TWO NEW HELMINTHS FROM *RHINOCEROS SONDAICUS*

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Of the three species of *Rhinoceros* extant in Asia, the lesser one-horned *R. sondaicus* appears to be by far the rarest. In the immediate past the species was known in the Sunderbans of Bengal, in Burma, the Malay Peninsula and some of the mountainous islands of the East Indies, but to such an extent have its numbers been reduced that the species is now considered very rare. A small herd of unknown size is being jealously conserved in the islands of the Dutch East Indies, in which country alone is it still definitely known to persist. Among the few specimens that are preserved in the museums of the world, the specimen in the Museum of Comparative Zoology is the only one in America. In the Malay States the species was thought to have become extinct, but a story, largely discredited by officials, persisted among the natives living on the edge of the bush in Lower Perak to the effect that an old cow of this species, presumably the mate of a specimen illicitly killed some ten years ago, still survived and at intervals various natives made claims of having seen the animal.

Commissioned, if possible, to secure this unique specimen for mounting in the British Museum of Natural History, Mr. Arthur S. Vernay, a celebrated naturalist and hunter of big game, fitted out an expedition to the region and in January, 1932, succeeded in locating and shooting the animal.

Before proceeding to the Malay States, Mr. Vernay had very graciously offered to save and preserve any of the "soft" parts of his prospective capture for members of the Museum of Comparative Zoology of Harvard University. Accordingly the writer prepared instructions to guide in the collection and fixation of parasitic worms. In due course we received the material upon which this report is based: several tubes containing admirably preserved cestodes and nematodes together with some interesting ticks which are to be reported on by my colleague, Dr. J. C. Bequaert.

Although the cestodes and nematodes both belong to well established genera, well known either from the same host or from related African species of *Rhinoceros,* the characters that have been used to distinguish the species in these genera are of debatable value, and I considered long before deciding to assign them to the independent specific status. In the absence of an extensive collection of comparative material from which conclusions may be drawn, one is compelled to assume the gen-

eral validity of the standards in vogue. On this basis both species described in this paper appear to be new. Brief discussions of the systematic positions are appended to each description.

NEMATODA

Family STRONGYLIDAE

Kiluluma vernayi spec. nov.

The material consists of nine specimens, of which three are males, taken from the large intestine. The worms are very much alike as to size and shape. The body is cylindrical, tapering gently anteriorly and posteriorly to abruptly rounded extremities. The cuticle is unusually thick and marked transversely by conspicuous, deep corrugations which tend to mask exceedingly fine superficial striae.

The head is set off from the main body of the worm by a narrow cuticular collar, the head emerging as from an ensheathing tube. There are six cephalic papillae—2 lateral and 4 submedian. Each of the four submedian papillae stand out prominently beyond the level of the mouth, and is made up of a cupola-shaped base from the summit of which there emerges, like a flagstaff, a narrow elongate process. The lateral papillae terminate in more typical fashion at the base of the mouth collar. The mouth (Fig. 1) is surrounded by the usual broad incurved lappets—

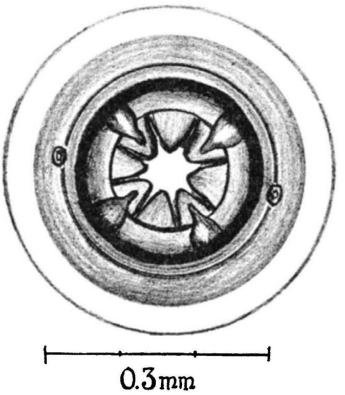

Figure 1. *Kiluluma vernayi.* End-on view of head.

eight in number. The buccal capsule is ring shaped—0.26 mm. broad and 0.07 mm. deep.

The claviform oesophagus is narrowest at the level of the nerve ring—0.36 mm. from the anterior extremity—and reaches a maximum breadth of 0.38 mm. near its middle. There is the usual terminal valve at the entry into the chyle intestine. In both male and female the length of the oesophagus ranges approximately from 0.95 mm. to 1.2 mm. The cervical papillae are elongate acicular structures that occupy posi-

tions either just in front of the oesophagial terminus or slightly posteriad. Also at about this level is the aperture of the massive excretory tube.

