REPORT ON A COLLECTION OF CESTODES FROM LUCKNOW (U. P., INDIA).

By L. N. JOHRI, *Department of Biology, University of Rangoon.*

INTRODUCTION.

The material described in this paper was mainly collected during the years 1928-1930 from Lucknow, either from neighbouring villages or from the local markets and from the Lucknow Zoological Garden. Attention was concentrated upon avian fauna though from time to time other hosts were also dissected. The investigation was mainly devoted to pigeons, and altogether some 200 birds from neighbouring localities were dissected. The present work on Cestodes was originally started under the guidance of Dr. G. S. Thapar, but owing to the lack of literature in Lucknow, permission was granted by Prof. K. N. Bahl to carry out the identifications at the University of Rangoon under the supervision of Prof. F. J. Meggitt, to whom I have great pleasure in expressing my indebtedness for the help afforded me, for the use of his extensive library and the loan of specimens from his collection. My sincere thanks are also due to Dr. G. S. Thapar for his help at Lucknow.

INFECTION OF HOSTS.

A large number of the hosts dissected were pigeons. It was observed that infection was usually heavier in birds from slums and fed on a poor quantity of corn: wild forms from rural localities with but little chance of obtaining infected corn were either free from infection or not infected to the marked extent characteristic of those from the town. This indicates that the intermediate host is a weevil or some small arthropod present in corn. It is worth mention that in some cases the presence of large number of nematodes apparently prevents infection with cestodes. The degree of infection had marked effect upon the general health and vigour of the host, heavy infection resulting in extreme emaciation and weakness.[1] A careful examination of 20-30 pigeons kept in a cage showed that those heavily infected were listless and moped so much that no attempt was made to escape on the opening of the cage every morning and evening. One pigeon in particular would neither move nor mix freely with others; it was always found more or less at the same spot in the cage. A few gravid proglottides of *Raillietina* were found in the faeces. It died after a few days. Its intestine was so full of cestodes that the lumen was entirely obstructed. Even after their removal, deep furrow like streaks could be seen in the inner walls of the gut. Two tapeworms and a few incomplete strobilae were found free in the rectum.

[1] In this connection reference may be made to somewhat similar observations made by Mr. G. Sondhi (*Proc. 14th Ind. Sci. Cong.*, pp. 193, 194, 1927).

No helminths were obtained from *Tyto alba javanica, Megalornis* sp. and only one small cestode, *R. polychalix* Kotlan, 1920, from *Psittacula krameri manillensis.*

Order CYCLOPHYLLIDEA Carus.

Family ANOPLOCEPHALIDAE Cholodkovsky 1902.

Subfamily ANOPLOCEPHALINAE Führmann 1907.

Anoplocephala Blanchard 1848.

Anoplocephala magna (Abildgaard 1789).

Host :—Equus zebra Linn. 1758.
Locality.—Zoological Garden, Lucknow.
The table on p. 155 gives the differences between the present form and those described by Baer (1927, pp. 26, 27).

Killigrewia Meggitt 1927.

Killigrewia frivola Meggitt 1927.

Host :—Columba livia intermedia.
Length 198, breadth 5·5. Scolex 0·104 long and 0·28 in maximum diameter. Genital cloaca absent. Maximum length of cirrus sac 0·315. Vesicula seminalis 0·128×0·082, present. Testes 113—154, usually 45-56, rarely, 82-89, poral ; and usually 63-89, rarely 31, aporal. Otherwise agreeing with the discription of Meggitt (1927, p. 316).
Killigrewia Meggitt 1927 has been regarded (Führamann 1932, p. 58) as a synonym of *Aporina* Führmann 1902. The two genera differ in the disposition of the testes, these organs being in two distinct lateral groups separated by the female glands in *Killigrewia* and in a continuous band across the proglottis in *Aporina.* The validity of these organs as a generic character is recognised in the Dilepidinae, Führmann 1907, and according to the diagnoses given by Führmann (1932, pp. 85-116) *Parorchites* Führmann 1932 (or *Anomotaenia* Cohn 1899) and *Parvirostrum* Führmann 1907, *Dilepis* Weinland 1834 and *Proorchida* Führmann 1907, and *Kowalewskiella* Baczynska 1914 and *Paricterotaenia* Führmann 1932 are separated only by this character. There appears, therefore, no reason for considering *Killigrewia* as a synonym of *Aporina.*

Moniezia Blanchard 1891.

Moniezia expansa (Rudolphi 1810).

Host :—Goat and Sheep.

Moniezia trigonophora Stiles and Hassal 1893.

Host :—Sheep.
Genital cloaca present 0·14 long and 0·135 in maximum breadth, otherwise agreeing with the description of Baer (1927, pp. 72-73).

CHART 1.

	Length.	Breadth.	Diameter of scolex.	Diameter of sucker.	Genital cloaca.	Cirrus sac (size).	Cirrus.	Testes.	Receptaculum seminis.
A. magna (Abildgaard 1789) . .	350[1]	25	3	1·2	Absen	1·4×0·01	Spiny	400—500	?
A. magna (present form) . . .	157	11	6	2·6	Present	0·82-1·71×0·24	Without spines.	330—460	Very large

[1] All measurements in mm.

Subfamily THYSANOMINAE Führmann, 1907.

Stilesia Railliet 1893.

Stilesia globipunctata (Rivolta 1874) Railliet 1893.

Host :—Sheep.

Maximum length 93 and maximum breadth 1·05. Testes 3-6 on each side. Cirrus sac 0·072—0·074×0·027—0·041.

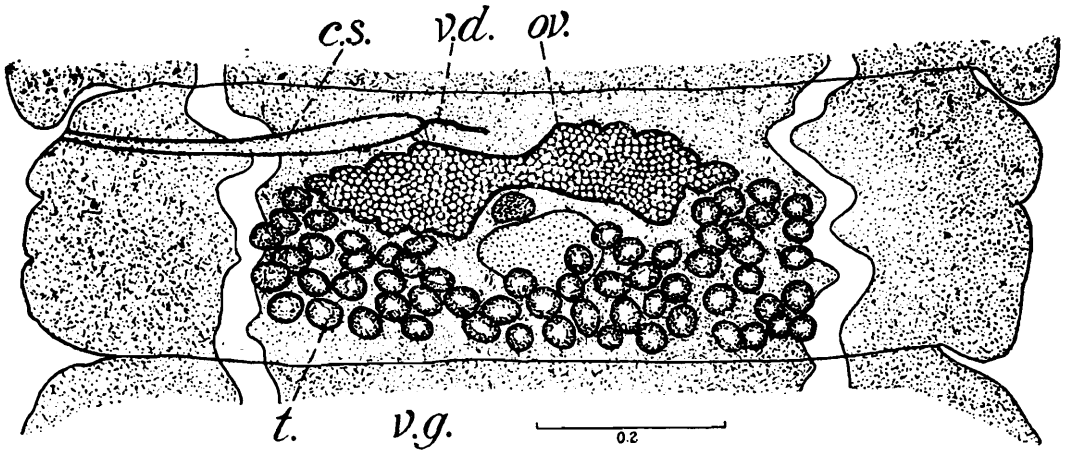
Subfamily LINSTOWIINAE Führmann 1907.

Oochoristica Lühe 1898.

Oochoristica thapari, sp. nov.

Host :—*Calotes* sp.

Maximum length 21 and the maximum breadth 2. All segments broader than long. Scolex 0·305 diameter. Genital pore in anterior third of the proglottis margin, often approaching extreme anterior. Genital ducts passing in between longitudinal excretory vessels. Testes 48-62 (max. diameter of testis 0·033—0·04), closely surrounding ovary and vitelline gland posteriorly and laterally and limited between the longitudinal excretory vessels, though a portion of a few of the testes lies dorsally to the excretory vessels. Cirrus sac 0·36—0·49 extending well past longitudinal excretory vessels.



TEXT-FIG. 1.—*Oochoristica thapari*, sp. nov. Mature proglottis.

The number of testes and the relative and absolute size of the cirrus sac separate the present form from all others of this genus except *O. surinamensis* Cohn 1902, which closely approaches the present form in the size of cirrus sac. The new species in addition to the larger number of the testes is further characterised by the dorsal position of the genital ducts in relation to the longitudinal excretory vessels.

Family DAVAINEIDAE Führmann 1907.

Subfamily DAVAINEINAE Braun 1900.

Cotugnia Diamare 1893.

Eighteen species of this genus have been recorded and are easily distinguishable except for *C. brotogerys* Meggitt 1915 and *C. digonopora*

(Pasquale 1890), *C. parva* Baer 1925 and *C. seni* Meggitt 1926. The first two only differ in the systematic position of the host and are otherwise similar; *C. brotogerys*, therefore, becomes a synonym of *C. digonopora*. *C. seni* differs from *C. parva* in the possession of a large receptaculum seminis, in the slightly smaller size of the rostellar hooks and the larger, absolute and relative, size of the cirrus sac, but with the present state of our knowledge of these forms it is not possible to be certain about their specific distinction.

Cotugnia bahli, sp. nov.

Host :—Turtur suratensis Linn. 1788.

