SOME NEW SPECIES OF AVIAN CESTODES FROM INDIA WITH A DESCRIPTION OF *BIUTERINA INTRICATA* (KRABBE 1882).

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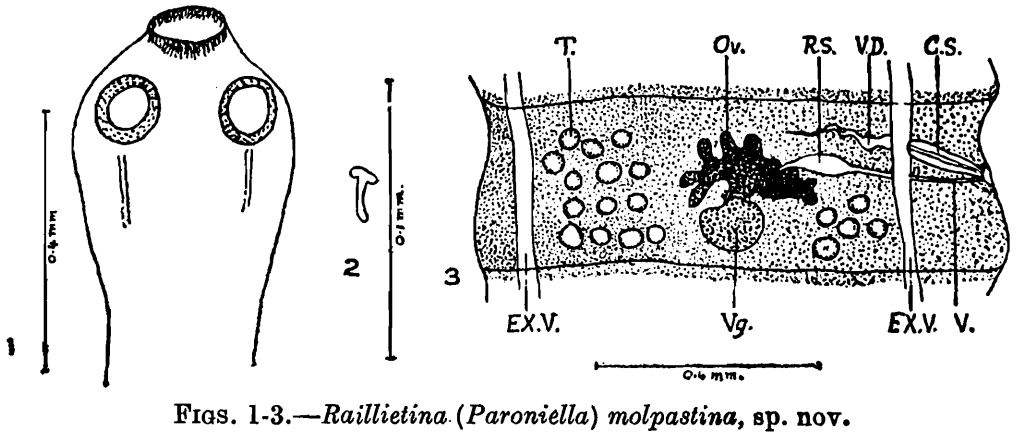
The present paper deals with five new species of cestodes collected from birds in the Central and United Provinces. A detailed description of *Biuterina intricata* (Krabbe 1882) is also appended.

We are greatly indebted to Dr. F. J. Meggitt for helping us with advice and literature for the preparation of this paper, and to the authorities of the Zoological Survey of India, for lending us the necessary references. The type-slides of the various cestodes described in this paper are deposited in the Indian Museum, Calcutta.

Raillietina (Paroniella) molpastina, sp. nov.

Several specimens of this worm were obtained from the intestines of two specimens of the Red-vented Bulbul, *Molpastes haemorrhous* (Gmelin).

Anatomy.—Maximum length of worm about 50-55 mm.; maximum width (posteriorly) about 1·5 mm. All proglottids much wider than long, varying in size from 0·1—0·6 mm. × 0·3—0·5 mm. in various regions of the strobilus. Scolex (fig. 1) 0·3 mm. × 0·35 mm.; rostellum 0·108 mm. in diameter, armed with a double crown of about 180 hooks of the



FIGS. 1-3.—*Raillietina (Paroniella) molpastina*, sp. nov.
FIG. 1.—Scolex.
FIG. 2.—Rostellar hook.
FIG. 3.—Entire mature proglottid.

Davaineid type. The shape of the hooks is shown in fig. 2; each hook is 15μ in length. Suckers 113μ × 93μ; armed with three rows of minute hooks. There is a short unsegmented neck region behind the scolex. Genital pores unilateral, situated a little anteriorly to the middle point of lateral proglottid margin. There are about 19 testes (fig. 3, *T.*) in each proglottid, arranged in two groups, one on either side of the ovary;

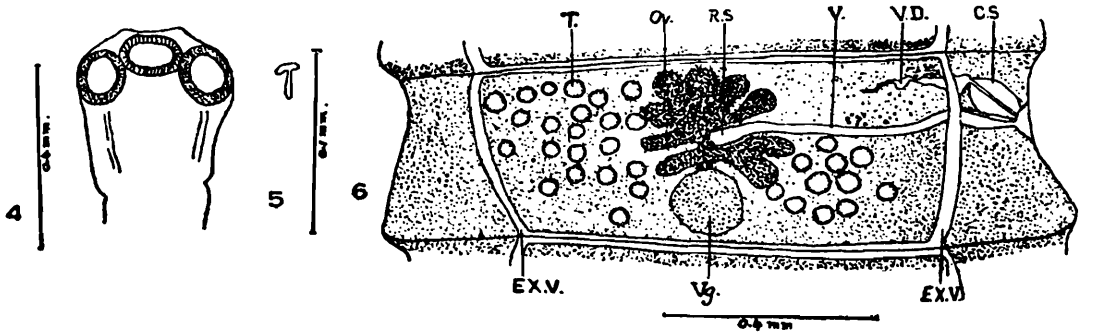
NOTE.—Explanation of lettering of text-figures *C. S.* Cirrus sac; *Ex. V.* Excretory vessel; *Ov.* Ovary; *P. U.* Paruterine organ; *R. S.* Receptaculum seminis; *T.* Testis; *U.* Uterus; *V.* Vagina; *V. D.* Vas deferens; *Vg.* Vitelline gland.

