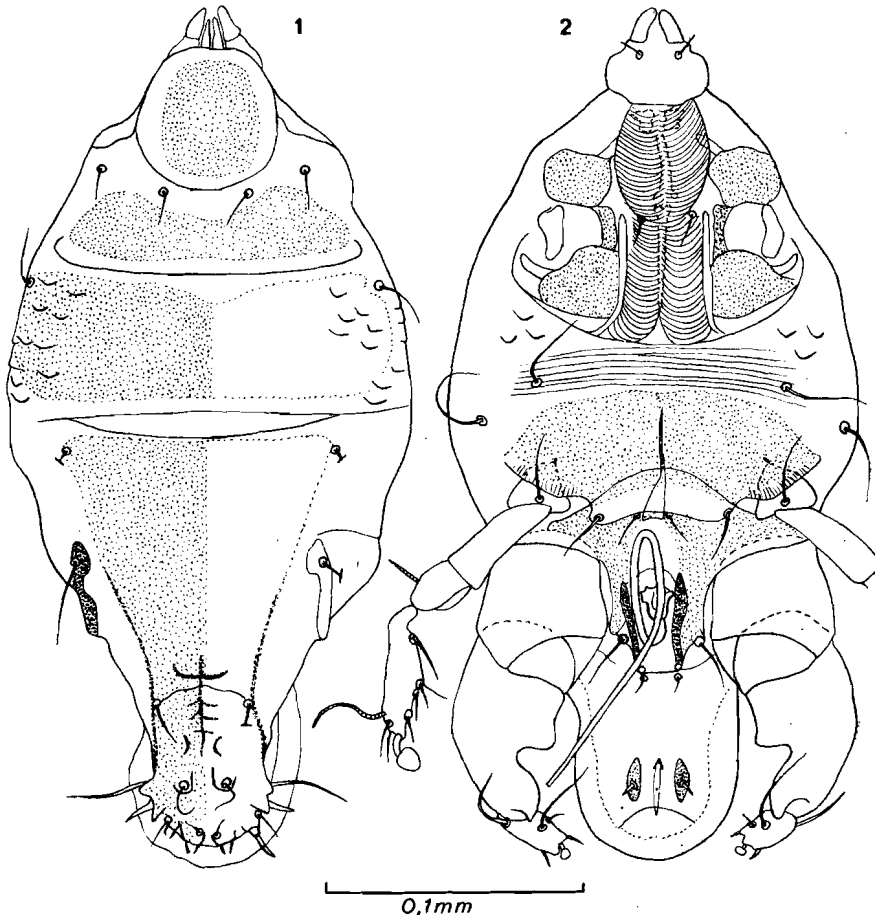
*Campylochirus chelopus* Trouessart, 1893 : 699, 1917 : 154; Domrow, 1956a : 191. *Nec* Domrow, 1956b : 234, 1958 : 43; Fain, 1972 : 122.

*Cricetomysia andrei* Lawrence, 1956 : 356; Domrow, 1958 : 43.

*Material.* Two ♂♂ and one ♀, mislabelled (in Trouessart's handwriting) *Cricetomys gambianus* Waterhouse (Rodentia : Muridae), West Africa, but said by Trouessart to have come from *Pseudocheirus peregrinus* (Boddaert), Tasmania (MNHN). Two ♂♂, same data (NM).

One ♂ (MNHN) (that figured by Lawrence, 1956) is designated lectotype and the remaining four specimens paralectotypes of *Campylochirus chelopus* (Rees 74B and E). Although Lawrence (pers. comm.) did not select a holotype for *Cricetomysia andrei*, no type designation seems necessary now, since it is an objective junior synonym of Trouessart's species.

