ON A NEW SPECIES OF *APORORHYNCHUS* FROM THE WHITE SCAVENGER VULTURE *NEOPHRON PERCNOPTERUS* (LINN.) FROM INDIA.

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[Plate VI.]

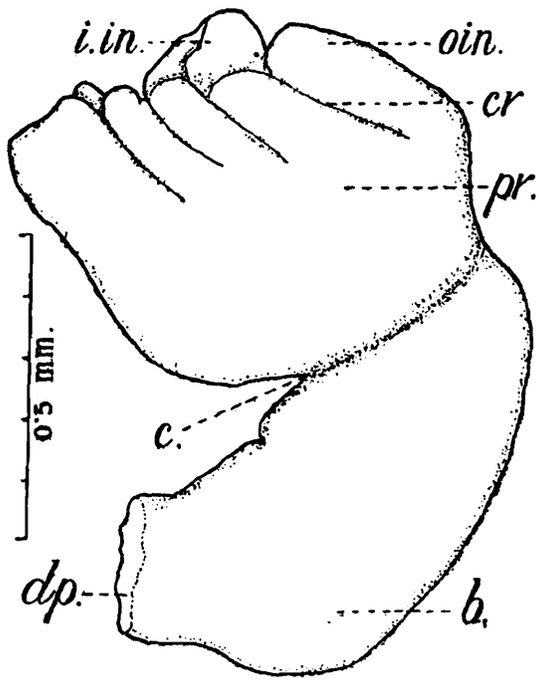
In describing a new species of an Acanthocephalan worm from a bird, *Hemignathus procerus*, Shipley (1897) created the genus *Arhynchus* literally meaning "without proboscis" In 1899, he proposed the name *Apororhynchus* for it on the ground that *Arhynchus* was preoccupied. A second species of this genus *Apororhynchus aculeatus*, was described by Meyer (1931) from the intestine of a bird, *Casicus cristatus*. I collected three specimens of a worm belonging to this genus from the intestine of the White Scavenger Vulture, *Neophron percnopterus*. All the three specimens are adult females. Since it was impossible to make out the details of the anatomy of the worm from specimens cleared in lactophenol, I cut sagittal sections of one of the three specimens and reconstructed a wax model, magnified 75 times. The specimens described below are remarkable in many ways and represent a new species of *Apororhynchus* for which I propose the name *Apororhynchus bivolucrus*, sp. nov.

Apororhynchus bivolucrus, sp. nov.

Diagnosis of the species.—Entire length of the parasite 1·4 mm.; length of proboscis 0·53 mm.; breadth of proboscis 0·70 mm.; maximum breadth of the body 0·46 mm.; breadth of the posterior end 0·25 mm. Proboscis marked off from the body by a deep constriction; proboscis divided into two involucres and an inner cone-like proboscis by means of deep cleavages; the colour of the parasite dark brown; giant nuclei measure 0·09 mm. × 0·05 mm.; Ovary, spherical, 0·13 mm. in diameter; giving rise directly to eggs, persisting throughout the maturity of the worm. Eggs oval, measuring 0·10 mm. × 0·06 mm. × 0·04 mm. Uterus very much elongated; vaginal gland and the horse-shoe shaped muscle present.

The worm (Text-fig. 1) is cylindrical in shape and round in cross section. It is curved on the dorsal side. In the living condition it was dark brown in colour and could be easily passed off as a faecal pellet. It measures 1·40 mm. in length and 0·70 mm. in maximum width in the region of the proboscis and 0·46 mm. in maximum width in the region of the body. The worm is divisible into two parts, an anterior representing the proboscis and a posterior representing the body. The proboscis (Text-fig. 1, *pr.*) is separated from the body by a deep constriction (Text-fig. 1, *c*) and the maximum width in this region is 0·38 mm. The posterior end is narrower than the rest of the body and measures 0·25 mm. in width.

