ON A NEW SPECIES OF ACANTHOCEPHALA OF THE GENUE *MEDIORHYNCHMS* (VAN CLEAVE, 1916) FROM INDIA.

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Introduction

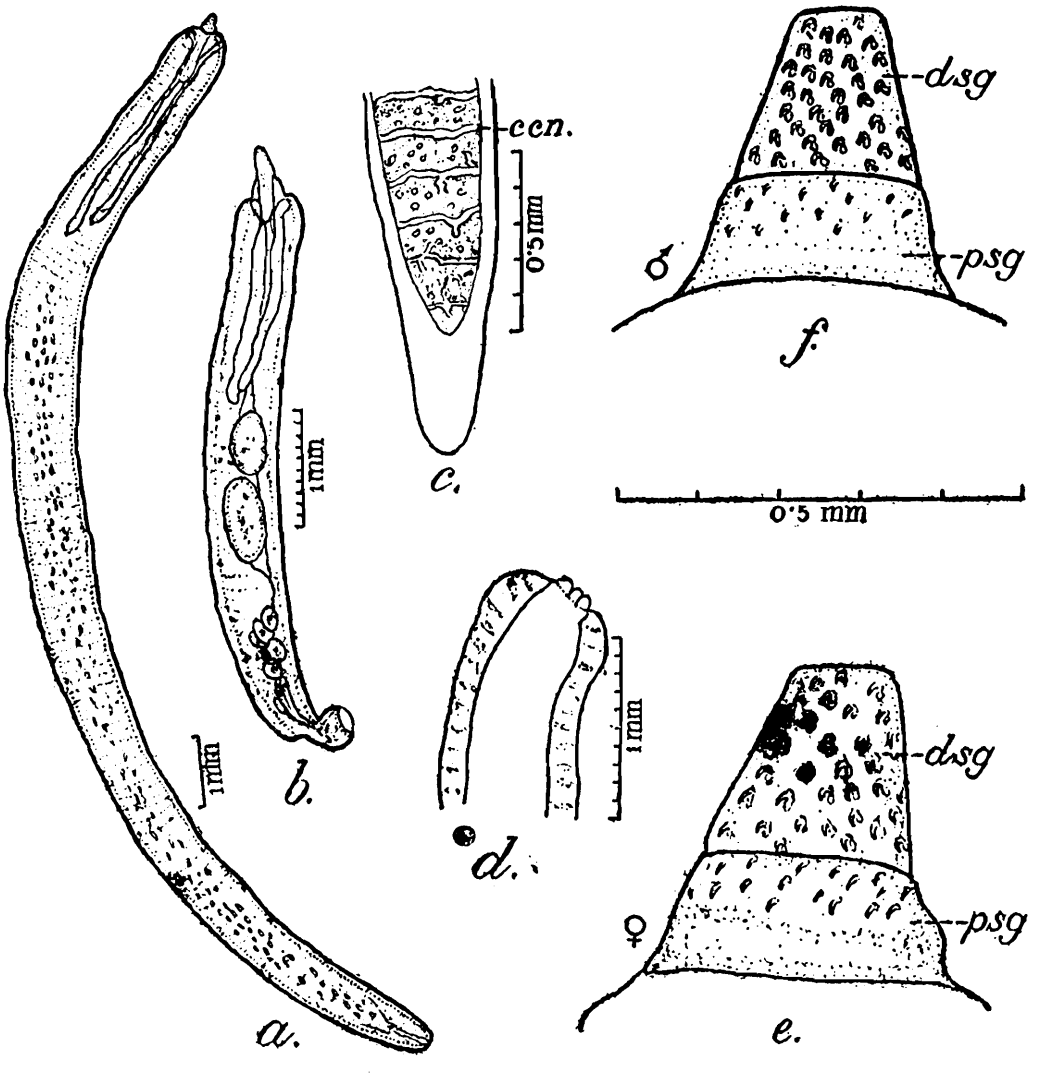
I possess in my collection several larval, immature and mature forms of Acanthocephala mainly collected from amphibians, reptiles, some mammals and falconid birds. These belong to the genera *Centrorhynchus* and *Echinorhynchus*, some of which I have described. I collected some Acanthocephala from birds other than the Falconidae such as the Blue-jay (*Coracias benghalensis*), House-Sparrow (*Passer domesticus indicus*) and Seven Sisters (*Turdoides somervillei*). I examined about 150 specimens of House-Sparrow. Most of them harboured cestodes and nematodes and from only one I collected four specimens of Acanthocephala, which on examination were found to belong to the genus *Mediorhynchus*, Van Cleave. Of these three were females and one male. They were firmly attached to the wall of the intestine and one of the three female specimens could be released from its hold with considerable difficulty. It retracted its proboscis completely. The female specimen was sectionised to enable me to describe it as fully as possible. The specimen were cleared in lactophenol and in creosote.