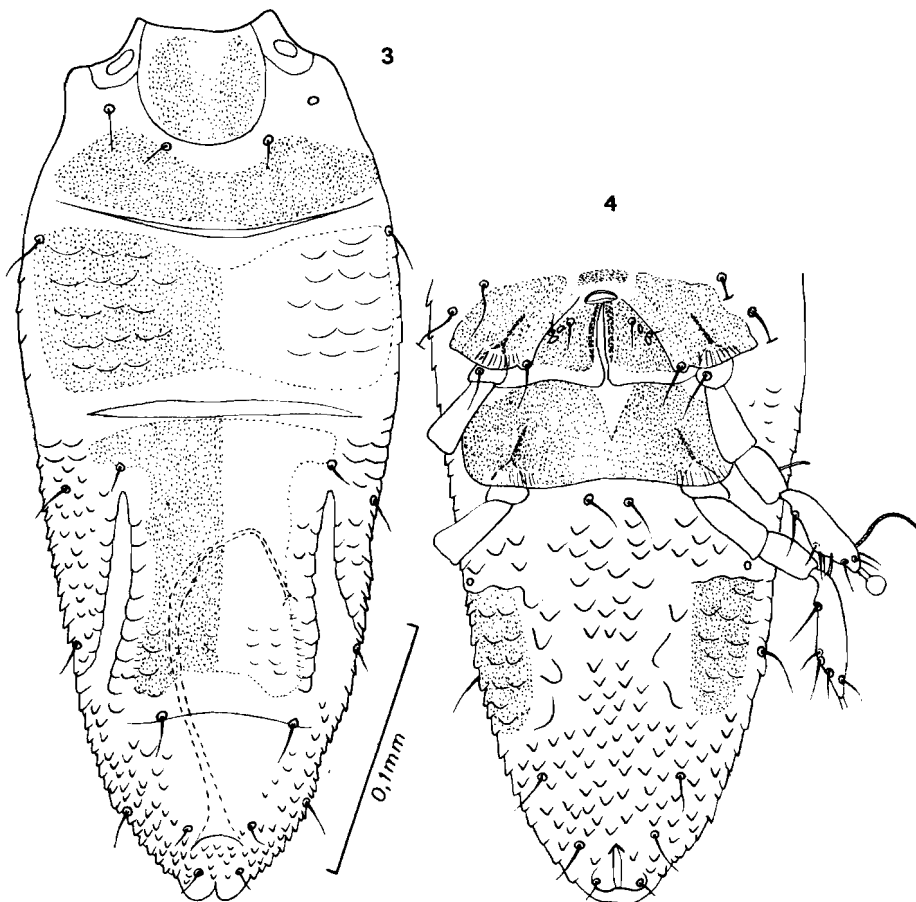
**Male lectotype** (Figs 1-2). Length (including capitulum) 330; maximum width 153. Prescapular shield subcircular, sclerotised except marginally. Postscapular shield shallowly concave anteriorly. Hysteronotal shield with few scales laterally. Opisthonotal shield posteriorly with median design formed by



Figs 1-2. *Campylochirus* (*Campylochirus*) *chelopus* lectotype ♂. 1. Dorsum. 2. Venter.

short longitudinal line bearing several short arborescences; posteriorly with two paramedian setose prominences and two lateral bifid processes. Coxae III confluent, with straight longitudinal sclerite medially. Penis describing two turns of  $180^\circ$  and long enough for distal half to be displaced  $45^\circ$  laterally in mounted specimens; total length 186. Anus flanked by pair of oval adanal organs, each carrying small curved spine posteriorly. Legs IV strongly swollen, with tibiotarsi IV quite short and carrying reduced sucker on short peduncle. Genua IV with strong distal boss directed dorsally.

*Female paralectotype* (Figs 3-4). Length (including capitulum) 366; maximum width 144. This specimen contains an egg with thin shell,  $177 \times 47$ . Anterior three dorsal shields as in ♂. Opisthonotal shield in form of T, falling well short of vestibule of bursa copulatrix. Cuticle scaly on either side of shield except for longitudinal textureless gutter. Bursa copulatrix with broad vestibule opening dorsally 27 from end of body; bursa relatively long, dilated past mid-length, and then sharply narrowed and more sclerotised towards internal aperture; total length 153, length of very narrow portion 45. Cuticle smooth in



Figs 3-4. *Campylochirus (Campylochirus) chelopus* paralectotype ♀. 3. Dorsum. 4. Venter.

front of vestibule, but scaly behind and beside it. Propodosoma ventrally as in ♂. Coxae III punctate, separated in front by punctate band. Coxae IV confluent, at least posteriorly. Opisthogaster entirely scaly, with small punctate shield to either side. Anus subterminal.

*Notes.* The above description supplements that of Lawrence (1956) and is based solely on specimens that are at once the syntypes of *Campylochirus chelopus* and *Oricetomysia andrei*.

See also notes on *Campylochirus brevipenis* below.