poral group consisting of 5 and aporal of 14 testes; diameter of each testis is 46μ. Cirrus sac (*C. S.*) cylindrical, not extending beyond the lateral excretory vessel of the poral side; 0·14 mm. in length and 0·04 mm. in width at its base; cirrus and its sac both unarmed. Vas deferens (*V D.*) a straight, slightly coiled tube. Ovary (*Ov.*) slightly poral, lobed. Vagina (*V.*) posterior to the cirrus sac, forming a dilated receptaculum seminis (*R. S.*) near its junction with the ovary. Vitelline gland (*Vg.*) rounded, situated posteriorly to the ovary. Shell gland small. The uterus first appears as an elongated sac on the poral side round about the receptaculum seminis but later includes the sex glands; in fully gravid proglottids it disintegrates into egg capsules, 44μ×33μ, each of which has a single egg; the capsules extend beyond the excretory vessels. Eggs (in canada balsam) have a diameter of about 21μ.

Raillietina (Paroniella) duosyntesticulata, sp. nov.

A few specimens, mostly in pieces, were obtained from the intestine of a specimen of *Xantholaema haematocephala* (Müller).

Anatomy.—The largest piece is 40 mm. long and probably the total length of the worm would be about 60 mm., the maximum width is 2·1 mm. All proglottids wider than long, varying in size from 0·058—0·264 mm.×0·29—2·1 mm. in different regions of strobilus. Genital pores unilateral, situated in the anterior third of the lateral margin of the proglottid. The genital ducts pass between the longitudinal excretory vessels. Scolex (fig. 4) measures 0·68 mm.×0·4 mm. Rostellum 114μ long, with a double crown of 234 Davaineid hooks. The form of the hooks is T-shaped (fig. 5). Each hook 17μ in length. Suckers 140μ ×120μ, armed with 5 rows of minute hooks. The unsegmented neck region is very short. 32-37 testes (fig. 6, *T.*) in each proglottid, situated



FIGS. 4-6.—*Raillietina (Paroniella) duosyntesticulata,* sp. nov.
FIG. 4.—Scolex.
FIG. 5.—Rostellar hook.
FIG. 6.—Entire mature proglottid.

laterally and posterior to the ovary; the poral group consists of 9-14 and the aporal of 23 testes; diameter of each testis 21μ. Cirrus sac (*C. S.*) 96μ×47μ, extending three-fourths the distance between lateral proglottid margin and the poral excretory vessel. Cirrus and its sac both unarmed. Vas deferens (*V D.*) in the form of a straight coiled tube. Ovary (*Ov.*) slightly aporal, deeply lobed. Vagina (*V.*) only slightly dilated near its junction with the ovary. Vitelline gland (*Vg.*) large, round. Shell gland small. The uterus makes its appearance as a sac round the ovary but later fills the entire proglottid extending

beyond the excretory vessels and breaking up into egg capsules, 11μ ×8μ, and containing a single egg measuring 10μ×7μ (in canada balsam).

