

Ministry of Agriculture  
Technical and Scientific

(Veterinary Section)

BULLETIN

WORMS AND  
MINUTE PARASITES

FROM THE

GIZA ZOOLOGICAL GARDENS

WITH AN APPENDIX ON

SOME NEMATODES FROM THE AFRICAN

BY

MOHAMMED ABD ELMONEIM ELZAKARY

*Veterinary Pathological Laboratory*

Thesis for the Degree of

M.V.Sc.

Presented to Fouad Ist University,  
Faculty of Veterinary Medicine

CAIRO, 1943

GOVERNMENT PRESS, CAIRO

1945

3719  
E2226 1945

## Appendix

### SOME NEMATODES OF THE AFRICAN RHINOCEROS

Following is a description of some nematodes which have been found in the collection of this Department and obtained from *Rhinoceros* hosts, from African Sources other than Egypt, where this host does not occur. It was previously stated that this host was thought to have died in Egypt, but later it was discovered that the host did not die in the zoo.

The results of our study of these parasites are presented, therefore, in this paper in the form of an appendix, with the sincere hope that it may prove some value to other workers interested in this subject.

---

# PTERIDPHARYNX AFRICANA LANE 1921

Pl. L (Figs. 94 and 95)

From the intestine of *Rhinoceros bicornis*, black African rhinoceros, b No. 980 (five females and two males) and bottle No. 1094 (five males and females).

In the present material the external leaf crown is composed of a fourty leaflets. The dorsal and ventral leaflets do not project beyond mouth collar, while the laterals project. The leaflets have a rather base and are sharply pointed distally with the exception of the longest central-lateral rays which terminate distally in a square-cut end (figs. 92 and 93).

There is an internal leaf crown composed of small rays which do project beyond the level of the mouth capsule. These rays correspond in number and arrangement to the leaflets of the external leaf crown. In a ventral or dorsal view they are more distinct than when seen from a lateral view.

The buccal capsule is broader than long and measures 42 to 57  $\mu$  in length and 96 to 118  $\mu$  dorso-ventrally.

In the male, the bursa is 0.45 to 0.5 mm. in length and 0.375 mm. in breadth. In the specimens examined the author noticed that the dorsal just before its division has an irregular outline and gives off a small branch or process on each side. This feature as stated by Khalil (1922) is not constant in all the specimens examined by him.

In the female, the vulva which has two prominent lips, leads to a transverse short vagina 78  $\mu$  in length. The latter opens at the posterior extremity of the muscular pars ejectrix which lies parallel to the longitudinal axis of the body and measures 0.429 to 0.5 mm. in length. Its cephalad extremity opens into the two laterally situated pars haustrires each of which measures 1.125 to 1.375 mm. in length, their upper third is strengthened to form a strong sphincter.

The following is a table of measurements of the specimens examined compared with those given by Lane (1921), from the African elephant. The figures which were not given by Lane are calculated from his figures.

Author		Lane	Present
Total length ... ..	♂ ○○ +○	17 18	12-14 15-16.7
Maximum breadth ... ..	♀ ○○ +○	0.55 0.625	0.475-0.5 0.56-0.6

Author	Lane	Present
Diameter of head ... ..	0.182	0.15-0.19
Mucal capsule } Length ... ..	0.043	0.042-0.057
	0.108	0.096-0.118
Curve ring to ant. extremity ... ..	0.3	0.25-0.28
Secretory pore to ant. extremity ... ..	0.975	0.87-0.93
Cervical papillae to ant. extremity ... ..	1.1	0.975-1.06
Length of oesophagus ... ..	0.575	0.475-0.637
Breadth of oesophagus ... ..	0.25	0.2-0.24
Length of oesophagus plume ... ..	0.15	0.117-0.13
Length of spicule ... ..	0.9	0.81-0.875
Length of gubernaculum ... ..	0.11	0.13
Palva to posterior extremity ... ..	0.23	0.95-1.125
Length of vagina ... ..	—	0.078
Length of pars ejectrix ... ..	0.45	0.429-0.5
Length of pars haustrix ... ..	—	1.125-1.375
anus to posterior extremity ... ..	1.03	0.875-1
Eggs (Khalil)... ..	62 × 32μ	

#### Discussion.

The number of leaflets of the external leaf crown was not mentioned by Lane (1921). Khalil (1922, p. 46) stated that the number was sixteen. This number, at any rate, cannot be considered constant as in the present specimens number of forty has been reached and in accordance to this, Lane's figure 2. l. XI, shows that the number of the lateral leaflets on one side only is about fourteen.

*PTERIDOPHARYNX MEMPHISIA* (Khalil, 1922) Monnig, 1926

Pl. LI (Fig. 96)

From the intestines of *Rhinoceros bicornis* bottle 973 (eight males and ten females) and bottle 1044 (six males and seven females). The first bottle is labelled "*Memphisia africana*," a designation which, as far as the author is aware does not exist in the literature.

This species was first described by Khalil 1922, as *Memphisia memphisia* (1). The genus *Memphisia* has been considered synonym to genus *Pteridopharynx* Lane, 1921, by Ware (1924).