Systematic Account.

Mediorhynchus passerus, sp. nov.

Diagnosis : Female.—Entire length 16·4 mm ; maximum width in the region of mid body 1·0 mm ; posterior end 0·5 mm. in width ; entire length of proboscis 0·36 mm ; length of distal segment 0·23 mm, breadth at tip 0·13 and at base 0·23 mm, length of proximal segment 0·13 mm, breadth at base 9·33 mm ; hooks arranged spirally, 7 spiral rows with 5 to 6 hooks in each on the distal segment and the same number of spiral rows with 2 to 3 hooks in each on the distal segment ; root of hooks on distal segment measure 19 μ to 30 μ, and base rounded, protruding portion of hooks 10μ to 20μ long, hooks on the proximal segment almost completely embedded, 14 to 18μ long ; proboscis sheath with single layered muscle wall and length of proboscis sheath 0·46 mm ; breadth of the anterior part of the proboscis sheath 0·13 mm and of the narrow posterior part 0·07 mm ; length of lemnisci 2·6 mm, width 0·08 mm to 1·7 mm, giant nuclei present in linear order through out lemnisei measure 0·08 mm$\times$0·03 mm ; giant nuclei also present in subcuticle measuring 0·026 mm$\times$0·01 mm to 0·056 mm$\times$0·026 mm ; embryo oval shaped, measuring 0·03 mm$\times$0·02 mm with 3 concentric coverings.

Male.—Entire length of the body 5·6 mm, width 0·6 mm. Other diagnostic features are the same as described for the female; testes one behind the other; anterior. testis measures 0·56×0·31 mm, posterior testis measures 0·8×0·38 mm.



TEXT-FIG. 1.—*Mediorhynchus passerus*, sp. nov.

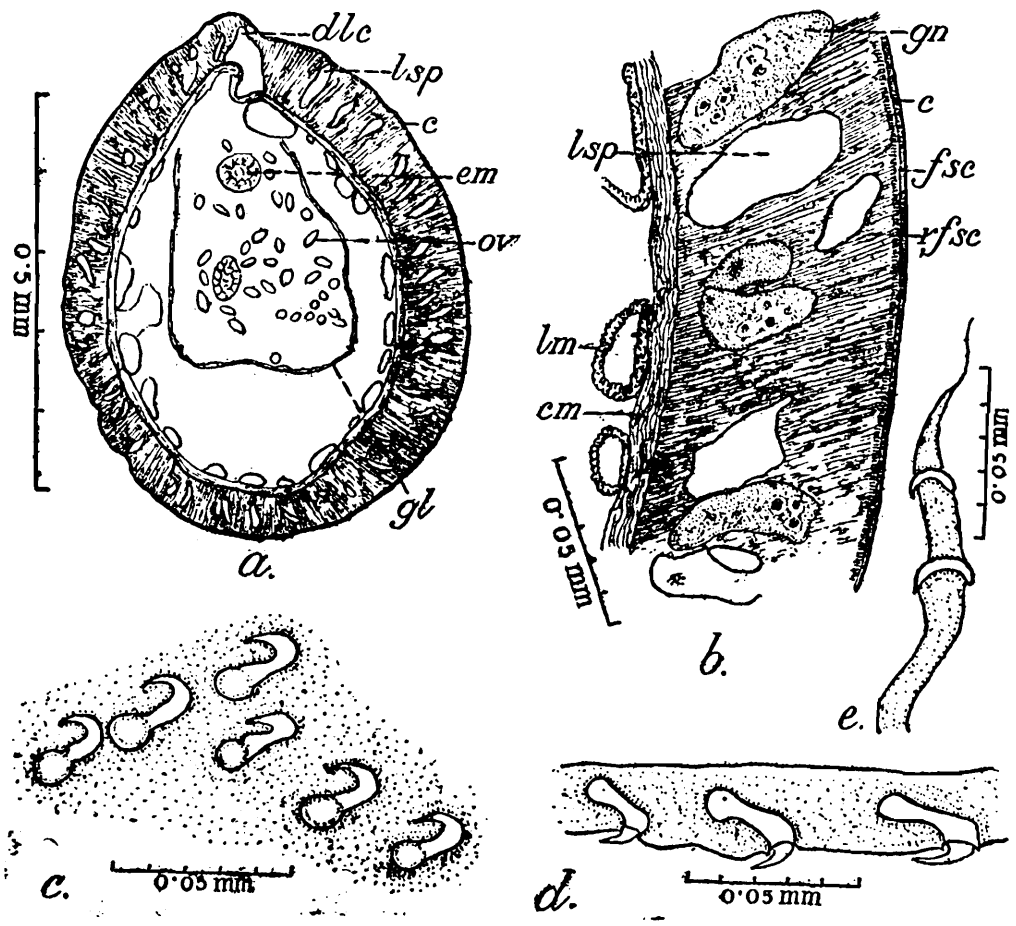
a. Female specimen, entire; *b*. Male specimen, entire, *c*. A. slice of body wall; *d*. retracted proboscis; *e*. female proboscis; *f*. male proboscis. (*Ccn.*, circular canal; *dsg.*, distal segment; *psg.*, proximal segment).

