

SOME FILARIAL PARASITES OF AUSTRALIAN BIRDS

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[Read 12 September 1940]

Much of the material dealt with in this paper was collected by Professor J. B. Cleland, the late Dr. T. L. Bancroft, and the late Dr. MacGillivray; most of the remainder by the senior author. Acknowledgment is made of assistance received through the Commonwealth Research Grant to the University of Adelaide. Types of new species have been deposited in the South Australian Museum.

List of parasites arranged under their hosts:

PASSERIFORMES

- Corvus coronoides* Vig. and Horsf. (Eidsvold, Burnett River, Qld.), *Diplotriaena beta* n. sp.; (Musgrave Ranges, South Australia), *Aprocta corvicola* n. sp.
Strepera graculina White (Mount Irvine, South Australia), *Diplotriaena* n. sp.; (Scone, New South Wales) *Paralemdana clelandi* n. g., n. sp.
Graucalus melanops Latham (Fraser Island, Queensland), *Carinema graucalinum* n. sp.
Malurus lamberti Vig. and Horsf. (Ooldea, South Australia), *Diplotriaena delta* n. sp.
Cracticus destructor Temm. (Brisbane), *Diplotriaena epsilon* n. sp.
Myzantha flavigula Gould (Renmark, South Australia), *Pseudaprocta myzanthae* n. sp.
Acanthogenus rufigularis Gould (Monarto, South Australia); *Diplotriaena zeta* n. sp.; (Eidsvold, Queensland) *Filaria* (s.l.) sp.
Aphelocephala nigrincta North (Musgrave Ranges, South Australia), *Austro-filaria vestibulata* n. g., n. sp.
Spres superbus (Abyssinia, via Adelaide Zoological Gardens), *Diplotriaena gamma* n. sp.

CORACIIFORMES

- Halcyon vagans* Lesson (Lord Howe Island), *Hamatospiculum howense* n. sp.

PSITTACIFORMES

- Calopsittacus novae-hollandiae* Gmelin (New South Wales), *Filaria* (s.l.) sp.
Pseudopsittacus mclennani MacGillivray (North Queensland), *Carinema dubia* n. sp.

COLUMBIFORMES

- Columba livia* Linn. (Adelaide), *Eulimdana clava* (Wedl) Founikoff.

***Hamatospiculum howense* n. sp**

(Fig. 1-2)

From subcutaneous tissues of head and neck of *Halcyon vagans*, Lord Howe Island.

Males up to 20 mm. in length, 0.4 mm. diameter; females to 35 mm. in length, 0.62 mm. diameter. Body cylindrical with rounded ends. Head with two short lateral cuticular projections on either side of small mouth, projections continuous with short root in hypodermis; externally from each is row of five papillae. Anterior part of oesophagus short, 0.2 mm. long in male, 0.3 mm. long in female; surrounded by nerve ring about mid-length; posterior part very long, reaching a third of body length.

Male—Tail rounded, cloaca $50\ \mu$ from tip; very slight alae in front of cloaca; one pair of large postanal and five pairs small preanal papillae, latter in alae. Spicules tapering to point, very unequal in size, $2\cdot3\ \text{mm.}$ and $\cdot27\ \text{mm.}$ in length.

Female—Anus atrophied, posterior gut not seen. Vulva salient, $1\cdot2\ \text{mm.}$ from head end. Eggs thick-shelled, $31\ \mu$ by $19\ \mu$.

This species closely resembles *H. leticiae* Tubanguui 1934, differing in the number of postanal papillae, the relative position of vulva, and the size of the eggs.