The present specimens agree in their anatomical details with the description given by Khalil (1922) with the exception of the following features:

The buccal capsule is in some specimens longer than in the original material, being 78 to 96  $\mu$  in length. From a lateral view, it measures dorsoventrally at its outlet 78  $\mu$  and at its middle 67  $\mu$ .

In some specimens the collar-like expansion is followed by successive inflations of the cuticle surrounding the region of the anterior part of the oesophagus. These vesicular inflations may be three in number, the largest being the most anterior and as they pass posteriorly they gradually decrease in size (fig. 94).

For about 84 to 104  $\mu$  the cuticle lining the lumen of the anterior part of the oesophagus has the plumose structure.

The following is a table of measurements in millimetres given of the present material compared with measurements given by Khalil (1922).

Author		Khalil 1922	Present
Total length ... ..	♂	13.5-14	12.5-13.5
	♀	14.5-16	13-16
Max. breadth ... ..	♂	0.55	0.43
	♀		0.43-0.5
Buccal capsule {	Length ... ..	80 $\mu$	78-96 $\mu$
	Breadth ... ..	90 $\mu$	78-65 $\mu$
Nerve ring to ant. end ... ..		0.25	0.273

(1) Khalil's figures 52 and 53, pp. 52 and 53, as well as the description of the mouth capsule, reversely interpreted, the ventral being lateral and vice versa.

Author	Khalil 1922	Present
Secretory pore to ant. end ... ..	0.85	0.812-0.875
Papillae to ant. end ... ..	0.92	0.825-0.937
Length of oesophagus ... ..	0.48	0.475-0.54
Breadth of oesophagus ... ..	0.18	0.2-0.26
Male Bursa .. {	0.7	0.625-0.775
	0.35	0.33-0.4
Length of spicule ... ..	0.9	0.88-0.9
Length of gubernaculum ... ..	0.4	0.09
Ant. to post. extremity ... ..	0.66	0.768-0.829
Post. to post extremity ... ..	0.58	0.625-0.712
Ova ... ..	55 × 35 μ	

When this species was first described by Khalil 1922, no mention was made of the presence or absence of the plumose structure of the anterior end of oesophagus. A re-examination of the type species which is present in this Department, bottle No. 1035, revealed the presence of this structure.

*PTERIDOPHARYNX AZIZA* (Khalil, 1922) Monnig, 1926

Pl. LI, LII, LIII and LIV (Figs 97, 98, 99, 100, 101, 102, and 103)

From intestines of *Rhinocerot bicornis*, African black rhinoceros, bottles Nos. 977 (a large number of females and three males) and 1094 (21 females and 18 males).

This species was first described by Khalil 1922, as *Memphisia aziza* from the intestines of the African elephant.

In the present specimens the following characters are observed:—

The external leaf crown is composed of leaflets the laterals of which project a small distance above the mouth collar, the central rays being the longest. The ventral and dorsal rays do not project beyond the anterior border of the mouth opening, the central rays being the shortest. The distal end of each leaflet is not sharp, but terminates in a blunt, nearly square cut end (figs. 95, 96 and 97).

The buccal capsule is longer than broad and measures 46–52  $\mu$  in length and 39–40  $\mu$  in breadth.

The submedian papillae are rather broadly tipped.

In the male, the genital cone is bounded ventrally by a broad conical boss, anterior and ventral to which there is a pair of fairly stout long papillae.

The spicules are thin and similar, provided throughout their total length except at their distal extremities, with finely striated alae giving it a plumose appearance (fig. 98).

The externo-dorsal ray gives off near its origin a small ray which ends either in a blunt process or a small round knob (fig. 99).

In the female, the vulva has anterior and posterior prominent lips. The latter being more prominent than the former (fig. 100).

The vulva leads to a short muscular vagina which measures 117 to 140  $\mu$  in length, and opens into the caudal extremity of the pars ejectrix which measures 0.36 to 0.4 mm. in length. At its anterior end the two laterally situated pars haustres open. They are long tubes measuring 1.2 to 1.3 mm. in length. The wall of their upper third is strengthened to give this portion a distinctly sphincter like appearance (fig. 101).

The eggs as seen in the pars ejectrix measure 65  $\mu$  in length and 33  $\mu$  in breadth.

The following is a list of measurements in millimetres of ten females and 3 males compared with figures given by Khalil 1922 :—

Author	Khalil 1922	Present
Total length ... ..	12 15	12-12·8 12·2-14·5
Max. breadth ... ..	0·5	0·37-0·5 0·437-0·57
Diam. of head ... ..	0·1	0·1-0·11
Mucal caps. { Length ... .. { Diameter ... ..	45μ 72μ	46-52μ 39-40μ
Length of oesophagus ... ..	0·47	0·36-0·41
Maxim. breadth of oesophagus ... ..	0·14	0·13-0·15
Distance from ring to anterior end ... ..	0·2	0·156-0·195
Distance from cervical papillae to ant. end ... ..	0·82	0·712-0·875
Distance from tr. por. to ant. end ... ..	0·72	0·625-0·75
Length of pharyngeal plume ... ..	70μ	65-70μ
Length of spicule ... ..	0·75	0·715-0·806
Length of gubernaculum ... ..	0·1	0·078-0·1
Distance from vagina to posterior end ... ..	0·91	0·83-0·93
Distance from pars ejacatrix to posterior end ... ..	0·66	0·6-0·685
Length of vagina ... ..	0·52	0·114-0·117
Length of pars ejacatrix ... ..		0·36-0·43
Length of pars haustrix ... ..	—	0·812-0·927
{ Length ... ..	0·5	0·4-0·5
{ Breadth ... ..	0·45	0·32-0·35