Description.—In the living condition, the worms show traces of segmentation which is probably due to the highly developed lacunar system. The male and female show pronounced sexual dimorphism like some other species of this genus. Van Cleave (1947) states, " In fact the difference between males and females is so great that it is equivalent to the difference between distinct species in some other representatives of this genus " In view of this, I thought it convenient to describe the two sexes separately.

Body.—(text-fig. 1*a*) Body is cylindrical and uniform in thickness except at the posterior extremity where it tapers. The total length of the worm is 16·4 mm, and width 1·0 mm, and at the narrow posterior end 0·5mm.

Body wall.—The body wall is 0·08 to 0·10 mm in thickness. Below the outermost cuticle (text-fig. 2*b*, *c*) there is a thin region of fibrillar subcuticle (text-fig. 2*b*, *fsc*) below which the fibrillae of the subcuticular layer are radially disposed (text-fig. 2*b*, *rfsc*). It is traversed by lacunar spaces (text-fig. 2*b*, *lsp*) of various sizes and by giant nuclei (text fig. 2*b*, *gn*) situated at various intervals. Each giant nucleus measures 0·026× 0·0 1 mm to 0·056×0·02 mm. Below this region there is a narrow layer of circular muscles (text-fig. 2*b*, *cm*) and below it longitudinal muscles (text-fig. 2*b*, *lm*). These longitudinal muscles do not form a continuous layer but form patches of bands from the anterior to the posterior end of the worm. These bands consist of muscle fibres so arranged as to leave a central space between them.

Lacunar system.—There is a main lacunar canal (text-fig. 2*a*, *dlc*) situated on the dorsal side of the worm running in the median line. It extends from the base of the proboscis to very nearly the posterior end of the worm. The circular canals (text fig. 1*c*, *ccn*) are situated at regular

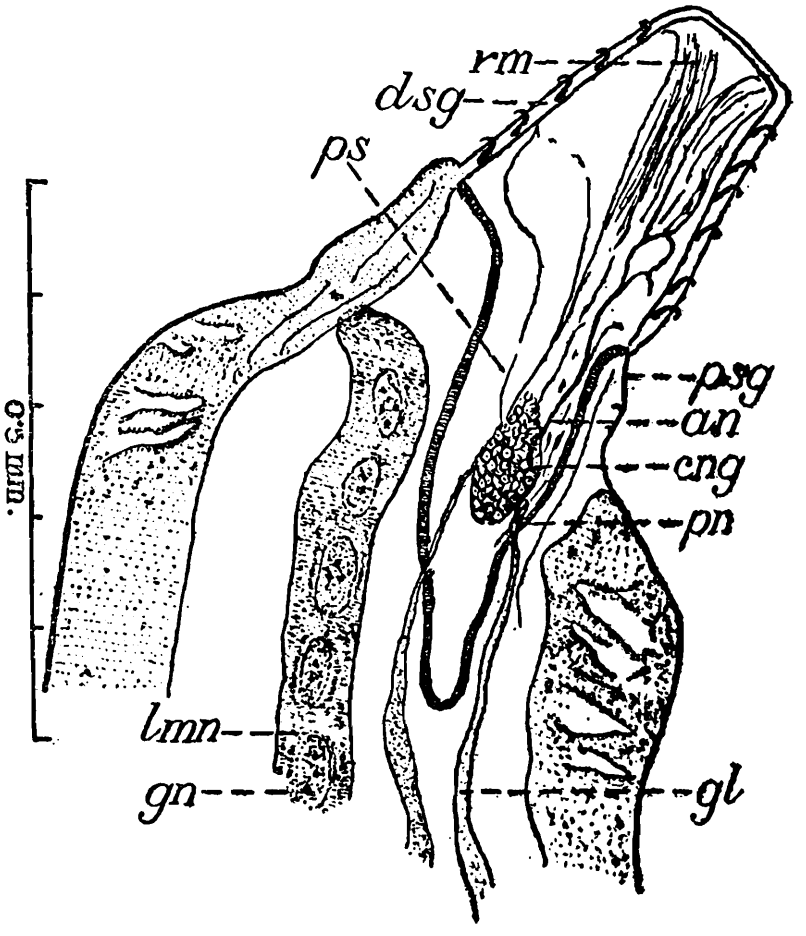


Text-fig 2.—*Mediorhynchus passerus*, sp. nov.