Maximum length 55 and greatest breadth 3·3 (gravid segment) and 2·4 (mature segment). Scolex 0·5 diameter. Rostellum 0·34 diameter. Rostellar hooks approximately 332, 0·0125—0·0135 and 0·0175 long. Genital pore in anterior half of the proglottis margin. Cirrus sac 0·215-0·223 long, extending to the longitudinal excretory vessels. Testes 69-74, in two groups, arranged as in *C. govinda* (described below) except that they extend lateral to excretory vessels.

Of the species of *Cotugnia* with the testes in two groups, *C. collini* Führmann 1909 is separated by its larger rostellar hooks, greater number of testes and larger cirrus sac; *C. inaequalis* Führmann 1909 by the smaller number of testes and a smaller cirrus sac, *C. polycantha* Führmann 1909 by the smaller rostellar hooks and greater number of testes, *C. noctua* (described below) by the much larger number of testes, *C. fleari* Meggitt 1927 by the smaller number of testes and a longer cirrus sac, and *C. govinda* by the extension of the testes within the excretory vessels.

Cotugnia cuneata var. **nervosa** Meggitt 1924.

Host :—Columba intermedia.

This variety differs from var. *tenuis* in being much larger, the proglottis much broader, and in the development of strong musculature. Otherwise it agrees with the original description of the variety.

Cotugnia cuneata var. **tenuis** Meggitt 1924.

Host :—Columba intermedia.

Rostellar hooks 416, 0·011-0·013 and 0·0155-0·018 long. Testes 65-75 in a continuous band. Other details comparable with the original description.

Cotugnia digonopora (Pasquale 1890).

Host :—Columba intermedia.

Cirrus sac 0·32. Testes 128-158. Otherwise agreeing with Meggitt's description. Recorded from the Columbiformes for the first time.

Cotugnia fila Meggitt 1931.

Host :—Duck.

Cotugnia fleari Meggitt 1927.

Host :—Columba intermedia.

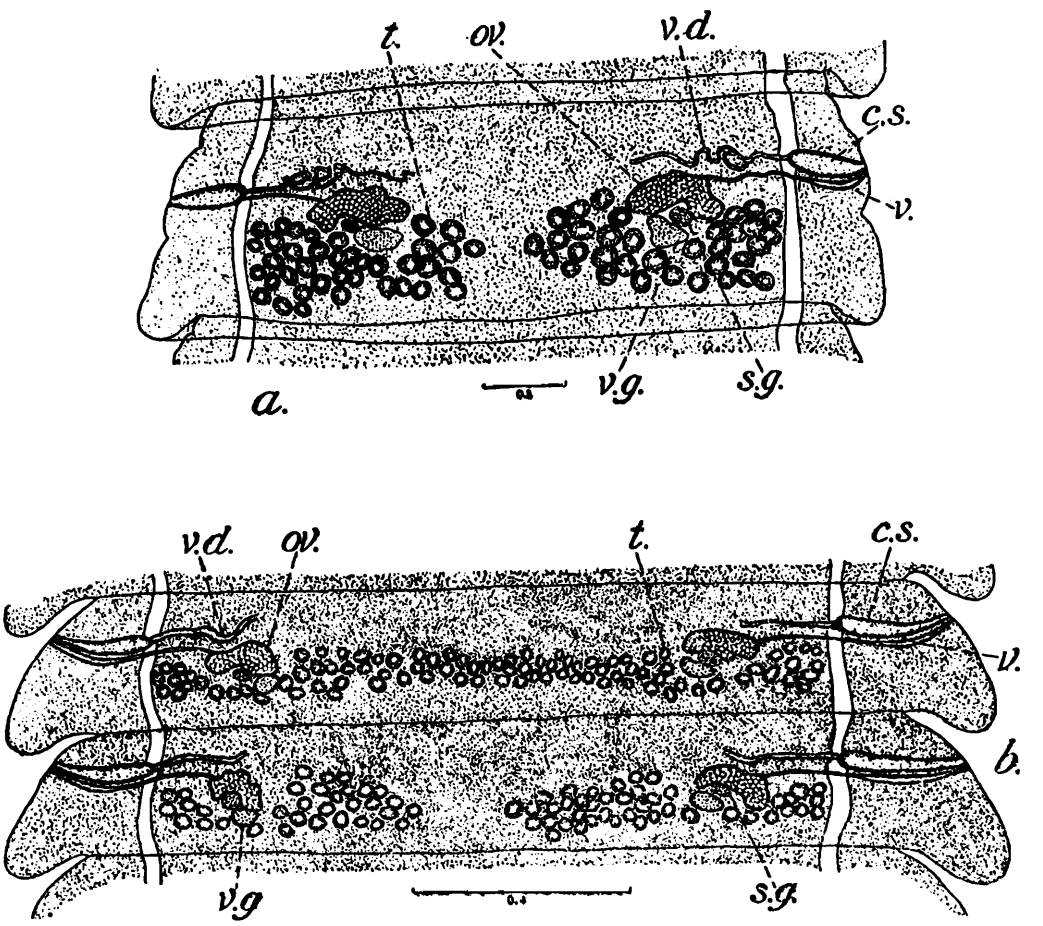
Length 53, breadth 1·5. Rostellar hooks approximately 308, 0·015 and 0·018 long. Cirrus sac 0·26 long extending to the longitudinal excretory vessel. Testes 46-57, in two clearly separated groups. These groups are not marked into poral and aporal groups. Receptaculum seminis present.

Cotugnia govinda, sp. nov.

Host :—Milvus govinda.

Locality :—Malhiabad, District Lucknow.

Maximum length 53·5 and greatest breadth 2. Scolex 0·565 diameter. Rostellum 0·25 diameter. Rostellar hooks 0·016 and 0·014 long, in two rows. Genital pore usually in anterior third of proglottis margin. In two proglottides female reproductive organs single, similar to those of *Raillietina* form. Cirrus sac 0·148-0·26 long, extending to or nearing to ventral longitudinal excretory vessel. Vas deferens partly straight and partly in convolutions. Testes in two clearly separated groups within



Text-fig. 2.—*a. Cotugnia govinda,* sp. nov. Mature proglottis.
b. Cotugnia intermedia, sp. nov. Mature proglottis.

longitudinal excretory vessels : each group consists of 25-54, and again is subdivided into two, each postero-lateral to ovary ; the two being joined by a chain of a few testes. Median medullary parenchyma free from testes. Gravid segments absent.

From *C. polycantha* Führmann 1909, *C. inaequalis* Führmann 1909. and *C. noctua* (described below) the present form is distinguished by the testes not extending lateral to excretory vessel. This is the first record of this genus from the Accipitriformes.

Cotugnia inaequalis Führmann 1909.

Host :—Columba livia domestica.

Cirrus sac 0·1-0·112, not reaching the ventral longitudinal excretory vessel. Testes approximately 57. Otherwise agreeing with the original details. First record from the Columbiformes.

Cotugnia intermedia, sp. nov.

Host: —Columba intermedia.

Maximum length 48. Greatest breadth 3·2. Scolex 0·44-0·525 diameter. Rostellum armed with double circle of hooks, 0·012-0·017 long, arranged alternately. Genital pore in anterior half of proglottis margin. Cirrus sac 0·18-0·268 long, just reaching or just passing ventral longitudinal excretory vessel. Vas deferens partly straight and partly in coils. Testes 63-90, in some segments appearing in two distinct groups, while in others as a single broad band stretching from side to side of the proglottis ; in either case mostly within longitudinal excretory vessel, rarely one or two outside. The anterior border of proglottis free from testes.

The size of the rostellar hooks and cirrus sac, together with the number of the testes, clearly separates the present species from others of the same genus except *C. fastigata* Meggitt 1920 which is distinguished by the larger number of testes and a larger cirrus sac, *C. inaequalis* Führmann 1909 by its smaller cirrus sac ; *C. polycantha* Führmann 1909 by the smaller rostellar hooks, smaller cirrus sac and the larger number of the testes, and *C. fila* Meggitt 1931 by fewer testes. In addition, from all forms it is distinguished by the possession of testes in two groups or in a single continuous band in the same strobilous. This is the sole major character separating it from *C. cuneata* Meggitt 1924 ; and if it be of no specific value, the two species will have to be regarded as identical.

