

STRONGYLE NEMATODES FROM CENTRAL AUSTRALIAN KANGAROOS AND WALLABIES

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The senior author took the opportunity, whilst accompanying anthropological expeditions to Central Australia between 1928 and 1936, to examine for the presence of parasites many of the larger marsupials shot in order to supply meat for the aborigines assembled at the various camping places. Generally, only the stomach was searched because of the lack of time and the prevalence of very persistent muscid flies. In those cases where the intestine was examined, nematodes were not found in it. This accounts for the absence of trichostrongyles amongst the material studied. In spite of the long periods of dry weather and the low rainfall of the regions visited, the very heavy infestation of nearly all stomachs examined was remarkable. No doubt the scanty soil in the vicinity of the few springs and rockholes becomes heavily contaminated with eggs and larvae. The great number of different species and of individual worms to be found reminds one of similar conditions often encountered in the digestive tract of other herbivores such as the horse, ox, sheep, elephant, etc.

The two main animals searched were the rock wallaby, *Petrogale lateralis* Gould, which has a wide distribution in Central Australia and adjacent parts of South Australia, though restricted to the very rocky areas; and the euro, *Macropus robustus* Gould, occupying the less rocky parts of the hilly country in the same regions. The local subspecies was *M. r. crubescens* Sclater. Occasionally a kangaroo, *Macropus rufus*, Desm., was taken on the great plains. We have included in our examination some material from *M. isabellinus* Gould, a species (or perhaps a subspecies of *M. robustus*) inhabiting a part of North-western Australia, the actual host specimens having died in Sydney Zoological Gardens, the material having been received through the kindness of the Director, Mr. A. S. Le Souef.

The localities mentioned in this paper are Mount Liebig, now included in the northern portion of the Aboriginal Reserve in Central Australia; Cockatoo Creek, lying further to the northward; Hermannsburg, in the Macdonnell Ranges; also the following localities in northern South Australia: Ernabella in the Musgrave Ranges, and Nepabunna in the northern Flinders Ranges. The types of all new species described in this paper have been deposited in the South Australian Museum.

HOSTS AND PARASITES REFERRED TO IN THIS ACCOUNT

Macropus robustus crubescens Sclater.

Labiostrongylus macropodis; *L. longispicularis* Wood; *L. grandis*.

Cloacina minor; *C. parva*; *C. communis*; *C. frequens*; *C. macropodis*;

C. dubia; *C. australis*; *C. magna*; *C. curta*.

Macropus isabellinus Gould.

Labiostrongylus longispicularis Wood.

Macropus rufus Desmarest.

Labiostrongylus longispicularis Wood.

Cloacina minor; *C. petrogale*; *C. hydriformis*; *C. liebigi*; *C. inflata*.

Petrogale lateralis Gould.

Pharyngostrongylus alpha; *P. beta*.

Labiostrongylus longispicularis Wood; *L. petrogale*.

Cloacina minor; *C. parva*; *C. macropodis*; *C. petrogale*; *C. hydriformis*;
C. ernabella; *C. elegans*.

Unless otherwise indicated, all species of nematodes mentioned above are considered new. The absence of species of *Macropostrongylus* and the abundance of species and individuals of the related genus *Cloacina* are noteworthy. *Pharyngostrongylus* was found only in rock wallabies (*Petrogale*). *Labiostrongylus* was represented in all host species examined.

Of the species found in *Macropus robustus*, *Cloacina minor*, *C. parva* and *C. communis* were by far the most common; *C. frequens* and *C. macropodis* very common; *C. australis*, *C. magna* and *C. curta* not uncommon; *C. dubia* was recognised only once; and a few *Labiostrongyles* were found in nearly all examinations. Only one stomach from *Macropus rufus* from Central Australia was searched, most of the parasites being species of *Cloacina*, but worms obtained many years ago from a red kangaroo from the western plains of New South Wales were identified as *L. longispicularis*, as also were worms from *Macropus isabellinus* from North-western Australia.

The commonest parasites of the stomach of *Petrogale lateralis* were *Cloacina minor*, *C. parva*, *C. petrogale*, *C. hydriformis*, *Pharyngostrongylus alpha*, *P. beta*, and *Labiostrongylus petrogale*. *C. ernabella* was fairly common. The remainder were much less frequently met with.

All parasites described in this paper were collected from the stomach.

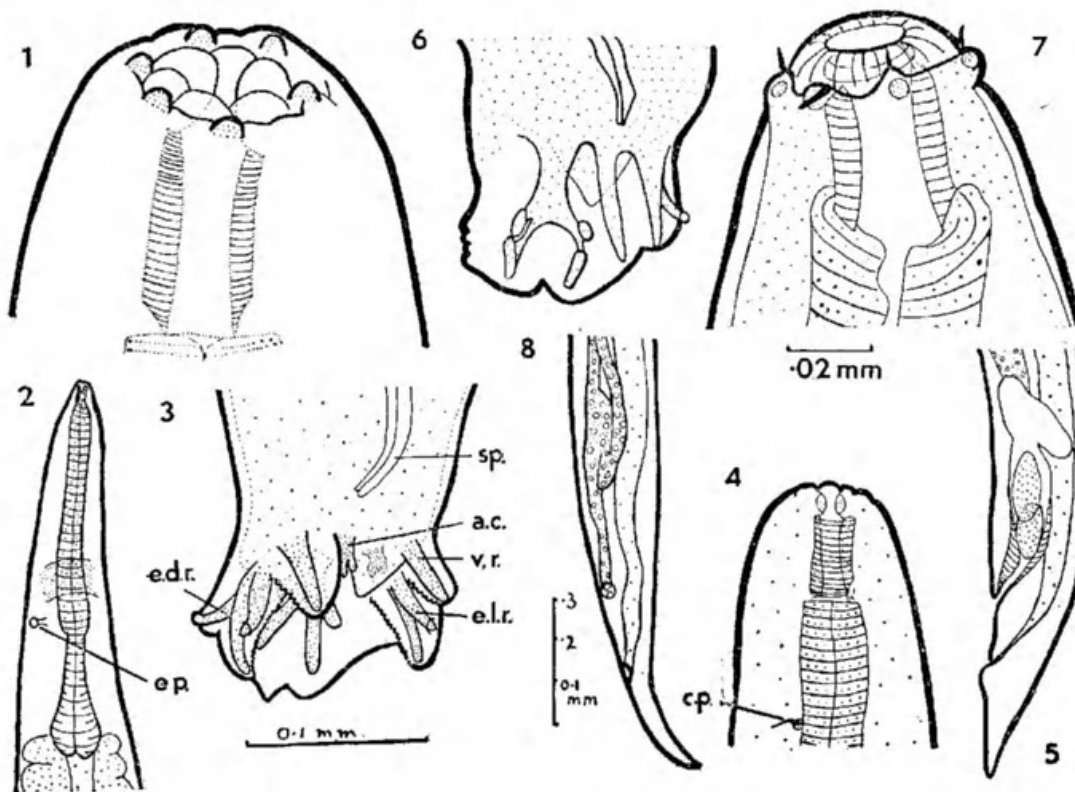
***Pharyngostrongylus alpha* n. sp.**

Figs. 1-5

Host—*Petrogale lateralis*, Mount Liebig.

Short, thin, 6-7.5 mm. long in both sexes. Cuticle with very fine striations. Anterior end with six small rounded papillae, inwardly from these are six rounded inner lips surrounding narrow mouth, 5 μ diameter. A short passage, 7 μ long, with slightly chitinated walls, leads into a vestibule, 0.04 mm. long, 0.012 mm. wide, with strongly chitinated striated walls. Oesophagus differentiated as in succeeding species. Excretory pore behind nerve ring and lying at junction of the two oesophageal regions. Cervical papillae thread-like; about 0.12 mm. from anterior end. Anterior end of intestine with thick sacculate walls.

Male—Ventral lobes of bursa quite separated from each other and almost so from the long lateral lobes; dorsal lobe well defined with slight median cleft. Inside wall of bursa with small rough papillae of various sizes, very small on dorsal and ventral lobes, largest near bursal edge, most abundant on lateral lobes. Ventral rays close together, parallel, passing into apex of ventral lobes; externo-lateral short like externo-dorsal, both forming projections on lateral wall of bursa; lateral rays run together to bursal edge in longest part of lobe; externo-dorsal arises separately; dorsal ray bifurcates just beyond half its length, each part giving rise to a short lateral branch, none of these branches reaching bursal edge. Genital cone, small, rounded; accessory cone with two finger-like processes on each side; spicules 1.36 mm. long, straight, with striated alae extending for



References to lettering—a.c., accessory genital cone; b.p., prebursal papilla; b.r., chitinous ring in buccal capsule; c.p., cervical papilla; d.l., dorsal lip; d.r., dorsal ray; e.c., moulting cuticle; e.d.r., externo-dorsal ray; e.l.r., externo-lateral ray; e.p., excretory pore; g.c., genital cone; i., intestine; l.c., leaf crown; l.l., lateral lip; o., oesophagus; s.l., submedian lip; s.p., spicule; t.p., tail papilla; v.r., ventral ray.

Figs. 1-5. *Pharyngostrongylus alpha*—1, head, antero-lateral; 2, anterior end, lateral view; 3, bursa, ventro-lateral; 4, head, lateral; 5, female, posterior end. Figs. 6-8 *Pharyngostrongylus beta*—6, bursa, dorsal; 7, head, antero-lateral; 8, female, posterior end. Figs. 1 and 7 to same scale; 6, 3 and 4; 2, 5 and 8.

almost their whole length, tips curved; gubernaculum heart-shaped when viewed dorsally.

Female—Uteri parallel, joining near vulva; vagina straight, rather short and, except in very young specimens, projects through vulva and sometimes is rolled back like a cuff. Anus 0.3 mm. and vulva 0.082 mm. from tip of thin tail.

This species differs from *P. beta* in the characters of the head, position of excretory pore, relative length of oesophagus and of spicules, and in total length of body. It resembles *P. australis* in many features, but differs in dimensions of vestibule and in possessing no leaf crown. Neither Wood nor Mönnig noted the presence of an accessory genital cone, and the continuation of the dorsal ray noted by them was not observed in the present species.

Pharyngostrongylus beta n. sp.

Figs. 6-8

Host—*Petrogale lateralis*, Mount Liebig.

Short, thin, more or less straight when preserved. Male, 3.9-5 mm.; female, 7-8 mm. long. Cuticle very finely striated. Mouth collar with six small papillae, each with an antero-lateral projecting portion, bearing a delicate process $7\ \mu$ long. Inwardly from the collar arises the smooth dome-like anterior extremity surrounding the circular mouth. No leaf crown. Buccal capsule $18\ \mu$ in diameter, $9\ \mu$ in length, with chitinous ring at its base. Vestibule about 0.04 mm. long in young specimens, with annulate chitinous wall. Oesophagus long, narrow, with longer anterior region and shorter narrower posterior portion widening into a bulb before joining intestine. Cervical papillae bristle-like, about 0.08 mm. (in young specimens) from anterior end. Excretory pore just anterior to junction of the two regions of oesophagus. Nerve-ring just in front of level of excretory pore.