### Discussion.

The above description and measurements show some variation from original description of Khalil 1922. Although Khalil stated that the length of the chitinous ring is 0.045 mm. and the breadth is 0.072 mm., yet he p. 58 that the oral cavity is longer than it is broad. Therefore comparing figures 59 and 60 p 57 and 58 to the accompanying scale reveals the fact the buccal capsule measures about 50  $\mu$  in length and about 45  $\mu$  in breadth.

In other aspects Khalil's specimen differs from the present in the following :—

(1) The anterior end of the leaflets of the external leaf crown is sharply pointed as shown in fig. 59, p. 57.

(2) The central ventral and dorsal rays of the external leaf crown project more than those in the immediate vicinity but are still shorter than the lateral rays.

(3) The submedian papillae are rather tipped (fig. 59), lateral view (nec ventral view).

(4) The small branch of the external dorsal is pointed.

(5) The spicular sheath is transversely striated in its upper third only.

(6) The lips of the vulva are not so prominent as in the present specimen.

These differences cannot be considered of specific importance to justify the formation of a new species for the present specimens which, therefore, is considered identical with *Pt. aziza*.

---

*PTERIDOPHARYNX BOZASI* (Neveu-Lemaire, 1924)

PL. LIV (Fig. 104)

From the intestine of *Rhinoceros bicornis* bottle No. 1094. One male was encountered among a large number of other species of this genus.

This species was first described by Neveu-Lemaire (1924) as *Henryella bozasi*. The genus *Henryella* has been considered synonym to the genus *Pteridopharynx* by Witenberg, 1925.

The most prominent character in this species is the presence of a slight constriction in the cephalic end and the comparatively long and thin oesophagus.

The external leaf crown is composed of about forty leaflets which are sharply pointed at their distal end with the exception of the centro-lateral rays which are the longest and terminate in a broad end (fig. 102).

The buccal capsule is broader than long, having at its floor two teeth overlapping the oesophageal funnel.

For about 90 $\mu$  of the anterior end of the oesophagus, its internal cuticular lining is furnished with the feather like structure.

In other anatomical details the present specimen agrees with Neveu-Lemaire's description.

The following is a table of measurements in millimetres of the present specimen compared with figures given by Neveu-Lemaire 1924.

Author	Neveu-Lemaire	Present
Total length ... ..	11	15
Max. breadth ... ..	0.5	0.56
Diam. of head ... ..	0.11	0.143
Buccal capsule $\left\{ \begin{array}{l} \text{L.} \\ \text{Br.} \end{array} \right.$ ... ..	$\left\{ \begin{array}{l} 50\mu \\ 60\mu \end{array} \right.$	$\left\{ \begin{array}{l} 57\mu \\ 67\mu \end{array} \right.$

Author	Neveu-Lemaire	Present
Nerve ring to anterior end ... ..	—	0·234
Excretory pore to anterior end	—	0·75
Cervical papillae to anterior end ... ..	—	0·937
Length of oesophagus ... ..	0·52	0·625
Breadth of oesophagus ... ..	0·15	0·143
Male bursa     \ L. ... ..	0·9	0·8
\ Br. ... ..	0·34	0·375
Length of spicule... ..	—	0·812
Length of gubernaculum ... ..	—	0·078

### Discussion.

Neveu-Lemaire, 1924, did not mention anything about the presence of the plumose structure of the oesophagus and the two teeth overhanging the oesophageal funnel.

The author observes that he also did not mention them in his species *Buissonia rhinocerotis* in which they are also present as will be described below. Accordingly, the author attributes their absence in these two species as described by Neveu-Lemaire to obscurity occurring in his material.

*QUILONIA AFRICANA* Lane, 1921

PL. LIV and LV (Figs. 105 and 106)

From the intestine of *Rhinoceros bicornis*, African black rhinoceros bottle No. 957. The material consists of about twelve females and three males.

In nearly all the worms examined, the cuticle at the anterior extremity including the mouth collar is much damaged and the formation of the mouth collar could only be made out from two specimens which were not as much damaged as the others.

The present specimens show some features which have not been mentioned before.

The external leaf crown does not project beyond the mouth collar. Each leaflet is thin and sharply bent to the exterior at its distal extremity. It is attached proximally to the tip of the external surface of the broad leaflet which form the internal leaf crown (fig. 103).

On the lateral sides of the posterior border of the mouth collar, there are two small cuticular spines.