The proboscis.—The proboscis (Text-fig. 2, *pr.*) measures 0·43 mm. in length and 0·70 mm. in breadth. It is devoid of hooks and spines. Externally it bears resemblance to an half opened flower. There are two involucres. The outer involucre (Text-fig. 2, *o. in.*) forms a complete cup. The anterior end of the cup is divided into clefts. One such cleft carrying on it a muscle mass is shown in Text-fig. 2, *p.* Dorsally the outer involucre is much thinner than it is on the ventral side. The thickness is 0·05 mm. on the dorsal and 0·18 mm. on the ventral side. The inner



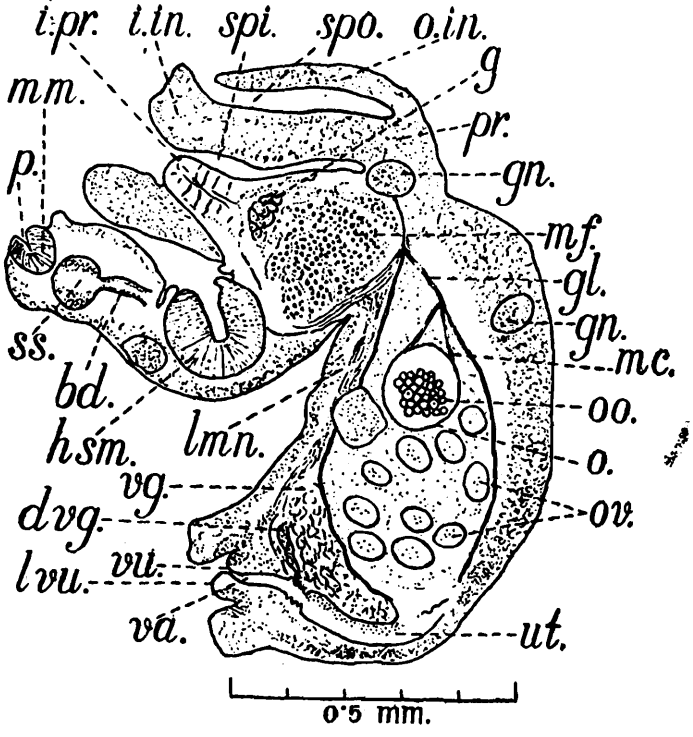
TEXT-FIG. 1.—*Apororhynchus bivolucrus*, sp. nov. Entire specimen.

b. body; *c.* constriction; *cr.* cleaves in the rim; *dp.* depression formed by the extension of the posterior wall of the body; *i.in.* inner involucre; *o.in.* outer involucre; *pr.* proboscis.

involucre (Text-fig. 2, *i. in.*) has a uniform thickness measuring 0·08 mm. but is incomplete on the ventral side. Its rim is also cleaved and the whole of it protrudes beyond the outer involucre, the protrusion being 0·06 mm. on the dorsal side. The inner involucre encloses within it a solid cone-like structure which could be called the inner proboscis (Text-fig. 2, *i. pr.*). It measures 0·45 mm. in length and 0·30 mm. in thickness at the base, it is a solid mass of muscles and in a sagittal section the muscle fibres are cut transversely. The nerve ganglion is situated half way between the apex and the base. The two involucres are not in contact with each other but they enclose a distinct space between them. In sagittal sections the space (Text-fig. 2, *spo.*) between the walls of the two involucres measures 0·30 mm. in length from anterior to posterior and 0·03 mm. in width. There is a similar space (Text-fig. 2, *sp. i.*) between the inner involucre and the inner cone-like proboscis and it measures 0·30 mm. in length and 0·01 mm. in width. The length of the space between the outer and the inner involucre is less than the length of the proboscis because at the base of the proboscis near the constriction, the involucres and the cone are all joined together. On the ventral side, in the region where the wall of the inner involucre is incomplete, there lies a horse-shoe shaped muscle (Text-fig. 2, *hsm.*), at the base of the cleft near