Male—Inside of bursa with numerous, very small, papillae, fewer and smaller on dorsal lobe. All lobes separated by deep clefts; dorsal lobe with short median cleft. Externo-lateral and externo-dorsal rays give rise each to a lateral projection on bursa. Medio- and postero-laterals extend almost to edge of bursa. Dorsal ray bifurcates just beyond half its length, each part giving off a shorter lateral branch; no part of dorsal ray reaches edge of bursa. Genital cone short; accessory cone with two finger-like projections. Spicules straight, 1.4 mm. long, with striated alae and curved tips. Gubernaculum not seen.

Female—Uteri parallel; vagina straight; distance from vulva to anus about equal to that from anus to tip of tail. Body narrows from level of vulva to form a thin tail.

P. beta differs from all described species in the absence of a leaf crown and in the character of the head papillae. The anterior end suggests that of *P. australis* in general form, but the latter has a narrower vestibule and its anus and vulva are much nearer to each other. The oesophagus and dorsal ray of the bursa resemble those of *P. brevis*, but the new species differs from the latter in having longer spicules, papillae on the bursa and in the absence of a leaf crown.

Labioststrongylus macropodis n. sp.

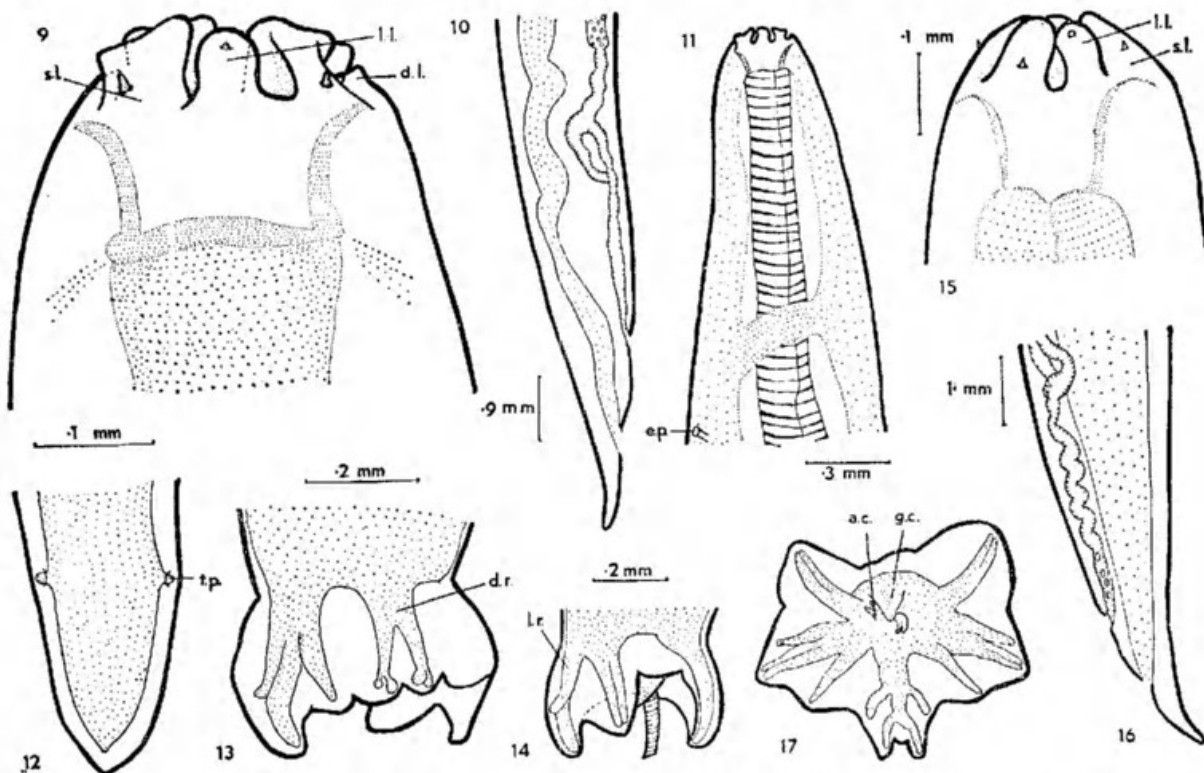
Figs. 9-14

Host—*Macropus robustus*, Mount Liebig, Cockatoo Creek.

Males, 21-30 mm. long; females, 24.8-31.2 mm. Maximum breadth, 1.1 mm. Long stout worms with anterior end prolonged into eight lip-like processes—four

of them large bilobed submedian, two rather shorter simple lateral, one short simple dorsal, and one short simple ventral. Each submedian with long conical papilla, each lateral with small rounded papilla. Buccal capsule 0.08 mm. long, 0.15 mm. wide, lined by cuticle. Oesophagus long, about one-fifth body length, straight. Anterior end of intestine surrounded by granular mass forming two pairs of lateral lobes. Nerve-ring at about 1 mm. from anterior end, and just in front of excretory pore. Cervical papillae not observed.

Male—Spicules long thin striated, sometimes much curved, 9.4–11.1 mm. long, about 1.2–5 of body length. Bursa large, lobes well differentiated, ventral lobes separate. Ventral rays reach almost to bursal edge. Externo-lateral rays



Figs. 9-14. *Labiostrongylus macropodis*—9, female head; 10, female, posterior end; 11, anterior end, lateral; 12, female, tail; 13, bursa, lateral; 14, bursa, ventral. Figs. 15-17. *Labiostrongylus longispicularis*—15, head, male; 16, bursa, flattened, posterior view; 17, female, posterior end. Figs. 9 and 12 to same scale; 11 and 17.

short, close to medio-laterals; medio- and postero-laterals long, reaching almost to bursal edge; externo-dorsal arises from same root as laterals, is thick, intermediate in length between medio- and externo-laterals. Dorsal ray relatively narrow, dividing at about half length, each branch terminating in two short rounded processes reaching almost to bursal edge.

Female—Uteri parallel, uniting at some distance from vulva; ovejectors 0.8 mm. long; vagina 3 mm., narrow. Anus about midway (0.94 mm.) between vulva and tip of tail. Tail long, narrow, tapering, with rounded extremity.

The species differs from *L. labiostrongylus* and *L. longispicularis* in dimensions, structure of the dorsal ray, and length of spicules.

LABIOSTRONGYLUS LONGISPICULARIS Wood 1929

Figs. 15-17

Wood's unfigured account was based on a male specimen from *Macropus robustus* var. *woodwardi*, a race living in the Murchison district of Western Australia. Our material was taken from *M. robustus* var. *erubescens*, from Nepabunna, Northern Flinders Ranges, South Australia.

Long stout worms; male, 4.4 cm.; female, 5.6 cm.; slightly tapering anteriorly. Six lips, four submedian, two lateral, submedian lips broadened, slightly bifurcated at tips and bending inwards over mouth; each submedian with short bristle just behind its midregion; each lateral with small rounded papilla near tip; no leaf crown. Buccal capsule 0.115 mm. long in male, slightly longer than broad, walls thinly chitinated, cavity as wide anteriorly as posteriorly. Oesophagus 8.7 mm. long in male, 9 mm. in female (1:5 and 1:6.2 of body length respectively), narrow, without definite bulb, though wider near base than anteriorly. Nerve cord about 1.6 mm. from anterior end; excretory pore about 2 mm. from head end. Cervical papillae not observed.

Male—Bursa stout, lobes definite, ventral lobes distinct from laterals and separated from each other ventrally. Ventral rays parallel, arising near laterals but soon bending ventrally to the corner of corresponding ventral lobe. Ventro-lateral ray short, bending outwards to form slight projection (5μ) on side of bursa. Medio- and postero-laterals much longer, travel together, the corresponding part of the lateral lobe forming a horn-like projection when seen dorsally or ventrally. Externo-dorsal ray short, arises with laterals, and projects like the ventro-lateral. Dorsal lobe separated from lateral by deep fissure. Dorsal ray very stout, giving off a lateral branch on each side midway from its origin, the branch extending almost to bursal edge at lateral termination of dorsal lobe; main ray divides into two parallel branches. Dorsal lobe long, its posterior edge forming two or three lappets, the two outer (which contain the ends of the dorsal ray) rounded; between these may be a third more or less developed, sometimes containing an abortive median continuation of dorsal ray. Genital cone short, conical with small button-like papilla at tip. Accessory cone wider, not quite so long, with several elongate processes laterally. Spicules 17.8 mm. long (1:2.5 of body length), stout, fairly straight, striated, with striated alae.

Female—Uteri joint about 3.8 mm. from vulva; vagina narrow, coiled; anus 1.4 mm. from tip of short narrow pointed tail; vulva 2.5 mm. from tip of tail.

A male *Labiostrongylus* was found in the stomach of a rock wallaby, *Petrogale lateralis*, from Mount Liebig, Central Australia, agreeing in its head characters with *L. longispicularis*. The position of the nerve cord was similar, but the excretory pore was posterior to the oesophagus instead of being near the nerve-ring, the oesophagus was about one-seventh of the body length, and the spicules 1:5.6 of body length instead of 1:2.5. The specimen was only 24 mm. long. The bursa was asymmetrical and the dorsal ray differed somewhat from that described above.

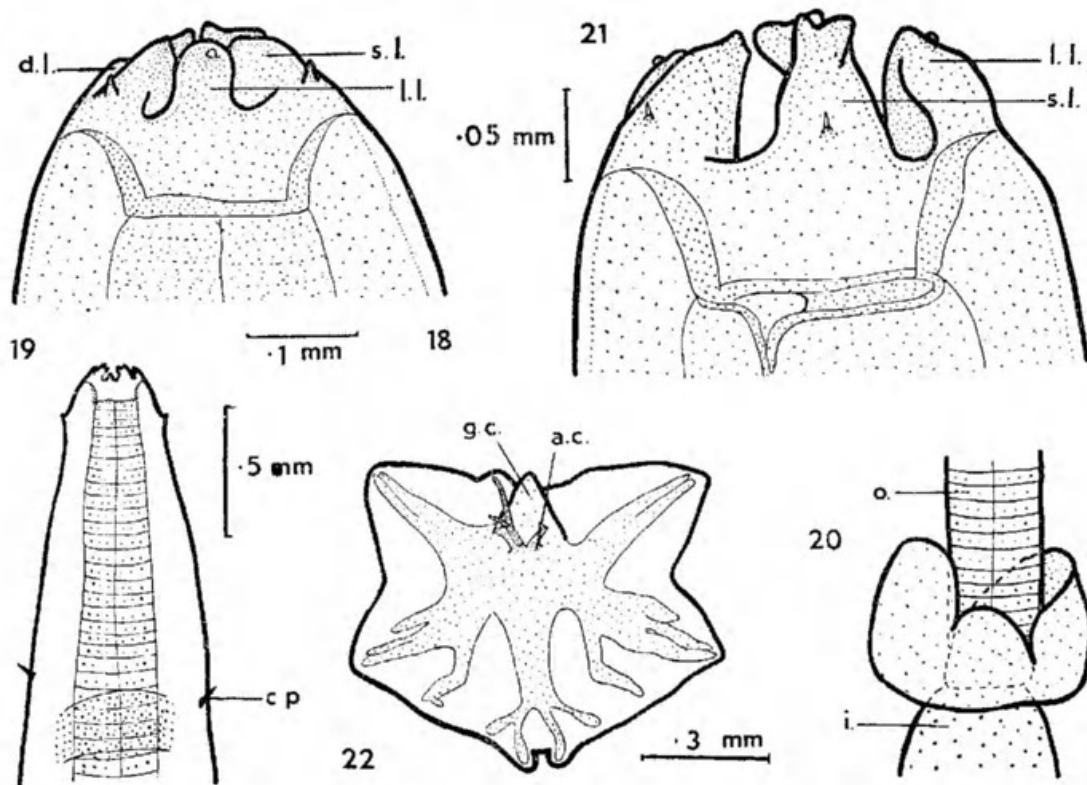
As there was only one specimen available, we deem it unwise to erect a new species for it. It seems to be most closely related to *L. longispicularis*.

