SOME PARASITIC NEMATODES IN THE COLLECTION OF THE AUSTRALIAN MUSEUM.

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(Figures 1–26.)

A small collection of unnamed parasitic nematodes belonging to the Australian Museum was submitted to us for examination. Those from marsupials have already been dealt with (Johnston and Mawson, 1940), the remainder, from reptiles, birds and rodents, are recorded in this paper. The greater part of the collection was made by Mr. E. Troughton while visiting South Australia on a collecting trip on behalf of the Museum. Two other members of the staff, Messrs. F. A. McNeill and H. S. Grant, also contributed to it. Some material belonging to the old collections of the Museum and obtained by G. Masters and G. Krefft was also examined, but its condition was rather unsatisfactory. The host names, locality, parasites identified, and Museum registered number, are as follows:

Reptiles.

Varanus varius Shaw, from Birchmore Lagoon, Kangaroo Island: *Physaloptera antarctica* var. *typica* Irwin-Smith (W1061).

Elseya dentata Gray, Queensland: *Spironoura elseyae* n. sp. (G11106).

Birds.

Malurus leuconotus Gould, Mt. Lyndhurst, South Australia: Two cysts of *Filaria* (s.l.) sp. (W1077).

Cysticola exilis Vig. and Horsf., Moa (Banks) Island, Torres Strait: *Diplotriaena tricuspis* Fedtsch. (W989).

Chibia bracteata Gould, Russell Island, Queensland: *Hamatospiculum chibiae* n. sp. (W1611).

Ninox boobook, Hayman Island, Whitsunday Group, Queensland: *Hamatospiculum mcneilli* n. sp. (W.3147).

Nycticorax caledonicus Gmelin, Bulli district, N.S.W.: *Contracaecum nycticoracis* n. sp. (W3236).

Polyteles alexandriae Gould, Beecroft, N.S.W. (in captivity): *Ascaridia columbae* (Gmelin) (W3238).

Strepera fuliginosa Gould, Deep Creek, Kangaroo Island: *Oxyspirura streperae* n. sp (W1075).

Halcyon pyrrhopygius Gould, Mt. Lyndhurst, South Australia: *Hamatospiculum halcyonis* n. sp. (W1074, W1070, and W1063).

Halcyon sanctus Vig. and Horsf., Kingscote, Kangaroo Island: *Hamatospiculum halcyonis* n. sp. (W1076).

Corvus, probably *cecilae* Matthews, Mt. Lyndhurst, South Australia: *Acuaria corvicola* n. sp. (W1057).

Mammals.

Melomys banfieldi De Vis, Dunk Island, Queensland: *Physaloptera banfieldi* n. sp. (W3237).

Rattus assimilis Gould, Deep Creek, Kangaroo Island (W1060); Birchmore Lagoon, Kangaroo Island (W1055); *Physaloptera troughtoni* n. sp.

Mus musculus Linn., Moree, New South Wales: *Protospirura muris* (Gmelin) (G10983).

"Rats", probably *Rattus rattus* var., Lismore, New South Wales: *Protospirura muris* (Gmelin) (W893).

"Brush-tailed Rat"—almost certainly the polyprotodont marsupial *Phascogale penicillata* (Shaw)—Locality not stated, but probably the Sydney district: *Denticulospirura dentata* n.g., n. sp. (G11109).

Denticulospirura dentata n.g., n. sp.

(Fig. 1.)