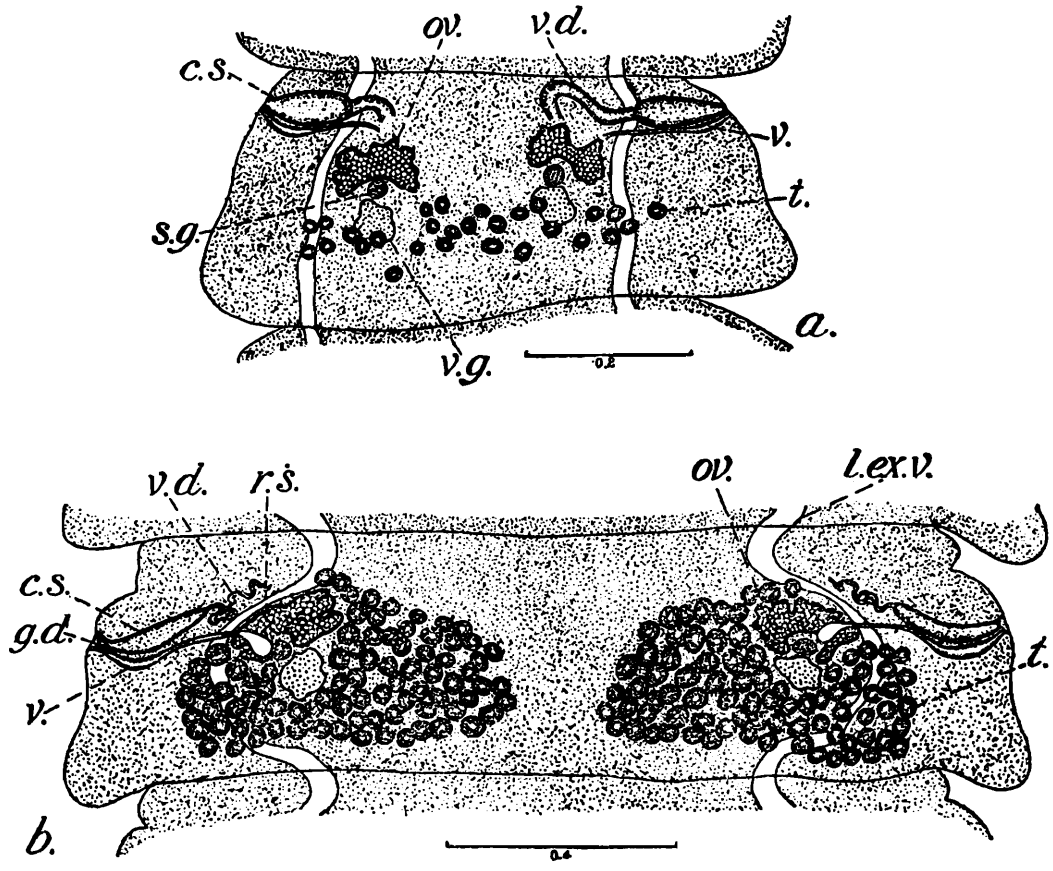
Cotugnia januaria, sp. nov.

Host :—Gallus domesticus.

Length 3-11. Breadth 0·28-0·8. Scolex 0·55-0·85 diameter. Rostellum 0·28 in diameter, armed with a double circle of approximately 403 hooks, 0·006-0·007 and 0·005-0·006 long respectively. Genital pore at anterior extreme margin of proglottis. Cirrus sac 0·11-0·14 long extending to and often crossing longitudinal excretory vessel ; vas deferens, a short uncoiled wide tube. Testes 18-35, a single broad band across proglottis posterior to ovary and extending a little beyond the longitudinal excretory vessel : anterior and most of posterior area of proglottis entirely free from testes. The gravid segments absent. Last few segments much smaller than preceding ones.

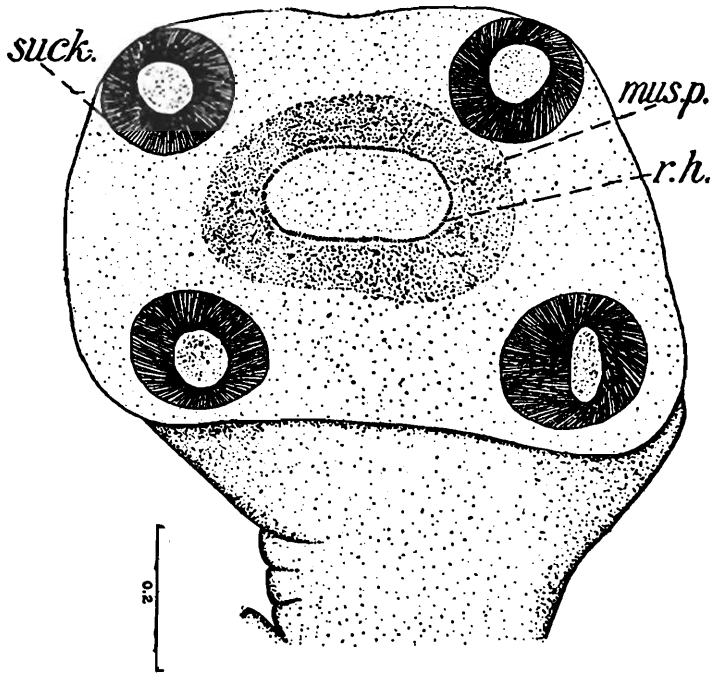
The present form is easily distinguished from the species of the same genus with the testes arranged in two distinct groups. *C. margereta*

Beddard 1916, is characterised by the rostellum being smaller than the sucker. *C. crassa* Führmann 1909, *C. digonopora* (Pasquale 1890), *C.*



Text-fig. 3.—*a. Cotugnia januaria*, sp. nov. Mature proglottis.
b. Cotugnia noctua, sp. nov. Mature proglottis.

fastigata Meggitt 1920 and *C. fuhrmanni* Baczynska 1914 are separated by the much greater number of testes, *C. joyeuxi* Baer 1924 by the larger rostellar hooks, and a smaller cirrus sac, *C. cuneata* Meggitt 1924, *C. parva*



Text-fig. 4—*Cotugnia januaria*, sp. nov. Scolex.

Baer 1925, *C. seni* Meggitt 1926 and *C. fila* Meggitt 1931, by the larger rostellar hooks, large number of testes and larger cirrus sac.

Cotugnia noctua, sp. nov.

Host :—Columba intermedia.

Length 51, maximum breadth 2. Scolex 0·51 diameter. Rostellum 0·225 diameter with double row of hooks, 0·012 and 0·018 long. Musculature with two layers of longitudinal muscles, the inner one the weaker and consisting of smaller and scattered muscular fibres. Transverse muscles not seen.

Genital pore in anterior half of proglottis margin. Genital cloaca poorly developed. Cirrus sac 0·176-0·2 long extending to ventral longitudinal excretory vessel. Coils of vas deferens few and small. Testes approximately 170-182, in two distinct groups, congregated round ovary on all sides and extending beyond ventral longitudinal excretory vessel. Gravid segments absent.

The possession of two distinct groups of testes in the present form distinguishes it from all the species of this genus with a single band of testes. *C. collini* Führmann 1909 is distinguished by the size of its rostellar hooks and cirrus sac. The smaller number of testes together with minor differences separates the remaining forms.

Cotugnia parva Baer 1925.

Hosts :—Corvus macrorhynchus and *Columba intermedia.*

Rostellar hooks 378-396, 0·015-0·016 and 0·018-0·02 long. Cirrus sac 0·101-0·106 long and 0·04 maximum diameter. Testes approximately 32-41.

Cotugnia polycantha Führmann 1909.

Host :—Pigeon.

Genital pore in anterior one-third of proglottis margin. Cirrus sac 0·168 to the ventral longitudinal excretory vessels. Testes, in two distinct groups, approximately 88.

Raillietina Führmann 1920.

Raillietina (Fuhrmanetta) echinobothridia (Mégnin 1880).

Host :—Jungle-fowl.

Rostellar hooks approximately 239, 0·011 and 0·017 long. Testes 30-32. Egg-capsules approximately 80.

Raillietina (Paroniella) reynoldsae (Meggitt 1926).

Host :—Corvus splendens.

Numerous small forms 0·9-2·0 long and 0·19-0·515 broad. Scolex 0·22 diameter rostellar hooks 144-167.

Raillietina (Paroniella) rangoonica (Subramanian 1928).

Host :—Milvus govinda.

Maximum length 98, maximum breadth 1·52. Scolex 0·27 diameter. Rostellar hooks 291. Acetabullar hooks absent. Cirrus sac 0·11-0·16. Vas deferens greatly convoluted. Testes 23-37, of which 5-8 poral and the rest aporal ; no testis either anterior or posterior to ovary. Ovary with small processes marked anteriorly, extends from centre of the proglottis to its anterior border, sometimes touching it. Egg-capsules lateral to longitudinal excretory vessels but leaving clear margins at the sides.

Raillietina (Raillietina) flabralis Meggitt 1927.

Host :—Dichoceros bicornis bicornis.

Raillietina (Raillietina) fuhrmanni (Southwell 1922).

Host :—Crocopus chlorogaster.

Length 18-50, breadth 0·46-1·05. Scolex 0·23 maximum diameter. Rostellum 0·14 diameter, hooks in two rows, each 0·023-0·029 and 0·024-0·033. Cirrus sac 0·114-0·172 long. Testes 8-15. Egg capsules approximately 30-60 per segment, each containing 4-9 eggs extending external to excretory vessel.

Raillietina (Raillietina) galeritae Skrjabin 1914.

Host :—A small black bird (unidentified).

Maximum length 67, greatest breadth 0·55. Scolex 0·236 diameter. Rostellar hooks 254, 0·014 and 0·0175 long. Suckers nearly spherical, 0·116 maximum diameter. Acetabular hooks 7-8 rows. Cirrus sac 0·11-0·142×0·045. Egg capsules more irregularly packed than described by Skrjabin and not extending external to excretory vessel.

Raillietina (Raillietina) macrocirrosa Führmann 1909.

Host :—Francolinus sp.