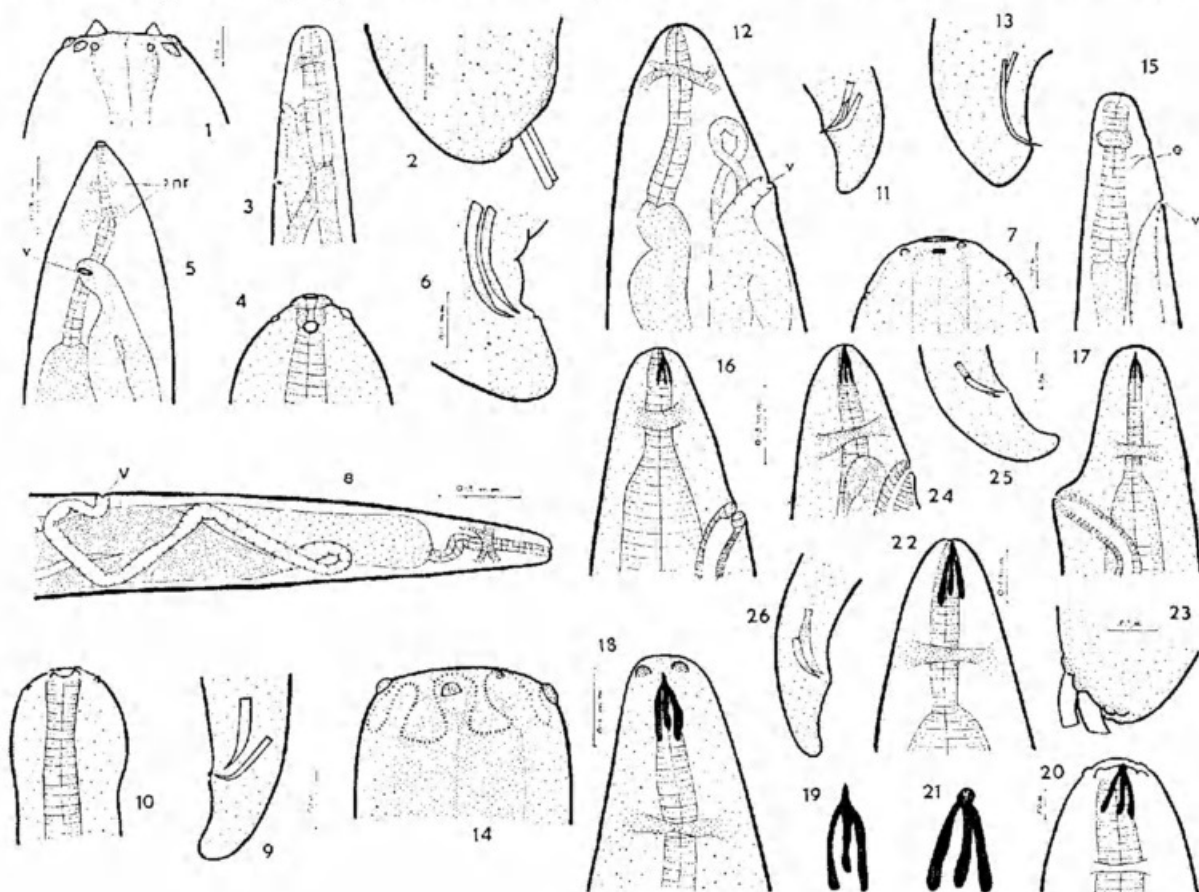


Fig. 1-26

Fig. 1-2, *Hamatospiculum horvense*: 1, head; 2, tail of male. Fig. 3, *Paralemdana clelandi*: anterior end. Fig. 4-6, *Austrofilaria vestibulata*: 4, head; 5, anterior end; 6, tail of male. Fig. 7-9, *Carinema dubia*: 7, head; 8, anterior end; 9, male tail. Fig. 10-11, *Carinema graucalinum*: 10, head; 11, male tail. Fig. 12-13, *Aprocta corticola*: 12, anterior end; 13, male tail. Fig. 14-15, *Pseudaprocta myzanthae*: 14, head, sub-lateral view; 15, anterior end. Fig. 16, *Diplotriacna alpha*. Fig. 17, *Diplotriacna beta*. Fig. 18-19, *Diplotriacna gamma*: 18, anterior end; 19, trident. Fig. 20-21, *Diplotriacna delta*: 20, anterior end; 21, trident. Fig. 22-23, *Diplotriacna epsilon*: 22, anterior end; 23, tail of male. Fig. 24, *Diplotriacna zeta*. Fig. 25, *Filaria* (s.l.) sp. from *Acanthogenys ruficularis*, male tail. Fig. 26, *Filaria* (s.l.) sp. from *Calopsittacus novae-hollandiae*, male tail.