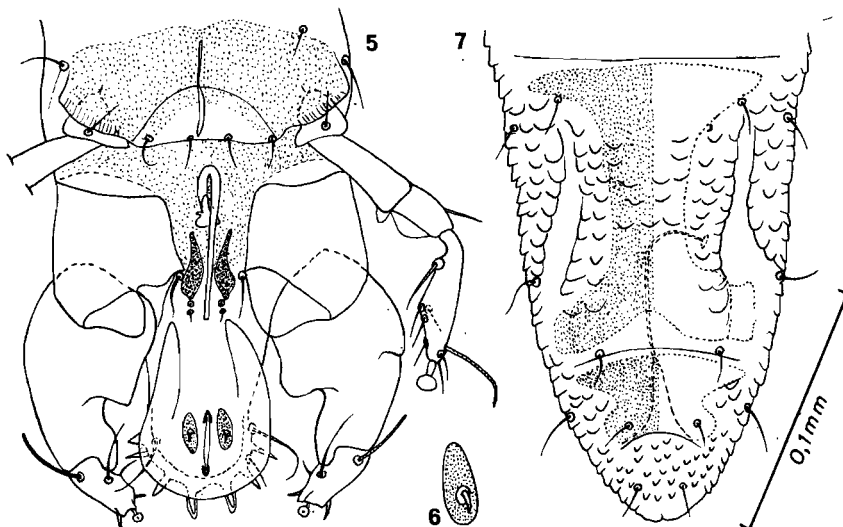
*Campylochirus (Campylochirus) brevipenis*, n. sp.

(Figs 5-7)

*Campylochirus chelopus* Domrow, 1956b : 234 (♂ ~~and nymph~~), 1958 : 43 (♂ ~~and nymph~~); Fain, 1972 : 122 (♂ ~~and nymph~~). *Nec* Trouessart, 1893 : 699, 1917 : 154; Domrow, 1956a : 191.

**Material.** Holotype and three paratype ♂♂, allotype and six paratype ♀♀, *Pseudocheirus peregrinus*, Dartmouth, Vic., 22.xi.1973, I. Beveridge; two paratype ♂♂ and four paratype ♀♀, *Pseudocheirus peregrinus*, Launceston, Tas., 1.x.1973, R.H. Green. Holotype and allotype in ANIC; paratypes in IMTPL and QIMR.

As noted above, some material (one ♂) Domrow (1956b) figured and described from the same host, Woodbury, Tas., has been recovered (NM).



Figs 5-7. *Campylochirus (Campylochirus) brevipenis*. 5. Venter holotype ♂. 6. Adanal organ ♂. 7. Dorsum allotype ♀.

**Male holotype** (Figs 5-6). This specimen is flattened and broken in two, but its length (including capitulum) does not exceed 350 nor its maximum width 120. In two paratypes, these dimensions are 285 × 120 and 308 × 126. Dorsum and venter as in *Campylochirus chelopus* except for very much shorter penis (which describes only one turn of 180°) and slightly different shape of aggenital sclerites. Maximum length of penis 77 in holotype, 72, 75, and 81 in three paratypes.

**Female allotype** (Fig. 7). Length (including capitulum) 338; maximum width 125. Dorsum as in *Campylochirus chelopus*, but hysteronotal shield somewhat narrower at midlength and with urn-shaped accessory shieldlet in front of vestibule of bursa copulatrix. Bursa very narrow throughout (beyond vestibule), not expanded near midlength; total length only 96 in allotype, 90, 92, and 94 in three paratypes.

**Notes.** The new species is closely related to *Campylochirus chelopus*, but is readily separable in both sexes by the genitalic characters noted in the description.

## Subgenus CAMPYLOCHIROIDES Fain

*Campylochiroides* Fain, 1971 : 240. Type-species *Campylochirus (Campylochiroides) antechinus* Fain.

*Definition.* Male with penis short to very short, directed backwardly without describing any curve; body without any membrane posteriorly; legs IV moderately swollen, with normal tibiotarsi IV bearing normal suckers. Female with either a median or no shield on opisthogaster; opisthonotal shield not flanked by depressed textureless zones.

*Campylochirus (Campylochiroides) antechinus* Fain

*Campylochirus (Campylochiroides) antechinus* Fain, 1971 : 241, 1972 : 126.

*Material.* Six ♂♂ and one ♀, *Schoinobates volans* (Kerr) (= *Petauroides volans* (Kerr)), Dartmouth, Vic., 20.i.1974, I. Beveridge, represent a new (and more likely) host-record. In IMTPL; type-series in BMNH and IMTPL.