In the male, the dorsal ray is 0.750 mm. in length, and at 0.28 mm. from its origin it gives off the externo-dorsal rays. The main branch begins to divide again at 0.22 mm. from the origin of the externo-dorsal.

In the female, the vulva leads to a transverse short vagina which is 0.078 mm. in length. It opens in the centre of the ventral surface of the pars ejectrix, which is a muscular organ, lying parallel to the axis of the body and measuring 0.3 to 0.35 mm. in length. Its anterior and posterior extremities are slightly constricted joining the anterior and the posterior pars haustrices which are also muscular organs provided with a strong sphincter. Each pars haustrix measures 0.39 to 0.475 mm. in length (fig. 104).

The following is a table of measurements of five females and three males compared with figures given by Lane (1921), Khalil (1922) and measurements of *Quilonia rhinocerotis* Neveu-Lemaire, 1924.

Author's name	Lane and Khalil	Q. rhinocerotis Neveu-Lemaire, 1924	Present
Total length ... .. ♂ ♀ +	17·5 20·5	15 23	11·7-15 19·2-22
Max. breadth ... .. ♂ ♀ +	0·25 0·625	0·55 0·8	0·47-0·48 0·6-0·7
Diam. of head ... ..	0·25	0·2	0·2-0·25
Bucc. caps. } Length ... } Diam. ...	0·033 0·19	0·02-0·025 0·125-0·15	0·032-0·039 0·141-0·156
Nerve ring to ant. extr.	0·5	0·33	0·3-0·375
Cerv. papi. to ant. extr.	1·0	—	1·0
Excr. pore to ant. extr.	0·95	0·88	0·8-0·95
Length of oes. ... .. ♂ ♀ +	0·85 —	0·55-0·6 0·6-0·7	0·65-0·7 0·75-0·8
Br. of oesoph. ... .. ♂ ♀ +	—	0·18 0·22-0·225	0·18-0·19 0·23-0·27
Length of spicule ... ..	0·9	0·7	0·75-0·85
L. of gubernaculum ...	0·18	0·2	0·17-0·18
Vulva to post. extr. ...	6·85	5·7	5·5-6·6
Anus to post. extr. ...	3·6	2·6	2·5-3·5
Eggs ... ..	73 × 43μ	70 × 45 μ	72 × 41 μ

### Discussion.

The above table shows little variations in the present material from the original, as well as similarity in measurements between the present specimen and *Q. rhinocerotis*. As regards the minute difference from the original data, the author considers this of no specific importance.

*Q. rhinocerotis* can be recognised according to Neveu-Lemaire's description and figures 2 and 3, plate IX, by the atrophied or nearly absent mouth collar and the total absence of the submedian papillae. In some specimens of the present material, the anterior extremity was similar to that of *Q. rhinocerotis*, but the cuticle surrounding this part shows distinctive evidence that it was detached.

The total absence of the submedian papillae in *Q. rhinocerotis* and its presence in the species of the genus, raises in the author's mind a doubt whether Neveu-Lemaire was dealing with incomplete specimens of *Q. africana* (due to the above mentioned cuticular detachment).

This view is justified, in addition, by the statement of Neveu-Lemaire, p. 123, that "L'externité antérieure étant en mauvais état chez tous les exemplaires examinés, il est difficile de distinguer nettement ses caractères." Moreover, the tail of the female and its genital organs, the formation of the male bursa, the length and mode of branching of its rays in *Q. rhinocerotis* are exactly similar to what has been observed in the present specimen and in *Q. Africana*.

For these reasons, the author thinks that *Q. rhinocerotis* Neveu-Lemaire, 1924, is most probably synonym to *Q. africana* Lane, 1921.

---

*QUILONIA BRUMPTI* (Neveu-Lemaire, 1924)

PL. LV and LVI (Figs. 107, 108, 109 and 110)

From the intestine of *Rhinoceros bicornis* bottle No. 960 (five females and one male).

This species was first described by Neveu-Lemaire (1924) as *Paraquilonia brumpti* from the intestine of African rhinoceros.

The genus *Paraquilonia* has been considered as synonym to the genus *Quilonia* by Baylis and Daubney (1926).

The present specimens have large heads measuring just behind the mouth collar 0.26 to 0.36 mm. in breadth.

The mouth is surrounded by a mouth collar which has the form of six round lips, two lateral, two subdorsal and two subventral.

The external leaf crown sinks inside the mouth collar and does not project beyond it (figs. 105 and 106). It consists of ten massive broad rays whose distal ends are curved externally and are sharply pointed.

The mouth capsule is broad and measures 28 to 39  $\mu$  in length and 190 to 228  $\mu$  in breadth.

From the floor of the buccal capsule two teeth overhang the opening of the oesophagus.

The two lateral head papillae are blunt and do not project above the mouth collar; they act as terminal openings of the cephalic glands.

The following is a table of measurements in millimetres of the specimens encountered compared with figures given by Neveu-Lemaire (1934), the measurements which were not given by him are calculated from his figures.