Systematic Position.—Both the worms described above belong to the genus *Raillietina* Führmann 1920, since they possess a rostellum armed with numerous T-shaped hooks, and in both the uterus breaks into egg capsules. The genital pores are unilateral and each of the egg capsules contains a single egg. They, therefore, belong to the subgenus *Paroniella* Führmann 1920. A list of the species of this subgenus was recently published by Führmann (1932); *R. acanthovaginata* Purvis 1932 from a fowl is not included in this list and *Raillietina rangoonica* Subramaniyam (1928), should, in our opinion, also be referred to this subgenus. On referring to the key to the species of *Davainea* by Meggitt (1921) and the descriptions of these species given by Lopez-Neyra (1931) while proposing a new classification for this group of cestodes which, however, is not accepted by Baer (1931) and Führmann (1932), it is found that *R.* (*P.*) *sphecotheridis* has accessory rostellar spines, *R.* (*P.*) *magninumida* and *R.* (*P.*) *urogalli* both possess an armed cirrus, *R.* (*P.*) *reynoldsae* has a spiny collar on the scolex, the rostellar hooks in *R.* (*P.*) *rhynchota* form a rosette with eight limbs, *R.* (*P.*) *facile* has a very small number (9) of testes, *R.* (*P.*) *numida*, *R.* (*P.*) *compacta*, *R.* (*P.*) *cruciata* have a relatively longer cirrus sac, *R.* (*P.*) *fecunda* has a larger number of rostellar hooks of a smaller size, *R.* (*P.*) *paradisea* has a larger number of testes, the cirrus sac is relatively smaller in *R.* (*P.*) *corvina* and a smaller number of rostellar and a larger number of acetabular hooks, *R.* (*P.*) *rangoonica* has smaller rostellar hooks and fewer testes and finally *R.* (*P.*) *acanthovaginata*[1] has a larger number of rostellar hooks of a smaller size and a larger cirrus sac. It is, therefore, evident that the two worms described above differ from all other known species of this subgenus. Unfortunately we have not been able to consult the descriptions of *R.* (*P.*) *conopophilae* and of *R.* (*P.*) *polycalcaria*, both from Passeriform birds.

SPECIFIC DIAGNOSES.

Raillietina (Paroniella) molpastina, sp. nov.

Length 50-55 mm., maximum width 1·5 mm.; scolex with a double crown of 180 hooks on the rostellum, length of each hook 15μ; suckers armed with three rows of minute hooks; testes 19 in number, each 46μ in diameter; cirrus sac just reaching the lateral excretory vessel of the poral side; eggs (in canada balsam) 21μ×20μ.

Host.—Red vented Bulbul, *Molpastes haemorrhous* (Gmelin).

Habitat.—Intestine.

Locality.—Nagpur, C. P., India.

Raillietina (Paroniella) duosyntesticulata, sp. nov.

Length about 60 mm., maximum width 2·1 mm.; rostellum armed with 234 hooks, each 17μ in length; suckers armed with 5 rows of minute hooks; cirrus sac extends to a distance equal to three-fourths the dis-

[1] We are indebted to Dr. F. J. Meggitt for furnishing us with a description of *R.* (*P.*), *acanthovaginata* Purvis 1932.

tance between the lateral proglottid margin and the poral lateral excretory vessel ; eggs (in canada balsam) 10μ×7μ.

Host.—*Xantholaema haemacephala* (Müller).

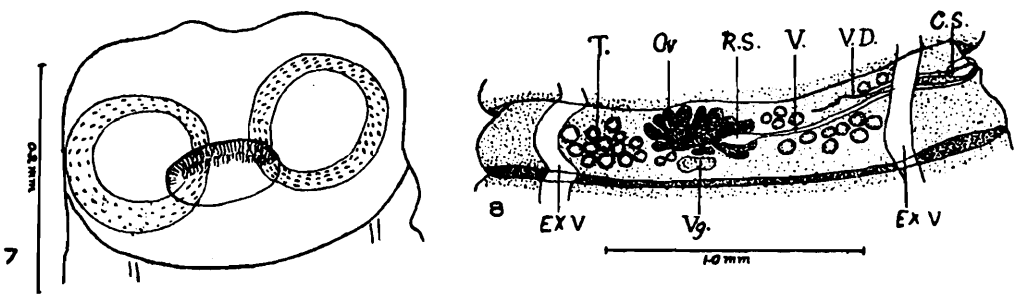
Habitat.—Intestine.

Locality.—Nagpur, C. P., India.

Ophryocotyloides monocantis, sp. nov.

One flattened and six unflattened specimens of this cestode collected from a Tree Pie, *Dendrocitta rufa* (Scop.). We are indebted to Mr. S. C. Verma of the Zoological Department, University of Allahabad, for this material.