a. Transverse section through mid-body ; *b*. A part of the same, magnified ; *c*, A. slice of the anterior segment of the proboscis ; *d*. Sagittal section of the wall of distal segment of proboscis ; *e*. Sagittal section of the wall of proximal segment of proboscis (*c*., cuticle ; *cm*., circular muscle ; *dlc*, dorsal lacunar canal ; *em*, egg-mass ; *fsc*. fibrillar sub-cuticle ; *gl*. genital ligament ; *gn*., giant nucleus ; *lm*, longitudinal muscle *lsp*, lacunar space ; *orv*, embryo ; *rfsc*, radial fibrillar sub-cuticle).

intervals, and in transverse sections both are seen to lie entirely in the radial fibrillar subcuticle. A small slice (text fig. 1*c*) of the body wall cut longitudinally shows the circular canals one over the other showing branches. The relation of the circular canals to the median dorsal one is obscure and could not be made out.

Proboscis.—The entire proboscis (text-fig. 1*e*) measures 0·36 mm in length. The distal segment (text-fig. 1e, *dsg*) is conical in shape, 0·23 mm, long, 0·13 mm in width at the tip of the cone and 0·23 mm in width at the base. The proximal segment (text-fig. 1e, *psg*) of the proboscis is 0·13 long and 0·33 mm in width. Hooks on the proboscis are arranged in diagonal spiral rows and since in a mount of the worm in any position only a small part of the spiral is seen, it is not possible to count the total number. There are 7 spiral rows with 5 to 6 hooks in each row on the distal segment and the same number of spiral rows with 2 to 3 hooks in each on the proximal segment. The total number of hooks is not of any diagnostic significance in this genus. Van Cleave (1947) states, "As Meyer (1931) has maintained for these forms, the hook arrangement is in the form of diagnol spirals. This departure from tLe arrangement in straight, parallel longitudinal rows renders enumeration extremely difficult. It is wholly impossible to follow spirals from one surface to the other specially because the tips of the hooks are so frequently obscured by cuticular elevations of the body wall. Since number and arrangement of the hooks had been the chief characteristic on which species had been described it has been necessary in the present study to revaluate the features on which species may be distinguished."



TEXT-FIG. 3.—*Mediorhynchus gracilis*, sp. nov.

Sagittal section through the proboscis and anterior part of the body.

an, anterior nerve ; *cng.*, central nerve ganglion ; *lmn*, lemniscus ; *pn*, posterior nerve ; *ps*, proboscis sheath ; *rm*. retractor muscles. (Other lettering as in text-figs. 1 and 2).

Hooks.—Hooks (text-figs. 2 *c* & *d*) of the distal segment vary much in size and shape from those on the proximal segment (text-fig. 2*e* Hooks on the distal segment have large ensheathed roots rounded bases

each measuring 19 μ to 30 μ. The base is embedded in the thick sub-cuticle of the proboscis wall. The free part of the hook *viz* the portion which protrudes out of the proboscis wall is sharp and short and measures 10 μ to 20μ in length. Hooks on the proximal segments are almost completely embedded in the wall of the proboscis so that only a small part of the hook is free. The base is not rounded as in those of the distal segment.

Proboscis sheath.—The proboscis sheath (text-fig. 3, *ps*) measures 0·46 mm in length. The broad anterior part measures 0·13 mm in width and the narrow posterior part measures 0·07 mm in width. The wall of the proboscis sheath is composed of a single muscle layer.