Fig. 2, 4, 9, 10, 11, and 14 to same scale; fig. 3, 5, 8, 12, 13, 15, 16, 17 and 24; fig. 19, 21, 25, 26. e, excretory pore; nr, nerve ring; v, vulva.

Paralemdana clelandi n. g., n. sp.

(Fig. 3)

From body cavity of *Strepera graculina* from Scone, New South Wales (Coll. Professor Cleland). A single female $13\ \text{mm.}$ long, $0\cdot55\ \text{mm.}$ wide. Head truncated, posterior end rounded; mouth small, circular, leading through small ring of chitinous material to oesophagus; latter cylindrical, muscular, $0\cdot5\ \text{mm.}$

long, surrounded by nerve ring at 0.11 mm. from head. At least four head papillae. Vulva about middle of oesophageal region; uteri uniting well behind this, passing posteriorly beyond mid-body; an ovary at either end of body; no ripe eggs present. Tail, 0.1 mm. long; anus distinct.

Not being assignable to any genus already erected, we suggest a new genus of Filariinae, **Paralemdana**, near *Lemdana* Seurat, characterised by a smooth anterior end; short wide oesophagus, not divided into two parts; vulva in oesophageal region; tail rounded and short; anus present. Type, *P. clelandi* n. sp.

Austrofilaria vestibulata n. g., n. sp.

(Fig. 4-6)

From *Aphelocephala nigrincta*, Musgrave Ranges, South Australia. Males 8.5 to 9.5 mm. long, 0.4 mm. wide; females 20 to 25 mm. long, 0.6 mm. wide. Head with four submedian papillae and possibly two lateral papillae; body cylindrical, conical anteriorly, rounded posteriorly. Stout chitinous cylindrical vestibule, anterior edge rolled outwards, forming thick ring around mouth, projecting beyond the body proper; in male, vestibule 25 μ long, 21 μ wide at base, inclusive of walls. Oesophagus 0.6 mm. long in male; 0.76 mm. in female; with an anterior thinner part 0.24 mm. long. Nerve ring difficult to distinguish; either at base of anterior part of oesophagus or around its mid-length.

Male—Caudal papillae absent; spicules equal, tapering, 0.25 mm. long. No gubernaculum. Posterior end forming spiral of one and a half coils; tail 0.15 mm. long.

Female—Tail 0.1 mm. long; uteri uniting near vulva; latter 0.5 mm. from head. Eggs thick-shelled, 40 μ by 25 μ .

The characters of the head of this worm do not agree with those of any genus of the Filarioidea hitherto described, so far as we have been able to determine. The presence of a well-defined chitinous support in the buccal region indicates a member of the subfamily Setariinae. We suggest a new genus, **Austrofilaria**, with characters as follows:—*Setariinae*; cylindrical worms with rounded posterior ends and conical heads; relatively large and well developed vestibule with stout chitinous supporting walls; short oesophagus of two parts. Male without caudal alae or papillae; with short, equal, similar spicules. Female with vulva in region of second part of oesophagus. Type, *A. vestibulata*, n. sp.

Carinema dubia n. sp.

(Fig. 7-9)

From abdominal cavity of *Pseudopsittacus mclennani*, North Queensland, (coll. Dr. MacGillivray). Females about 25 mm. long, 0.32 mm. wide; male 15 mm. long, 0.184 mm. wide. Head rounded with four submedian and two lateral papillae, all very small. Mouth circular, leading by 3 μ long funnel-shaped vestibule to oesophagus; this tiny vestibule at its base surrounded by chitinous ring. Oesophagus very narrow, division into two parts more clearly indicated in some specimens than others, the distinction being that of cell structure, not of size. In male, oesophagus 0.38 mm. long, including anterior part 0.2 mm.; in female anterior portion 0.25 mm., the whole organ 0.45 mm. Nerve ring surrounding oesophagus at base of first part.

Male—Tail blunt, not coiled. Cloaca 0.7 mm. from posterior end. Perhaps a pair of papillae immediately anterior to, and a pair immediately posterior to, cloaca, but these (seen only in lateral view of the single male) may be the lips of the cloacal opening; latter on a prominence. Apart from these no caudal papillae have been observed. Spicules equal, tapering distally, 10 μ long.