Author	Neveu-Lemaire	Present
Total length ... ..	14 22	13·6 19·2-21·5
Maxim. breadth ... ..	0·525 0·7	0·5 0·67-0·75
Diam. of head ... ..	0·172-0·2	0·26-0·36
Buccal capsule } Length ... .. } Breadth ... ..	120μ 120-150μ	28-39μ 190-228μ
Nerve ring to anter. end ... ..	0·3	0·4-0·5
Excr. pore to anterior end ... ..	0·81	1
Cerv. papillae to anter. end ... ..	—	1·1
Length of oesophagus ... ..	0·6-0·65	0·687-0·875
Breadth of oesophagus ... ..	0·2	0·18-0·3
Length of spicule ... ..	0·8	0·785
Length of Gubernaculum ... ..	0·1	0·18
Vulva to posterior end ... ..	7·2	5·5-6·8
Length of vagina ... ..	—	0·075
Length of pars ejectrix ... ..	0·3	0·28-0·33
Length of pars haustrix ... ..	0·5	0·44-0·5
Anus to posterior end... ..	3·6	2·5-3·3
Ova ... ..	70×40μ	70×39μ



*Discussion.*

Neveu-Lemaire, 1924, differentiated the genus *Paraquilonia* from the genus *Quilonia* by the presence in the former of a rudimentary leaf crown and six lips, two lateral, two subdorsal and two subventral. Baylis and Daubney, 1926, p. 159, have considered the genus *Paraquilonia* a synonym to the genus *Quilonia* without giving any reason for their suggestion.

The mentioned lips are not true lips; it is the mouth collar which gives the appearance of six thick and rounded lips. Such formation of the mouth collar is observed to a more or less extent in other species of the genus *Quilonia*, among which may be mentioned *Quilonia khalili* Neveu-Lemaire 1928, whose figure 26, p. 190, shows distinctly the presence of six lips.

As regards the rudimentary external leaf crown, some of the present specimens could not be cleared to show the exact formation of the cephalic end. In these specimens the external leaf crown could not be detected and it was thought that this structure is rudimentary or absent. Careful examination of the other specimens, however, revealed its presence which is much obscured by the prominent lip-like mouth collar. To this difficulty in tracing the leaflets, the author most probably attributes Neveu-Lemaire's statement about the rudimentary external leaf crown.

These remarks confirm Baylis and Daubney's suggestion and accordingly the present specimens are identified as *Q. brumpti*.

---

*BUISSONIA RHINOCEROTES* Neveu-Lemaire 1924

PL. LVII (Figs. 111 and 112)

From the intestine of *Rhinoceros bicornis* bottle No. 952.

This species is represented by fifteen females and ten males.

In the present material some important features were observed which were not mentioned by Neveu-Lemaire (1942).

Two small lateral papillae were present.

The external leaf crown is composed of about thirty rays which are sharply pointed at their distal end, with the exception of the four centro-lateral rays which are broad at their tips (figs. 109 and 110).

The buccal capsule is longer than broad and measures 46 to 59  $\mu$  in length and 41 to 46  $\mu$  dorso-ventrally. The wall of the buccal capsule gives off from its inner surface a thin offshoot, which runs inwards and forwards to join the cuticular lining of the mouth opening.

The floor of the mouth capsule is furnished with three teeth which overhang the opening of the oesophagus.

For about 65 to 78  $\mu$  of the anterior end of the oesophagus the cuticle lining the lumen has a plumose structure similar to that found in genus *Pteridopharynx*.

The vulva has two prominent lips and leads to a short transverse vagina, 42 to 52  $\mu$  in length. It opens at the posterior extremity of the pars egestrix, which measures 0.45 to 0.5  $\mu$  mm. in length, and leads at its anterior extremity to two laterally situated pars haustrices. Each pars haustrix measures 1 to 1.37 mm. in length, its upper third before joining the uterus is strengthened to form a sphincter.

In other anatomical details the present specimen agrees with Neveu-Lemaire's description.

The following is a table of measurements in millimetres of the present specimens compared with measurements given by Neveu-Lemaire.

Author	Neveu-Lemaire	Present
Total length ... ..	13 15	10·5-13 13·5-14
Max. breadth... ..	0·475 0·530	0·4-0·45 0·47-0·5
Diam. of head ... ..	0·1	0·11-0·15
Buccal capsule <sup>Al.</sup> ... .. <sup>Br.</sup> ... ..	0·04 0·04	0·046-0·0 0·041-0·0
Nerve ring to anterior extrem. ....	0·173	0·182-0·21
Exc. pore to anterior extrem. ....	—	0·75-0·812
Cerv. papillæ to anterior extrem....	—	0·85-0·96
Length of oesophagus ... ..	0·35	0·36-0·46
Breadth of oesophagus ... ..	0·15-0·17	0·13-0·15
Length of spicule ... ..	0·7	0·65-0·728
Length of gubernaculum ... ..	0·05	0·065
Vulva to post. extremity ... ..	0·87	0·83-0·937
Length of cirrus ... ..	—	0·046-0·052
Length of pars ejectrix ... ..	—	0·437
Length of pars haustrix ... ..	—	1-1·37
Anus to posterior extremity ... ..	0·630	0·625-0·77
Eggs ... ..	50 × 30μ	70 × 28μ

### Discussion.

The most prominent features in the present specimens which were mentioned by Neveu-Lemaire, are the presence of teeth on the floor of the buccal capsule and the plumose structure at the anterior part of the oesophagus. It has been already referred above to their absence in his description of this species and of *Pteridopharynx rhinocerotis*.