A number of specimens taken from *Macropus rufus* from western New South Wales and from *M. isabellinus* (which is probably a variety of *M. robustus*) from North-western Australia (from Sydney Zoological Gardens) also belong to *L. longispicularis*.

***Labiostrongylus grandis* n. sp.**

Figs. 18-20

From *Macropus robustus*, Mount Liebig. Male, 4 to 4.5 cm.; female, 6.8 to 7.5 cm. Very large worms, resembling *L. longispicularis* in general proportions. Maximum diameter of female, 2.5 mm. Anterior end with eight prolongations characteristic of genus; submedian bilobed; lateral lips larger than dorsal and



Figs. 18-20. *Labiostrongylus grandis*—18, male head, lateral; 19, anterior end, male, ventral; 20, junction of oesophagus and intestine. Figs. 21-22. *Labiostrongylus petrogale*—21, head, young female, submedian view; 22, bursa, flattened, posterior view.

ventral, shorter than submedians. Laterals, ventral and dorsal lips simple, conical. Submedian and lateral lips each with papilla, conical on submedians, small and rounded on laterals. Apparently small rounded papillae about 0.2 mm. from anterior end, two of them lateral and perhaps one ventral and one dorsal. Cervical papillae long, thread-like, arising from cuticular depression 1.1 mm. from anterior end. Buccal capsule shallow, 0.12 mm. wide, with chitinised portion 0.08 mm. long; from tip of lips to floor of capsule 0.15 mm. Nerve-ring 1.3 mm. and excretory pore 1.8 mm. from anterior end. Oesophagus long, straight, 0.8-0.9 mm. (one-fifth body length) in male, one-sixth in case of female.

Male—Bursa with well-defined dorsal, lateral and ventral lobes; ventrals quite separated from each other and smaller than laterals. Ventral rays equal, parallel. Externo-laterals, laterals and externo-dorsals arise from same root, the first shortest, the other two reaching nearly to bursal edge. In posterior view of bursa externo-lateral and externo-dorsal rays appear to form projections on lateral walls. Dorsal ray stout, bifurcating at beginning of second half of its length, each branch subdividing at half its length into an inner club-shaped and an outer short ray, neither reaching bursal edge. Spicules 12.4 mm. long, 1:3.3 of body length, fairly straight, striated, with alae extending nearly to the rounded tips. Accessory genital cone not observed.

Female—Body narrows suddenly after vulva; tail long, thin, with rounded end bearing two small lateral subterminal papillae, 0.2 mm. from tip. Vulva 2.6 mm. from posterior end. Uteri wide but narrowing greatly into ovejectors just before the two join about 4 mm. from vulva; vagina narrow, twisted. Eggs, 0.145 by 0.11 mm.

The species differs from *L. labiostrongylus* in its spicules; from *L. longispicularis* in its lips; and from other species in the structure of the dorsal ray.

***Labiostrongylus petrogale* n. sp.**

Figs. 21-22

From *Petrogale lateralis*, Mount Liebig. Male up to 4.4 cm., female up to 6 cm. Four submedian lip-like prolongations bilobed at distal end, almost meeting over buccal capsule. Lateral lips shorter, conical, with small rounded papilla near tip; submedian lips each with thin pointed papilla arising from slight bulbous cuticular enlargement. No dorsal or ventral lips. Buccal capsule with thick chitinous lining (0.11 mm. long) continuous at its base with lining of oesophagus; floor of capsule 0.195 mm. from anterior end of lips. Oesophagus 6.66 mm. long in male, *i.e.*, one-sixth body length, narrow, surrounded by mass of dark cells at junction with intestine. Cervical papillae thin, about midway between nerve-ring and anterior end. Nerve-ring and excretory pore at about level of end of first quarter of oesophagus.

Male—Bursa large; ventral lobes separated from each other, distinctly marked off from laterals; dorsal lobe with short median cleft. Ventral rays long, parallel, reaching bursal edge. Externo-lateral shorter than laterals, which extend almost to edge and are cleft for nearly half length; externo-dorsal thick, arises with laterals, and longer than externo-laterals. Dorsal ray very thick, bifurcating at two-thirds length, each branch giving off a lateral, all final branches slightly bulbous and extending almost to bursal edge. Genital cone long, conical; accessory cone with two short thick processes, each ending in one or two finger-like projections. Spicules about 7.25 mm., *i.e.*, one-fourth to one-sixth body length, curved, with striated alae along most of length. Gubernaculum present.

Female—About 0.2 mm. in maximum diameter. Anus about midway between vulva and tip of tail; latter rather short, tapering, with rounded end terminating in button-like structure. Vagina long, narrow, twisted.

The species resembles *L. longispicularis* in its head region, but differs in the length of spicules and the character of the dorsal ray.

CLOACINA Linstow (emend.)

Linstow's original diagnosis (1898, 287) indicated that the genus differed from all known nematode genera in having the vulva and anus united into a female cloaca. Railliet and Henry (Bull. Soc. Path. exot., 6, 1913, 506) stated that the two apertures were distinct and that the genus was synonymous with *Zoniolaimus*. York and Maplestone (1926) gave a much more satisfactory diagnosis based on Linstow's account and figures of the type *C. dahli*, as also did Baylis and Daubney (1926). The original material came from *Macropus browni* Ramsay, from Ralum, New Britain. The genus has been placed in Strongylidae; Cloacininae; Cloacinidae; Trichoneminae; and amongst the Strongyloidea "insufficiently known."

Amongst our material from Australian marsupials we have found numerous species which we have been able to assign to Linstow's genus as amended by us. A revised diagnosis is now given.

Trichoneminae—Mouth directed straight forwards. Mouth collar with 6-8 lips, four of them submedian and two lateral, with in some cases a dorsal and a ventral; each submedian lip with a prominent papilla; on lateral lips usually an insignificant papilla. Buccal capsule cylindrical, broader than long; leaf crown of six elements arising from its internal surface and projecting through mouth opening. Oesophagus with more or less developed swelling at its posterior end.

Male—Well developed bursa; ventral lobes joined in front; ventral rays cleft distally; externo-dorsal may or may not arise with laterals; medio- and postero-laterals lying side by side; dorsal ray bifurcates after an half to one-third of its length, and the two branches subdivide further back. Spicules usually long, thin, with striated alae. Gubernaculum present or absent.

Female—Body tapering behind vulva; tail usually pointed; distance between vulva and anus usually about equal to that between anus and tip of tail. Uteri parallel.

Parasites of the stomach of marsupials. Type *C. dahli* Linstow.

The chief distinctions between this genus and *Macropostrongylus* are the presence of lips and the relative sizes of the lateral and submedian papillae.

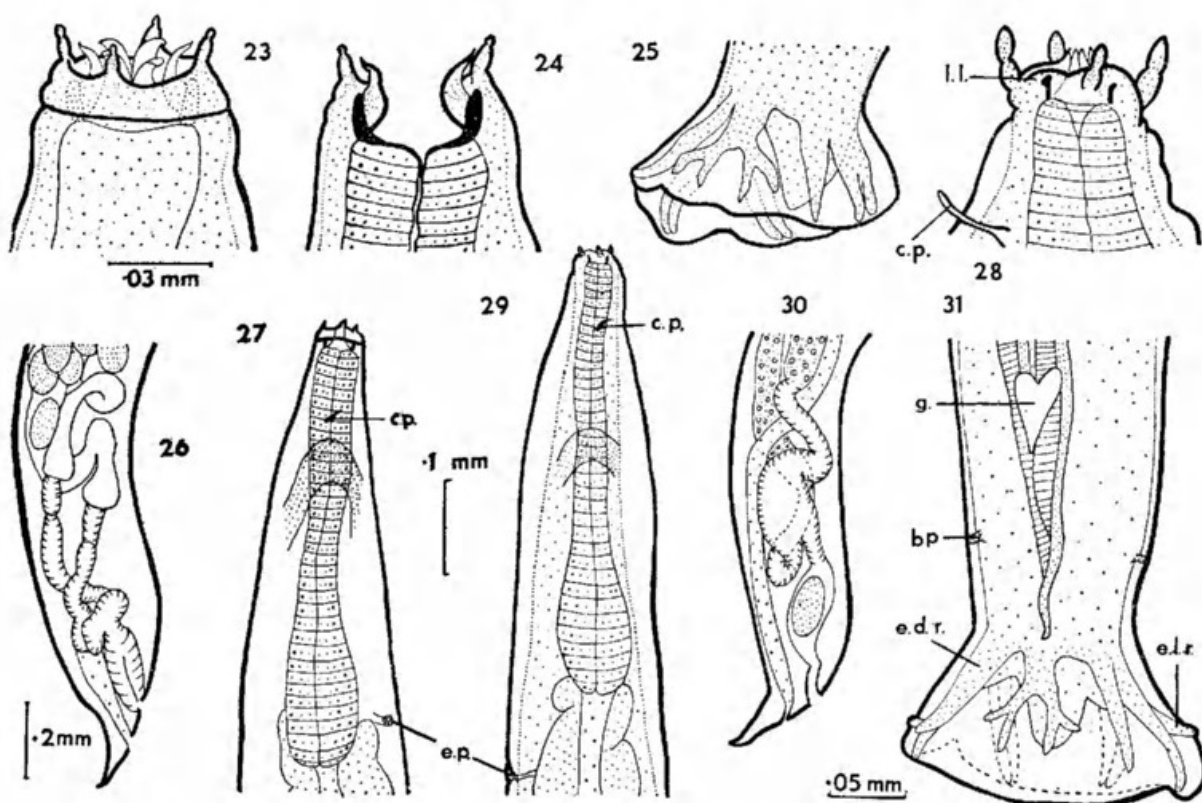
Cloacina elegans n. sp.