Maximum length 89-125, breadth 0·655-0·7. Scolex 0·32 diameter. Rostellum 0·165 diameter. Rostellar hooks 320, 0·014 and 0·017 long. Genital pore in anterior half of proglottis margin. Cirrus sac 0·06-0·087 long. Cirrus simple and unarmed. (Führmann's form possesses a muscular cirrus, also thick and very much coiled). Testes 28-30, lateral and posterior to ovary. Egg capsules imperfectly developed. First record from the Galliformes.

Raillietina (Raillietina) michaelseni Baer 1925.

Host :—Pigeon.

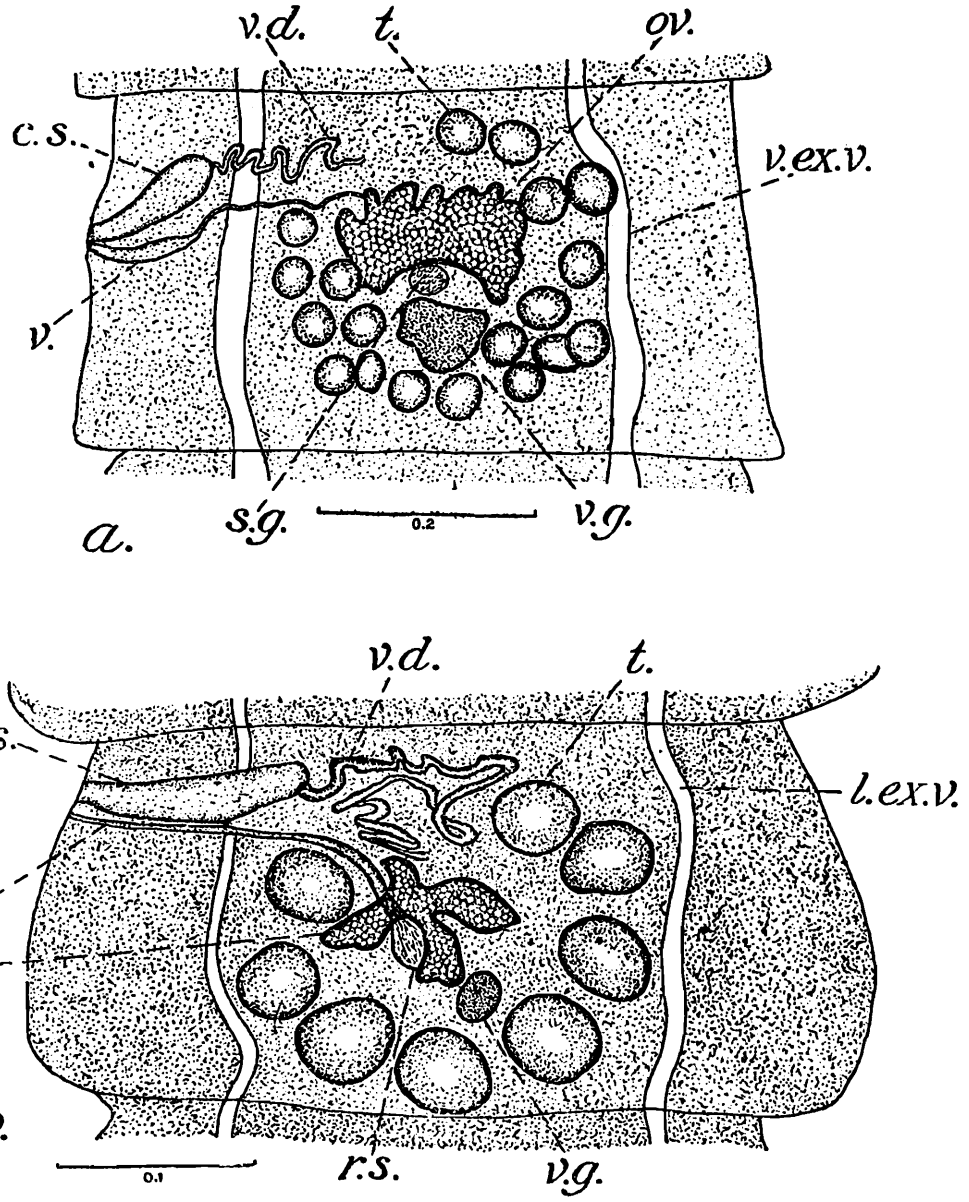
Maximum length 223, breadth 0·27. Scolex 0·26 diameter. Rostellar hooks 240-320, 0·014 and 0·0165 long. Testes 20-22, often 2-3 slightly

anterior to ovary on aporal side. Gravid segments absent. First record from the Columbiformes

Raillietina (Raillietina) penetrans nova, subsp. nov.

Host :—Indian Mynah.

Maximum length 248, maximum breadth 0·67. Scolex 0·25 diameter. Rostellar hooks 154-184, 0·014 and 0·019 long. Acetabullar hooks 4-5 rows. Musculature with two longitudinal muscular layers. Genital pore in anterior half of the proglottis margin. Genital cloaca very



TEXT-FIG. 5.—*a. Raillietina (Raillietina) penetrans nova,* subsp. nov. Mature proglottis.
b. Raillietina (Skrjabina) kakia, sp. inq. Mature proglottis.

shallow. Cirrus sac 0·125-0·134 long, not or nearly touching ventral longitudinal excretory vessel. Cirrus unarmed. Testes 16-19 lateral and posterior to ovary, with a few anterior aporally. Egg-capsules 35-58 extending beyond the ventral longitudinal excretory vessel, each containing 5-7 eggs.

The following chart gives the differences between the present form and *R.* (*Raillietina*) *penetrans* Baczynska 1914 :—

CHART 2.

	Host.	Length.	Breadth.	Acetabular hooks.	Proglottides.	Muscles.	Genital cloaca.	Cirrus sac.	Testes (arrangement).	Diameter of onchosphere.
R. (*Raillietina*) *penetrans* Baczynska, 1914.	Galliformes	30-40	1·5	14-15 rows	All broader than longer.	4 longitudinal layers.	Muscular canal.	With specially developed muscles.	Two lateral groups.	0·0104
R. (*Raillietina*) *penetrans nova*, subsp. nov.	Passeriformes	248	0·67 (mature segment). 0·62 (gravid segment).	4-5 rows	Gravid ones longer than broad.	2 longitudinal layers.	No muscular canal.	Without specially developed muscles.	Nearly surrounding the ovary.	0·047—0·055

The differences as tabulated in the above chart distinguish the present form from *R.* (*Raillietina*) *penetrans* Baczynska 1914 but are not sufficient to justify the creation of a new species : it is, therefore, listed as a subspecies.

Raillietina (Raillietina) polychalix Kotlan 1920.

Hosts :—Columba livia domestica, and *Psittacula krameri manillensis.*

Maximum length 273, maximum breadth 0·75. Scolex 0·26 diameter. Rostellar hooks 324, 0·011 and 0·014 long. Suckers armed with 6-7 rows of hooks ; the outermost with 0·006-0·007 long hooks, the size of hooks gradually diminishing towards the interior. Genital pore unilateral, in posterior half of the proglottis margin. Cirrus sac 0·125-0·13 long not reaching longitudinal excretory vessel. Vas deferens with numerous coils and surrounded by a large number of prostate cells. Testes 8-9. 30-40 egg-capsules extending laterally to longitudinal excretory vessels, each containing 6 eggs. The above description is of the forms from the Columbiformes : those from the Pisttaciformes differ in the following respects :—

Scolex 0·103 diameter. Rostellar hooks approximately 190, 0·0135 and 0·019 long. Testes 9-11. Cirrus sac 0·061 long. Egg-capsules 48.

These differences are not sufficient to justify the separation of the two forms

Raillietina (Raillietina) tunetensis Joyeux and Houdemer 1927.

Host :—Columba livia domesticata.

Cirrus sac 0·085 long and not extending to ventral longitudinal excretory vessel. Egg-capsules extending lateral to longitudinal excretory vessel.

Raillietina (Raillietina) volzi Führmann 1905.

Host :—Columba livia domestica.

Maximum length 313, maximum breadth 0·95. Scolex 0·235 maximum diameter. Rostellar hooks 182, 0·0135 and 0·016-0·0175 long. Suckers with 5-7 rows of hooks. Cirrus sac 0·133-0·17. Testes 30-32. 70-87 egg-capsules per segment, each egg-capsule contains 6-7 (usually 7) eggs. Otherwise agreeing with the original description. First record from the Columbiformes.

Raillietina (Skrjabina) kakia, sp. inq.

Host :—Corvus splendens.

A single specimen without scolex. Length 5, maximum breadth 0·45. Genital pore in anterior quarter of the proglottis margin. Genital cloaca absent. Cirrus sac 0·085-0·123, extending beyond ventral longitudinal excretory vessel. Receptaculum seminis slightly developed. Testes 6-10, surrounding ovary laterally, posteriorly with a few anteriorly. Ovary trilobed : sometimes these lobes give out small processes and occupy nearly centre of proglottis. Egg-capsules numerous in each segment, not extending beyond longitudinal excretory vessels.