The type-series is from museum specimens of various Australian dasyurid marsupials (Dasyuroidea) and, in the light of the present record and the host-relationships of all other species in the complex, may well comprise contaminants.

*Female.* Bursa copulatrix narrow and weakly sclerotised, 180 long in one paratype from *Antechinus stuartii* Macleay (= *A. unicolor* Gould, see Wakefield and Warneke (1967)), and describing 4–5 curves.

*Campylochirus (Campylochiroides) sthenophallus*, n. sp.

(Figs 8–9)

*Material.* Holotype ♂, allotype ♀, and two paratype ♂♂, *Schoinobates volans* (Kerr), Dartmouth, Vic., 20.i.1974, I. Beveridge. Holotype and allotype in ANIC; paratypes in IMTPL and QIMR.

*Male holotype* (Fig. 9). Length (including capitulum) 302; maximum width 135. General facies as in *Campylochirus antechinus*, but genitalia considerably more complex. Penis proper 18 long, flanked by two elongate formations of similar length, all three travelling within stout U-shaped sclerite. Behind penis lie two strong paramedian elongate-triangular sclerites; these, U-shaped sclerites, and complex structure supporting base of penis all lacking in *Campylochirus antechinus*.

*Female allotype* (Fig. 8). Length (including capitulum) 315; maximum width 137. General facies as in *Campylochirus antechinus*, but bursa copulatrix thick-set, about 300 long, and describing several curves. Internal aperture of bursa dilated, 12–14 long. Vestibule not discernible.

*Notes.* The new species is closely related to *Campylochirus antechinus*, but is readily separable in both sexes by the genitalic characters notes in the description.

*Campylochirus (Campylochiroides) pseudocheirus* Fain

*Campylochirus (Campylochiroides) pseudocheirus* Fain, 1972 : 128.

*Material.* Type-series from *Pseudocheirus forbesi* Thomas, Papua New Guinea (BMNH and IMTPL). One ♀ from *Pseudocheirus* sp., Irian Jaya (IMTPL).

*Campylochirus (Campylochiroides) petauricola* Fain

*Campylochirus (Campylochiroides) petauricola* Fain, 1972 : 131.

*Material.* Type-series from *Petaurus breviceps papuanus* Thomas, Irian Jaya, and *Petaurus breviceps* Waterhouse, Victoria (BMNH).

*Campylochirus (Campylochiroides) caparti* Fain

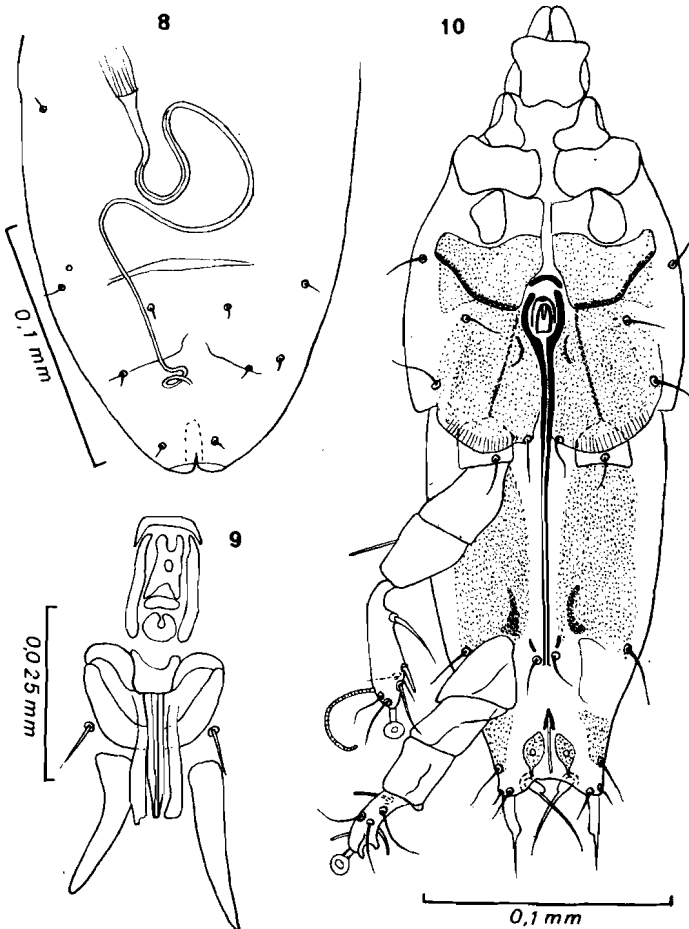
*Campylochirus (Campylochiroides) caparti* Fain, 1974 : 14.