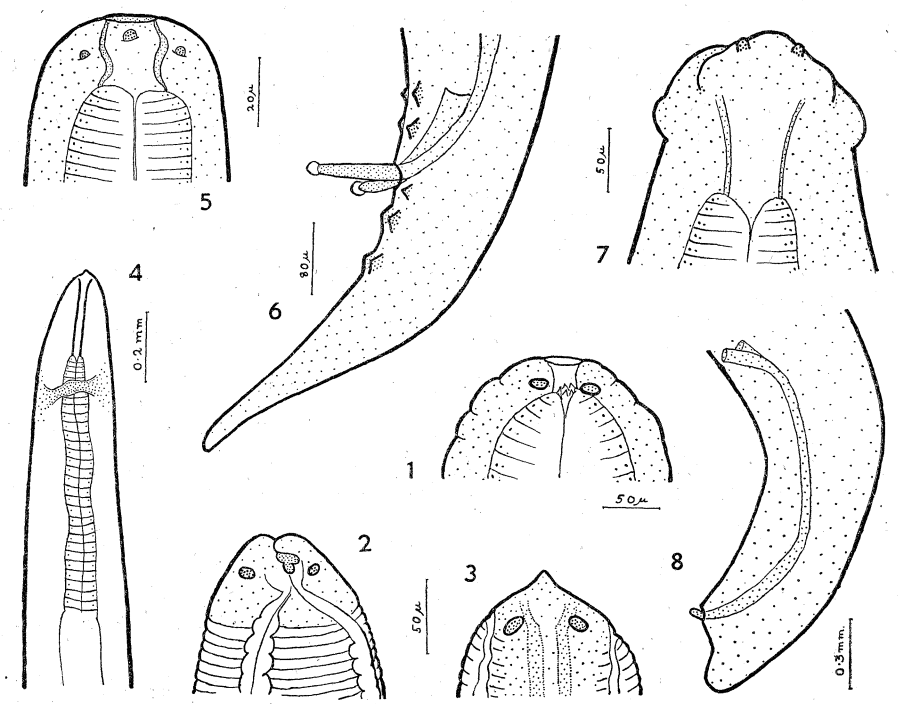
From a "Brush-tailed rat", probably a marsupial, *Phascogale penicillata*; G11109. Single immature female present 52 mm. long, ·88 mm. wide. Anterior end more or less rounded; no lips; four submedian oral papillae. Mouth leading to cylindrical vestibule 20μ long, with six triangular teeth at its base. Oesophagus straight, ·24 mm. wide, surrounded by nerve ring ·36 mm. from head. Excretory pore ·48 mm. from head, associated with sac-like "gland" or "bladder"; latter ·48 mm. long, lying parallel with oesophagus posteriorly from excretory pore. Tail ·1 mm. long, rounded except for terminal spine 9μ long; body width at level of anus ·11 mm.

The characters of the head do not appear to agree with those of any Spiruroid genus yet described. The head characters are so distinctive that, although our specimen is but a young female, we consider it necessary to erect for it a new genus, *Denticulospirura*, whose characters are as follows: Spirurinae: anterior end rounded, posterior tapering; no lips; four submedian oral papillae. Mouth leading into circular vestibule with six teeth at its base; oesophagus straight. Male unknown. Female with tail ending in short spike; position of vulva unknown. Type *D. dentata* n. sp.

Acuaria corvicola n. sp.

(Figs. 2–4.)

A single female worm (Reg. No. W1057) found in the stomach of a crow, probably *Corvus cecilae*, from Mt. Lyndhurst, South Australia. Collected by Mr. E. Troughton.



Figs. 1-8.—1. *Denticulospirura dentata*; 1. head. 2-4. *Acuaria corvicola*; 2. head, ventral view; 3. head, lateral view; 4. anterior end. 5-6. *Oxyspirura streperae*; 5. head of female; 6. male tail. 7-8. *Spironoura elseyae*; 7. head; 8. male tail. Figs. 2 and 3 to same scale.

It is 19·6 mm. long, ·36 mm. wide. Body transversely striated except at the four cordons. Each of the two lateral lips with two large papillae. Cordons nearly reaching mid-body. vestibule ·23 mm. long; oesophagus ·75 mm. long, nerve ring surrounding it at ·35 mm. from head. Tail tapering, rounded extremity, ·3 mm. long. Vulva just posterior to middle of body, 9·9 mm. from head; vagina extending posteriorly. Eggs about 20μ by 30μ, with embryos.

Oxyspirura streperae n. sp.

(Figs. 5–6.)