Anatomy.—Total length of the worm 40 mm. with a maximum width 2·42 mm. The entire strobilus consists of about 500 proglottids varying in size from 0·024—0·701 mm.×0·22—1·5 mm. in different regions of the strobilus. All proglottids wider than long. Genital pores unilateral. Scolex (fig. 7) of the Davineid type ; 0·2 mm. in length, with a maximum width of 0·285 mm. Rostellum, 0·1 mm.×0·043 mm., armed with two rows of minute hooks, each hook being 8μ in length. Suckers, 0·122 mm.×0·108 mm., armed with three rows of minute hooks. 30 to 35 testes (fig. 8, *T*), of a diameter of 60μ, in each proglottid, situated laterally



FIGS. 7-8.—*Ophryocotyloides monocantis*, sp. nov.
FIG. 7.—Scolex.
FIG. 8.—Entire mature proglottid.

and posteriorly to the ovary. There is approximately an equal number of testes on each side of the ovary. Cirrus sac small, just reaching the nerve, 0·128 mm. long and 40μ broad at its base. It contains a straight unarmed cirrus, which is continued into a straight vas deferens (*V D.*). Ovary (*Ov.*) slightly aporal, occupying more than half the length of proglottid and almost more than a third of the width between the lateral excretory canals. In a fully mature segment, the ovary is still larger and occupies the entire length and half the width of the proglottid. Receptaculum seminis present. Vitelline gland (*Vg.*) rather small ; shell gland still smaller. Uterus sac-like, occupying the whole proglottid, extending beyond the lateral excretory vessels nearly up to the lateral proglottid margins ; persistent and not breaking into egg capsules. The eggs (in canada balsam) 27μ×21μ ; embryos 11μ×9μ.

Systematic position.—The presence of a rostellum armed with Davaineid hooks and a persistent uterus place this worm in the subfamily Ophryocotylinae Führmann 1907, and owing to the unilateral genital pores it has to be referred to the genus *Ophryocotyloides* Führmann 1920. This species differs from others (*vide* table of characters

of species by Moghe (1933) in the size of the rostellar hooks, in having hooks of one size only and in the number of testes, and we propose for it the name, *Ophryocotyloides monocantis* with the following specific diagnosis:—Length 40 mm., maximum width 2·42 mm.; restellum armed with two rows of equal hooks, each 8μ in length; suckers armed with three rows of minute hooks; testes 30 to 35 in number, each 60μ in diameter; eggs in balsam 27μ×21μ.

Host.—Tree Pie, *Dendrocitta rufa* (Scop.).

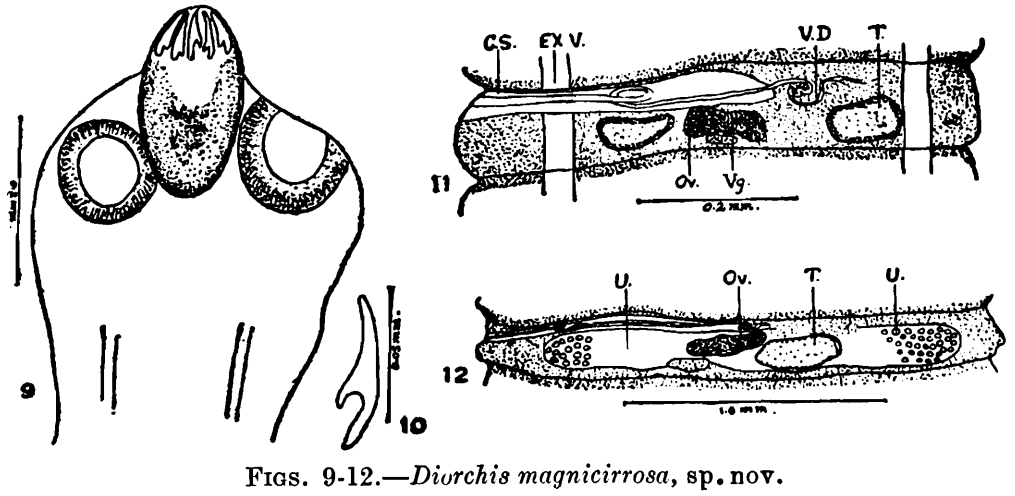
Habitat.—Intestine.

Locality.—United Provinces, India.

Diorchis magnicirrosa, sp. nov.

Three mounted slides of entire worms were given to one of us (M. A. M.) by Mr. S. C. Verma of Zoology Department, University of Allahabad. The host was described as a 'Dove' and it is not clear which particular species of the family Columbidae it represents. We are indebted to Mr. Verma for giving us this material.