The female body undergoes a very gradual diminution in its diameter towards the posterior end. This extremity ends very abruptly simulating a worm that has been subjected to a slightly oblique cut and producing in consequence a veritable posterior plane. On this posterior surface a small caudal extremity of the body stands out like a cone-shaped appendage; on this surface open the anal and vaginal apertures (Fig. 2). When a female specimen is mounted on its side (under

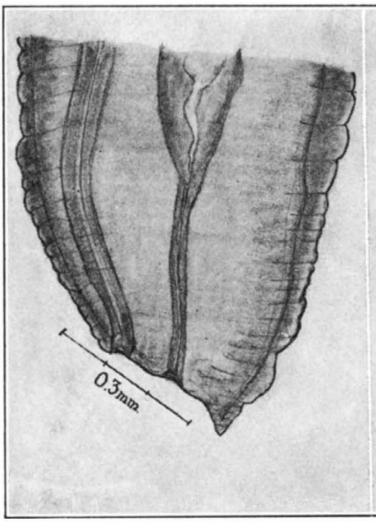

Figure 2. *Kiluluma vernayi.* Caudal extremity of female.

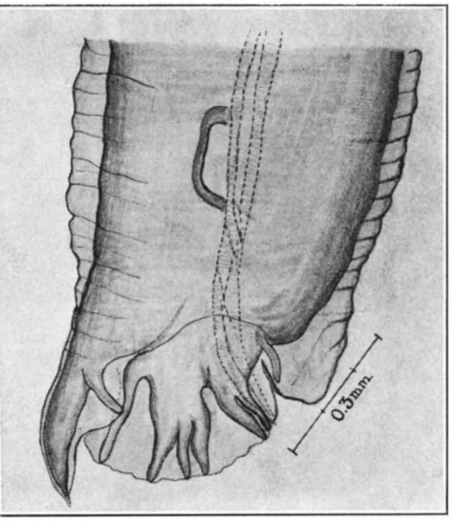

Figure 3. *Kiluluma vernayi.* Caudal extremity of male.

a certain amount of local pressure between slide and cover slip) the distance between the extremity of the body and the anus is 0.160 mm. and the vulva is situated about 0.1 mm. preanally. When the specimen is examined ventrally these distances appear fore-shortened. To some extent this will account for slight differences found in tail measurements of the other species that are described in the genus. The vagina, with slight variations, measures 0.95 mm. in length before dividing into two more or less intertwining branches that extend for a distance of 2.6 mm. before the ejaculatory swellings are reached.

The eggs in utero measure about 55 μ by 70 μ but these dimensions do not represent the size of the completely formed eggs that would pass from the body.

In the male the lobes of the caudal bursa and their supporting rays are in all major criteria characteristic of other species in the genus.

There is a well developed preventral ray which obviously represents merely a ventral prebursal papilla that has become elongated and shifted posteriorly. It has not, however, quite entered into the support of the lateral lobe of the bursa but is thrust out to the edge of the cuticle near the point of origin of the lateral bursal lobe. The extra lateral ray can plainly be seen arising from the common trunk which gives origin to the remaining lateral rays. The external dorsal (which itself shows no sign of forking) originates high up near the dorsal-ray root. The dorsal ray bifurcates at its extremity into two small branches.

The spicules are characteristically alate with proximal terminal knobs. They measure from 4.80 to 5.01 mm. in length in the three specimens and may be twisted when extruded.

The gubernaculum, while always detectable in the well cleared specimen, is very lightly chitinised and because of this condition its shape and size appear to be rather variable. In no instance could the gubernaculum be described as ring or horseshoe shaped even when viewed from the dorsal or ventral surface; rather was it in the form of a semilune with the posterior horn curved in the median direction and the anterior horn almost straight. There is, in one specimen, evidence of a secondary cuticularization of the cloacal wall which appears to be in contact with the gubernaculum. This telemon-like structure is, unfortunately, not sufficiently definite to warrant the stressing of size or shape. The characteristics of the posterior end of the male are shown in figure 3.

The very distinctive genus *Kiluluma* was created by Skrjabin for a number of Strongyles collected from *Rhinoceros bicornis* at Kiluluma in East Africa. The material described by Skrjabin as *Kiluluma stylosa* (von Linstow, 1909) was according to Thapar (1924) a composite of several species. As a device to avoid subsequent confusion, Thapar thought it desirable to allow the species *K. stylosa* to lapse, at any rate provisionally, and described the material collected by Professor Leiper from an East African *Rhinoceros* (*R. africanus*) as assignable to six different species. In a later paper written on the same collection of worms Thapar (1925) presented descriptions of what he believed to be four more new species of this genus.