*Material.* Type-series from *Pseudocheirus* sp., Irian Jaya (IRSNB).

Genus CAMPYLOCHIROPSIS Fain

*Campylochiropsis* Fain, 1972 : 120. Type-species *Campylochirus (Campylochiropsis) dolichurus* Fain.

**Definition.** Both sexes with four dorsal shields of which the postscapular shows two strongly sclerotised, but medially interrupted, bands posteriorly; coxae IV widely separated from coxae III. Female with long external copulatory tube. Male with genitalia displaced anteriorly, set either between, or in front of, trochanters III; legs IV only slightly swollen, sometimes shortened, but always with normal suckers on tibiotarsi IV.



Figs 8-9. *Campylochirus* (*Campylochiroides*) *sthenophallus*. 8. Dorsum ♀. 9. Genitalia ♂.

Fig. 10. *Campylochiropsis dolichurus* ♂. Venter.

*Campylochiropsis dolichurus* (Fain)

(Fig. 10)

*Campylochirus* (*Campylochiropsis*) *dolichurus* Fain, 1972 : 123.

**Material.** Eleven ♂♂ and ten ♀♀ from type-host, *Schoinobates volans* (Kerr), Dartmouth, Vic., 20.i.1974, I. Beveridge. In IMTPL and QIMR; type-series in BMNH.

**Male** (Fig. 10). Penis considerably displaced forward, lying between anterior portions of coxae III, at level of setae *sh*.

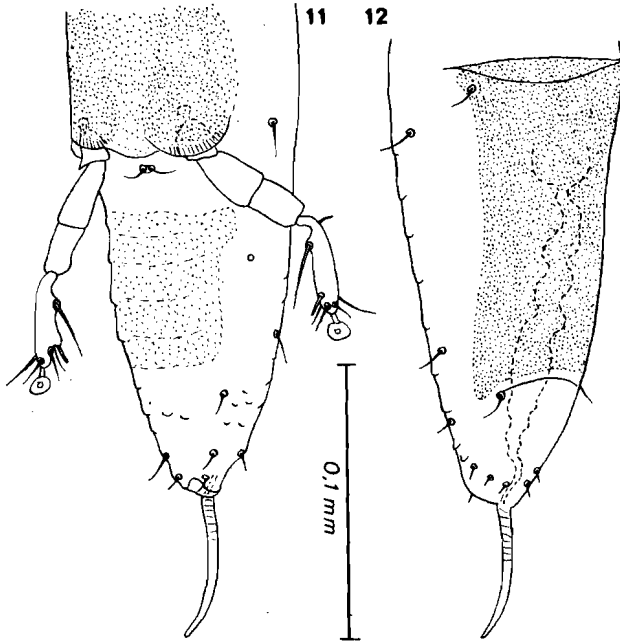
*Notes.* The position and details of the genitalia could not be seen in the one laterally mounted male in the type-species.

*Campylochiroopsis misonnei* Fain

Figs. 11-12

*Campylochiroopsis misonnei* Fain, 1974 : 16.

*Material.* Two ♀♀ from type-host, *Pseudocheirus* sp., Jiwika, Irian Jaya (IRSNB).



Figs 11-12. *Campylochiroopsis misonnei* ♀. 11. Venter. 12. Dorsum.

*Female* (Figs 11-12). Length (including capitulum, but excluding copulatory tube) 345 ; width (in oblique view) 90. Dorsum as in *Campylochiroopsis dolichurus*, but lacking scales on opisthonotal shield and area behind setae  $d_3$  smooth. Opisthogaster with ill-defined and lightly punctate shield that lacks scales, though some occur behind it. Copulatory tube 3-4 wide at most, 51 long in one specimen and 57 in other. Bursa copulatrix sclerotised and very narrow over first 10-12, but becoming membranous and wide for 110 before reaching hemispherical internal aperture.

*Notes.* The two females just described come from the same animal as the type-series, which comprised only males.

*Campylochiroopsis micrura* Fain and Domrow

(Figs 13-16)

*Campylochirus chelopus* Domrow, 1956b : 234 (♀) <sup>and nymph</sup> 1958 : 43 (♀) <sup>and nymph</sup> Fain, 1972 : 122 (♀) <sup>nymph</sup> *Nec* Trouessart, 1893 : 699, 1917 : 154 ; Domrow, 1956a : 191.