The smaller number of testes of the present species separates it from all other forms of this sub-genus except *S. magnicoronata* (Führmann 1908), *S. maroteli* (Neveu-Lemaire 1912), *S. oligacantha* (Führmann 1908) and *S. retusa* (Clerc 1903). From these the first is separated by the relative and the absolute lengths of the cirrus, together with the position of testes at the posterior end of the segment. *S. oligacantha* and *S. retusa* are not sufficiently described to distinguish them from the present form, while details of *S. maroteli* are not available in Rangoon. The present form is, therefore, listed as a sp. inq.

Raillietina sp.

Host :—Gyps indicus.

Length 47, greatest breadth 0·2. Rostellar hooks approximately 300-357, 0·012 and 0·015-0·016 long. Acetabular hooks in 4-5 rows. Genital pore unilateral. Genital organs poorly developed and in an immature condition.

Family DILEPIDIDAE Führmann 1907.

Subfamily DIPYLIDIINAE Stiles 1896.

Dipylidium Leuckart 1863.

Dipylidium caninum (Linnaeus 1758).

Host :—Cats and dogs.

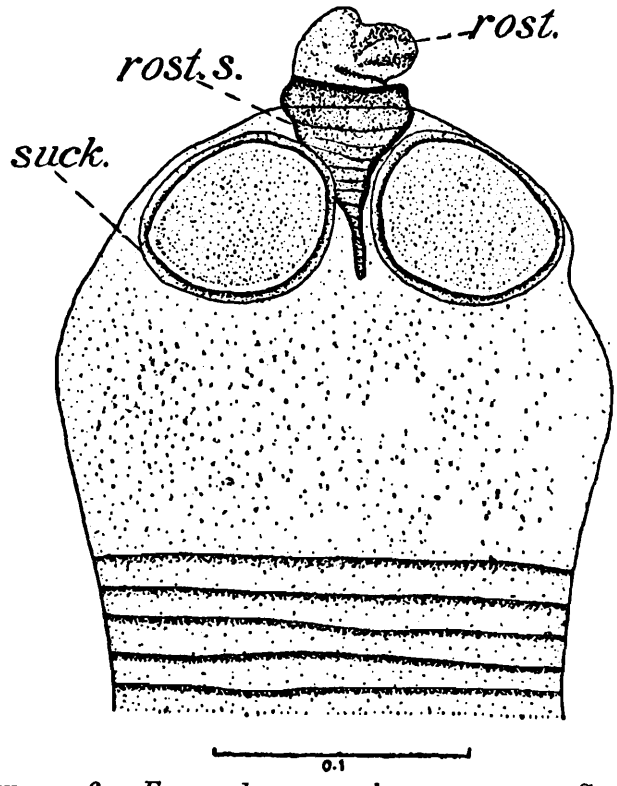
Eugonodaeum Beddard 1913.

Eugonodaeum ganjeum sp. nov.

Host :—Acridotheres tristis.

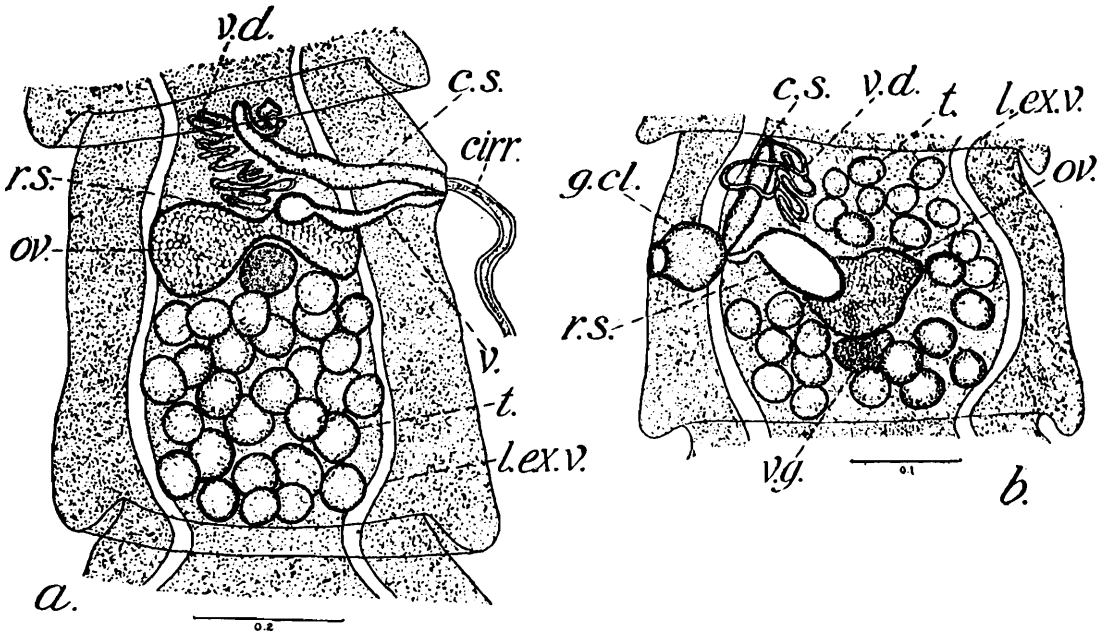
Length 31-35, maximum breadth 0·6 (mature segment) and 0·75 (gravid segment). Scolex globular slightly elongated, 0·178-0·185 in length and 0·225 maximum diameter. Rostellum ordinarily very small but seen protruding in the living specimen (it never extends so far as the length of the scolex). Rostellar hooks absent. A small rostellar pouch present, 0·78 long, not extending below the lower margin of the suckers. Suckers comparatively small, 0·083 maximum diameter, unarmed, situated at the anterior border of scolex. Genital pore irregularly alternates, in anterior fourth of the proglottis margin. Genital cloaca absent. Genital ducts pass between excretory vessels. Cirrus sac 0·315-0·366 × 0·027-0·042, crossing ventral longitudinal excretory vessel, obliquely directed towards anterior border of proglottis. Cirrus greatly elongated and protruded out of the proglottis (cirrus shown in diagram not complete, a part of it being damaged). Vas deferens greately coiled. Testes 27-40, posterior to ovary, and do not extend beyond ventral longitudinal excretory vessel, though a portion of some actually lies dorsally to the excretory vessel. Ovary in immature segments compact, in mature ones distinctly bilobed and extends from one longitudinal excretory vessel to the other. Uterus persistent, whole mounts and

transverse sections through gravid proglottis show that the egg-capsules are formed inside the uterus, which later expands to allow the egg-capsules



TEXT-FIG. 6.—*Eugonodaeum ganjeum*, sp. nov. Scolex.

to become thickly crowded and extend beyond the ventral longitudinal excretory vessels.



TEXT-FIG. 7.—*a. Eugonodaeum ganjeum*, sp. nov. Mature proglottis.
b. Eugonodaeum testifrontosa, sp. nov. Mature proglottis.

The present form may be included in either of the genera *Eugonodaeum* Beddard 1913 or *Unciunia* Skrjabin 1914. Originally these were separated by the possession of the unilateral genital pores in the former and of alternating genital pores and chitinous cirral hairs and spines of the latter. So far, including the new forms in the present paper, six species have been recorded.

CHART 3.

No.	Species.	Host.	Distribution.	Scolex.		Cirral hairs.	Genital pores.	Genital cloaca.	Genital ducts.	Cirrus sac (size).	Testes.
				Rostellum.	Rost. hooks.						
1	*Eugonodaeum oedicnemi* Beddard 1913.	Charadriiformes	New World	Present	Absent	Absent	Unilateral	Present	Between	Large	few
2	*Unciunia trichocirrosa* Skrjabin 1914.	Accipitriformes	Paraguay	Present	Absent	Present	Alternate	Present	?	0·11	30—35
3	*U. sudanea* Woodland 1928.	Galliformes	Sudan	Absent	Absent	Absent	Alternate	Present	Between	0·34—0·41	30—35
4	*U. acapillicirrosa* Moghe 1933.	Anseriformes	Nagpur, India.	Present	Absent	Absent	Alternate	Present	Between	0·19×0·057	60
5	*Eugonodaeum ganjeum*, sp. nov.	Passeriformes	Lucknow, India.	Present	Absent	Absent	Alternate	Absent	Between	0·315—0·366	27—40
6	*E. testifrontosa*, sp. nov.	Charadriiformes	Lucknow, India.	?	?	Absent	Alternate	Present	Between	0·085—0·14	25—30

From the above table it will be seen that the cirral hairs have only once been found, *i.e.*, by the original investigator, and are absent in the other five forms. Apart from this, the only character separating the genera is the position of the genital pores, a character by itself not usually regarded as of generic rank (*e.g.*, *Raillietina*). Until the presence of cirral hairs is substantiated or until the hitherto undescribed female organs show any difference it is advisable to regard the genus *Unciunia* as a synonym of *Eugonodaeum*.

In the above table the differences between the present form and the previously described species are also tabulated.

Eugonodaeum testifrontosa, sp. nov.

Host :—Gallinago coelestis.