Monnig (1926) working over material from *Rhinaster bicornis* from Zululand (South Africa) states that he found five of Thapar's original six species and described a new species, *K. longispiculata,* which having in the meantime been described in Thapar's second (1925) paper as *K. goodeyi* was consequently synonymised with the latter.

Yorke and Maplestone (1926) commented on Thapar's disposition of the genus *Kiluluma* with the following statement: "With the excep-

tion of *K. magna,* these species appear to us to be very similar to one another. We have examined a large collection of worms belonging to this genus obtained from five rhinoceroses, and although the individual worms were found to exhibit considerable variation we have been unable to satisfy ourselves that more than one species was present."

The difficulty of differentiating the majority of species of *Kiluluma* erected by Thapar is, as Yorke and Maplestone indicate, a very real one. With the possible exception of *K. magna,* which is slightly larger, and *K. goodeyi, K. brevivaginata* and perhaps *K. brevicauda,* in which the male may be distinguished by its longer spicules, the remaining species do not possess clear differential characters. The characters which Thapar regarded as distinctive of the species are not succinctly specified and only by a careful reading of the short accounts of the various species that he gives, can one glean the characters which appear to have prompted the separation of species. Many of these characters are really of trivial worth and even the size relationships of the different organs which might substantiate the differentiation of species are valueless because Thapar gives measurements from only a single specimen of each sex.

On one important item in the description of most species, concerning the number of plume-like lappets, comment is particularly necessary. Skrjabin (according to Neveu-Lemaire, 1924) originally described *K. stylosa* as possessing "quatre levres peripheriques (probably the saillient submedian papillae) et six levres internes." As Thapar observes: "in several respects Skrjabin's description is insufficient and his description of the mouth parts is particularly misleading." Thapar describes six fleshy lobes or "internal lips" (leaf-like elements of an internal corona) in *K. rhinocerotis* and the other species described in his first paper. In this author's second paper all the species, with the exception of *K. cylindrica,* are described as bearing 8 "lips" and in the diagram provided of the "end-on" view of the head this contention is confirmed. Monnig (1926) described six fleshy lobes arising from the buccal capsule of his *K. longispiculata* which he synonymised with *K. goodeyi* of Thapar. In *K. goodeyi,* however, the number of leaf elements sketched is eight. Yorke and Maplestone (1926) mention and sketch six elements in the leaf crown of the genotype, *K. stylosa.*

In the writer's material the examination of the toto-mounted specimens gave the impression of there being six leaf elements springing from the buccal cavity but the number could not be determined with any degree of certainty until the head was cut off. In the end-on view the leaf-crown is very definitely seen to be composed of eight elements. The question of the number of leaf elements does not appear to have been made a major consideration in the determination of species.

Thapar does not appear to have been particularly concerned with the question until his second paper was written, when in all instances he included an end-on sketch of the head which illustrates the point. Presumably there are species with six and other species with eight leaf elements, *K. vernayi* being among the latter. I take pleasure in naming this species in honor of its collector.

K. vernayi, so far as concerns the length of its spicules, bears greatest resemblance to *K. brevicauda* but it appears to differ most conspicuously from this species in the length of the vagina and its horns, in the shape of its gubernaculum and perhaps in the disposition or point of origin of the pre-ventral and extra-lateral rays.

CESTODA

ANOPLOCEPHALIDAE

Anoplocephala diminuta spec. nov.

Some twenty tapeworms with the characteristic structure of the genus *Anoplocephala* as defined by Baer (1927) and labelled as being taken from the small gut of *Rhinoceros sondaicus* were received in three percent formalin. As will be shown later, these specimens, despite their relatively small size, are structurally fully grown.