Figs. 23-27

From *Petrogale lateralis*, Hermannsburg. Male 6.2 mm. long, 0.5 mm. maximum breadth; female 6-11 mm. long, 0.6 mm. maximum breadth; rather thick body forming at least one coil. Six very low lips; the two laterals each with minute rounded papilla; four submedians each with conical papilla consisting of longer proximal and small button-like distal portion. Buccal capsule with stout chitinous ring, 0.014 mm. long, 0.025 mm. diameter, continuous with chitinous

floor; six elements of leaf crown arise from base, extend inwardly and then forwards to surround mouth aperture, free end of elements projecting beyond lips. Cervical papillae thread-like, about 0.1 mm. from head end; nerve-ring at 0.17 mm., and excretory pore at 0.37 mm. from anterior end in female. Oesophagus short, 0.52 mm. long, straight, anterior part slightly wider and extending beyond nerve-ring, bulb in region of excretory pore. Anterior end of intestine thickened, without lobes.

Male—Spicules 2.2 mm., 1:3 of body length, not straight, with narrow striated alae extending along almost whole length, tips rounded. Gubernaculum heart-shaped in dorsal view. Bursa large, lobes distinct, laterals longest. Ventral



Figs. 23-27. *Cloacina elegans*—23, female head; 24, female head, optical section; 25, bursa, dorso-lateral; 26, female, posterior end; 27, head end, female, lateral; Figs. 28-31. *Cloacina hydriformis*—28, head, female; 29, anterior end, male, lateral; 30, female, posterior end; 31, male, posterior end, dorsal. Figs. 23, 24 and 28 to same scale; 25 and 31; 26 and 30; 27 and 29.

rays thin, straight, almost reaching bursal edge; externo-lateral and externo-dorsal project slightly on lateral wall of bursa; laterals long, slender, almost reaching edge. Dorsal ray stout, soon dividing, each branch passing postero-laterally and then giving off a lateral ray extending outwards, then bending to run parallel with main branch; none of the dorsal branches reaching bursal edge. Genital cone fairly large; dorsal lip of cloaca without processes.

Female—Body narrows suddenly in region of vagina; tail thin, pointed, bending dorsally. Uteri parallel; ovejectors 0.49 mm. long; vagina 2.6 mm. long,

straight; vulva about 1.3 mm. in front of anus; anus about 1.3 mm. from tip of tail. Eggs 0.035 by 0.16 mm.

***Cloacina hydriformis* n. sp.**

Figs. 28-31

From *Petrogale lateralis*, Mount Liebig; Hermannsburg; Ernabella.

Short; males, 4.4-5.1 mm. long, 0.29 mm. broad; females, 5.8-6.5 mm. long, 0.36-0.45 mm. broad. Four submedian lips each with long "two-jointed" papilla, projecting characteristically from head; two lateral lips. Buccal ring long, thin, with upper edge turned outwards; elements of leaf crown relatively thick, arising from base of capsule, with free ends bending inwards around mouth opening. Cuticle inflated in oesophageal region. Oesophagus 0.26-0.4 mm. long, 1:12-17 of body length, narrow, straight, with slight enlargement. Cervical papillae bristle-like, 0.08 mm. from head end. Nerve ring at mid-oesophagus, about 0.2 mm. from anterior end. Excretory pore at posterior end of oesophagus, 0.45-0.49 mm. from head end.

Male—Spicules stout, short, 1.14-1.4 mm., 1:3.6-3.8 of body length, with alae on second half of length and ending near tips, tips curved slightly. Gubernaculum more or less heart-shaped in dorsal or ventral view, larger (thicker) at anterior than at posterior end when viewed laterally. Small prebursal papillae at about 0.25 mm. in front of anterior edge of bursa. Bursa lobes hardly distinct, ventral lobes joined. Ventral rays long, thin, reaching bursal edge; externo-laterals short, projecting on side of bursa; laterals reaching bursal edge; externo-dorsals short, equal to externo-laterals; dorsal ray very short, bifurcating after half length, each branch giving off rather short lateral stem. Genital cone long, rounded.

Female—Uteri parallel; ovejectors 0.4 mm. long; vagina short, straight; vulva 0.3-0.36 mm. from posterior end. Tail narrows sharply beyond vulva and is bent back to make angle with body. Anus at 0.2 mm. from tip of tail. Eggs, 0.17 by 0.08 mm.

Specimens also assigned to this species were taken from the stomach of *Macropus rufus* from Mount Liebig. They agreed in all particulars except in having relatively shorter spicules which were only one-fifth body length.

***Cloacina frequens* n. sp.**

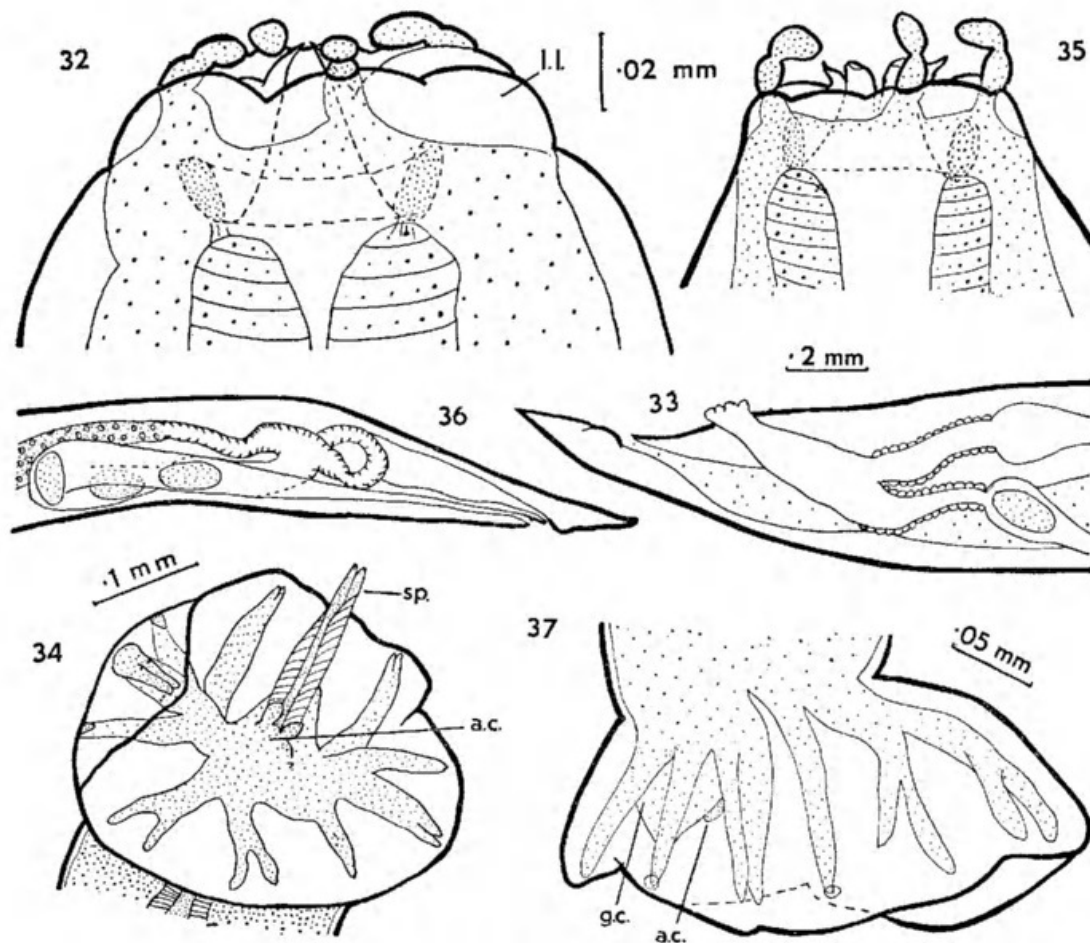
Figs. 32-34

From *Macropus robustus*, Mount Liebig; Cockatoo Creek.

Male, 6-11.5 mm. long, 0.4 mm. broad; female, 14.7-18 mm. long, 0.72 mm. broad. More or less straight, tapering towards ends. Six lips; four submedian each with a "two-jointed" papilla bent inwards over mouth in most specimens; lateral lips with very small papilla. Cuticle ridged behind anterior end. Buccal capsule with chitinous ring from which arises leaf crown of six elements; ring wider at top (0.055 mm.) than at base (0.045 mm.), and 0.013 mm. deep. Oesophagus commences at about 0.05 mm. from anterior end of lips, 0.9-1.13 mm.

long in male (1:7-10 of body length), 1.03-1.27 mm. long in female (1:13-17 of body length); almost straight, narrow except for slight enlargement near posterior end. Nerve ring at second quarter of oesophagus length and 0.3-0.43 mm. from anterior end. Excretory pore in region of third quarter of oesophagus and 0.55-0.8 mm. from anterior end, distance varying with length of worm. Cervical papillae long, thread-like, about one-eleventh body length from anterior end in male, and one-twentieth in female.

Male—Ventral lobes of bursa joined. Ventral ray long, thin; externo-lateral short; medio- and postero-laterals joined except at tips, latter ray slightly longer,



Figs. 32-34. *Cloacina frequens*—32, head, female; 33, female, posterior end; 34, bursa, flattened, posterior view. Figs. 35-37. *Cloacina australis*—35, head, female; 36, female, posterior end; 37, bursa, dorso-lateral. Figs. 32 and 35 to same scale; 33 and 36.

both extending almost to bursal edge; externo-dorsal short, stout, arising from same root as laterals; dorsal ray dividing into two, each branch bifurcating near distal end, no branch reaching edge. In many specimens each of the first two branches of the dorsal ray gives off a short narrow stem laterally, just before bifurcation. Spicules short, 0.86-0.89 mm., 1:7-13 of body length, tapering to tips, alae extending nearly to tips. Gubernaculum small, irregular; genital cone long; pair of accessory processes present.

Female—Uteri parallel; ovejectors 0.32 mm. long, uniting near vulva; vagina very short, 0.4 mm.; vulva 0.22 mm. in front of anus. Tail more or less straight, body tapering rapidly to vulva and ending in sharp point. Anus at about 0.27 mm. from tip. Eggs, 0.17 by 0.08 mm.

***Cloacina australis* n. sp.**

Figs. 35-37

From *Macropus robustus*, Mount Liebig; Cockatoo Creek.

Body rather long, curved, tapering towards anterior end; 10 mm. long, 0.5 mm. broad in male; 9.5-11.5 mm. long, 0.6 mm. broad in female. Cuticle in vicinity of level of anterior end of oesophagus standing out from underlying tissue, and though seen in all specimens the condition may be an artefact as it was more marked in some than in others. Head with 4 shallow wide submedian lips; perhaps a pair of narrower lateral lips between them; submedians each with large "two-jointed" papilla. Buccal capsule with chitinous ring 0.017 mm. long, 0.04 mm. diameter (in female); distance from floor of cavity to tip of lips 0.02 mm. Leaf crown of six elements arising from lower inner edge of ring and projecting inwards; outer edge of each element appearing to be continuous with corresponding lip; free end of each element bent backwards. Nerve ring around oesophageal bulb and 0.32-0.4 mm. from anterior end. Cervical papillae long, hair-like, 0.39 mm. from head end, each arising from button-like outgrowth. Oesophagus 0.64-0.75 mm. long, narrow, straight in anterior half, then bulbous, followed by a constriction and then by a club-shaped end leading into the narrow intestine whose anterior end surrounds the end of the oesophagus; oesophagus 1:14-16 of body length.