Female—Tail rounded; anus not observed; vulva 1.7 mm. from head; uteri uniting at about this level, median uterus passing forward nearly to oesophagus; vagina coming back from this region to vulva. Uteri packed with larvae, on which no sheaths were detected. Larvae 4 μ in diameter, 360 to 370 μ long, with rounded anterior ends and elongate tails.

It is with some reserve that this species is assigned to *Carinema* because of the division of the oesophagus into two parts and the presence of six cephalic papillae and a buccal ring in our species.

***Carinema graucalinum* n. sp.**

(Fig. 10-11)

From *Graucalus melanops*, Fraser Island, Queensland. One male and several females obtained. Male 8 mm. long, female 15-18 mm. long with maximum breadth of 0.15 and 0.32 mm. respectively. Anterior end somewhat club-shaped, with four submedian papillae around mouth. Oesophagus 0.4 mm. long in male, 0.55 mm. in female, cylindrical, surrounded anterior to its mid-length by nerve ring. Lateral lines marked by a double row of small refracting bodies under cuticle.

Male—Spicules subequal, about 60 μ long, spatulate, with rolled edges and terminating in narrow spine. Cloaca 50 μ from rounded tip of tail; caudal alae absent; and caudal papillae not seen.

Female—Vulva 0.95 mm. from head (*i.e.*, post-oesophageal). Anus probably absent; rectum not seen in any specimen, but in one there was an elevation resembling anal region at 0.2 mm. from the tip. Larvae in uteri 270 to 290 μ long, 5 to 6 μ in diameter, with rounded head and pointed tail; no sheath observed.

This species seems to be more closely related to *Carinema* than to any other genus. It differs from the only other known species, *C. carinii* Pereira and Vaz from a Brazilian bird and *C. dubia*, in the number of head papillae.

***Aprocta corvicola* n. sp.**

(Fig. 12-13)

From behind the eye of *Corvus coronoides*, from the Musgrave Ranges. Males 12 to 20 mm. long, about 0.6 mm. in diameter; females 50 to 60 mm. long, 0.8 mm. diameter. Anterior end rounded; mouth circular; oral papillae not observed, small thistle-shaped vestibule leading to simple, narrow oesophagus; latter 0.65 mm. long in male, 0.7 mm. long in female, surrounded by nerve ring just behind its anterior end, 0.1 mm. from head in male, 0.15 mm. in female.

Male—Tail 0.2 mm. long, blunt, rounded. Neither papillae nor caudal alae present. Spicules equal, 0.28 to 0.32 mm. long.

Female—Uteri uniting very close to vulva, forming a short median uterus; vagina 0.1 mm. long; vulva 0.6 mm. behind head, about the middle of oesophageal region. Eggs thick-shelled, 45 to 50 μ by 30 μ , containing coiled larva.

The species differs in the position of the vulva from any other member of the genus the description of which we have been able to obtain.

***Pseudaprocta myzanthae* n. sp.**

(Fig. 14-15)

From *Myzantha flavigula* (yellow-throated minah) (Coll. Dr. Cleland), 75 miles north of Renmark, South Australia. Only three females were taken, 23 to 24 mm. long.

Anterior end rounded, head with four submedian and two smaller lateral papillae. Dorsal and ventral papillae not seen. Cuticular ornamentation of

anterior end characteristic of genus festooned above and between cephalic papillae. Buccal cavity $20\ \mu$ long, 23 to $25\ \mu$ wide. Oesophagus 0.6 to 0.65 mm. long; nerve ring at 0.15 mm. and excretory pore at 0.23 mm., from head end.

Tail rounded, 0.2 to 0.23 mm. long, ending in papilla-like tip, and bearing pair of large rounded papillae in lateral positions, $30\ \mu$ from tip. Anus well marked; rectum strongly cuticularised.

Vulva not salient, 0.3 to 0.4 mm. from head. Ripest eggs in vagina 50 to $55\ \mu$ by $30\ \mu$, thick-shelled, containing larvae.

The differences between the two species of the genus previously described, *P. gubernacularia* by Shikhobalova and *P. decorata* by Li, depend (according to Li) on male characters. Since the present material consists only of females, it is impossible to continue the comparison on these lines; in our specimens, however, the cephalic festoons appear to be somewhat differently arranged in ventral and dorsal positions, and the eggs are much larger than in Li's species, while the female tail is longer than in that described by Shikhobalova. From these distinctions and the difference in distribution of the hosts, we assume it to be a new species.