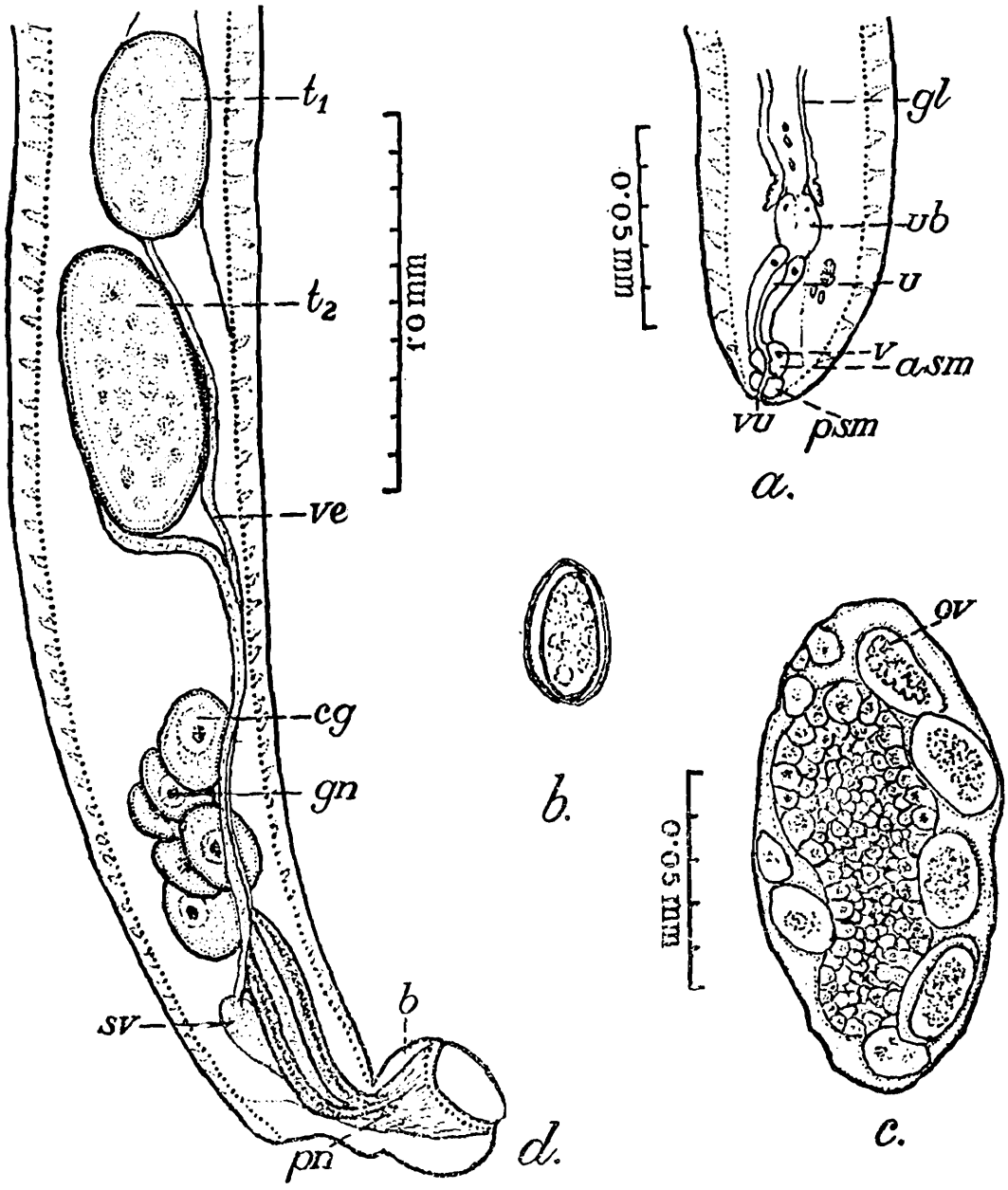
Lemnisci.—The lemnisci (text-fig. 3, *lmn*) are long and finger like and they measure 2·6 mm in length and 0·08 to 1·7 mm in width. In gittal sections they show the presence of giant nu clei arranged one hind the other in a linear row. A giant nucleus mea sures (text-fig. 3, *gn*) 0·08×0·03 mm.

Nervous system.—The central nerve ganglion (text-fig. 3, *cng*) is situated in the middle of the proboscis sheath. From it, nerves are given off both to the anterior and posterior regions of the worm. Nerves anteriorly (text fig. 3, *an*) to the retractor muscles of the proboscis and posteriorly (text-fig. 3, *pn*) to the genital ligaments could be clearly made out both in whole worms cleared in lactophenol and in sagittal sections.

Genitalia.—The genital ligaments (text-fig. 3, *gl*) arise from the sides of the proboscis sheath at the level of the nerve ganglion, enclose the egg masses between them and finally rest on the uterine bell (text-fig. 4*a*, *ub*). In close proximity of the uterine bell, each ligament is slightly broader. The embryo mass (text-fig. 4*c*) measures 0·12 mm×0·06 mm. Its central region is full of embryos in different stages of maturity. The more mature embryos are found at the periphery of the embryo mass. Each embryo (text-fig. 4*b*) is oval in shape measuring 0·03×0·02 mm and is enclosed within three concentric egg-membranes. The uterine bell is spherical and measures 0·15×0·10 mm and lies immediately behind the egg masses. At its posterior end lies the elongated uterus (text-fig. 4*a*, *u*) with a narrow lumen and thick walls showing in a sagittal section the presence of two nuclei anteriorly placed. These nuclei are much smaller than the giant nuclei. The uterus measures 0·2 mm in length ; it is 0·06 mm in width at its posterior end and 0·1 mm at its anterior end immediately behind the uterine bell. The uterus is continued into a narrow vaginal canal (text-fig. 4*a*, *v*) measuring 0·12 mm in length. The vaginal canal is guarded on each side by an anterior (text-fig. 4*a*, *asm*) and a posterior sphincter muscle-mass (text-fig. 4*a*, *psm*). The terminal opening of the vaginal canal is the vulva (text-fig. 4*a*, *vu*).