Male—Lateral lobes of bursa distinctly separated from dorsal and ventral lobes; ventrals joined to, but distinct from, each other; dorsal lobe with median cleft. Ventral rays long, reaching bursal edge; laterals long, not reaching edge; externo-lateral and externo-dorsal project on side of bursa; externo-dorsal arising separately. Dorsal ray subdivides near its base, each branch soon dividing into inner long thin branch and a lateral short thicker branch, neither reaching edge. Spicules long 4.4-4.8 mm. 1:2.1-2.3 of body length, narrow, with striated alae, fairly straight. Genital cone well developed, conical; dorsally to it are two small projections which may be associated with an accessory genital cone.

Female—Uteri long, parallel, uniting about 0.8 mm. from posterior end of body; vagina passing forwards, then turning back to vulva lying 0.3-0.4 mm. from tip of tail. Tail straight, tapering; tip directed backwards. Anus 0.2 mm. from tip.

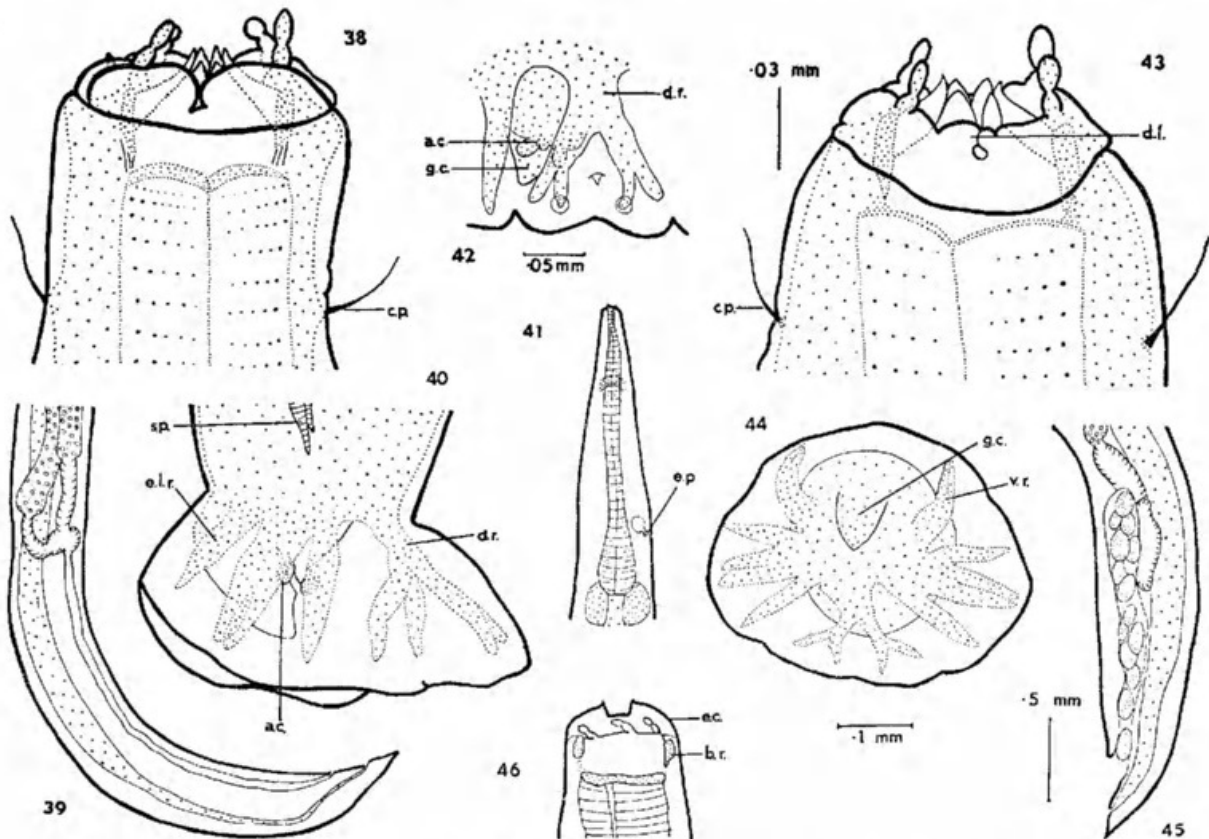
***Cloacina communis* n. sp.**

Figs. 38-41

From *Macropus robustus*, Mount Liebig; Cockatoo Creek.

Male, 11 to 13 mm. long; female, 15-45 mm., generally 20-25 mm. long, stouter towards anterior end, tapering markedly in posterior third, with slight

prominence in region of vulva. Anterior end suddenly narrowed in buccal region. Six lips, four submedians each bearing elongate papilla with marked constriction, two laterals each with small conical papilla. Nerve ring 0.32-0.42 mm., excretory pore 1.2-1.4 mm., and cervical papillae 0.09-0.11 mm., from anterior end. Maximum breadth 0.55-0.63 mm. in male, 0.6-0.7 in female. Buccal ring longer and wider than in most species of the genus; chitinous ring thin, 0.04 mm. diameter, 0.021 mm. long in male; leaf crown of six elements arising about half-way along ring. Oesophagus 1.25 to 1.77 mm. long, 0.07 mm. wide, length 1:7.5-13 of body length, usually 1:8-9; first and second thirds slightly wider than last third which ends in a spherical bulb 0.22 mm. in diameter. Anterior end of intestine surrounded by mass of granular tissue arranged in paired lobes.



Figs 38-41. *Cloacina communis*—38, head, female, ventral; 39, female, posterior end; 40, bursa, dorso-lateral; 41, female, anterior end. Figs. 42-46. *Cloacina petrogale*—42, dorsal ray of bursa, genital cone, accessory cone; 43, head, female, ventral; 44, bursa, flattened, posterior view; 45, female, posterior end; 46, young female undergoing ecdysis. Figs. 39, 41 and 45 to same scale; 42, 40 and 46; 38 and 43.

Male—Spicules 3.47-4.13 mm. long, 1:2.7-3.7 of body length, slender, with striated alae. Gubernaculum appearing in dorsal view as heart-shaped structure between spicules. Genital cone short, directed dorsally; rudimentary accessory cone formed of two button-like processes on dorsal lip of cloaca. Ventral lobes of bursa not clearly marked off from each other or from lateral lobes. Ventral rays long, reaching almost to bursal edge, cleft at tip. Externo-lateral short, thick; medio- and postero-laterals together, longer than externo-lateral, but not

reaching bursal edge; externo-dorsal thick, from same root as laterals, but shorter. Dorsal ray bifurcating after half its length, each branch subdividing into two equal rays after half its length, none reaching edge of bursa.

Female—Body narrowing rapidly beyond vulva; tail conical, short, pointed. Intestine narrowed before reaching anus, latter 0.2 mm. from tip of tail. Uteri parallel, joining some distance before vulva; vagina long, narrow, nearly straight; vulva 0.15 mm. in front of anus. Ripe eggs, 0.17 by 0.08 mm.

***Cloacina magna* n. sp.**

From *Macropus robustus*, Cockatoo Creek.

Male 10 mm., fairly stout; female 30 mm., anterior region stout, posterior much thinner and curved. Anterior end with six low lips; four of them submedian, each with large papilla constricted into two parts; two laterals each with or without very small papilla. Buccal capsule very wide, with chitinous ring 0.07 mm. diameter, 0.02 mm. long, bearing leaf crown passing anteriorly and bending inwards. Oesophagus long, narrow, 1.4 mm. in male (1:7 of body length), 2.02 mm. in female (1:15); anterior two-thirds wider, 0.08 mm. broad in male at anterior end, 0.15 mm. wide at base where it widens into a bulb. Excretory pore at 0.9 mm. from anterior end, and just in front of oesophageal bulb; nerve ring at 0.26-0.28 mm. from head end.

Male—Bursa rather longer than usual, with ventral lobe distinct from laterals but not deeply separated from them. Ventral rays long, narrow, parallel not separated, reaching almost to bursal edge. Externo-dorsal arising from same root as laterals and of same length, none of these reaching bursal edge. Medio- and postero-laterals separated for about half length. Dorsal ray divides after one-third length, each branch dividing into an inner and a rather shorter lateral, neither reaching bursal edge. Genital cone short, conical. Spicules 3.7 mm., 1:2.8 of body length, fairly straight, with wide striated alae ending near tips.

Female—Sudden narrowing beyond vulva; tail short, pointed, and strongly curved. Anus 0.2 mm., and vulva 0.25 mm. in front of tip of tail. Vagina rather long, about 2.1 mm., ovejectors directed forwards, 0.55 mm. long, leading into parallel uteri. Eggs, 0.17 by 0.08 mm.

The species closely resembles *Cloacina communis* but differs in size, positions of nerve ring and excretory pore, relative sizes of spicules and oesophagus, and form of the anterior end.

***Cloacina petrogale* n. sp.**

Figs. 42-46

From *Petrogale lateralis*, Mount Liebig; Hermannsburg; Ernabella.

Male 7.5-8 mm. long, 0.48 mm. broad; female 10-21 mm. long, 0.75 mm. broad; body tapering more markedly anteriorly in both sexes. Eight lips arise inside mouth collar, each of the four submedians with long "two-jointed" papilla, dorsal and ventral lips represented by very shallow bilobed folds. Buccal capsule surrounded by chitinous ring, 0.031 mm. long, 0.6 mm. diameter (in female) and

not reaching oesophagus; floor of capsule with thin chitinous plate. Leaf crown of six elements arising from about half-way up chitinous ring and bending inwards over mouth aperture and recurved at anterior edges. Cervical papillae 0.08 mm. from anterior end in female. Nerve ring at 0.24 (male), -0.4 mm. (female) from anterior end; excretory pore near oesophageal bulb, 1.14 mm. from head end in male. Oesophagus 1.06-1.4 mm. long in male, 1:6-7 of body length; 1.65-1.7 in female, 1:6 of body length in young specimens, 1:12.5 in large females; long, thin, with bulb at posterior end. Anterior end of intestine with distinct lobes.

Male—Bursal lobes not deeply separated from each other; two ventral lobes united. Ventral rays long, cleft for almost half length, reaching nearly to bursal edge. Externo-ventral, ventrals and externo-dorsals arising from same root; first longest and almost reaching edge; ventrals long, stout, not reaching edge; externo-dorsal almost as long as externo-ventral. Dorsal ray divides after half its length, each branch bifurcating into more or less equal rays, none reaching bursal edge. Spicules 3.3-3.88 mm., 1:2-2.4 of body length, with alae striated almost to tips, curved in body. No gubernaculum.

Female—Tail short, conical; vagina long, almost straight; uteri parallel; ovejectors about 0.45 mm. Anus at 0.3 mm. and vulva at 0.5 mm. from posterior end in large females. Eggs, 0.19 mm. by 0.08 mm.