Anatomy.—Total length of worm 225 mm. with a maximum width of 0·65 mm. Proglottids 0·1 to 0·15 mm. in length and 0·525 to 0·625 in width in the different regions of the strobilus. All segments wider than long. Genital pores unilateral, genital ducts passing dorsally to the longitudinal excretory vessels. Scolex (fig. 9) 0·44 mm. in length and 0·4 mm. in maximum width. Rostellum 0·224 mm.×0·165 mm. with a single row of 10 hooks; each hook is 60μ in length and has the shape shown in fig. 10. Suckers 0·16 mm.×0·128 mm., unarmed. Scolex followed by a short unsegmented region. Two testes (fig. 11, *T*)



FIGS. 9-12.—*Diorchis magnicirrosa*, sp. nov.

FIG. 9.—Scolex.

FIG. 10.—Rostellar hook.

FIG. 11.—Entire mature proglottid.

FIG. 12.—Entire gravid proglottid.

in each proglottid, one on either side of the ovary which is centrally placed; aporal testis larger of the two. Cirrus sac (*C. S.*) reaches beyond the centre of the proglottid; cirrus straight near the lateral margin, but bent on itself in the middle of the cirrus sac, inner end of cirrus sac dilated to form a vesicula seminalis. Ovary (*Ov.*) situated in the centre of proglottid between the two testes; very small in size in early mature proglottids, but in fully mature ones of the same size as

the testes. No receptaculum seminis. Vitelline gland (*Vg.*) situated posteriorly to ovary. The uterus at first appears as a narrow elongated sac round about the testes but later spreads and occupies the entire proglottid. (Fig. 12.) Eggs (in canada balsam) 21μ×20μ and the onchospheres 10μ×9μ.

Discussion.—The presence of rostellum armed with 10 hooks of the Hymnolepid type and the presence of two testes in each proglottid, place this worm in the subfamily Hymenclepidinae and in the genus *Diorchis*. A list of the species of *Diorchis* is given by Führmann (1932) while descriptions of the species except of *D. longicirrosa* Meggitt 1927, in which the hooks are absent and in which both the testes are aporal to the ovary and of *D. spiralis* Szpotanska 1931, were published by Mayhew (1929).

The species herein described resembles *D. spinata* Mayhew (1929), *D. kodonoides* Mayhew (1929) and *D. spiralis* Szpotanska (1931) in having a long cirrus sac, but it can be distinguished from *D. spinata* Mayhew, and *D. kodonoides* Mayhew in having longer rostellar hooks and from *D. spiralis* Szpotanska in the absence of a spiral sphincter muscle on the vaginal aperture. We regard it, therefore, as a new species and propose the name *Diorchis magnicirrosa*, with the following specific diagnosis :—

Length 225 mm., maximum width 0·65 mm. ; rostellum 0·224×0·165 mm., rostellar hook 60μ in length ; suckers 0·160×0·128 mm. ; ovary between the two testes ; cirrus sac reaching beyond the centre of the proglottid. Eggs (in canada balsam) 21μ×20μ.

Host.—Dove.

Habitat.—Intestine.

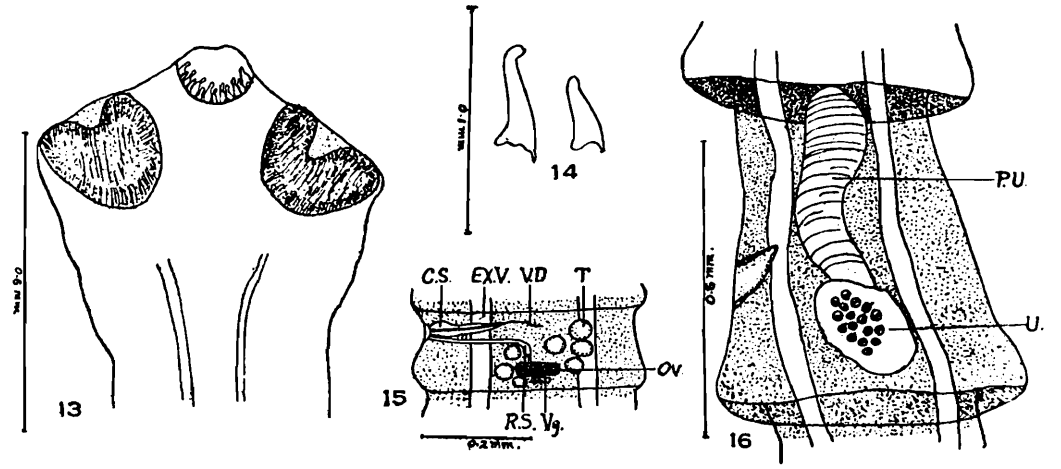
Locality.—United Provinces, India.