Greatest length 8, greatest breadth 0·4. Scolex absent. Genital pore irregularly alternating, slightly anterior to centre of the proglottis margin. Genital cloaca 0·07 deep ×0·064 maximum breadth, crossing ventral longitudinal excretory vessel. Cirrus sac 0·085-0·14×0·023, running more or less parallel with longitudinal excretory vessels, and nearly touching anterior border of the proglottis. Vas deferens greatly coiled. Testes 25-30, almost filling the proglottis excepting the anterior poral area mainly occupied by cirrus sac, vas deferens, and receptaculum seminis. Ovary in centre of proglottis, compact. Vagina comparatively short opening into genital cloaca just posterior to cirrus sac. Receptaculum seminis large. Uterus persistent, greatly comparable to the previous form excepting that the capsules are limited between the ventral longitudinal excretory vessels. Maximum diameter of egg 0·027.

Unilateral genital pores together with the large size of the cirrus sac and the few testes are enough to distinguish the new species from *Eugonodaeum oedicnemi* Beddard 1913. The previous species *E. ganjeum* and *U. sudanea* Woodland 1928 differ in the larger size of the cirrus sac and the disposition of the genital organs : cirrus sac in the present case is nearly parallel with the longitudinal excretory vessels, and the testes are anterior to the ovary. The typical disposition of the cirrus sac. together with its small size and the absence of the hair cluster with the chitinous spine at its base, clearly distinguish the present form from *U. trichocirrosa* Skrjabin 1914. It is also separated from *U. acapillicirrosa* Moghe 1933 by the disposition of the testes and the cirrus sac together with the smaller number of the former.

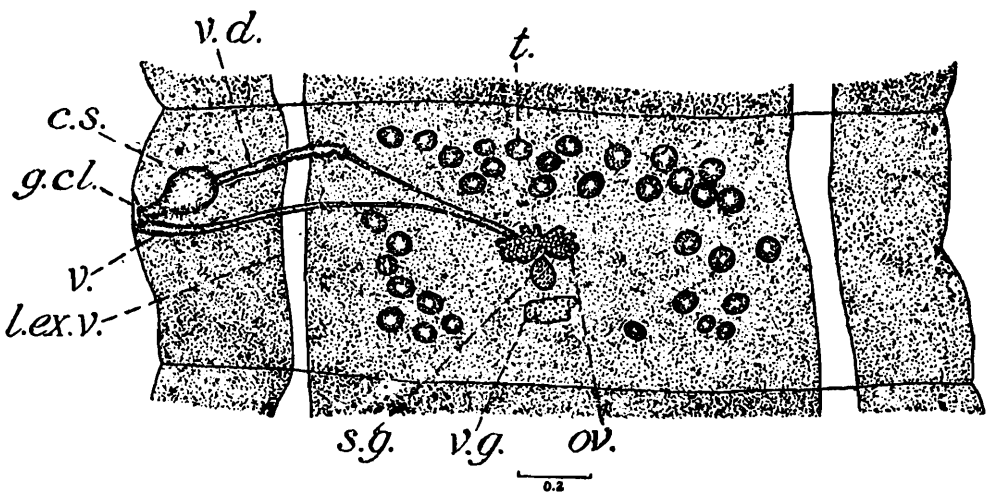
Subfamily DILEPIDINAE Führmann 1907.

Gidhaia indica, gen. *et* sp. nov.

Host :—Gyps indicus.

Maximum length 206, maximum breadth 5. Scolex absent. Segmentation distinct. Genital cloaca present. Genital pore irregularly alternates, in anterior half of proglottis margin. Cirrus sac very small, flask-shaped 0·206×0·125 not extending to ventral longitudinal excretory vessel but well separated from it. Often a small external vesicula seminalis present. Genital ducts pass dorsal to longitudinal excretory vessels. Testes 32-40, anterior to female genital organs stretching

from one longitudinal excretory vessel to the other, poral and aporal groups, and also sometimes a few posterior to female genital organs. Receptaculum seminis absent. Ovary nearly in the centre of the proglottis or slightly poral. Small sac-like structures often appear on either side of shell gland and show the early development of uterus later on it is transversely elongated with lateral extremities sub-divided.



TEXT-FIG. 8.—*Gidhaia indica*, gen. *et* sp. nov.. Mature proglottis.

The present form differs from *Parvirostrum magnisomum* Southwell 1930 by its smaller number of testes, larger size of cirrus sac and the absence of the receptaculum seminis.

The characters given above clearly indicate that the present form must be included in the *Dilepidinae.* From the genera of this subfamily with alternating genital pores such as *Angularella* Strand 1925 synonym *Angularia* Clerc 1906, *Parvirostrum* Führmann 1907, *Paricterotaenia* Führmann 1932, and *Laterorchites* Führmann 1932, it is distinguished by the location of the testes anterior to ovary, from *Bancroftiella* Johnston 1911 and *Kowalewskiella* Baczynska 1914 by the course of the genital ducts and the presence of the testes lateral to the female genital organs, from *Cyclustera* Führmann 1901 by the irregularly alternating position of the genital pores and the absence of the ring-like uterus, from *Parorchites* Führmann 1932 (genital ducts passing dorsal to longitudinal excretory vessel) by the presence of the testes anterior to ovary and from *Liga* Weinland 1857, by the lateral disposition of testes and the absence of the tubular prolongations from eggs. It is, therefore, essential to create for it a new genus for which I propose the name *Gidhaia* with the present species as the type and with the following diagnosis :—

Dilepidinae ; Genital pores irregularly alternate. Genital canals pass dorsally to longitudinal excretory vessels. Testes in two groups, poral and aporal, anteriorly to the female organs connected by several rows and with a few testes posterior to them. Female genital organs slightly poral or in centre of proglottis. Uterus transversely elongated, with lateral extremities greatly sub-divided. Adults in birds.

Type-species.—Gidhaia indica, sp. nov.

As in *Parvirostrum* Führmann 1908, the testes are never anterior to the ovary (Führmann 1932, p. 112). *Parvirostrum magnisomum* Southwell 1930 can not be included in that genus : its characters, on the contratory place it in *Gidhaia.*

It should, however, be mentioned that genus *Taufikia* Woodland 1928 retains its validity and cannot in any way be considered as a synonym of *Parvirostrum* as has been suggested by Southwell (1930, p. 167).

Family HYMENOLEPIDIDAE Führmann 1907

Subfamily HYMENOLEPIDINAE Perrier 1897

Diploposthe Jacobi 1896.

Diploposthe laevis (Bloch 1782) Jacobi 1896.

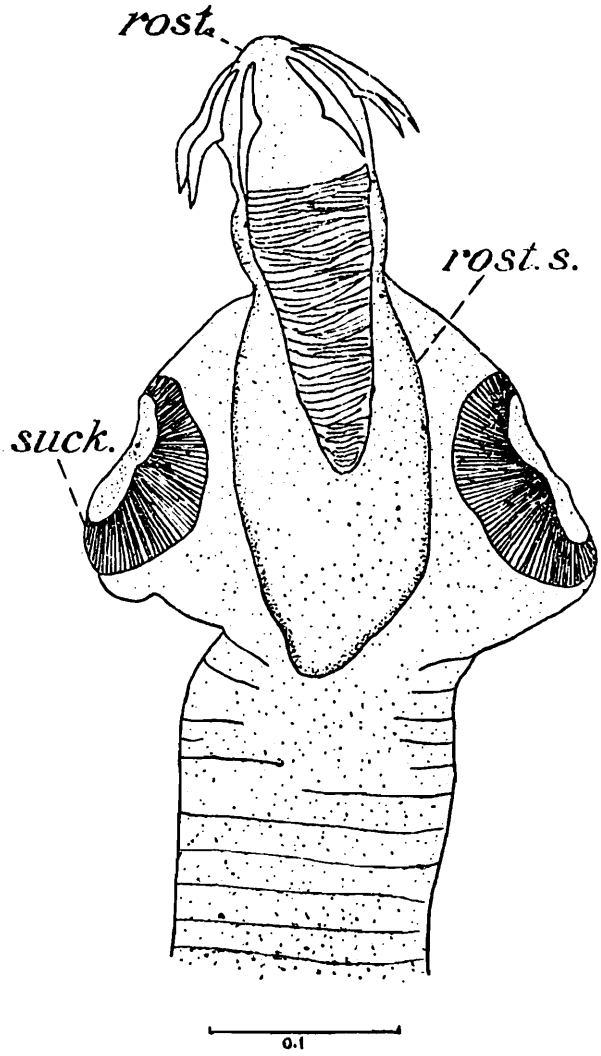
Host :—Duck.

Maximum length 166, maximum breadth 5·5. Genital pore slightly posterior to middle of the proglottis margin. Cirrus sac 0·658 ×0·11 extending to longitudinal excretory vessels. Testes three.

Hymenolepis Weinland 1858.

Hymenolepis clausa Linstow 1906.

Host :—*Columba intermedia.*



TEXT-FIG. 9.—*Hymenolepis clausa* Linstow. Scolex.

Rostellor hooks 0·068-0·084 long. Cirrus sac comparatively longer (0·272), extending half the breadth of the proglottis. Otherwise agreeing with the original description.

Hymenolepis furcata (Stieda 1862).

Host :—Crocidura sp.

Maximum length 3, maximum breadth 0·19. Scolex more or less rectangular, maximum breadth 0·24, and minimum breadth 0·17. Rostellar hooks 36, 0·016-0·018 long. Genital pore in anterior half of the proglottis margin. Cirrus sac 0·029-0·04, extending to ventral longitudinal excretory vessel. Of the two aporal testes, one internal and anterior to the other. Ovary small, poral mostly between cirrus sac and anterior testis.