the constriction, wedged in between the base of the inner cone and the wall of the outer involucre. It measures 0·26 mm. in width and 0·40 mm. in length. It is seen to occur in five sections only each 20 μ in thickness. The muscle is situated at the base of the proboscis between the outer involucre and the inner cone and seems to regulate the size of the cleft or space between the outer involucre and the inner cone. It works in such a manner that either the wall of the involucre could be pushed out or the inner cone could be narrowed so as to widen the space between the outer involucre and the inner cone. It may also bring the wall of the outer involucre nearer to the inner cone thus reducing the space between the two. Probably this mechanism provides an adhesive organ in the absence of hooks. Probably it allows the contents of the intestine of the host to pass round in the clefts between the involucres and the inner cone so as to provide a larger absorptive surface. At the tip of the ventral wall of the outer involucre of the proboscis where a small portion of it is bifid, there is a similar but smaller muscle mass and it helps the portion of the bifid wall to work as a pincer (Text-fig. 2, *p.*).

Just below this muscle there is a spherical hollow cellular structure (Text-fig. 2, *ss.*), the lumen leading into a cellular duct (Text-fig. 2, *bd.*), which ends blindly. It is difficult to assign any particular function to this structure.



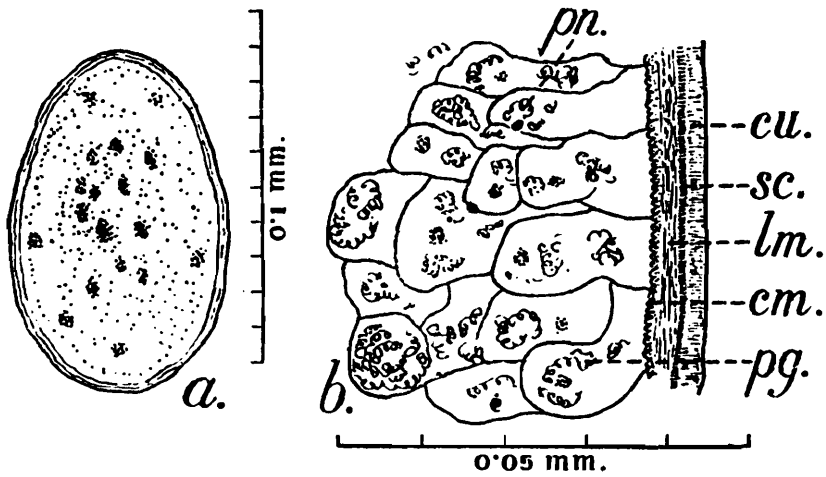
TEXT-FIG. 2.—*Apororhynchus bivolucrus*, sp. nov. Reconstruction of sagittal sections.

bd. blind duct ; *dvg.* duct of the vaginal gland ; *g.* ganglion ; *gl.* genital ligament ; *gn.* giant nuclei ; *hsm.* horse-shoe shaped muscle ; *i.in.* inner involucre ; *i.pr.* inner proboscis ; *lmn.* lemnisci ; *lvu.* lips of vulva ; *mc.* muscular connectives ; *mf.* muscle fibres ; *mm.* muscle mass ; *o.* ovary ; *o.in.* outer involucre ; *oo.* ova in the ovary ; *ov.* ova within the genital ligaments ; *p.* pincer ; *spo.* space in between the two involucres ; *spi.* space between the inner involucre and the inner proboscis ; *ss.* spherical structure ; *ut.* uterus ; *va.* vagina ; *vg.* vaginal gland ; *vu.* vulva.

The body.—The body (Text-fig. 1, *b.*) is sac-like in shape, and is markedly convex on the dorsal side, it is narrower in girth than the proboscis.

I could see faint annulations on the outer surface of the body in the living worms. The vulva is situated at the posterior end of the body and lies in a cup-like depression surrounded by the body wall.