Collected by Mr. E. Troughton from under the eyelids of *Strepera fuliginosa* at Deep Creek, Kangaroo Island (Reg. No. W1075). Males about 12–13 mm. long, ·22 mm. wide; females 15–18 mm. long, ·31 mm. wide. Body of uniform width, tapering near both ends, anterior end rounded; tail long, pointed. Circular mouth surrounded by one pair of lateral and two pairs of sub-median papillae; strongly chitinized buccal cavity wider in its mid-length than at either end, 35μ long, 28μ wide at middle. In young females oesophagus narrower anteriorly to excretory pore. Oesophagus in adult without division into anterior and posterior parts; 1·3 mm. long in a female 16·4 mm. long, ratio about 1:13 of body length. Nerve ring ·15 mm. and excretory pore ·28 mm. from head end.

Male: caudal papillae large, prominent, three pairs preanal, three pairs postanal, the most anterior pair of postanals being more laterally situated. Longer spicule, ·4 mm., cylindrical proximally, flattened distally, with narrow alae towards its tip in distal third; shorter spicule coarse, blunt, ·16 mm. long; points of both with membranous tips. Tail ·35 mm. long.

Female: anus ·4 mm., and vulva 1 mm., from tip of tail. Eggs 40μ by 20–24μ, thick-shelled, embryonated.

This species does not agree with *O. mansoni* (Cobbold), in the shape and size of spicules and in the shape of the buccal capsule. *O. acanthochaerae* Johnston 1912 is shorter, has the nerve ring differently situated, and a different arrangement of the vulva and anus. *O. sigmoidea* (Molin) is shorter and wider, and has a coiled tail and differently arranged caudal papillae in the male.

Physaloptera banfieldi n. sp.

(Figs. 9–10.)

From *Melomys banfieldi*, collected by the late E. J. Banfield at Dunk Island, north Queensland (Reg. No. W3237).

Very short worms; male 10–12 mm. long, 1 mm. wide; females 15–20 mm. long, 1·5 mm. wide. Cephalic collarette not deeply reflected over lips. Each lip with two median teeth of approximately equal height, inner tripartite; no other teeth present. Oesophagus 2·8 mm. long in male, 3·5–4 mm. in female (a fifth to a quarter of body length), anterior muscular part ·4 mm. long in male, ·4–·5 mm. in female (a seventh and an eighth oesophageal length respectively). Nerve ring around posterior end of muscular part of oesophagus; cervical papillae small, hook-like, about ·45 mm., behind nerve ring in young female.

Male: alae wide, voluminous, not joined posteriorly; cloaca ·55 mm. from tip of tail. Spicules ·55 and ·42 mm. long. Six pairs of pedunculate papillae in groups laterally from cloaca; three sessile papillae immediately in front of cloaca; four immediately posterior to it; and two pairs on the ventral surface of tail, the second of them being midway along tail.

Female: vulva in oesophageal region; in a worm 15 mm. in length, with oesophagus 3·48 mm. long, vulva is 2·7 mm. from head, vagina 1·1 mm. long, egg chamber ·6 mm.; in worm 20 mm. in length, vagina ·6 mm. long, egg chamber ·9 mm. These dimensions support Miss Irwin-Smith (1922) in her suggestion that the actual measurements of different parts of the female genital tract in *Physaloptera* are of no diagnostic value; and, besides, the relative sizes of egg chamber and vagina vary with the number of eggs in the former. Two uteri; receptacula seminis short, broadly pyriform. Eggs 25μ by 41μ. The species is named in acknowledgement of the work of the late Mr. Banfield, who was

the author of interesting books on the natural history of Dunk Island, where he spent so many years of his life.

Physaloptera troughtoni n. sp.
(Figs. 11–13.)

From the stomach of *Rattus assimilis*, collected by Mr. E. Troughton at Birchmore Lagoon and Deep Creek, Kangaroo Island (Reg. No. W1055, W1060).

Long slender worms, males to 26 mm. long, females to 42 mm. Cephalic collarette not covering lips; each lip with two median teeth, the inner tripartite and shorter; no other teeth present. Four large sub-median papillae on lips. Oesophagus about 4·2–4·3 mm. long in both sexes; with anterior muscular part ·52 mm. and ·6 mm. long in male and female respectively; surrounded near base (·52 mm.–·56 mm. from lips) by nerve ring. Cervical papillae 1 mm. from head.