Paruterina septotesticulata, sp. nov.

Five scolices and several pieces were found in the intestine of *Coracias indica* (Linn.). These on examination proved to be a new species of the genus *Paruterina* Führmann 1906. No species of this genus has so far been recorded from Coraciiformes (*vide* list by Führmann 1932), and no species has so far been recorded from India (Southwell 1930).

Anatomy.—Total length of worm probably 55 to 60 mm. with a maximum width of 0·638 mm., approximately 200 proglottids. The gravid proglottids are the longest, 0·695×0·537 mm., while the early gravid proglottids are the widest, 0·221 mm.×0·638 mm., the measurements of mature proglottids are 0·157 mm.×0·406 mm. Scolex (fig. 13) 0·429 mm. in length and 0·663 mm. in maximum width, forms the broadest part of the entire worm. Rostellum, 0·132 mm. in diameter, armed with 32 hooks arranged in two rows. The hooks of the two rows have the shape shown in figure 14, and measure 43μ and 31μ respectively. Suckers nearly globular, 0·246 mm. in diameter. The scolex is followed by an unsegmented region, 0·472 mm. in length. Genital pores irregularly alternating, genital ducts lying between the longitudinal excretory vessels. Seven testes (fig. 15 *T*) in each proglottid, arranged in two groups situated laterally and posteriorly to ovary ; three testes poral, four aporal, each 37μ in diameter. Cirrus sac (*C. S.*) 0·151 mm. in length and 31μ in width at its base, extending beyond the poral lateral

excretory vessel. Vas deferens (*V D.*) simple, narrow, wavy. Vagina a narrow tube opening into a genital atrium, near the ovary slightly dilated to form a small receptaculum seminis (*R. S.*). Ovary (*Ov.*) slightly aporal. Small vitelline gland (*Vg.*) situated posterior to ovary. The uterus commences to appear as a sac round the female complex and in its fully formed condition, forms a spherical sac in the middle of the proglottid nearer its posterior border and is anteriorly attached to a paruterine organ (fig. 16, *P. U.*) in which the eggs finally pass. The



FIGS. 13-16.—*Paruterina septotesticulata*, sp. nov.
FIG. 13.—Scolex.
FIG. 14.—Rostellar hook.
FIG. 15.—Entire mature proglottid.
FIG. 16.—Entire gravid proglottid.

eggs, in the paruterine organ, are all stored up at one place, forming a compact mass, round which the paruterine organ is specially dilated. This dilatation is near the uterus and thus is not an anterior dilatation as in *Sphaeruterina* Johnston 1914. The eggs (in canada balsam) are 23μ in diameter and the contained onchosphere 14μ in diameter.

Discussion.—The presence of a rostellum armed with a double row of Hymenolepid hooks and a longitudinally elongated paruterine organ places this worm in the subfamily Paruterininae Führmann 1907, and in the genus *Paruterina* Führmann 1906. A list of the species of this genus is given by Führmann (1932) and a table of characters of most of these species by Skrjabin (1914). *P. angustata* Führmann 1906, and *P. guinensis* Joyeux & Baer 1928, have unilateral genital pores and thus form a group by themselves. Of the remaining species of *Paruterina* with irregularly alternating genital pores, *P. melierax* (Woodland 1929) Johri (1931), has an unarmed rostellum and a large number of testes (50 to 60). *P. candelabraria* (Goeze 1782) Führmann 1906, *P. meggitti* Johri 1931, *P. cholodkowskii* Skrjabin 1914, *P. sinensis* (Ransom 1909) Linton 1927, *P. otidis* Baczynska 1914, *P. bucerotina* Führmann 1909, are all characterised by the possession of a larger number of hooks and a larger number of testes than found in the species described in this paper. We could not get any reference to the number of testes in *P. parallelipipeda* (Rudlophi 1810) Führmann 1908, and *P. vesiculigera* (Krabbe 1882) Führmann 1926, but in the former the number of hooks is fewer (19), while in the latter it is larger (50) than in the species described here. *P. fuhrmanni* Baczynska 1914 has been transferred to the genus *Sphaeru-*

terina Johnston 1914, by Führmann (1932) because of a distinct anterior dilatation of the paruterine organ. The species described above thus differs from other species of *Paruterina* and we propose for it the name *Paruterina septotesticulata* with the following specific diagnosis :—

Length 55 to 60 mm. ; maximum width 0·638 mm. ; scolex 0·429 mm. × 0·663 mm. ; diameter of rostellum 0·132 mm., armed with 2 rows of 32 hooks, each 43μ and 31μ in length respectively ; diameter of sucker 0·246 mm. ; testes 7, each 37μ in diameter. Eggs (in canada balsam, 23μ and onchospheres 14μ in diameter.