*Campylochiroopsis micrura* Fain and Domrow, in Fain, 1974 : 16.

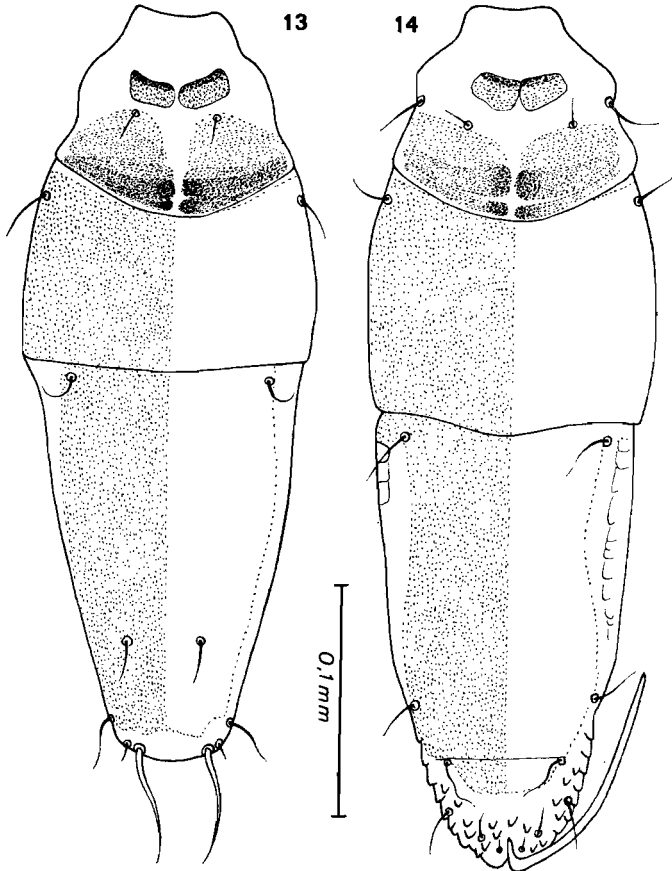
*Material.* Type-series from *Pseudocheirus peregrinus*, Victoria. Holotype and allotype in QM ; paratypes in IMTPL and QIMR.



As noted above, some material (three ♀♀, one ♂, one nymph) Domrow (1956*b*) figured and described from the same host, Woodbury, Tas., has been recovered (NM). The nymph is associated with the ♀ rather than with the ♂ because of the resemblance of legs I and the elongate coxae IV.

Two ♀♀ from *Petaurus* sp., Irian Jaya (IMTPL):

*Male allotype* (Figs 13 and 15). Length (including capitulum) 330; maximum width 115. Prescapular shield divided into two rectangular halves; other dorsal shields as in *Campylochiropsis dolichurus*. Opisthogaster largely obscured by legs IV, but adanal organs present. Penis very small, set between trochanters III. Legs IV shorter, but hardly thinner, than legs III; tibiotarsi IV smaller than tibiotarsi III.



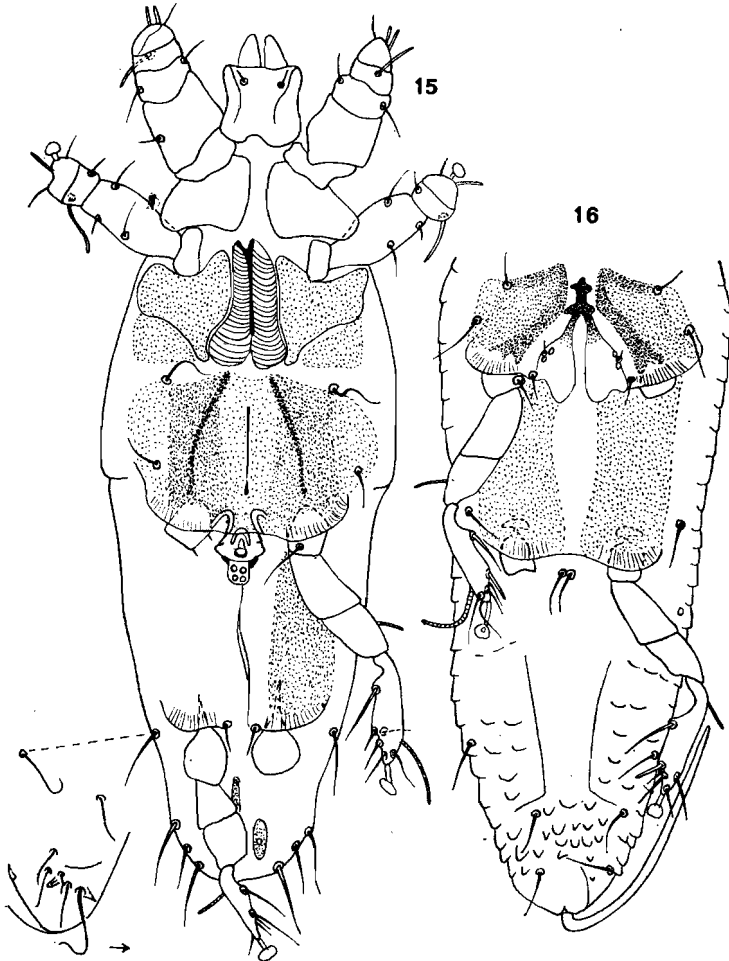
Figs 13-14. *Campylochiropsis micrura*. 13. Dorsum allotype ♂. 14. Dorsum holotype ♀.