DIPLOTRIAENA Railliet and Henry

The characters of this genus have been discussed by Li (1933, 193). As he points out, the features of most value systematically are the tridents and the spicules. In our material few males are present, and we have several species represented by female worms only, so that we have been compelled to rely on differences in lengths of body and trident and the relation of the latter to the position of nerve ring. In many of our specimens the posterior tips of the tridents were not clearly defined, so that it was often uncertain whether the middle prong was shorter than the lateral ones.

To facilitate comparison of our species the following table is appended, all measurements being in millimetres except where otherwise stated:

	alpha	beta	gamma	delta	epsilon		zeta
	♀	♀	♀	♂	♀	♂	♀
Length	70-90	56-69	58-68	34	to 45	to 20	36
Breadth	.95	.84		.45	.55	.45	.8
Antr. Oesoph.	.32	.47	not	.3	.4	.3	} 2.6
Post. Oesoph.	5.7	5-6?	divided	2.8	?	2.0	
Tridents	.12	.17	.09	.08, .095		.13	.15
Head-Nerve Ring	.25	.33	.22	.18		.22	.32
Head-Vulva	.7	.6	.4		.68		.5
Eggs, breadth	$34\ \mu$		$14\ \mu$		$25\ \mu$		
" length	$50\ \mu$		$30\ \mu$		$40-41\ \mu$		
Tail	$90\ \mu$						
Spicule 1				Broken		.6-.7	
" 2				Broken		1.2-1.4	

Diplotriaena alpha n. sp.

(Fig. 16)

From *Strepera graculia*, Mount Irvine, South Australia (Coll. Professor Cleland). Two females from the peritoneum, one 70 and the other 90 mm. long, both about 0.96 mm. wide. Anterior end rounded, with two small lateral and two smaller submedian papillae. Tridents 0.11 mm. long in longer worm and 0.13 mm. in shorter worm; in the latter the two tridents are not similar in shape, the median prong being the longest on one side, but the three of equal length on the other side. In the larger worm both tridents are alike and have three equal prongs. Anterior narrow part of oesophagus 0.3 to 0.35 mm. long, surrounded by nerve ring on its second half, 0.25 to 0.26 mm. from head; posterior part of oesophagus ending about 6 mm. from head. Vulva 0.7 mm. from head, *i.e.*,

shortly after beginning of second part of oesophagus. Uteri uniting 1.8 mm. behind vulva; vagina straight. Eggs, $35\ \mu$ by $50\ \mu$. Tail rounded, anus $90\ \mu$ from tip.

***Diplotriaena beta* n. sp.**

(Fig. 17)

From *Corvus coronoides*, collected by the late Dr. T. L. Bancroft at Eidsvold. Two females present, 56 and 69 mm. long, 0.84 mm. wide. Anterior end rounded with four low papillae in submedian positions. Tridents 0.16 and 0.19 mm. long. Anterior part of oesophagus 0.43 to 0.5 mm. long; termination of second part not seen, owing to conditions of specimens. Nerve ring 0.32 to 0.34 mm. from head. Vulva on shoulder-like prominence of body 0.59 to 0.6 mm. from head end, *i.e.*, just posterior to beginning of second part of oesophagus. Eggs absent.

***Diplotriaena gamma* n. sp.**

(Fig. 18-19)

From *Spres superbus*, the Abyssinian starling, obtained from the Adelaide Zoological Gardens through the courtesy of the South Australian Museum. Two females present, 58 and 68 mm. long. Head rounded, with four large submedian and two smaller lateral papillae. Tridents $90\ \mu$ long, middle prong shortest, posterior tip of each prong somewhat enlarged. In specimen 58 mm. long nerve ring 0.22 mm. from head. Oesophagus apparently of the "undivided" type, its posterior end indistinguishable because of the twisted mass of uteri obscuring it. Vulva at 0.4 mm. from head end, lip salient. Uteri uniting about 1.2 mm. from vulva. Eggs, $30\ \mu$ by $40\ \mu$.