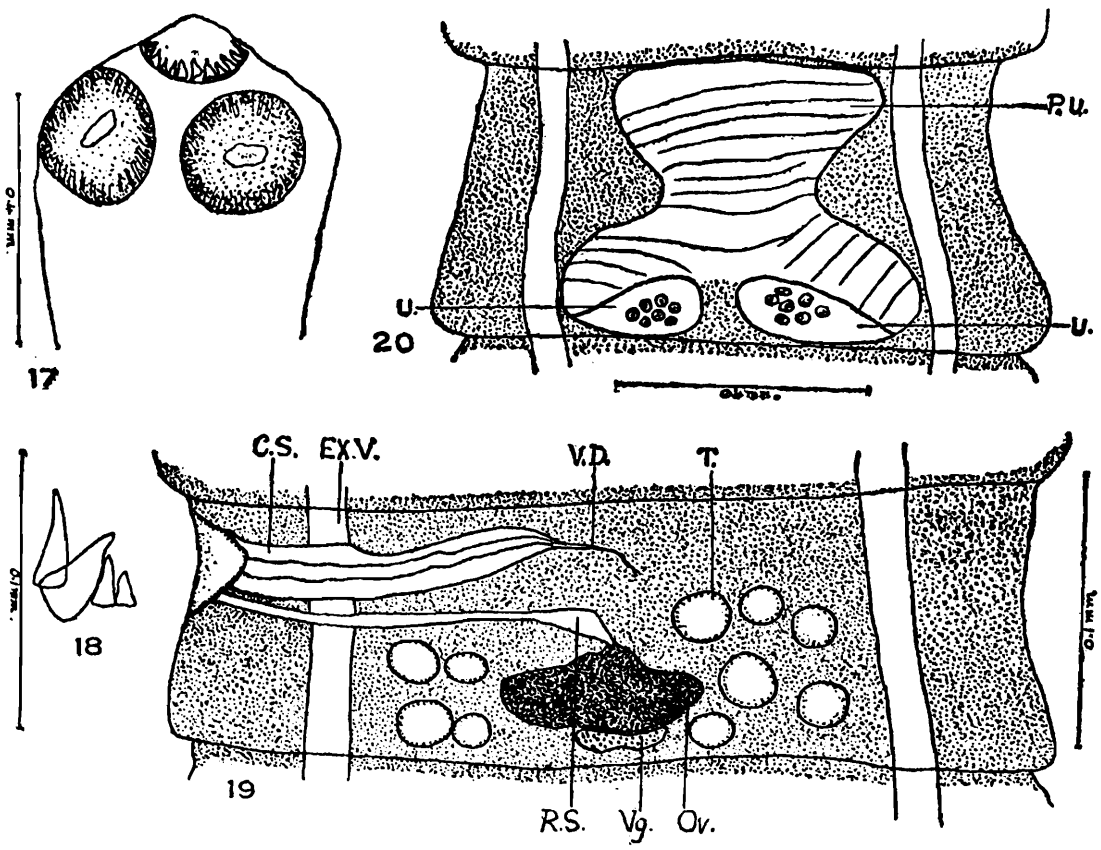
Host.—*Coracias indica* (Linn.)

Habitat.—Intestine.

Locality.—Nagpur, C. P., India.

Biuterina intricata (Krabbe 1882).

The description of *Biuterina lobata* Führmann (1908) was based on material which contained only gravid proglottids. According to him the uterus consists of two portions, a character which is common to all the species of the genus. He further suggested, though querying



FIGS. 17-20.—*Biuterina intricata* (Krabbe 1882).
FIG. 17.—Scolex.
FIG. 18.—Rostellar hook.
FIG. 19.—Entire mature proglottid.
FIG. 20.—Entire gravid proglottid.