***Cloacina macropodis* n. sp.**

Figs. 47-50

From *Macropus robustus* and *Petrogale lateralis*, Mount Liebig; Cockatoo Creek.

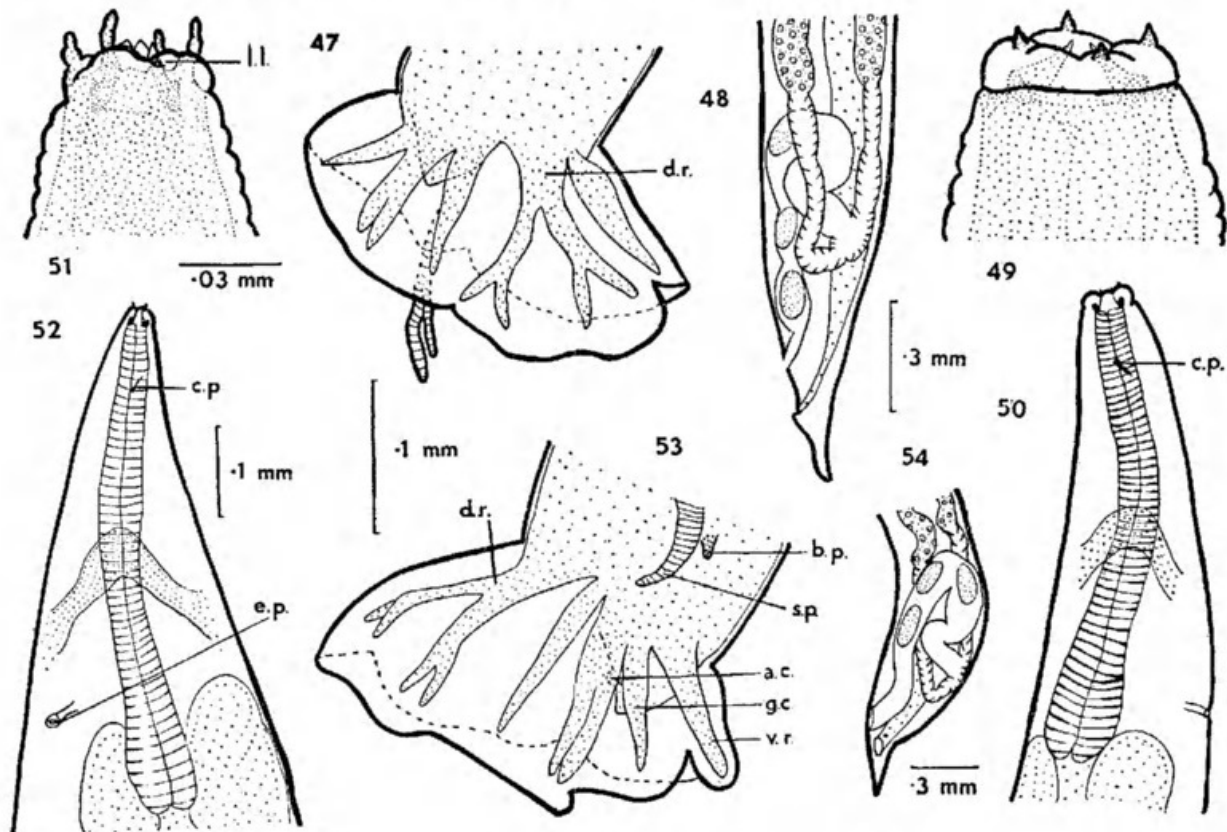
Rather short slender worms tapering at each end. Male 7.7-55 mm. long, 0.28 mm. maximum breadth; female 8.2-10.6 mm. long, 0.38 mm. maximum breadth. Two lateral lips; four submedian lips each with small conical papilla of two parts, larger basal portion and smaller conical tip. Buccal capsule broader than long, with chitinated ring around base, 0.01 mm. long, 0.026 mm. diameter at bottom, wider in anterior part. Leaf crown of six elements apparently. Nerve ring around middle of oesophagus, at 0.23 mm. in male and 0.24-0.35 mm. in female from anterior end. Excretory pore just in front of posterior end of oesophagus and about 0.43 mm. from head end in female. Cervical papillae thread-like, at 0.065 mm. from anterior end in female. Oesophagus 0.4-0.54 in male (1:14-19 of body length), 0.49-0.58 in female (1:17-18 of body length), narrow, widening at posterior end.

Male—Lobes of bursa not separated by deep clefts; bursa longer dorsally than ventrally. Ventral rays long, slender, almost reaching bursal edge; externo-lateral shorter, stouter; medio- and postero-laterals separated near tips, latter ray slightly longer; externo-dorsal arising apart from laterals, not reaching edge. Dorsal ray dividing soon after origin, each branch ending in short bifurcation, none reaching bursal edge. Variation in the final branches of the dorsal ray was

noticed, these being sometimes short and close together, at other times longer and more divergent. Spicules $2.83\text{--}3.87$ mm. long, $1.2\text{--}2.4$ of body length, slender, with wide striated alae extending nearly to tips. Genital cone short, blunt; rudimentary accessory cone present.

Female—Long pointed tail, somewhat dorsally directed. Uteri parallel, uniting near vulva; vagina more or less bent; vulva $0.35\text{--}0.4$ mm. from tip of tail; anus at $0.23\text{--}0.25$ mm. from end of tail. Eggs, 0.14 by 0.06 mm.

Some specimens were found resembling closely those described above, but having the oesophagus and labial papillae relatively longer.



Figs. 47-50. *Cloacina macropodis*—47, bursa, dorso-lateral; 48, female, posterior end; 49, female head; 50, female, head, lateral. Figs. 51-54. *Cloacina curta*—51, head; 52, female, head, lateral; 53, bursa, dorso-lateral; 54, female, posterior end. Figs. 49, 51 to same scale; 47, 53; 50, 52.

Cloacina curta n. sp.

Figs. 51-54

From *Macropus robustus*, Mount Liebig; Cockatoo Creek.

Short, rather stout (especially females), slightly curved, tapering towards each end. Male, $6.5\text{--}7.4$ mm. long; female, $7\text{--}7.12$ mm. Cuticle striated with striations 5μ apart anteriorly (in male). Four large submedian lips each with elongate papilla of two stout "joints"; two small bilobed lateral lips each with very small conical papilla. Larger papillae project 0.01 mm. and lateral papillae 0.001 mm. from surface. Buccal capsule about as long as wide, with chitinous ring 0.02 mm. in diameter surrounding lower part. Leaf crown with six elements

arising from base of ring and projecting inwards. Cervical papillae hair-like, 0.02 mm. long, on small button-like outgrowths, 0.08 mm. from anterior end of worm. Nerve ring 0.2-0.25 mm. in male, 0.23-0.28 in female from anterior end; excretory pore at 0.28 mm. from head end. Oesophagus 0.45-0.5 mm. long, 1:13-16 of body length.

Male—Three males which agreed in length, oesophagus, positions of nerve ring, excretory pore and cervical papillae, length of spicules, general shape of bursa and general arrangements of rays, were found to differ in regard to the dorsal ray which in two was asymmetrical and unlike, while in the third it was regular, as figured. Bursa lobes distinct but not deeply separated. Ventral rays joined, parallel, bending forward into ventral lobe; externo-lateral short; medio- and postero-laterals separate at tips, reaching nearly to bursal edge; externo-dorsal arising separately, not reaching edge, being more remote from it than end of externo-lateral is; externo-lateral shorter than externo-dorsal and bursa wider in its vicinity. Dorsal ray bifurcating after about one-third length, in regular type each branch subdivides after the half length into two equal rays, none reaching bursal edge. Spicules 2.35-2.97 mm long, 1:2.3-2.9 of body length, curved, with striated alae terminating near tips, with spoon-like ends. Gubernaculum not seen. A pair of lateral prebursal papillae.

Female—Uteri long, parallel; ovejector 0.45 mm. long; vagina wide, bending forwards for about 0.5 mm. before passing back to vulva lying at 0.32 mm. from posterior end of worm and 0.12 mm. in front of anus. Body tapering suddenly from level of anus, 0.2 mm. from tip of short pointed tail. Eggs, 0.19 by 0.08 mm.

Cloacina dubia n. sp.

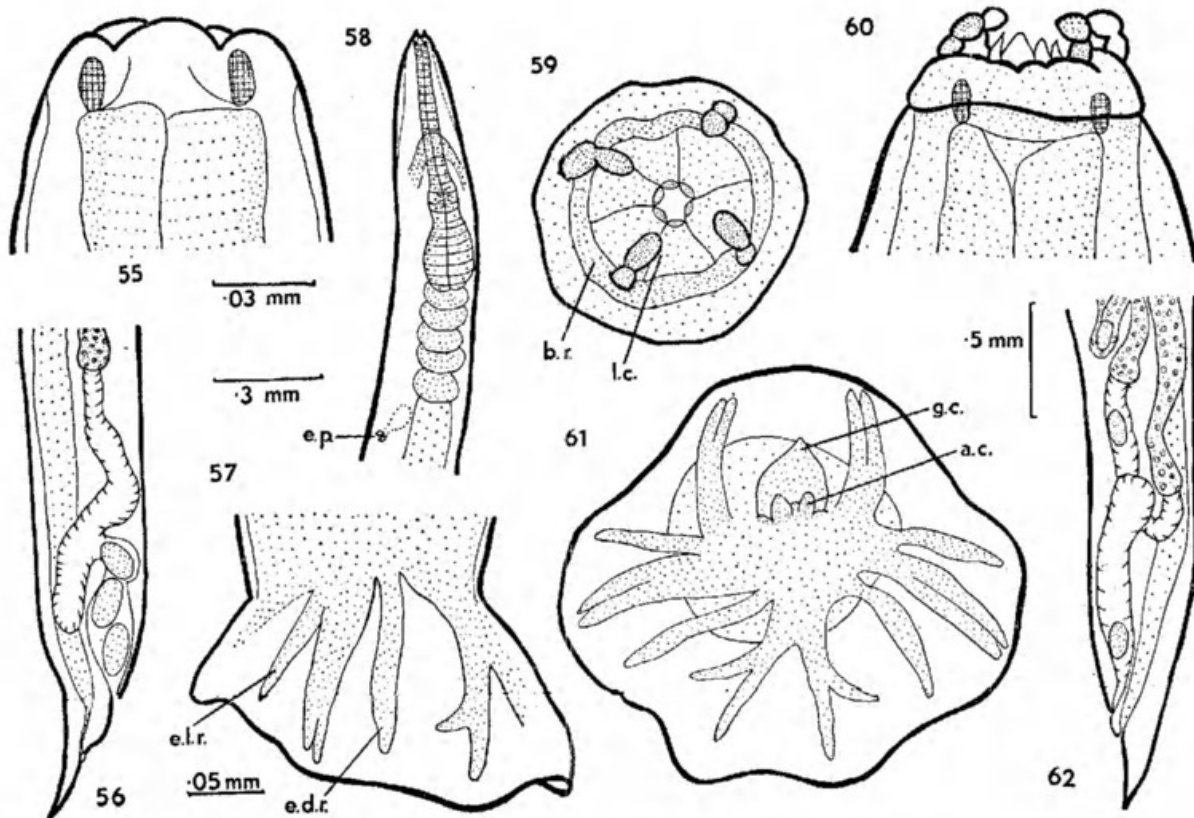
Figs. 55-57

From *Macropus robustus*, Mount Liebig.