Male.—(text-fig. 1*b*) It is not necessary to describe again the body wall, lacunar system, position of the central nerve ganglion, as these structures are similar to female worms. The male is much smaller than the female being about one third its size and measures 5·6 mm in length and 0·6 mm in maximum width. It is uniformly thick except at the proboscis and at its posterior end where it constricts immediately anterior

to the bursa (text-fig. 4*d*, *b*). In the only male specimen at my disposal the total length of the proboscis is the same as in the female specimens. The distal part of the proboscis (text-fig. 1*e*, *dsg*) is 0·23 in the female and 0·21 (text-fig. 1*f*, *dsg*) in the male and the proximal part of the proboscis (text-fig. 1*e*, *psg*) is 0·13 in the female and 0·15 in the meal (text-fig. 1*f*, *psg*). This small difference in the relative lengths of the two regions in the two sexes may be due to unequal contraction of the proboscis and does not appear to be a character of taxonomic importance.



TEXT-FIG. 4.—*Mediorhynchus passerus*, sp. nov.

a. Sagittal section of the posterior extremity of female, showing genital organs *b*. Embryo ; *c*. Egg mass ; *d*. Male genital organs. [*asm*, anterior sphincter muscle ; *b*. bursa ; *cg*., cement glands ; *ov*, embryo : *pn*., penis ; *sv*., seminal vesicle ; *ti*., anterior testis ; *t2*, posterior testis; *v*, vagina ; *ve*, vas efferens ; *vu*, vulva] (Rest of the lettering as in other figures).

Genitalia.—The genital ligaments have the same position as in the female. The two oval testes (text-fig. 4*d*, *t1* & *t2*) are one behind the other, the anterior (text-fig. 4*d*, *t1*) is slightly smaller. The anterior

testis measures 0·56×0·31 mm. and lies approximately in the middle of the body. The posterior testis (text-fig. 4*d*, *t2*) measures 0·8×0·38 mm. Each gives off a vas efferens (text-fig. 4*d*, *ve*) and the two unite behind the posterior testis to form the vas deferens which runs by the side of the cement gland (text-fig. 4*d*, *cg*). It enlarges behind the cement glands to form a vesicula seminalis (text-fig. 4*a*, *sv*) and ultimately opens in the penis (text-fig. 4*d*, *pn*), which is seen protruding in the everted bursa. I could see only six cement glands though there ought to be eight. Van Cleave (1949) states, " It has long been recognised that eight globular or pear shaped cement glands are characteristic of the Archiacanthocephala " He further states that " the pairing of the glands is not always followed exactly since occasionally in some species and regularly in others the individual parts are less symmetrically arranged in such instances they often overlap one another, obscuring the pattern of their arrangement and making the recognition of the number difficult" I consider that in the male specimen I have in my possession, there is overlapping and hence actually I see only six. Each cement gland measures 0·28×0·10 mm in the cleared specimen. Each gland is a uninucleated structure with centrally placed giant nucleus. This observation conforms to that of Van Cleave's (1949). He states, " This is the case in all forms of the Archiacanthocephala." The cement ducts form two groups and open in the bursa. The bursa is a cup shaped structure 0·40 mm in width with an opening 0·25 mm in diameter.

Systematic position.

Heteroplus, Kostylev, 1914.

Mediorhynchus, Van Cleave, 1916.

Empodius, Travassos, 1917.

Leiperacanthus, Bhalerao, 1937

The genus *Mediorhynchus* was created by Van Cleave in 1916, and was included by him in the family Centrorhynchidae, which he created to include the genera *Mediorhynchus* and *Centrohynchus*. Travassos (1917) included the genus *Mediorhynchus* in the family Gigantorhynchidae, which was included in the order Archiacanthocephala by Meyer (1932-33) in his monograph on Acanthocephala, Van Cleave later accepted the inclusion of the genus *Mediorhynchus* in the family Gigantorhynchidae realizing the mistake he made in considering only one character *viz.*, the insertion of the proboscis sheath in the middle of proboscis as of value in assigning it to the family Centrorhynchidae. Meyer (1932-33) includes in the family Gigantorhynchidae the genera *Empodius* Travassos 1916, *Mediorhynchus* Van Cleave 1916, and *Giganto hynchus* Hamann 1892. Bhalerao (1937) described a new species of Acanthocephala belonging to the genus *Leiperacanthus* for which he created a new family Leiperacanthidae. Van Cleave (1947) considers Bhalerao's genus, *Leiperacanthus* as synonymous with *Mediorhynchus*. He states, " The nomenclatorial history of the genus *Mediorhynchus* has been long and intricately involved." Kostylev in Europe, Travassosin