The present form is placed in this species provisionally pending an investigation of the cestodes of *Crocidura*.

Hymenolepis multihamata Meggitt 1927.

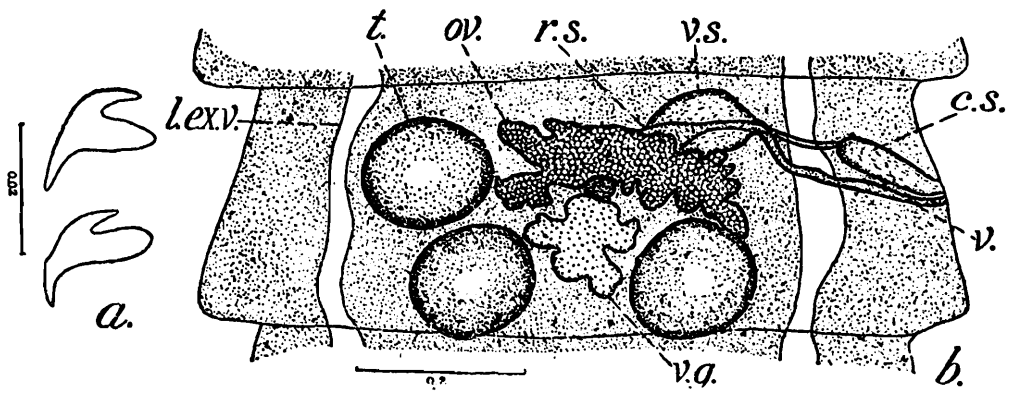
Host :—Milvus govinda.

Length 1·68, maximum breadth 0·27. Scolex 0·19 diameter. Rostellum 0·09 in diameter. Rostellar hooks 10, 0·114 and 0·075-0·087. Genital pore in anterior third of the proglottis margin. Cirrus sac 0·13-0·133 in mature segments, crossing longitudinal excretory vessels Cirral spines absent.

Hymenolepis planestici Mayhew 1925.

Host :—Acridotheres tristis.

Length 175, greatest breadth 1·525. Scolex 0·31 diameter. Rostellum 0·08 diameter. Rostellar hooks 6; 0·017-0·02 long. Cirrus sac 0·125-0·135 long, extending to ventral longitudinal excretory vessel. Vas deferens short, narrow, ending in an external vesicula seminalis.



TEXT-FIG. 10.—*Hymenolepis planestici* Mayhew. *a*. Rostellar hooks. *b*. Mature proglottis.

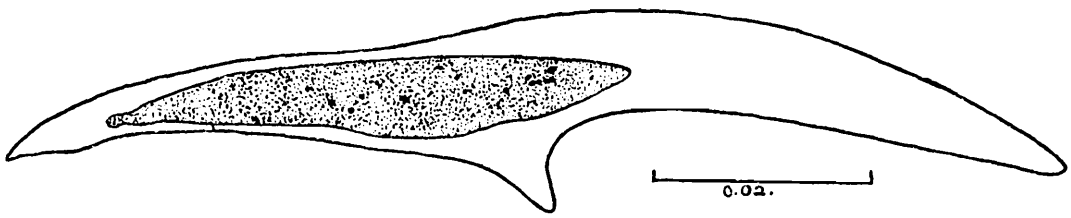
Receptaculum seminis often present but poorly developed. Genital atrium absent. Testes 0·16 in maximum diameter. Vitelline gland with 4-5 distinct lobes.

The Lucknow form differs from the original description (Mayhew 1925, p. 73) in the smaller number of rostellar hooks, slightly smaller relative size of cirrus sac and the lobed vitelline gland. These differences, however, do not appear sufficient to justify the creation of a new species.

Hymenolepis rugosa birmanica Meggitt 1924.

Host :—Columba intermedia.

Rostellar hooks 0·087-0·097 long. Cirrus sac 0·166 long, slightly exceeding half the breadth of the segment. Testes, variable in arrange-



TEXT-FIG. 11.—*Hymenolepis rugosa birmanica* Meggitt. Rostellar hook.

ment, usually in a transverse row towards the posterior margin of the proglottis.

H. serrata Führmann, 1906 greatly resembles *H. rugosa* Clerc, 1906. It differs only in the shape of hooks and the slightly smaller relative size of the cirrus sac, and specific identity of the two species appears to be clearly indicated.

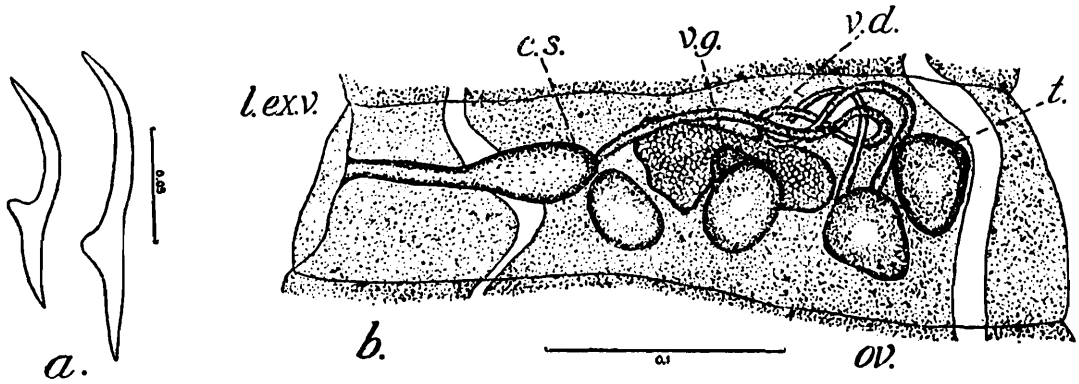
Oligorchis Führmann 1906.

Oligorchis hierticos, sp. nov.

Host :—Milvus govinda.

Locality.—Kakori, District Lucknow.

Maximum length 6·5, maximum breadth 0·45. Scolex 0·375-0·39 diameter. Rostellum 0·13 diameter, armed with approximately 16-18 hooks, 0·083-0·1 and 0·113-0·19 long. Suckers spherical, 0·11-0·14 diameter. Segments much broader than long. Genital pore unilateral, in anterior third of the proglottis margin. Genital ducts pass dorsal to the longitudinal excretory vessels. Musculature with two layers of longitudinal muscles, the bundles in the inner layer being feebly developed and lined internally by transverse muscles. Cirrus sac 0·065-0·125, crossing and extending a little beyond the ventral longitudinal excretory



TEXT-FIG. 12.—*Oligorchis hierticos,* sp. nov. *a.* Big and small rostellar hooks. *b.* Mature proglottis.

vessels. Cirrus well developed and spiny. Both seminal vesicles absent. Vas deferens specially developed, its coils usually extending to the aporal testis, sometimes beyond it. Testes, one aporal and anterior to the others, which are in a transverse row (posterior and lateral to ovary) : in more

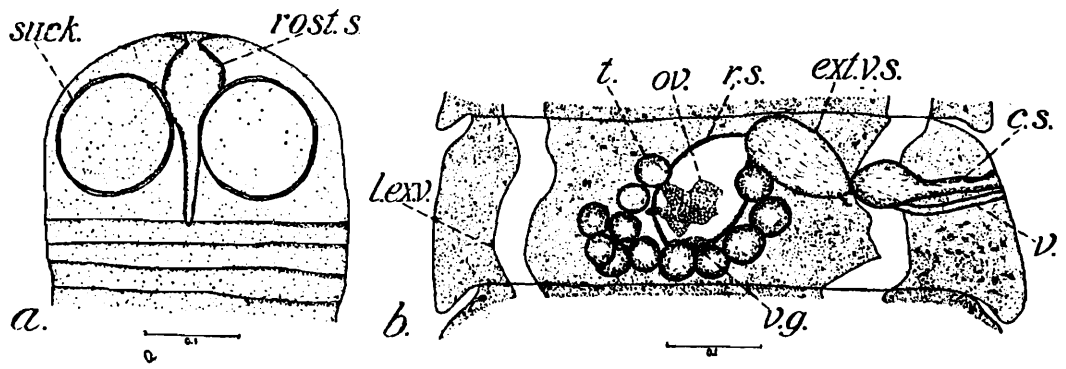
posterior segments all form a single row in contact with the posterior border of the proglottis. Uterus divided longitudinally into usually right and left sacs, often with a (comparatively much smaller) third between the two, containing 116-150 eggs.

From the present species, *Oligorchis paucitesticulatus* Führmann 1913 may be distinguished by the large number of testes, *O. yorkei* (Kotlan 1923) by the difference in number, size, shape and arrangement of the rostellar hooks while *O. toxometra* Joyeux and Baer 1928 and *O. strangulatus* Führmann 1909 are distinguished by the smaller size of the rostellar hooks, and their different shapes. Assuming the author's description to be aceurate, *O. longivaginosus* Mayhew 1925 is to be distinguished by a characteristic division of the ovary into 4-6 knob-like lobes, a specially long vagina and the arrangement of the rostellar hooks in a single row and their uniform size.

Pseudoligorchis magnireceptaculata, gen. *et* sp. nov.