Male: bursa 2 mm. long; cloaca at about mid-length of bursa, ·9 mm. from tip. Four pair of pedunculated papillae laterally about level of cloaca; three sessile preanal and four sessile postanal papillae; behind these three pairs on ventral surface of tail, third pair about midway between tip and cloaca; central one of the three preanal papillae sometimes double. Spicules equal, tapering, ·36 mm. long. Ventral surface of tail bearing tubercles distributed as shown in Fig. 12.

Female: maximum width ·8 mm. Tail ·35 mm. long, conical. Two uteri uniting to form short common duct, leading to fusiform egg chamber and short vagina, opening just posterior to oesophagus. Eggs in vagina 40–43μ by 25–26μ.

This species closely resembles *P. muris-braziliensis* Diesing, differing from it in the position of the vulva, and in the shape of the bursa, whose more elongate form, the absence of a median ventral papilla and the more anterior situation of the three ventral pairs of papillae are distinguishing features of *P. troughtoni*.

Physaloptera antarctica Linstow var. typica Irwin-Smith.

From the intestine of *Varanus varius* caught near the Birchmore Lagoon, Kangaroo Island, by Mr. E. Troughton (Reg. No. W1061).

The worms agree very closely with the description given by Irwin-Smith (1922, 233). The row of denticles on each lip on either side of the median tooth consists in our specimens of more than the three teeth described by this author, and there appears to be a wider range in the branching of the four uteri from the common duct, in some cases the four diverging at the same level, others showing a strictly dichotomous arrangement as indicated in her figures. One specimen showed three uteri coming from the common duct, one of these bifurcating after a short distance. We assigned the worms to the variety *typica* because of their slender build.

Protospirura muris (Gmelin 1790).

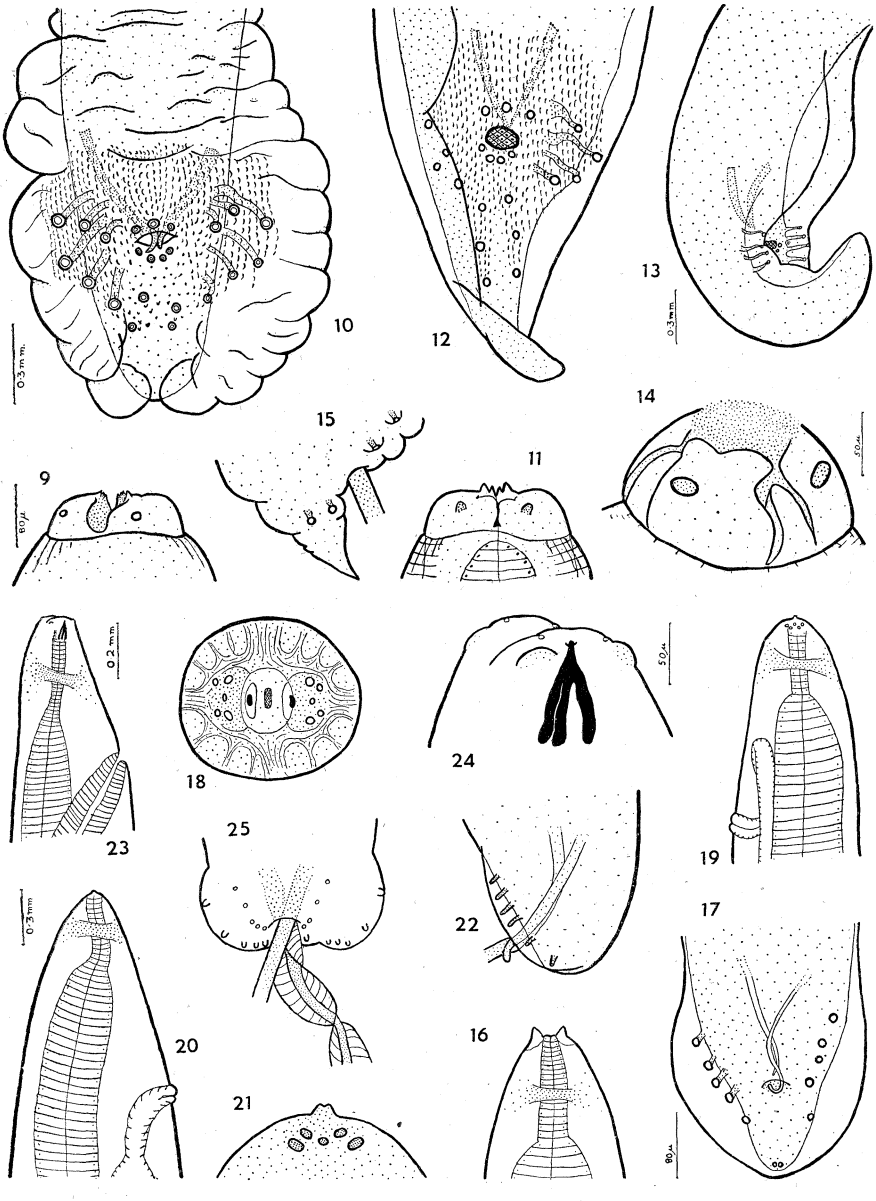
We have assigned to this species some female worms from a house mouse (*Mus musculus*) from Moree, New South Wales (Reg. No. G10983), and a collection of males and females from rats from Lismore, New South Wales (Reg. No. W893). We did not observe on the male tail a median preanal papilla nor a group of eight tiny papillae subterminally, which are apparently present in typical *P. muris*. This difference, however, was not considered sufficient to justify the erection of a new species.