Only one male and one female examined. The species is assigned to *Cloacina* only provisionally, since the head characters are not typical of that genus. Male 8.1 mm. long, maximum breadth 0.38 mm., female 8.67 mm. long; slender, tapering towards each end. Cuticle with annulations 0.015 mm. apart. Six low lips. No leaf crown. Buccal capsule with chitinous ring. Oesophagus 0.57-0.58 mm. long, 1:14-15 of body length, posterior region swollen. Nerve ring 0.29 mm. from head end.

Male—Spicules 3.42 mm., 1:2.3 of body length, with narrow striated alae not reaching tip. Ventral lobes of bursa united. Ventral rays separated at tips; externo-lateral slender, shorter than other laterals; medio- and postero-laterals joined, the latter being longer and neither reaching bursal edge; externo-dorsal long, stout, arising separately, extending towards bursal edge as far as does externo-lateral; dorsal ray bifurcated near base, each branch giving off short lateral stem after two-thirds length, inner main branch incurved and not reaching edge of bursa. Genital cone short, blunt.

Female—Body narrows suddenly at level of vulva, ending in fine point bent dorsally. Ovaries in second quarter of body; uteri long, parallel; ovejectors 0.45 mm. long; vagina 0.4 mm.; vulva 0.4 mm. from tip of tail; anus 0.2 mm. from posterior end.



Figs. 55-57—*Cloacina dubia*—55, male, head; 56, female, posterior end; 57, bursa, dorso-lateral. Figs. 58-62. *Cloacina ernabella*—58, anterior end, lateral; 59, head, anterior view; 60, head, lateral; 61, bursa, flattened, posterior view; 62, female, posterior end. Figs. 55, 59, 60 to same scale; 56, 58; 57, 61.

Cloacina ernabella n. sp.

Figs. 58-62

From *Petrogale lateralis*, Mount Liebig; Hermannsburg; Ernabella.

Short, stout, males tapering at both ends, females narrowing more markedly from oesophageal region forwards. Male 8.4-8.6 mm. long, 0.34-0.38 mm. in maximum breadth; female 13.4-14.7 mm. 0.58-0.66 in maximum breadth. Cuticle finely striate transversely; at anterior end inflated as far back as nerve ring. Mouth collar prolonged into six low lips, four submedian each with large "two-jointed" papilla whose upper "joint" is ovoid and rather larger than lower. Buccal capsule with ring 0.011 mm. long, 0.035 mm. in diameter; floor 0.02 mm. from tip of lips; leaf crown of six elements arising from base of ring; elements bending inwards to surround mouth, with anterior ends bent outwardly. Cervical papillae thread-like, 0.14-0.15 mm. from anterior end. Excretory pore posterior to oesophagus; 1.1 mm. from anterior end. Nerve ring at mid-oesophagus,

0.27-0.3 mm. from anterior end. Oesophagus rather long, 0.7-0.76 mm. in male (1:11-12 of body length), 0.9-0.94 in female (1:15 of body length), narrow anteriorly, slight swelling in posterior third followed by bulb. Anterior end of intestine with several lobes.

Male—Bursa with ventral lobes joined, lateral lobes distinct from ventral and dorsal lobes. Ventral rays long, parallel, separate for about two-thirds length; externo-lateral long, thin; laterals long, cleft for about half length; externo-dorsal arising from root of laterals, thin, rather shorter than laterals; dorsal ray wide, soon dividing into two branches, each sending out a lateral, rather shorter than main branch. No ray reaches bursal edge; laterals and ventrals longest. Spicules straight with wide alae almost to their curved tips; 1.8-1.85 mm. long, 1:4.6 of body length. Gubernaculum not chitinised but represented by large irregular mass of cells. Genital cone short, rounded; dorsal to opening at base of cone are two small conical structures probably representing an accessory cone.

Female—Body narrows posterior to region of vagina, and very suddenly after vulva to form straight pointed tail. Uteri parallel, uniting near posterior end; ovejectors about 0.5 mm. long; vagina 1.1 mm. long, curving forwards before passing back to vulva. Vulva about 0.45 mm. from posterior end and 0.15 mm. in front of anus. Eggs, 0.17 by 0.07 mm.

***Cloacina parva* n. sp.**

Figs. 67-72

From *Macropus robustus*, Mount Liebig; Cockatoo Creek; Hermannsburg. From *Petrogale lateralis*, Mount Liebig; Hermannsburg; Ernabella.

Slender, short, size varying with age, male 5-10.6 mm. long, female 8-20 mm. Mouth collar with six rather large lips (four submedian, two laterals) and two smaller (a dorsal and a ventral); each submedian with short "two-jointed" papilla; each lateral with small conical papilla. Inwardly from lips six rounded lobes surrounding mouth. Buccal cavity narrow, 0.04 mm. long in large specimens, with chitinous ring forming capsule 0.041 mm. diameter, 0.1 mm. long, thin anteriorly, with plain margin, thicker at base where leaf crown arises to pass forwards closely applied to inner surface of lobes surrounding mouth and projecting beyond them. Oesophagus 0.45-0.65 mm. long, 1:10-16 of body length in male; 1:20 in female; with wider, more muscular anterior portion about 0.15 mm. long, *i.e.*, nearly half oesophageal length; posterior part with elongate bulb. Cervical papillae about 0.12 mm. from anterior end; nerve ring at about mid-oesophagus, 0.27-0.34 mm. from head end; excretory pore near base of oesophagus, 0.46-0.52 mm. from anterior end.

Male—Spicules 1.4-3.3 mm. long, 1:3-3.2 of body length; slender, with striated alae extending almost to curved tips. Genital cone small; gubernaculum present. Bursa large; dorsal, ventral and lateral lobes distinct. Ventral rays almost reach bursal edge; externo-lateral, lateral and externo-dorsal arise from same root and subequal. Dorsal ray bifurcating just after half-length, each part dividing into two equal branches at mid-length.

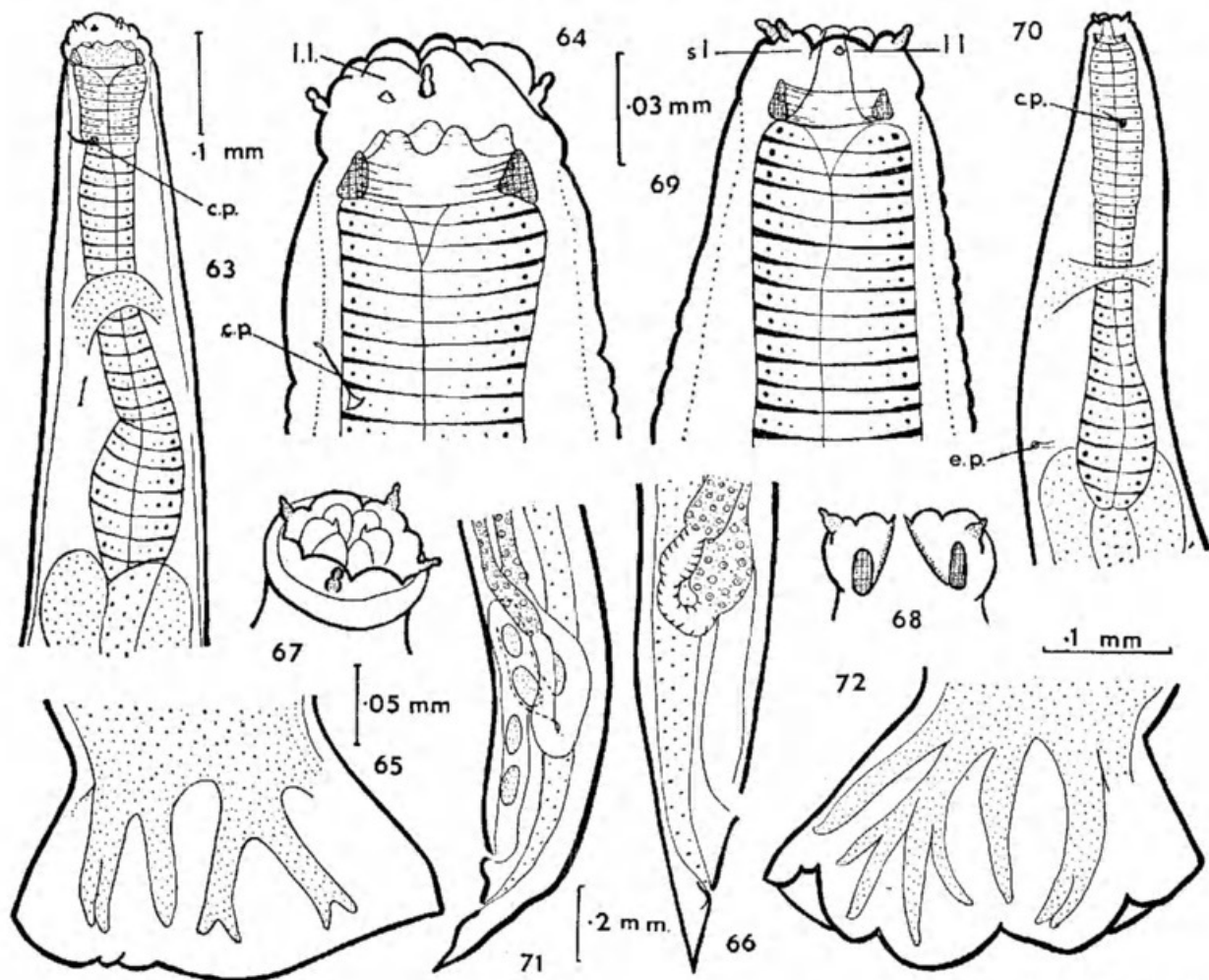
Female—Body narrowing behind vulva, tail pointed. Vagina commencing 0.4 mm. above vulva, then passing forwards for about 0.3 mm. before returning. Vulva 0.16–0.18 mm. in front of anus; latter 0.16 mm. from tip of tail.

***Cloacina minor* n. sp.**

Figs. 63–66

From same hosts and from same localities as *Cloacina parva*. Also from *Macropus rufus*, Mount Liebig.