The body wall.—The body wall is composed of a thin layer of cuticle (Text-fig. 3, *cu.*) forming the outer most layer. Inside this there is a thin layer of the fibrillar sub-cuticle (Text-fig. 3, *sc.*). Next to the sub-cuticle lies the muscular layer consisting of an outer layer of longitudinal muscle fibres (Text-fig. 3, *lm.*) and an inner layer of circular muscle fibres (Text-fig. 3, *cm.*). Parenchymatous cells (Text-fig. 3, *pn.*) laden with pigment (Text-fig. 3, *pg.*) occupy the deeper region of the body wall. The layer of the parenchyma is thicker on the dorsal side than on the ventral side. Giant nuclei (Text-fig. 2, *gn.*) measuring 0·09 mm. by 0·05 mm. are found scattered in the parenchyma. The musculature of the body wall is reinforced by strands running from the cone like inner proboscis to the body wall.



TEXT-FIG. 3.—*Apororhynchus bivolucrus*, sp. nov.

a. Mature ovum ; *b.* Longitudinal section of body wall ; *cm.* circular muscles ; *cu.* cuticle ; *lm.* longitudinal muscle ; *pg.* pigment ; *pn.* parenchyma ; *sc.* subcuticle.

The lemnisci.—The two elongated lemnisci (Text-fig. 2, *lmn.*) are fibrous. They originate from the base of the proboscis on the ventral side and run for more than half of the length of the body lying 80 μ to 100 μ apart from each other. Each measures 0·40 mm. long and 17 μ broad.

The genital organs.—The genital ligaments (Text-fig. 2, *gl.*) arise from the base of the proboscis, and diverge to enclose a saccular space within the body in which the genital organs lie. They consist of a single ovary and the eggs. The ovary (Text-fig. 2, *o.*) is a spherical structure, measuring 0·13 mm. in diameter. It lies towards the anterior end of the genital sac and is held in position by muscular connectives (Text-fig. 2, *mc.*) given off from the genital ligaments.

The mature egg (Text-fig. 2, *ov.* & Text-fig. 3, *a.*) is a typical acanthocephalan egg. It is oval in shape and measures 0·10 mm. by 0·06 mm. by 0·04 mm. It has three concentric membranes surrounding it.

The uterus (Text-fig. 2, *ut.*) is an elongated structure and lies on the dorsoposterior side between the genital space containing the eggs and the body wall. In many Acanthocephala, eggs pass into a short tube called the uterine bell and pass out into the cavity outside the bell if the eggs are not in the proper condition of maturity or pass into the uterus if they are mature. This arrangement does not obtain in this worm. The broad uterus is continuous with the posterior narrow portion which is the vaginal canal. It seems that eggs undergo maturity in the body cavity and thus pass into the bell *cum* uterus. The vaginal canal (Text-fig. 2, *va.*) is a much narrower duct than the uterus. Seen in a section, the inner wall of the vaginal canal is thrown into folds. The vagina opens out through the vulva (Text-fig. 2, *vu*), which is inclined towards the ventral side and is located in the centre of the cup like depression at the posterior end surrounded by the body wall.

The vaginal gland.—Between the posterior end of the genital sac and the uterus there is a glandular structure measuring 0·30 mm. by 0·10 mm. A small duct arises from the ventral side of this glandular structure and opens into the anterior end of the vagina. Owing to its close association with the vagina the duct is named as the vaginal duct (Text-fig. 2, *dvg.*) and the glandular structure as the vaginal gland (Text-fig. 2, *vg.*). Its function is presumably to secrete a substance and pour it in the vagina.

The nervous system.—The nervous system is composed of a large ganglion placed in the cone of the inner proboscis.