*Female holotype* (Figs 14 and 16). Length (including capitulum, but excluding copulatory tube) 362; maximum width 106. Opisthonotal shield without scales, but cuticle of opisthosoma entirely scaly except central area on opisthogaster. Copulatory tube 90 long.

*Notes.* The preliminary diagnosis of *Campylochiropsis micrura* given by Fain and Domrow (Fain, 1974) is here supplemented by illustrations and further description. The species is separable from *Campylochiropsis misonnei* (1) in the male, by the more strongly flared shape of the posterior end of the body (with a consequently much wider separation of the two strong setae thereupon), and by

the absence of an oval sclerotisation around the analia, and (2) in the female, by the more numerous scales on the opisthosoma and by the much longer copulatory tube.

Further, the species is separable from *Campylochiropsis dolichurus* (1) in the male, by the absence of strongly modified setae at the posterior end of the body and by the unmodified tibiotarsi IV; and (2) in the female, by the absence of scales on the opisthonotal shield and by the much shorter copulatory tube.



Figs 15-16. *Campylochiropsis micrura*. 15. Venter allotype ♂ (with inset of terminalia of Woodbury♂ in lateral view). 16. Venter holotype ♀.

*Nomenclature.* All ten specific names recognised above are nouns, two genitive (*caparti* and *misonnei*), and eight nominative in apposition.

#### ADDENDUM

While we accept that parasites are but one possible indicator of host relationships, we believe their collection serves as much to accumulate data on their hosts as the measurement of, say, tooth rows. So may we ask our colleagues who handle Australian vertebrates (especially the seldom seen, but even the common please to take time to collect their parasites? A wad of cotton wool soaked in ones, at least in potentially interesting areas such as the limits of their ranges), chloroform and rubbed briskly through the fur of a lightly anaesthetised animal

will dislodge a surprisingly good sample of free-roving mites. Soft skin (e.g. feet, perianal region, interior of ear) should be examined for attached mites, and scurfy lesions scraped off. Closer examination of the fur (or feathers, or scales), even by eye, will reveal mites, and, time and material permitting, they may also be found in internal organs (e.g. nasal passages and lungs). See Evans *et al.* (1961), Fain (1965) and McClure (1966). Material should be stored in ethanol (70% in water, preferably with 5% glycerol to counter hardening), *not* formalin, together with full, neatly written collection data. Further preparation is best left to the specialist.

Acarological data from such collections may be confirmatory (e.g. the species of *Trichosurolaelaps* on the lower macropodid *Hypsiprymnodon* belongs with those from phalangerids and petaurids, see Domrow, 1966); indicative of possible value (e.g. the species of *Laelaps* on "old endemic" rodents, see Domrow, 1973, under study); or, frankly, of little value (e.g. *Mesolaelaps australiensis* with its catholic tastes, see Domrow, 1967).

We conclude with two points. One, new species of such popular groups as birds are now seldom described, but "we cannot expect . . . to settle all the problems of mite taxonomy . . . for decades to come" (Mayr, 1969). Two, the recent recovery of some "lost" Australian mammals and birds and the chance location of a living colony of the former fossil *Burramys* give some hope, but the losses documented by Marlow (1958) imply a double extinction, of host *and* parasite.

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