***Diplotriaena delta* n. sp.**

(Fig. 20-21)

From *Malurus lamberti* collected by Dr. J. B. Cleland at Ooldea. One male only present, 34 mm. long, 0.45 mm. wide. Anterior end with four large submedian papillae. Tridents bossed, of unequal length, 95 and $80\ \mu$ long, the three prongs being of almost equal lengths. Oesophagus of two parts, anterior 0.3 mm. long, posterior 2.5 mm.; nerve ring 0.18 mm. from head. Posterior end is broken off, one broken spicule showing.

***Diplotriaena epsilon* n. sp.**

(Fig. 22-23)

From *Cracticus destructor*, collected at Brisbane by Dr. F. S. Roberts. Several males and females present, males up to 20 mm. and females up to 45 mm. in length, breadths respectively 0.45 and 0.55 mm.

Anterior end without apparent papillae. Tridents about $130\ \mu$ long in male; branches more or less equal length, with bosses. Oesophagus of two parts, anterior 0.3 mm. long in male, 0.4 in female, the termination of posterior obscured, in male probably 2 mm. from head end. Nerve ring in male 0.22 mm. from head end.

Tail of male rounded; two pairs of papillae before and two behind the subterminal cloaca, the two post-cloacal almost terminal in position. Spicules unequal; one 1.2 to 1.4 mm. long, tapering suddenly to end in a short spike; the other 0.6 to 0.7 mm., twisted, ending in a broad tip.

Vulva in region of beginning of second part of oesophagus, lips slightly salient. Eggs 40 to $41\ \mu$ by $25\ \mu$, thick-shelled, with coiled larvae.

These appear to be much slighter worms than those from *Strepera* or *Corvus*; the eggs are relatively wider and there was no sign of submedian papillae.

Diplotriaena zeta n. sp.

(Fig. 24)

From the body cavity of *Acanthogenys ruficularis*, the spiny-cheeked honey-eater, from Monarto, South Australia (coll. Professor Cleland).

One female worm present, 36 mm. long, 0.8 mm. wide. Tridents 0.15 mm. long, with anterior tip prolonged to a point, not rounded as in *D. delta*. Nerve ring 0.32 mm. from head end; oesophagus of undivided type, 2.6 mm. long. Vulva .5 mm. from head end.

EULIMDANA CLAVA (Wedl) Founikoff 1934

Several specimens of this species were found in the type host, *Columba livia*, from Adelaide. The females are up to 24 mm. in length, the measurements and structure agree exactly with Founikoff's description.

FILARIA (s.l.) sp.

(Fig. 25)

From *Acanthogenys ruficularis*, from Burnett River District, collected by the late Dr. T. L. Bancroft. One male and parts of several females not including the posterior end, were present. Male 7.5 mm. long, 0.13 mm. wide; longest female part apparently more than a quarter of the body length, 10 mm. long, 0.32 mm. wide. Females so badly preserved that it is impossible to see internal organs. Male shows a rounded head, no head papillae, a small mouth leading to a 0.38 mm. long oesophagus surrounded just anterior to its mid-length by the nerve-ring. Tail rounded 0.7 mm. long, bearing no caudal alae or papillae. Spicules tapering, almost equal in length, 50 μ long. Because of the incomplete description it was considered unwise to assign the worm to any genus. Microfilariae were recorded from the blood of this host species in New South Wales by the senior author, in 1912.

FILARIA (s.l.) sp.

(Fig. 26)

The posterior end of a male worm and the anterior end of a female were collected from *Calopsittacus novae-hollandiae* from New South Wales. Female fragment 2.9 mm. long, .13 mm. wide; male 3.8 mm. long, .13 mm. wide. Head smooth, rounded, showing no papillae. Vestibule supported by a narrow chitinous ring. Length of oesophagus and positions of anterior organs not ascertained. Male tail rounded at tip, 60 μ long, no papillae visible under oil immersion; spicules unequal, 60 μ and 45 μ in length, narrowing towards tips.

This species differs from *Carinema dubia* from *Pseudopsittacus mclennani* in that the head bears no papillae and the spicules are unequal. It has many features in common with *Filaria* (s.l.) sp. from *Acanthogenys ruficularis*, but since in that form the spicules are equal and no peri-buccal chitinous ring was observed, and in view of the different hosts, it is considered wise not to identify the worms with one another.

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