Systematic position and discussion.—The genus *Apororhynchus* is the only genus of the family Apororhynchidae. Only two species *Apororhynchus hemignathi* and *Apororhynchus aculeatus* are included in it. The peculiar morphological characters of the species have stimulated controversy regarding the exact systematic position of the family. Based on Shipley's (*op. cit.*) description of the species *Apororhynchus hemignathi*, Southwell and MacFie (1925) included the family Apororhynchidae in the Sub-order Neoechinorhynchidea, because of the presence of a subspherical proboscis and giant nuclei, both in the subcuticle and in the lemnisci. Thapar (1927) in his tentative classification of Acanthocephala erected a new order Apororhynchidea, consisting of one family, one genus and one species. He justified the creation of a new order on the ground that the form had neither hooks on the proboscis nor spines on the body, a character which makes it peculiar among Acanthocephala. Later Meyer (*op. cit.*) described a new form, in which he observed minute spines on the proboscis, but the general shape was almost the same as *Apororhynchus hemignathi.* He named the new species *Apororhynchus aculeatus.* In the classification which he proposed, Meyer reduced Thapar's Order Apororhynchidea to one of the six families in the order Archiacanthocephala, one of the two orders, he then created.

The characters of the family Apororhynchidae as given by Meyer (*op. cit.*) are as follows :—

(*a*) The proboscis is clearly globular without hooks but may have numerous spines ; (*b*) Lemnisci are long and finger like in shape ; (*c*) Absence of proboscis sheath ; (*d*) Presence of the giant nuclei both in the subcuticula and in the lemnisci.

The parasites belonging to this family are found in birds.

The characters of the form which is described in this paper conform to the characters of the family Apororhynchidae and consequently its only genus *Apororhynchus*. In shape it resembles the two known species though it is much smaller than any of them. The proboscis has no hooks. The proboscis sheath is absent. Giant nuclei are present in the body wall. The parasite was found in a bird.

Comparison with other species.—When compared with *Apororhynchus hemignathi* and *Apororhynchus aculeatus*, the only two species known, the new form is found to differ from them in many respects :

(1) It is a much smaller form than *Apororhynchus hemignathi* and *Apororhynchus aculeatus*, which measure 3·5 mm. and 4 mm. in length respectively. The new species measures only 1·4 mm. in length and 0·46 mm. in breadth in the region of the body and is 0·70 mm. broad in the region of proboscis.

(2) The body of the new species is much more curved than the other two species. In *Apororhynchus hemignathi* the body is divided into three regions : the proboscis, the collar and the trunk, whereas in *Apororhynchus aculeatus* the anterior part of the body is produced into a ridge which surrounds the base of the proboscis. In the new form there is neither the collar intervening between the proboscis and the trunk, nor the anterior region of the trunk produced into a ridge, but the proboscis is marked off from the body by means of a deep constriction, dividing the body only into two parts.

(3) The proboscis in *Apororhynchus hemignathi* has very small pits on its surface, in *Apororhynchus aculeatus*, it is split at the apex and is covered with very minute spines, but in the form under discussion the rim of the proboscis has clefts which go deep to the base dividing the proboscis into an external and an inner involucre enclosing a cone like inner proboscis.

(4) The lemnisci in *Apororhynchus aculeatus* are long, coiled and finger-like in *Apororhynchus hemignathi*, they are long and sac-like, whereas in the new form the lemnisci are fibrous.

(5) The ovary gives rise directly to eggs and not to egg masses as is found in the other two species. Besides it does not disintegrate when the worm attains full maturity, as is the case in the other two species.

(6) The uterus is very much elongated in the new form as compared with the other two species.

(7) The presence of the vaginal gland is known neither in *Apororhynchus hemignathi* nor in *Apororhynchus aculeatus*.

(8) The horse-shoe shaped muscles are also not found in the other two species.

This new species is a highly specialized form. The peculiar structure of the proboscis and the more developed musculature of the form are characters suitable for the environment in which it lives, as these parasites

are found in the intestine of a bird which feeds largely on human excrement, in which there is little of nourishment. With a well developed musculature the parasite can move in the intestine in the slow caterpillar-way of progression, and the cleavages in the proboscis increase the area of the absorptive surface to absorb maximum nourishment.

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