In the preserved state, the largest specimens, composed of from 20 to 25 segments, measure only from 10 to 12 mm. in length. The smallest specimens are about 7 mm. long. The scolex, which is blanched in contrast to the greyish yellow color of the segments, is usually partly covered or embedded in the concave border of the anterior part of the strobila and is slightly narrower in breadth (3.5 mm.) than these anterior segments. The scolices in other specimens are more overt with the aperture of the suckers opening conspicuously on the antero-lateral surfaces of the strobila. The suckers are about 1.2 mm. in outer diameter, their muscular walls being 0.4 mm. thick. Depending probably on the state of contraction, in some specimens the muscular parts of the scolex extend backwards as a mantle covering the middle sections on the dorsal and ventral surfaces of the first two or three narrow segments. This, however, does not produce the elongate lappeted appendages such as are described as characterizing *A. perfoliata* of the horse. The appearance of preserved specimens is shown in figure 4.

The individual segments of the strobila resemble a series of narrow elongate troughs set one within the other with their lateral margins, composed of the usual sub-cuticular muscle fibres extending in the dorso-ventral direction, two sets of longitudinal muscles aggregated in bundles of smaller fibres and a narrow band of transverse fibres that circumscribe the medullary parenchyma, overlapping about two-thirds of the surface of the segment following.

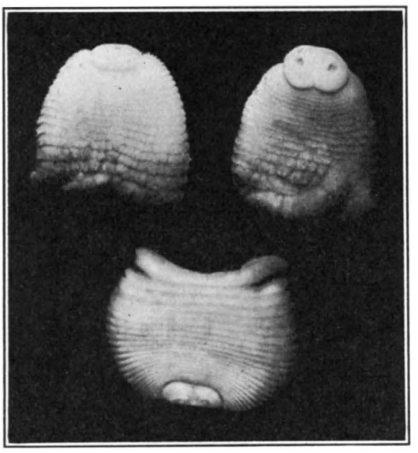

Figure 4. *Anoplocephala diminuta.* Photograph × 3.

Figure 5. *Anoplocephala diminuta.* Diagram of dextral side of mature segment showing male and female reproductive organs and system of excretory tubules. This figure is composite to the extent that at the stage where the vagina is patent the receptaculum seminis is not so large as in the above illustration nor are the ovarian follicles so well developed.

Especially towards the posterior end of the strobila, the overlapping horizontal edges of segments are frilled or scalloped. In a few specimens, where there is a more conspicuous scallop in the middle of the segments, more or less aligned, one behind the other, the appearance of a longitudinal furrow such as was pictured by Garrod (1887) is produced.

The greatest width attained by the segments is 9 mm. This width may be reached not more than 5 mm. from the scolex, behind which a gradual reduction in the width of the segments often occurs. The ultimate segments in the chain become very plump (2.5 mm. thick) and have a tendency to become separated at the margins from the chain; some are actually on the verge of complete separation.

As a result of the thickness of the specimens and the dense crowding of calcareous bodies in the cortical parenchyma, toto-mount specimens stained in the usual procedures to reveal the reproductive organs are very difficult to clear adequately with xylol or the essential oils. As an alternative to this, a method used by mammalian anatomists to demonstrate cartilaginous tissues in embryos was found eminently satisfactory (q.v. Miller, C. H., Anatomical Record, 1921, vol. 20, p. 415). Essentially the method consists of placing the washed specimens in 2%

KOH aq. for one or two hours and then transferring the specimens gradually to pure glycerin.

Owing to the relative weakness of the connecting tissues between the more mature segments, the latter can be pried apart by careful dissection with fine needles. When the segments thus isolated are individually mounted in series on their posterior surfaces, an ideal view is obtained of the gonads and their ducts in relation to the excretory vessels.

The structure of the mature segments is shown in figures 5 and 6.

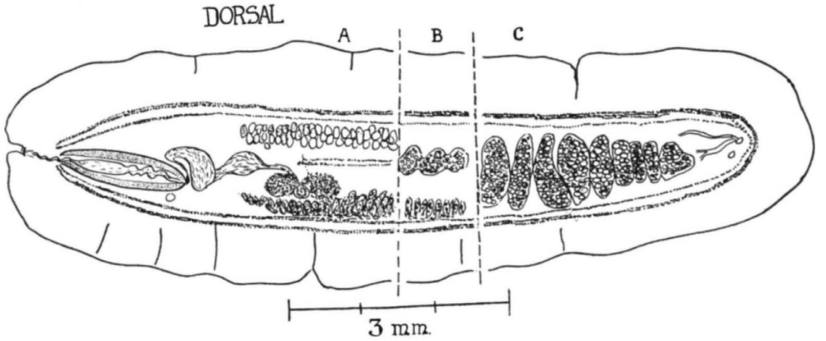

Figure 6. *Anoplocephala diminuta.* Compound diagram of a segment seen from its anterior face illustrating: A. Dextral side of segment after atrophy of vagina with male and female organs at height of functional maturity. B. Section of an older segment after disappearance of testicular follicles and with uterus in process of sacculation. C. Sinistral side of gravid segment with well developed uterus full of developing ova and granular material.