Hamatospiculum mcneilli n. sp.
(Figs. 16–17.)

Collected by Mr. F. A. McNeill from the tissues adjacent to the skull of *Ninox boobook* at Hayman Island, Whitsunday Group (Reg. No. W3147).

Males: 30–40 mm.; females: to 80 mm. long; width ·8 and ·9 mm. respectively. Cuticle at anterior end thickened into epaulette structures as described for other species of the genus; the two lateral teeth beside the mouth are rather longer than those we have seen described for other members of the genus. Oesophagus about 10·4 mm. long in male, 15 mm. long in female; anterior narrower part ·8 mm. long in male, 1 mm. in female; nerve ring just in front of middle of this part.

Male: tail blunt, ·12 mm. long. Alae ·22 mm. long, widest at level of cloaca, meeting posterior to tip of tail. Four pairs of pedunculated preanal papillae in a row reaching from level of cloaca to ·1 mm. in front of it; one pair pedunculated papillae posterior



Figs. 9-25.—9-10. *Physaloptera banfieldi*; 9. head of female; 10. bursa of male. 11-13. *Physaloptera troughtoni*; 11. head; 12, posterior end of male, ventral view, one of alae folded over tail; 13. complete bursa, lateral view. 14-15. *Contracaecum nycticoracis*; 14. head; 15. male tail. Figs. 9, 11 and 15 to same scale; Figs. 10 and 12. 16-17. *Hamatospiculum mcneilli*; 16. anterior end of male; 17. male tail. 18-19. *Hamatospiculum halcyonis*; 18. head of female, anterior view; 19. anterior end of female. 20-22. *Hamatospiculum chibiae*; 20. anterior end of female; 21. head of male, lateral view; 22. male tail; 23-25. *Diplotriaena tricuspis*; 23. anterior end of female; 24. head of female; 25. posterior end of male. Figs. 16, 19 and 23 to same scale; Figs. 17, 18, 22 and 25; Figs. 21 and 24.

to anus, not reaching edge of alae; a pair of very small sub-terminal papillae ventrally. Shorter spicule wider, ·3 mm. long; the other, narrow, needle-like, 1·25 mm. long.

Female: vulva at varying distance posterior to end of first part of oesophagus, ·8–1·3 mm. from head. Eggs about 45μ by 30μ, thin-shelled and containing larvae.

As has been mentioned, the conical projections on head of this species are larger than those previously described for species of *Hamatospiculum*, resembling more closely those of *Monopetalonema*; the spicules, however, do not resemble those of members of the latter genus.

Hamatospiculum halcyonis n. sp.

(Figs. 18–19.)