South America and Van Cleave in North America worked independently on this genus. Kostylev (1914) described some species of Acanthocephala and assigned to a new genus, *Heteroplus*. Independently of Kostylev, Van Cleave (1916) created the genus *Mediorhynchus* for species of Acanthocephala which could be included in the genus *Heteroplus*. The genus name *Heteroplus* was preoccupied and hence the species described by Kostylev (1914) and those described by Van Cleave (1916) were all included in the genus *Mediorhonchus* by Van Cleave 1916).

Travassos (1917) unaware of the work of Kostylev and of Van Cleave which have not been mentioned by him in the list of reference, described some Acanthocephala and assigned them to the genus *Empodius*, which he created. Later (1924), however, he accepted that the genus *Empodius* was synonymous with the genus *Heteroplus*. Van Cleave (1947) states, " This attempt of revival of direct synonymy as a generic name is in open violation of Article 36 of the International rule of Zoological nomenclature of 1926." Be that as it may, the name *Heteroplus* was preoccupied and therefore all species included in this genus have to be included in the genus *Mediorhynchus*, the two genera being perfectly similar. Thus all species belonging to the genera *Heteroplus* (Kostylev, 1914), *Mediorhynchus* (Van Cleave, 1916) and *Empodius* (Travassos 1917) and *Leiperacanthus* (Bhalerao 1937) belong to the genus *Mediorhynchus*, Van Cleave, 1916.

Southwell and Macfie (1925) retained the genus *Empodius*. They said that Van Cleave disregarded completely the structure of the wall of the proboscis sheath. In *Mediorhynchus*, the proboscis sheath wall is composed of a single layer of muscle, whereas in *Heteroplus* and *Empodius* the wall has a double layer. Commenting on this Van Cleave (1947) states, " The individuals who have maintained that there is a double wall to the receptacle in forms ascribed to *Empodius*, *Heteroplus*, *Leiperacanthus* and some species of *Mediorhynchus* have been misled into interpreting a portion of the specialized musculature for retraction of the neck and front part of the trunk as an integral part of the receptacle. There is no distinction of any sort between the receptacle in *Mediorhynchus* and these forms which have been ascribed to other genera."

Meyer (1932-33) retains the genus *Empodius* commenting on this Van Cleave states, " The only feature which Meyer found available to distinguish between his two artificial groups of species were (*a*) texture of the egg membranes, (*b*) relative size of the body and (*c*) the relative degree of pseudosegmentation. Two of these features (*b & c*) are wholly quantitative and the third (*a*) the texture of the membranes, is probably more of a quantitative than qualitative distinction. Relative differences are very generally recognized as of not more than specific value in taxonomy ". He further stated that the genus *Leiperacanthus* (Bhalerao 1937) is also a synonym of the genus *Mediorhynchus*. Van Cleave (1947), " The para-proboscidial sacs which Bhalerao regarded as "altogether a new structure in the organization of the Acanthocephala " have been observed in many species of *Mediorhynchus* and were figured by Skrjabin in his drawing of *Mediorhynchus empodius*"

Webster (1948) comments on Van Cleave's reasons for abolishing the genera *Empodius* Travassos (as amended by Meyer 1933) and *Leiperacanthus* Bhalerao (1937) as follows :—" Van Cleave failed to explain the structure and function of the paraboscidial sacs. He failed to examine specimens of *Mediorhynchus empodius* (Skrjabin, 1913) *Mediorhynchus giganteus*, Meyer, 1931, and *Leiperacanthus gallinarum* Bhalerao, 1937, each of which served as the type species or best studied species of genera recognized by such authorities as Meyer, 1933, Leiper (in Bhalerao, 1937) and Tubangui and Masilungan (1946)".

These controversies relating to the synonymy of *Empodius* and *Leiperacanthus* with *Mediorhynchus* are still undecided in considering these as synonymous.

(*b*) The characters of genus *Mediorhynchus* (Van Cleave, 1916).

1. Acanthocephala of medium size.

2. Proboscis insertion near the middle of the proboscis wall.

3. Receptacle of a single walled muscular sac.

4. Invertors of proboscis passing through its wall some distance anterior to the posterior tip of the receptacle.

5. Central nervous system near the centre of the proboscis.

6. Cement glands, pear shaped, usually 8 in number.

7. Proboscis hooks of two distinct type, those anterior to the insertion with flask shaped roots, bases of roots broad, hooks on the posterior-ptar not with reflected roots.