Host :—Bat.

Maximum length 76, maximum breadth 0·718 (gravid segment) and 0·638 (maximum width of the mature proglottis). In some strobilae, last but third or fourth segment gets reduced in width and the succeeding ones show further reduction till the last proglottis is reduced to 0·38 breadth. Scolex 0·318 maximum diameter. Rostellar sac embedded in the scolex, 0·067 diameter and 0·2 long. Rostellar hooks absent (the specimen were thoroughly examined in living state before fixation and the rostellar hooks were found completely absent). Genital pore unilateral, slightly anterior to middle of the proglottis margin. Genital cloaca absent. Genital ducts pass between the dorsal and ventral longitudinal excretory vessels. Cirrus sac 0·14-0·16×0·053, extending to ventral longitudinal excretory vessel, containing a fairly well developed external vesicula seminalis. Testes 8-12 in between the longitudinal excretory vessels and surrounding the ovary laterally and posteriorly, their number is usually greater on the aporal than on the poral side. Ovary with small irregular processes, in the middle of the proglottis. Receptaculum seminis large. Uterus an irregularly lobed sac, occupying the segment except the slight margin at the lateral sides.



TEXT-FIG. 13.—*Pseudoligorchis magnireceptaculata,* gen. *et* sp. nov. *a.* Scolex; *b.* Mature proglottis.

From the characters given, it is obvious that the above form must belong to Hymenolepidinae. Of the genera of this subfamily it is

clearly separated from *Aploparaksis* Clerc 1903, *Diorchis* Clerc 1903, *Hymenolepis* Weinland 1858 and *Oligorchis* Führmann 1906, by the number of testes, from *Diplogynia* Baer 1925 and *Diploposthe* Jacobi 1896 by its unilateral genital pores, from *Chitenolepis* Baylis 1923 (also from a mammal and with an unarmed rostellum) by the course of the genital ducts, lateral disposition of testes and the absence of the remarkably thickened outer shell of egg, from *Drepanidotaenia* Railliet 1892 by the lateral disposition of testes and the central position of ovary (never aporal), and from *Echinocotyle* Blanchard 1891 and *Hymenofimbria* Skrjabin 1914 by the absence of a sacculus accessorius and also of more than two longitudinal excretory vessels (as compared to the latter genus only).

I propose the name *Pseudoligorchis* for the new genus with the following diagnosis :—

Hymenolepidinae ; Scolex with an ? unarmed rostellum. Genital pore unilateral. Genital ducts pass between the longitudinal excretory vessels. Testes numerous (more than four) posterior and lateral to female glands. External vessicula seminalis present. Uterus an irregularly lobed sac.

Type-species.—Pseudoligorchis magnireceptaculata, sp. nov.

Including the form *Oligorchis hierticos* described above altogether seven species of *Oligorchis* Führmann 1906 have been recorded, all of which possess four testes except *O. paucitesticulatus* Führmann 1913, which has 7-11. Mayhew (1925, p. 37) is of the opinion that the presence of external and internal vesicula seminalis is comparatively unimportant and would therefore remove the species from Hymenolepididae. However, when the constancy of that organ in Hymenolepididae is considered, to dismiss it arbitrarily is unjustified and the writer is of the same opinion as Führmann, *i.e.*, that the form belongs to Hymenolepidinae. The constancy of the testes in that subfamily is a character on which the genera are founded, and there is no more reason for altering the diagnosis of the genus *Oligorchis* to 4-11 testes so as to include *O. paucitesticulatus*, than to alter it to 3-11 testes so as to include the genus *Hymenolepis* Weinland 1858 : excluding the species under discussion, the number of testes in both the genera is equally constant. *O. paucitesticulatus* is, therefore, transferred to the new genus *Pseudoligorchis*.

Family TAENIIDAE Ludwig 1886.

Taenia Linnaeus, 1758.

Taenia saginata Goeze, 1782.

Host :—Man.

Taenia hydatigena Pallas 1766.

Host :—Capra hircus.

Multiceps multiceps (Leske 1780) Hall 1910.

Host :—Ovis aries.

REFERENCES.

Baczynska, H.—(1914). Études anatomiques et histologiques sur quelques nouvelles espéces de cestodes d'oiseaux. *Bull Soc. sci. nat. Neuchátel,* XL, pp. 187-239.

Baer, J. G.—(1925). Sur quelques cestodes du Congo belge *Rev. Suisse de Zool.* XXXII, pp. 239-251.

Baer, J. G.—(1927). Monographie des cestodes de la famille des Anoplocephalidae. *Bull. biol. France, Suppl.* X, 1-241.

Baylis, H. A.—(1926). Some parasitic worms from Sarawak. *Sarawak Mus. Journ.* No. 10, 1926, pp. 303-322.

Beddard, F. E.—(1913). Contributions to the anatomy and systematic arrangement of the Cestoidea XI. On a new tapeworm from Oedicnemus. *Proc. Zool. Soc. London,* 1913, pp. 861-877.

Beddard, F. E.—(1914). Contributions to the anatomy and systematic arrangement of the Cestoidea XIII. On two new species belonging to the genera *Oochoristica* and *Linstowia* with remarks upon those genera. *Ibid.*, pp. 263-283.

Dujardin, M. F.—(1845). Histoire naturelle des Helminthes ou vers intestinaux. Paris.

Führmann, O.—(1908). Die Cestoden der Vogel. *Zool. Jahrb. Suppl.* 10.

Führmann, O.—(1909a). Neue Davaineiden. *Centralbl. Bakt. Abt.* I *Orig.* XLIX, pp. 94-124.

Führmann, O.—(1909b). Die Cestoden der Vogel des weissen Nils. *Results of the Swedish Zoological Expedition to Egypt and the White Nile* 1901.

Führmann, O.—(1913). Nordische Vogelcestoden aus dem Museum von Goteborg. *Meddelanden fran Göteborgs. Musei, Zoologiska Afdelning* 1.

Führmann, O.—(1932). Les Tenias des oiseaux. *Memoires de l'Universite de Neuchatel.*

Hamid, A.—(1932). A cestode, *Oochoristica khalili* n. sp. from a snake, Psammophis schokari Forskal. *Parasitol.* XXIV, pp. 238-240.

Johri, L. N.—(1933). On the genus Houttuynia Führmann, 1920 (Cestoda), with a description of some species of Raillietina from the pigeons. *Zool. Anz. Bd.* CIII, pp. 89-92.

Joyeux, Ch. and Houdemer, E.—(1927). Recherches sur la fauna helminthologique de l'Indochine (Cestodes et trematodes). *Ann. Parasit.* V, pp. 289-309.

Kotlan, A.—(1920). Vogel—Cestoden aus *Neu*-Guinea 1. Papagei-Cestoden. *Ann. Mus. National. Hungaria,* XVIII, pp. 1-27.

Linton, E.—(1927). Notes on cestode parasites of birds. *Proc. U. S. Nat. Mus.* LXX, art. 7.

Mayhew, R. L.—(1925). Studies on the Avian species of the Cestode family Hymenolepididae. *Illinois biological Monographs,* X, pp. 1-125.

Meggitt, F. J.—(1924). The tapeworms of the Rangoon Pigeon. *Parasitol.*, XVI, pp. 303-312.

Meggitt, F. J.—(1926). On a collection of Burmese cestodes. *Parasitol.* XVIII, pp. 230-237.

Meggitt, F J.—(1927). Report on a collection of cestoda, mainly from Egypt. Part 11, Cyclophyllidea : Family Hymenolepididae. *Parasitol.* XIX, pp. 420-450.

Meggitt, F. J.—(1931). On cestodes collected in Burma Part 11. *Parasitol.*, XXIII, pp. 250-263.

Moghe, M. A.—(1933). Four new species of avian cestodes from India. *Parasitol.* XXV, pp. 333-341.

Ransom, H. B.—(1909). The Taenioid cestodes of North American birds. *Smithsonian Institution U. S. Nat. Mus. Bull.*, LXIX.

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

Skrjabin, K. J.—(1914). Beitrag zur Kenntnis einiger Vogelcestoden. *Centralbl. Bakt. Abt.* 1, *Orig.* LXXV, pp. 59-83.

Southwell, T.—(1930). The Fauna of British India, including Ceylon and Burma. *Cestoda*, II, pp. 1-262.

Woodland, W. N. F.—(1928). On some new avian cestodes from the Sudan. *Parasitol.* XX, pp. 305-314.

REFERENCE LETTERS FOR THE TEXT FIGURES.

c. s.=cirrus sac ; *cirr.*=cirrus ; *ext. v. s.*=external vesicula seminalis ; *g. cl.*=genital cloaca ; *l. ex. v.*=longitudinal excretory vessel ; *mus. p.*= muscular pad ; *ov.*=ovary ; *r. h.*=rostellar hooks ; *r. s.*=receptaculum seminis ; *rost.*=rostellum ; *rost. s.*=rostellar sac ; *s. g.*=shell gland ; *suck.*=sucker ; *t.*=*testis* ; *v.*=vagina ; *v. d.*=vas deferens ; *v. ex. v.*= ventral excretory vessel ; *v. g.*=viteline gland ; *v. s.*=vesicula seminalis.