Collected by Mr. E. Troughton from between the eyeballs and roof of the mouth of *Halcyon pyrrhopygius* (type host), at Mt. Lyndhurst, South Australia (Reg. Nos. W1070, W1074, W1063), and by the same collector from the subcutaneous tissues of the neck of *Halcynon sanctus*, near Kingscote, Kangaroo Island (Reg. No. W1076).

Only females collected, varying in length from 35 to 50 mm., tapering to rounded anterior end and blunt posterior end. Head characters as for genus, the epaulette-like structure referred to by Caballero (1937, 405) being well shown in anterior view of head, but not in lateral view. Mouth almost round. Anterior part of oesophagus ·3 mm. long, posterior part 9·7 mm., in a worm 50 mm. long, i.e. oesophagus one-fifth body length. Nerve ring around middle of anterior part of oesophagus, ·8 mm. from head in worm 35 mm. long, in which anterior part of oesophagus is ·25 mm. long.

Anus just in front of tip of tail, atrophied. Tail with two minute rounded sub-terminal papillae. Eggs thick-shelled, about 25μ by 40μ.

In the absence of males it is difficult to decide definitely whether these worms belong to *Hamatospiculum* or to *Monopetalonema*. In members of the latter genus as diagnosed by Freitas and Lent (1936) there is not necessarily a pair of cuticular epaulette structures laterally to the mouth. The species figured by these authors have much larger tooth-like projections on either side of the mouth than have our specimens. We have found in other kingfishers worms similar to those described above (but belonging to different species), and since these are accompanied by males, allowing their assignment to *Hamatospiculum*, we suggest that the worms now described belong to a new species of that genus.

The species most closely resembles *H. dicruri* Tubangui, from the Philippines, differing from it in the ratio of the two parts of the oesophagus and in the size of the eggs. These differences are not great, but in view of the absence of males in our material and the difference in distribution of the hosts, it is considered wiser to place the worms in a new species.

Hamatospiculum chibiae n. sp.

(Figs. 20–22.)

From the skin of the neck of the drongo, *Chibia bracteata*, from Russell Island, Queensland (Reg. No. W1611), collected by the late Dr. W. E. Paradice. We have also identified females of this parasite from the same host species collected by the late Dr. T. L. Bancroft in the Burnett River district.

Male 17 mm. long, ·4 mm. wide; female 65 to 75 mm. long, up to 1 mm. wide. Teeth at either side of mouth very small, not conical in lateral view, but flattened and slightly bifid at tip. Five papillae at either side of mouth on cuticular thickening. Anterior part of oesophagus ·36 mm. in male, ·45 mm. in female; posterior part 6·2 mm. long in male, but is obscured in female. Nerve ring about middle of anterior part of oesophagus.

Caudal alae present, not meeting posteriorly, supported by four preanal and two postanal pairs of elongate papillae. Cloaca 70μ from tip of tail. Spicules 2·3 and ·6 mm. long with bluntly rounded tips.

In female anus sub-terminal; vulva with salient lips in region of anterior end of posterior part of oesophagus, about 1·2 mm. from head. Eggs thick-shelled, 30μ by 50μ.

This species is very like *H. halcyonis* described above. It differs in the length of the worms, the size of the eggs. It differs from *H. dicruri* Tubangui in the number of caudal papillae and in the lengths of the spicules.

Diplotriaena tricuspis Fedtsch.

(Figs. 23–25.)

From the abdominal cavity of *Cysticola exilis*, collected by H. L. White at Moa (Banks) Island, Torres Straits (Reg. No. W989).

Several specimens including males and females in excellent state of preservation. Males up to 50 mm. long, females up to 80 mm. long, both about ·5 mm. wide, i.e. relatively slenderer than most species of the genus. Head with four large sub-median papillae and just anterior and lateral to each of these a very much smaller papilla, making eight in all. Oesophagus 3·5 mm. long in male, 4 mm. in female; its narrower anterior part ·3 mm. and ·4 mm. long in male and female respectively; surrounded just behind its middle by nerve ring. Tridents as figured, with middle branch much nearer to one of laterals in each case; anterior tips pointed; whole trident about 85μ long in both sexes.