Closely resembling *C. parva* in size, form and general anatomy but differing in the following respects: buccal capsule longer, greater length from top of lips



Figs. 63–66. *Cloacina minor*—63, anterior end, lateral; 64, head, submedian view; 65, bursa, dorso-lateral; 66, female, posterior end. Figs. 67–72. *Cloacina parva*—67, head, oblique front view; 68, head, optical section; 69, head of young female; 70, anterior end, lateral view; 71, female, posterior end; 72, bursa, dorso-lateral. Figs. 64, 67, 68, 69 to same scale; 63, 70; 66, 71.

to floor of capsule, chitinous ring with lobed anterior end; anterior muscular part of oesophagus short, about twice length of buccal cavity; cervical papillae just in front of posterior end of muscular part of oesophagus; spicules 2.12–2.63 mm. long, 1:2.3–2.8 of body length; final branches of dorsal ray much shorter, outer

branch of each pair short and stout, inner slender and rather longer. Males, about 6 mm. long, maximum breadth 0.24-0.31 mm.; female 15 mm., maximum breadth 0.57 mm.; oesophagus 0.5-0.56 mm. long, 1:10-12 of body length in male, 1:29 in female; nerve cord at 0.25-0.3 mm. from head end; excretory pore at 0.46-0.52 mm.; cervical papillae 0.11-0.12 mm. Buccal capsule 0.048 mm. long in male, 0.056 mm. in female. Female: anus at 0.2 mm. and vulva at 0.4 mm. from posterior end.

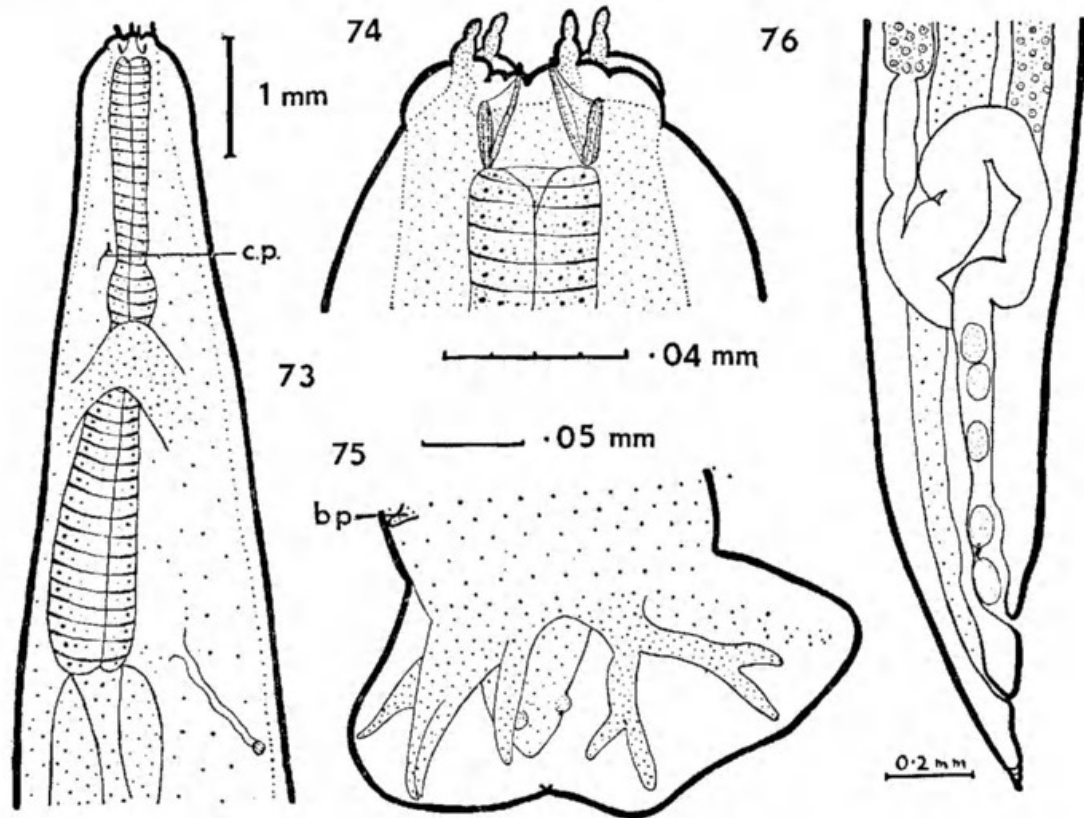
Commonly present along with the preceding species.

Cloacina liebigi n. sp.

Figs. 73-76

From *Macropus rufus*, Mount Liebig.

Fairly stout; male 14.75-17.6 mm. long, 0.55-0.64 mm. maximum breadth; female 23-24 mm. long, 0.6 mm. broad. Cuticle inflated behind head. Four sub-

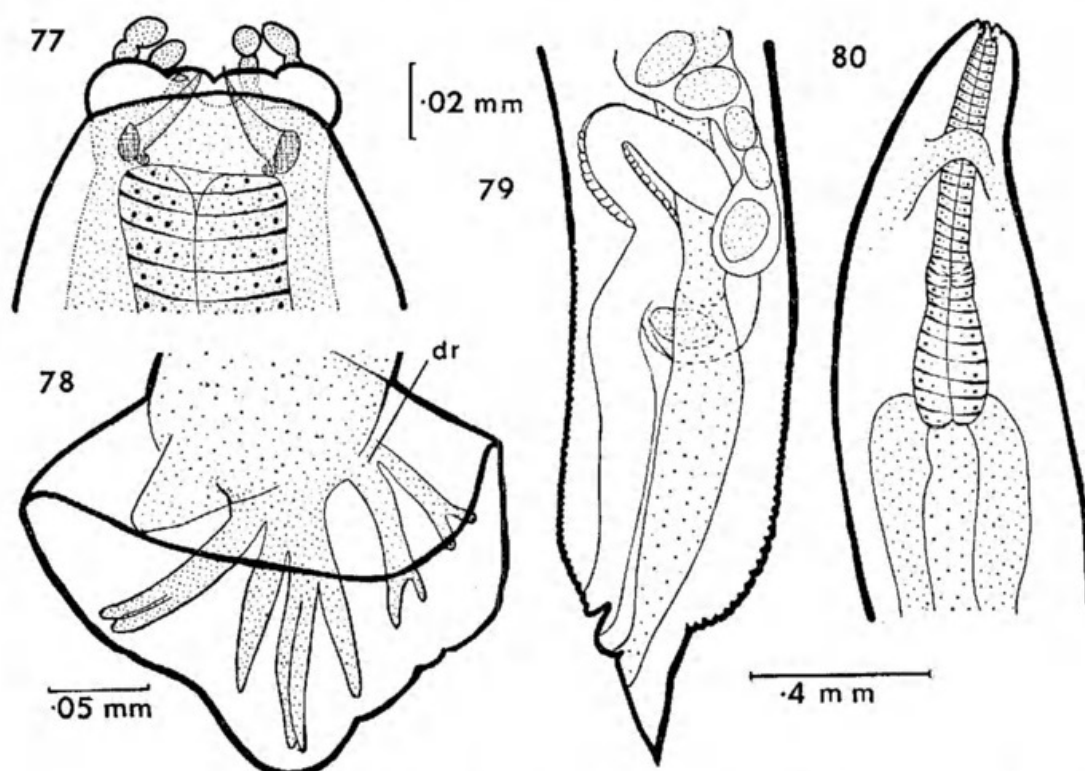


Figs. 73-76. *Cloacina liebigi*—73, female, anterior end, lateral; 74, female, head; 75, bursa, dorso-lateral; 76, female, posterior end.

median and two lateral lips, also shallow bilobed process dorsally and ventrally; submedian papillae "two-jointed," slender. Nerve ring about 0.3 mm., and excretory pore at 0.65-0.8 mm. from anterior end. Cervical papillae at 0.19 mm. from head end. Buccal capsule 0.02 mm. diameter, walls thin, rather high; leaf crown of six elements arising from base. Oesophagus 0.55 mm. long in male (about 1:30 body length), 0.6 mm. in female (about 1:40 body length), with

slight swelling in mid-region immediately in front of nerve ring; gradually widening behind nerve ring, widest just before junction with intestine; anterior end of intestine with thickened walls forming lobes.

Male—Spicules 3.62–4.4 mm. long, 1:4 of body length, slender, with striated alae extending almost to tip. Pair of prebursal papillae. Lobes of bursa not deeply separated from each other, ventral lobes united. Ventral rays parallel, reaching bursal edge; externo-lateral and externo-dorsal equal, long, slender, not reaching edge; laterals parallel, separate for most of length, almost reaching edge; externo-dorsal arising separately. Dorsal ray bifurcates at one-third length, each branch giving off at mid-length a shorter lateral before passing on almost to bursal



Figs. 77–80. *Cloacina inflata*—77, female, head, lateral; 78, bursa, dorso-lateral; 79, female, posterior end; 80, anterior end, lateral. Figs. 79, 80 to same scale.

edge. Genital cone long, rounded; with two rounded processes on dorsal lip of cloaca.

Female—Body narrows suddenly in region of vagina; tail pointed. Uteri parallel; ovejectors 0.4 mm. long; vagina long, looped forwards; vulva at about 0.4–0.45 mm. from tip of tail; anus at 0.2 mm. from end of tail. Eggs, 0.1 by 0.07 mm.

***Cloacina inflata* n. sp.**

Figs. 77–80

From *Macropus rufus*, Mount Liebig.

Male 6.7 mm.; female 9–10 mm. Cuticle inflated around anterior end. Two lateral lips; four submedian, each with two-jointed papilla with upper joint larger.

Buccal capsule shallow, with chitinous ring 0.01 mm. long, 0.045 mm. diameter. Nerve ring at 0.27 mm. from head end and surrounding end of first third of oesophagus. Excretory pore and cervical papillae not observed. Oesophagus 0.8 mm. in male (1:8.4 body length), 0.9 mm. in female (1:10.5 body length), with rather elongate terminal bulb in front of which is a slightly swollen region.

Male—Spicules very long, 4.6 mm. 1:1.4 of body length. Lobes of bursa large, well defined. Ventral rays long, slender, not reaching bursal edge, separate for almost entire length; externo-laterals and externo-dorsals shorter, thicker; laterals long, not reaching edge. Dorsal ray bifurcating very soon, each branch dividing near distal end into two short subequal processes not reaching bursal edge. Genital cone long, rounded.

Female—Body narrows suddenly behind anus; tail short, pointed, directed somewhat dorsally. Uteri parallel; vagina wide, straight; vulva 0.35 mm. from tip of tail; anus 0.19 mm. from tip. Eggs large, thick-shelled, 0.17 mm. by 0.09 mm.

DATA SHOWING RATE OF DEVELOPMENT OF TRUNK OF TREE FERN

On 15th November, 1921, close to the foot of Mount Dandenong, Victoria, in company with Mr. A. G. Campbell, of Kilsyth, Victoria, I collected a young tree fern, *Alsophylla australis*, which I brought back and planted in my "brush house" at Blackwood. The tree was found in swampy ground and had a few fronds of only slightly over 3 inches in length.

In November, 1937, the following measurements of this specimen were obtained:

Trunk: Circumference at ground level, 33 inches; at 3 feet above ground, 28 inches; at one foot from crown, 27 inches; height from base to crown, 51 inches.

Fronds: One of the larger ones, 7 feet 3 inches long; thus, when fully expanded, the expanse was nearly 14 feet.

Average annual growth, $3\frac{1}{2}$ inches.

14 July, 1938

E. ASHBY



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