8. Embryos with three concentric membranes.

The worm described in this paper is characterised by the possession of all these characters except that the number of cement glands is found to be 6, but may be 8 for reasons already mentioned.

I have carefully compared the characters of this species with the characters of the species previously described in the genera *Empodius*, *Mediorhynchus* and *Leiperacanthus*, and I find that this is a new species, which I propose to designate *Mediorhynchus Passerus* sp. nov.

(*c*) Comparison of M. *passerus*, sp. nov. with other species :—

The species of *Mediorhynchus* (including the species of the genera *Empodius* and *Leiperacanthus*) fall into two distinct categories *viz.*, those in which hooks on the proboscis are arranged in longitudinal rows atleast on the anterior part of the proboscis and those in which they are arranged in spiral rows. To the first category belong the species :

M. empodius (Travassos, 1916, 1917), *M. robustus* (Van Cleave, 1916) *M. grandis* (Van Cleave, 1924), *M. emberizae* (Travassos, 1924), *M. pintoi* (Travassos, 1923, 1924,), *M. oswaldocruzi* (Travassos, 1923, 1924), *M. vaginatus* (Baer, 1925), *M. zeosteropis* (Travassos 1926), *M. mirablis* (Baer, 1925), *M.* (*Empodius*) *otidis* (Kostylev, 1914*b*), *M.* (*Empodius*) *numidae* (Baer, 1925), *M.* (*Leiperacanthus*) *gallinarum* (Bhalerao, 1937), *M. garruli* (Yamaguti, 1939). The worm described belongs to the second category and in this group are included the species ;

Table indicating the important characters of M. micracanthus M. tenuis M. (Empodius) taeniatus M. (Empodius) giaganteus *and* M. colini.

		M. micracanthus (Rudolphi, 1819)	*M. tenuis* (Meyer, 1931)	*M. (Empodius) taeniatus* (Linstow, 1901).	*M. (Empodius) giganteus* (Meyer, 1931)	*M. colini.* (Webster, 1948)
Body dimensions	♀	20 mm long 0·75 mm max. breadth	30 to 33 mm long 0·5 to 0·75 mm max breadth	♀ and ♀ almost of equal size, 90 to 115 mm. 2·5 to 3 mm max. long. breadth	110 mm long 2 mm max. breadth	24 to 31 mm long 0·6 to 1 mm broad.
	♂	Not known	12 mm long 0·5 mm max. breadth		35 mm long	Not known
Proboscis dimensions	Anterior segment	0·3 mm × 0·25 mm	0·65 mm total length 0·35 mm max. breadth	0·86 mm total length 0·4 mm max. breadth	0·35 mm total length, 0·4 mm max. breadth	292 μ total length 288 μ max. breadth
	Posterior segment	0·12 mm × 0·355 mm				
Number of rows and hooks	Anterior segment	8 spiral rows ; 9 to 10 hooks in each row	12 to 14 spiral rows ; 9 hooks in each row	6 spiral rows ; 5 hooks in each row	8 spiral rows ; 9 hooks in each row	12 spiral rows ; 7 hooks in each row
	Posterior segment	16 spiral rows ; 3 to 4 hooks in each row	25 spiral rows ; 10 hooks in each row	12 spiral rows ; 16 hooks in each row		48 longitudinal rows ; 3 to 4 hooks in each row
Size of hooks	Anterior segment	0·175 mm long	Not known	Not known	Not known	31μ to 35μ
	Posterior segment	Not known	Not known	Not known	Not known	26 μ to 28 μ
Proboscis sheath dimensions		0·65 mm long	Not known	Not known	1 mm long	1·08 to 1·25 mm long 274 u max. breadth
Lemnisci dimensions		3·2 mm long	3·5 mm long	Not known	4 mm long	3·48 to 3·56 mm long
Size of embryo		0·05 mm × 0·026 mm	0·06 mm × 0·037 mm	0·1 mm × 0·04 mm	0·066 mm × 0·034 mm	18u × 217
Host		Birds	*Saxicola bimaculata*	*Numida ptilorhyncha N. rickwae, Otis tarda, O. macquenii, Oedicanemus crepitans*	*Maleagris gallopavo*	*Colinus virginianus texanus*
Locality		Europe	Egypt	Africa	Dutch East Africa	Texas

The species described in this paper does not resemble any of the foregoing known forms in its body length, in the number of hooks in each row, in the size of hooks where known and in the size of the embryo. These differences taken together justify the creation of a new species for this form for which I propose the name *Mediorhynchus passerus.* The specific diagnosis of this species is given at the beginning of the description.

The cotypes are deposited in Zoological Survey of India, Calcutta (Reg. No. W. 3773/1).

Host:— Passer domesticus indicus.

Locality.—Amraoti, Berar, India.

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