Caudal alae absent in male. On ventral surface of tail five pairs of very small papillae near mid-line, seven pairs of larger ones laterally. Longer spicule ·9 mm. long, simple, tapering to a point; the other ·6 mm. long, provided with two twisted alae.

In female anus absent; rectum degenerate; posterior end rounded; vulva ·6 mm. from head; vagina long. Eggs in vagina 30μ by 45μ.

In view of the very slight differences between our specimens and *D. tricuspis* (as described by Seurat), namely, the shorter spicules and more numerous caudal papillae in the male, and the shorter tridents, and the wide distribution of *D. tricuspis*, we consider it wisest to assign our specimens to that species. Linstow in 1897 described *Filaria tricuspis* from *Cysticola exilis* and other birds from New Britain.

Filaria (s.l.) sp.

Two cysts (Reg. No. W989) from the white-backed wren (*Malurus leuconotus*) were collected by Mr. E. Troughton at Mt. Lyndhurst, South Australia. Each contains what appears to be one very long tightly coiled worm, with length more than 60 mm. and width about ·4 mm. The internal organs have degenerated, leaving a homogeneous granular material inside the cuticle. The ends of the specimen, partly untwisted, are rounded and bear no distinguishing features. The parasite is probably a Filariid worm.

Spironoura elseyae n. sp.

(Figs. 7–8).

From a tortoise, *Elseya dentata* (Reg. No. G.11106). The material was collected in Northern Australia by G. Masters and was recorded by Krefft (1871) as *Ascaris* sp. There are five worms present, three males and two females, all in a very shrunken state. The label is in Krefft's handwriting. Such characters as can be seen lead us to assign the parasites to *Spironoura*. The distinguishing features for the species (position of vulva, size of eggs, caudal papillae of male, shape of lips) are so indefinite in the specimens that we have not been able to compare them with previously described species. Since no member of the genus has yet been reported from Australian tortoises, we deem it advisable to erect a new species for these parasites.

Males 18·2 mm.–20·8 mm. long; with vestibule 108–117μ long; oesophagus 2·55 mm. long; spicules 1·65 mm. long, massive with wide alae; tail bluntly rounded, ·3–·32 mm. long; owing possibly to the shrivelled condition, no caudal papillae were observed.

Females 12 mm. (young specimen) and 22 mm. long; with vestibule 117–130μ long; oesophagus 2 mm. and 2·34 mm. long; tail conical, pointed, about ·28 mm. long; vulva not observed.

Contracaecum nycticoracis n. sp.

(Figs. 14–15.)

From the bill of *Nycticorax caledonicus* (Nankeen heron) from the Bulli district, New South Wales (Reg. No. W3236).

Single male present 20 mm. long, 1 mm. wide. Interlabia nearly as long as lips. Oesophagus 2·6 mm. long, its appendix ·65 mm. long; intestinal caecum 1·7 mm. long, cone-shaped, voluminous. Nerve ring ·45 mm. from head. Tail ·13 mm. long, narrowing suddenly posterior to anus. At least twelve pairs of preanal papillae, one pair of papillae ventrally immediately behind anus, and two pairs laterally half-way down tail. Even in ventral view no other papillae were seen on tail. Spicules broken, part remaining in body 3·36 mm. long.

The species differs from *C. microcephalum* in the wider head, relatively shorter oesophageal appendix, and in the number of caudal papillae.

Ascaridia columbae (Gmelin 1790).

This parasite (Reg. No. W3238) was found by Mr. H. S. Grant in great numbers in the intestine of a Queen Alexandra parrot, *Polyteles alexandrae*, which had been kept in captivity at Beecroft, New South Wales. The small intestine was for the greater part of its length distended by an almost solid plug of worms. It is apparently a case of over-infestation by a helminth not normal to the host, the nematode being a common parasite of domestic pigeons.

The males are 25 to 30 mm. long, the females up to 45 mm. The spicules are 1·8 mm. long in 25 mm. worm, 2 mm. in 30 mm. worm. Anterior to each of the small papillae figured by most authors at the level of the anterior border of the sucker are three additional papillae arranged in a row reaching anteriorly about ·8 mm. from the sucker. Eggs near the vulva are 45μ by 70μ.

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