*KILULUMA MAGNA* Thapar, 1924

PL. LVIII (Fig. 113)

From the intestines of *Rhinoceros bicornis* bottle No. 1094 (two males and one female).

The most striking feature in this species is the presence of the cervical papillae in the oesophageal region and the slight double swellings of the oesophagus.

The mouth is surrounded by six lips, two subdorsal, two subventral, provided with projecting papillae and two lateral without projecting papillae (fig. 111).

Two thin shoots come from the inner posterior end of the wall of the buccal capsule and run anteriorly to surround the oral cavity.

The buccal capsule is 49 to 52  $\mu$  in length and 104-130  $\mu$  in breadth dorso-ventral.

The male bursa measures 182 to 200  $\mu$  in length and 400 to 500  $\mu$  in breadth.

In other anatomical details of the present specimens agree with Thapar's description.

The following is a table of measurements in millimetres of the specimens examined compared with figures given by Thapar 1924.

Author	Thapar	Present
Total length ... .. ♂ ♀ +	20 24	16-19 18.5
Maximum breadth ... .. ♂ ♀ +	— 0.85	0.75-0.87 0.63
Exc. pore to anterior end ... ..	0.91	0.77-0.812
Nerve ring to anterior end ... ..	0.36	0.312-0.338
Cervical papillae to ant. end ... ..	1.04	0.85-0.912
Buccal capsule { Length ... .. Breadth ... ..	64 $\mu$ —	40-52 $\mu$ 104-130 $\mu$
Length of oesophagus ... ..	1.3	1.07-1.25
Breadth of oesophagus ... ..	0.27	0.25
Length of spicule ... ..	2.5	2.1

Author	Thapar	Present
Length of gubernaculum ... ..	0.3	0.25
Vulva to posterior end ... ..	0.34	0.286
Anus to posterior end ... ..	0.215	0.195
Length of vagina ... ..	1.2	0.9
Ova ... ..	120 × 50 μ	130-135 × 57-65 μ

### References

- 1.—BAYLIS, H. A. ... .. 1936 Nematoda of India. 1. p. 278.
- 2.—BAYLIS, H. A. & DAUBNEY, R. ... .. 1926 A Synopsis of the families and Genera of Nematoda.
- 3.—BHALERAO, G. D. ... .. 1935 *Murshidia fulcifer* in large intestine of Indian elephant.  
Ind. Jl. Vet. Sc. Calcutta 5, p. 6.
- 4.—DAUBNEY, R. ... .. 1923 A note on two species of the genus *Murshidia* parasitic in the Wart-Hog. Ann. & Mag. Nat. Hist. Ser. 9, Vol. 15, p. 67.
- 5.—KHALIL, M. ... .. 1922 A revision of the Nematode Parasites of Elephants with a description of four new species.  
Proc. Zool. Soc., London, p. 205.
- 6.—KHALIL BEY, M. ... .. 1931 Parasites from Liberia and French Guinea. First Part. Nematoda Zeitschrift Fur parasitenkunde Berlin 4, p. 431.
- 7.—LANE, C. ... .. 1914 Bursate Nematodes from the Indian-Elephant.  
Ind. Jl. of Med. Res., Vol. 2, p. 380.
- 8.—LANE, C. ... .. 1915 A further note on Bursate Nematodes from the Indian Elephant. Ibid. Vol. 3, p. 105.
- 9.—LANE, C. ... .. 1921 Some bursate nematodes from Indian and African elephants. Ibid. Vol. 9, p. 163.
- 10.—MONNIG, H. O. ... .. 1926 On some Strongylid Nematodes of the African elephant.  
Trans. R. Soc. Africa 13, p. 313

- 11.—MONNIG, H. O. ... 1932 *Syngamus indicus*. A new nematode from the Indian elephant.  
Report of the Dir. of Vet. Serv. and Anim. Ind. Union of South Africa, August.
- 12.—NEVEU-LEMAIRE, M. ... 1924 Les Strongylidés du Rhinocéros Africain (*Rhinoceros bicornis*).  
Annales des Parasitologie humaine et comparée, Vol. 2, p. 121.
- 13.—NEVEU-LEMAIRE, M. ... 1925 Description d'un Strongyle nouveau du Rhinocéros Africain. *Quilonia parva*.  
Ibid. Vol. 3, p. 290.
- 14.—NEVEU-LEMAIRE, M. .. 1928 Strongylidés Nouveau du Genre *Quilonia* chez l'Elephant d'Afrique.  
Ibid. Vol. 6, p. 186.
- 15.—NEVEU-LEMAIRE, M. ... 1928 Strongylidés Nouveau des Genre *Murshidia* et *Memphisia* chez l'Elephant d'Afrique.  
Ibid. p. 291.
- 16.—RAILLIET, A., HENRY, A., & JOYEUX, C. ... 1913 Un nouveau Strongylidé du Singes.  
Bull. Soc. Path. Exot., Vol. 6, p. 264.
- 17.—SANDGROUND ... 1933 *Kiluluma vernayi* sp.n. in large intestine of *Rhinoceros sonpaicus*.  
Malay Jl. Parasitology Urbana 9. p. 193.
- 18.—THAPAR, G. S. ... 1924 On *Kiluluma* Skrjabin A genus of Strongylide nematodes parasitic in African rhinoceros.  
Jl. Helmin., Vol. 2, p. 219.
- 19.—THAPAR, G. S. ... 1925 On some new members of the genus *Kiluluma* from the African rhinoceros.  
Ibid. Vol. 3, p. 63.
- 20.—TRAVASSOS ... 1929 *Murshidia monosticha* (Dies.) in *Tapirus americanus*.  
Mem. Inst. Oswaldo Cruz 22, p. 136.
- 21.—VUYLSTEKE, Cl. ... 1935 Etude de quelque Nematodes Parasites de l'Elephant.  
Rev. Zool. Bot. Afr. Terværen 27, p. 319.