The usual pair of longitudinal excretory vessels are present on each side but they are narrow with exceedingly thin walls. The more dorsally situated of these two pairs of longitudinally vessels is so much reduced in size that it is especially difficult to detect on the poral side of the segments. Passing from these vessels and distributed in a network throughout the substance of the proglottids are numerous subsidiary vessels, many of which are practically as large as the longitudinal collecting ducts. The longitudinal vessels and the accompanying longitudinal nerve cords are situated in the characteristic positions ventral to the sexual ducts.

The sexual ducts open constantly on the dextral side of the strobila with the apertures near the middle of the segment margin. All the specimens examined have been sexually functional. The first signs of the developing testicular follicles are to be found in about the sixth segment behind the scolex. The ovarian follicles commence to appear shortly thereafter and both male and female organs are fully formed in the eleventh or twelfth segment.

The vagina in its fullest stage of development is a thin walled con-

voluted tubule running along the ventral wall of the cirrus pouch to open in a very small atrium that also receives the cirrus organ. In later segments the vagina has degenerated. It has already received its store of sperm which is found accumulated in a capacious receptaculum.

The testicular follicles in their fullest development are oval to fusiform in shape, measuring, on the average, 0.15 to 0.07 in diameter. They extend in a field two to three deep in both dorsal and dorso-ventral planes between the longitudinal excretory vessels on either side. Their number, not possible to estimate accurately, is probably between 150 and 250. As the male gonads proceed to function, the sperm passes into a massive vesicula seminalis which may be divided into two compartments and comes to lie over the terminal part of the cirrus pouch on the dorsal aspect of the latter. The cirrus pouch is a thick muscular organ that may attain a length of 1.3 mm., but may be a third or even more shorter in the younger segments. In it, sperm may accumulate in a so-called internal vesicula seminalis of relatively small dimensions. The cirrus may be everted from its pouch to a length of more than 1 mm. It is then in a favorable condition to observe that it is densely covered by minute spines. When not everted, the cirrus organ lies coiled in its pouch.

The ovary is composed of clavate acini extending for approximately two-thirds of the width of the segment from a level near the proximal end of the cirrus pouch. The vitellarium is also a large follicular structure composed of innumerable small cromophilic cells. It is situated on the poral side at about a third of the distance across the segment. The so-called "shell" gland is situated between the main lobes of the vitellarium and fragments of the ducts that carry the sperm for the fertilization of the ova from the receptaculum are to be seen in favorable sections but no attempt was made to reconstruct this complex of fine ducts.

The uterus, which is first seen as a tube with narrow lumen and thickly nucleated walls in about the twelfth segment, grows rapidly and by numerous outpocketings of its walls produces a sacculated organ filled with innumerable developing ova of minute size together with much granular material. While these ova attain a size of about 15 μ in diameter and are enveloped in a thin membranous covering, even in the largest ultimate segments which are on the verge of separating from the stobila, embryos with the typical pyriform apparatus and a refractile cuticularized shell are not to be found. The presumption is that in this species where sterility is not a factor to be considered, the development of the fertilized ova proceeds to completion after the segments are detached from the parent colony.

Anoplocephaline tapeworms from various species of *Rhinoceros* have been the subject of numerous reports and considerable difference of opinion is expressed as to their systematic positions and relationships. The first record was by Peters who, in 1856, briefly described a tapeworm 120 mm. long and 27 to 29 mm. in maximum width from *Rhinoceros bicornis* (=*R. africanus*) from Mozambique. This tapeworm received the name *Taenia gigantea.*

Murie (1870) described, under the name *Taenia magna,* incomplete tapeworms with "segments 1½ inches broad and 1 inch long" taken from the Indian rhinoceros, *R. indicus.* It was later shown that what Murie believed to be single isolated segments actually represented entire strobilas from which the scolices had fallen. In 1871 Peters erected a new genus, *Plagiotaenia,* to accommodate *Taenia gigantia* Peters, 1856. Garrod (1877) described a tapeworm from a Javanese specimen of *R. sondaicus* and identified it with *Taenia gigantia,* which had been previously described by Peters and by Murie. Garrod's description, like the descriptions of the previous authors, is concerned entirely with external features in the morphology and is by modern standards very inadequate. The full length of his specimens is not specifically mentioned but they were certainly considerably more than 10 cms. and the segments attained a width of 31 mm.