Krabbe's description, that *Taenia intricata* Krabbe 1882 was probably identical with *Biuterina lobata* Führmann 1908. Krabbe's species is characterised by having four rows of rostellar hooks and was found parasitic in an Upupiformes bird, *Upupa epops* Linn. which is the identical host for *Biuterina lobata*. Our material was also obtained from

the same host and consists of about 7 complete worms. We give below a complete description of this worm.

Anatomy.—Total length of worm about 50 to 55 mm. with a maximum width of 0·3 mm. All proglottids broader than long; mature proglottids 0·1 mm.×0·22 mm. Genital pores irregularly alternating, genital ducts pass between the longitudinal excretory vessels. Scolex (fig. 18) 0·43 mm. wide at its base. Rostellum 0·102 mm.×0·203 mm. with four rows of 64 hooks of different lengths; they measure: 0·052 mm., 0·036 mm., 0·030 mm., and 0·0196 mm. in diameter. A considerable portion of the strobilus behind the scolex is unsegmented. Ten testes (fig. 19, *T*) in each proglottid: 4 poral, six aporal of the ovary. Cirrus sac (*C. S.*) 0·107 mm. in length, with a straight unarmed cirrus. Vas deferens (*V D.*) a very compact coiled mass. Ovary (*Ov.*) situated centrally towards the posterior end of the proglottid. Vitelline gland (*Vg.*) compact, in close neighbourhood of the ovary posteriorly. Vagina (*V.*) a straight canal, opening in genital atrium posterior to cirrus sac; near the ovary it is dilated into a small bulb-like receptaculum seminis. Uterus (fig. 20) in all gravid proglottids appears as a double sac near the posterior border of the proglottid. The eggs pass into a paruterine organ which has the same appearance as that which is figured by Führmann (1908). Eggs (in canada balsam) 27μ×22μ.

REFERENCES.

Baer, J. G. (1931).—A Propos d'une Nouvelle Classification des Cestodes due Genre *Davainea* R. Bl. *s. l. Bull. Soc. Zool. France,* LV, pp. 44-57.

Führmann, O. (1908).—Das Genus Anonchotaenia and Biuterina-Das Genus Biuterina. *Centralbl. Bakt. Parasit.* (Abt. 1; Orig.) XLVIII, pp. 419-420.

Führmann. O. (1932).—*Les Tenias des Oiseaux.* Neuchatel.

Johri, L. N. (1931).—A New Cestode from a Grey Hornbill in India. *Ann. Mag. Nat. Hist.* (10) VIII, pp. 239-242.

Lopez-Neyra, C. R. (1931).—Revision del Genero Davainea. *Acad. Cien. Exactas, Fisicas y Naturelles Madrid.*

Mayhew, R. L. (1929.)—The Genus Diorchis. *Journ. Parasit.* XV, pp. 251-258.

Meggitt, F. J. (1921).—Two New Tapeworms from the Ostrich with a Key to the Species of Davainea. *Parasitology* XIII, pp. 1-25.

Meggitt, F. J. (1927).—Report on a Collection of Cestoda Mainly from Egypt. Part I, Families Anoplocephalidae, Davaineidae. *Parasitology,* XIX, pp. 314-327.

Moghe, M. A. (1933).—Four New Species of Avian Cestodes from India. *Parasitology,* XXV, No. 3, pp. 333-341.

Purvis, G. B. (1932).—Cestodes from Domestic Animals in Malaya, with Description of Two New Species. *Vet. Rec.*

Skrjabin, K. J. (1914).—Vogelcestoden aus Russiche Turkestan. *Zool. Jahrb.* (Syst.), XXXVII, pp. 411-492.

Southwell, T. (1930).—*Fauna of British India,* Cestoda, II, London.

Subramanian, K. (1928).—On a New Tapeworm (*Raillietina rangoonica*) from the Fowl. *Journ. Burma Res. Soc.,* XVIII, Part 3, pp. 78-79.

Szpotanska, I. (1931).—Quelques Especes Nouvelles ou peu Connues des Hymenolepididae Führmann (Cestoda). *Ann. Mus. Zool., Polonici,* IX, Nr. 17, pp. 247-266.

Woodland, W. N. F. (1929).—On a New Species of Rhabdometra, with a Note on Nematodiform Embryos of *Anonchotaenia globata* (Cestoda). *Proc. Zool. Soc. London,* pp. 25-29.