- 22.— WARE, F. ... 1924 Two Bursate Nematodes from the  
Indian elephant.  
Jl. Comp. Path. Therap.,  
Edinburgh. Vol, 37. p. 278.
- 23.— WESTHUYSEN ... 1938 A Monograph of the Helminth.  
Parasites of the Elephant.  
Ondersteport Jl. Pretoria  
10, p.86.
- 24.— WITENBERG, G. ... 1925 Notes on Strongylidae of Elephants.  
Parasitology, Vol. 17, p. 284.
- 25.— WU ... 1934 Some bursate nematodes from  
Indian elephant.  
Sinensia Nanking, China, Vol.  
5, p. 518.
- 26.— YORKE, W. & MAPLESTONE, P. A. The Nematode Parasites of Vertebrates.
-

*HABRONEMA KHALILI* sp. n.

PL. LVIII, LIX and LX, (Figs. 114, 115, 116, 117, and 118)

From the intestine of *Rhinoceros bicornis*, black African rhinoceros, bottle 1094. One male and one female only were encountered among a large number of bursate nematodes.

This is the first record, as far as the writer could gather from literature, encountering a nematode belonging to the genus *Habronema* from a rhinoceros.

*General description.*—Filiform worms, the body tapers at both ends reaching its maximum breadth at the middle. The cuticle is transversely striated. Cuticular lateral membranes are absent.

The head is slightly marked off from the body. It is armed with six papillae, two lateral and four submedian. The laterals are somewhat indistinct and the submedian are small and situated at the latero-posterior border of the dorsal and ventral lips.

The mouth is surrounded by two large trilobed lateral lips and two small dorsal and ventral lips. Each lobe of the lateral lip is rounded in outline, and its inner surface is provided with a single, tooth-like projection which interlocks with that of the opposite side (fig. 113). The dorsal and ventral lips are much shorter and smaller than the laterals. They are deeply notched, the notch nearly reaching their bases (fig. 112).

The position of the cervical papillae in this species is remarkable among the species of the genus *Habronema*, they are small with a rather broad base and are situated posterior to the nerve ring at a level with the beginning of the glandular portion of the oesophagus.

The mouth leads to a short vestibule with thick chitinized walls which extend and bound the floor of the vestibule. Dorsally and ventrally the vestibule has a somewhat arched chitinized anterior border, the lateral sides are without such a border. The vestibule is widest dorso-ventrally and is remarkably narrow between the lateral sides (fig. 112).

The oesophagus is composed of two portions, a short anterior muscular portion and a longer and broader glandular portion. The anterior portion is surrounded, a short distance before joining the posterior portion, by the nerve ring.

*The male.*—16 mm. in length, its maximum breadth at the middle is 1 mm.

The vestibule measures 52 $\mu$  in length.



The muscular portion of the oesophagus measures 0.286 mm. in length and the total length of the two portions is 4.3 mm.

The nerve ring is situated 0.3 mm. from the anterior extremity.

Cervical papillae are situated 0.387 mm. from the anterior extremity.

The posterior end is, unfortunately, in a bad condition and the following description is based only on what the writer could exactly notice.

It is spirally coiled, Bursal wings are present. Cloaca is 0.221 mm. from posterior extremity. It is surrounded by six pairs of pedunculated papillae (fig. 114). Four pairs are preanal, of which the anterior two pairs are close together and larger than the posterior two pairs. The latter are also close together and nearer to the middle line than the anterior papillae. The other two pedunculated papillae are postanal. Just posterior to the cloaca and close to it there is one pair, whose papillae are very close to each other and large. The other pair of postanal papillae is situated at the middle of the distance between the cloaca and the posterior extremity. These papillae are also large. The ventral surface of the tip of the tail appears to be supplied with a cluster of very small papillae.

The two spicules are unequal, the left is long, measures 1.09 mm. in length and is comparatively slender, measuring 13 $\mu$  in breadth at the middle. The right spicule is detached at its distal extremity and the remaining portion measures 0.39 mm. in length and 20 $\mu$  in breadth.