In 1891, E. Blanchard ascribed the species *Taenia gigantia* and *T. magna* from rhinoceroses to his genus *Anoplocephala* united under the single name, *A. gigantia.* Diener (1912) presented the first comprehensive study of the internal anatomy of the tapeworm from *R. indicus.* He described this under the name *Anoplocephala latissima* since Murie's specific name was preoccupied in this genus by *A. magna* (Abilgaard, 1879) from the horse. Diener concluded that *A. latissima* was distinct from *A. gigantia* of Peters and of Garrod on the basis of such dubious characters as the size and disposition of the scolex as described by these authors.

MacCallum and MacCallum (1912), presumably unacquainted with Diener's excellent morphological study, gave an account of the anatomy of fragments of a tapeworm passed by a specimen of *"Rhinoceros sondaicus"* in the New York Zoological Garden.* The fragments, 25 mm. broad, were stated to have been parts of an enormous worm up to 20 feet in length and, on account of the alleged length of the worm, the species was identified with Peter's *Taenia gigantia.* Southwell (1921) accepting the description given by the MacCallums' to represent *A. gigantea,* described as a distinct and new species, *A. vulgaris,* tape-

* Seemingly some confusion developed in the identification of the host, which was actually *R. sumatrensis.* The animal was sold by the New York Zoological Society and its skeleton was eventually deposited in the U. S. National Museum in Washington.

worms from 44 to 75 mm. long and from 11 to 27 mm. wide collected from *R. bicornis* in N. E. Rhodesia. In 1922 Southwell identified as belonging to the same species *A. vulgaris,* a specimen bearing the host label *R. sondaicus* in the collection of the Indian Museum.

In 1926 Stunkard published a detailed study of numerous specimens of a tapeworm collected in the Congo from the white rhinoceros, *Ceratotherium simum cottoni.* These worms, which he identified with Peter's *T. gigantia,* measured up to 120 mm. in length and 20 mm. in breadth. Stunkard critically reviewed the subject of *Rhinoceros* tapeworms and revived the genus *Plagiotaenia* of Peters, at the same time creating the new species *P. longa* for the worms described by the MacCallums and by Garrod. More recently Baer (1927) in his monograph on the family Anoplocephalidae has combined all the species described from the rhinoceroses of Africa and Asia under the single name *A. gigantia,* although in a previous paper (Baer, 1923) he had decided that the tapeworms of rhinoceroses represented at most a subspecies of the equine *A. magna* (Abilgaard).

It is as difficult to judge the propriety of this action as it is to support the contention of a plurality of species. It is well known that tapeworms of this genus and of related genera are subject to marked variation in such characters as the length of the chain, size and shape of the scolex, and the number and dimensions of the individual segments. This has been particularly stressed by Yorke and Southwell (1922) in their study of *A. perfoliata.*

The variation in shape of the strobila as a whole is dependent on the fixation treatment which almost always results in a good deal of contraction. The contraction in length, however, is usually compensated by an expansion in width and thickness. In our material, while some specimens are slightly thicker than others, the width of chains of approximately equal numbers of segments does not differ conspicuously.

The problem of the specific status of our material would be practically insoluble were the specimens immature or were they sterile as is so frequently the case in representatives of the genus. But, although the fully developed embryo with its pyriform apparatus and external chitinoid shell membrane are not found even in the ultimate segments that are about to be shed from the strobila, the probabilities are, as we have already stated, that the specimens are as mature as they are likely to be found in the strobilate condition. This character may, perhaps, be taken as distinctive of the species.

Unfortunately, the reproductive and excretory systems in the genus *Anoplocephala* present such uniformity of essential organization as to afford no significant characters for the definition of species and, despite the well known potentiality of varying in these matters, size relation-

ships still appear to be accepted as the best criteria for defining the species. Such are the characters which are presented, presumably for the purposes of comparison, in the tabulated list of species in the Baer monograph.

The possibility of recognising a multiplicity of species of *Anoplocephala* derived from the various species of *Rhinoceros* is rendered more difficult by the phenomenon of sterility that has been encountered in a certain proportion of strobilas and by the fact that in other strobilas the maturation of segments is often unaccountably delayed or even, apparently, suspended. Consequently it becomes difficult to determine on what material from different host reservoirs comparison may be legitimately instituted. It is because our material present proglottids in an advanced state of sexual maturity that we believe that it may be compared with previously described species in all their ranges of specific variation. While in the size of scolex and suckers, cirrus pouch and developing ova, our specimens present nothing to distinguish it from other species, actually the length and width of the strobilated colony make it the smallest species described in the genus. Comparing it with the species, single as believed by Baer or multiple as other authors presume, described from the African and Asiatic rhinoceros, it is difficult to concede that our largest strobila, composed of from 20 to 25 segments measuring barely 12 mm. in combined length and not more than 9 mm. in maximum width, can be identified with *A. gigantia,* the most juvenile specimens of which, having about 50 segments, measure 20 mm. in length (Stunkard, loc. cit., p. 2). Mature specimens in Stunkard's collection measure up to 120 mm. in length and 20 mm. in width. A comparable mature specimen with about 100 segments in Diener's material (Diener, loc. cit., p. 351) measures 56 mm. in length with segments as broad as 26 mm. Nor can the present species, for which I think the name *diminuta* is appropriate, be harmonised with the species described by the MacCallums. This species, named *Plagiotaenia longa* by Stunkard, attains a breadth of 6.5 to 7.5 cms. and is said to be as long as 20 feet (6 meters). Even Garrod's specimens attained a breadth of 31 mm.

It is, then, on the consideration of the size of the fully developed strobila that the parasite dealt with in the present paper is submitted as a new species. On this basis of comparison it appears to be most closely related to *Anoplocephala manubriata* described by Railliet, Henry and Bauche (1914) from *Elephas indicus* in French Indo-China.

REFERENCES

Monnig, H. O. 1926.—Helminthological Notes. 11th and 12th Rept. Dir. Vet. Ed. & Res., pp. 221–226. Pretoria, So. Africa.

Neveu-Lemaire, M. 1924.—Les strongylides du Rhinoceros africain (*R. bicornis*). Ann. Parasit., *2*:121–154.

Railliet, A., Henry R. and Bauche J. 1914. Sur les Helminthes de l'Elephant d'Asie. 1. Trematodes et Cestodes. Bull. Soc. Path. Exot., *7*:78–83.

Thapar, G. S. 1924.—On *Kiluluma* Skrjabin, a genus of Strongylid nematodes parasitic in the African Rhinoceros. Jl. Helminthology, *2*:209–238. Idem. 1925—On some new members of the genus *Kiluluma* from the African Rhinoceros. Ibid., *3*:63–80.

Baer, J. G. (1923).—Considerations sur le genre *Anoplocephala*. Bull. Soc. Neuch. Sc. Nat. 48:3–16. 1927. Monographie des Cestodes de la famille des Anoplocephalidae. Bull. Biol. de France et de Belgique Supplement X, 241 pp.

Deiner, E. 1912.—Anatomie der *Anoplocephala latissima* (nom. nov.). Arb. Zool. Inst. Vienna, 19:347–372.

Garrod, A. H. (1877).—On the *Taenia* of the rhinoceros of the Sunderbunds. Proc. Zool. Soc. London, 788–789.

Murie, J. 1870.—On a probable new species of *Taenia* from the rhinoceros. Proc. Zool. Soc. London, 608–610.

Southwell, T. 1921.—A new species of Cestode (*Anoplocephala vulgaris*) from an African rhinoceros. Ann. Trop. Med. & Parasit., 14:355–364.

Southwell, T. 1922.—Cestodes in the Collection of the Indian Museum. Ann. Trop. Med. and Parasit., 16:127–152.

Stunkard, H. W. (1926).—The tapeworms of the rhinoceroses, a study based on material from the Belgian Congo. Am. Mus. Novitates No. 210. 17 pp.

Yorke, W., and Southwell, T. 1921.—Lappeted *Anoplocephala* in horses. Ann. Trop. Med. & Parasit., 15:249–263.