The gubernaculum is small and irregular in shape.

*The female.* — 20 mm. in length, its maximum breadth at the middle is 0.56 mm.

The vestibule measures 52 $\mu$  in length.

The length of the muscular portion of the oesophagus is 0.234 mm. and the total length of the two portions of the oesophagus is 4.3 mm.

The nerve ring is situated 0.267 mm. from anterior extremity.

Cervical papillae are 0.403 mm. from anterior extremity.

The vulva is situated at the middle of the body. It is very small and provided with two small posteriorly directed lips. The anterior lip is larger than the posterior and terminates distally in a sharp point.

The vagina is 1.2 mm. in length, its whole length is clothed with a muscular layer and before joining the uterus it forms a wide vestibule (fig. 116).

The anus is 0.273 mm. from the posterior extremity. The tail tapers rather abruptly behind the anus and terminates in a cone-shaped blunt end (fig. 116).

The eggs contain fully developed embryo when deposited and measure 46-49  $\times$  23-26 $\mu$ .

The following table shows the important measurements in millimetres and characters which differentiate the present species from others representing the genus in herbivora.

	<i>Habronema muscae</i>	<i>H. zebrae</i>	<i>H. microstoma</i>	<i>H. megastoma</i>	<i>H. Khalili</i>
Total length	♂ 8-14 ♀ 12-22	10-13 17-18	9-22 15-35	7-10 10-13	16 20
Head ... ..	2 lateral, trilobed, unarmed lips.	2 lateral, trilobed, unarmed lips.	2 lateral, trilobed, unarmed lips.	2 lateral, trilobed, unarmed lips and a dorsal and ventral lips.	2 lateral, trilobed lips armed with three teeth and a dorsal and a ventral deeply notched lips.
Cervical papillae.	At the level of the nerve ring.	In front of the nerve ring.	At the level of the nerve ring.	At the level of the nerve ring.	Posterior to the nerve ring.
Length of Vestibule.	48-59 $\mu$	140-160 $\mu$	75 $\mu$	—	52 $\mu$
Lateral cuticular membranes.	On the left side only.	On the left side only.	On the left side only.	On each side.	Absent.
Anal papillae.	2 pairs pre-anal, 2 pairs adanal, 2 left post-anal, 1 right postanal.	4 pairs pre-anal left series in front of right, 2 left postanal, 2 right postanal. Post-anals asymmetrically arranged.	4 pairs pre-anal left side in front of right, 2 left postanal, 2 right postanal. Post-anal asymmetrically arranged, the 2 left in front of the right.	4 pairs pre-anal, 1 pair postanal.	4 pairs pre-anal, 2 pairs postanal symmetrically arranged.
Left spicule.	2.5	1.7-1.9	0.76-0.8	5.4	1.09
Right spicule.	0.5	0.4-0.56	0.35-0.38	0.2	0.39?
Vulva ... ..	Displaced dorsalward at end of ant. third of body.	Displaced dorsalward. In front of end of ant. third.	Not displaced. Post. to the ant. third.	In anterior third.	In middle of body with two lips.
Vagina ... ..	Long, passes transversely round the body.	Long, passes transversely round the body.	Surrounded by a mass of muscular tissue.	Long and curved.	Surrounded by muscular tissue.
Length of tail.	0.300-0.35	—	0.4-0.52	—	0.273

With regards to other species of *Habronema*, it closely resembles *H. urophasiana* Wehr, 1931; from sage grouse. The important differences between the two species are the following:—

(1) The ventral and dorsal lips in *H. urophasiana* have heel-like projections without notch.

(2) The presence of lateral cuticular membranes in *H. urophasiana* and its absence in the other.

(3) The cervical papillae are situated anterior to the nerve ring in *H. urophasiana* and are posterior to it in the present species.

(4) The caudal alae in *H. urophasiana* are supported by eight pairs of pedunculated papillae and four or five pairs of sessile papillae, while in *H. khalili* they are supported by six pairs of pedunculated papillae.

The differences justify considering the present species as new and is dedicated to Professor Khalil Bey.

### References to *Habronema*

- 1.—BAYLIS, H. A. ... 1931 *Habronema homospiculata* in *Manis tricuspis*.  
Ann. Mag. Nat. Hist. London,  
Vol. 8, p. 191.
2. BAYLIS, H. A. ... 1939 Nematoda of India 2, p. 71.
- 3.—BAYLIS, H. A. & DAUBNEY, R. ... 1926 A Synopsis of the families and genera of Nematoda, p. 211.
- 4.—CHITWOOD, B. G. & WEHR, E. E. 1934 The Value of Cephalic structure as characters in Nematode Classification.  
Zeitschrift fur Parasit. 7, Berlin,  
Band, 3, p. 273.
- 5.—CRAM, E. B. ... 1933 *Habronema incetra* in a new bird and in a new locality.  
Jl. of Parasit. Urbana, Vol.  
20, p. 74.
- 6.—FOSTER, A. O. & CHITWOOD, B. G. ... 1937 A new nematode, *Habronema clarki* n.sp. (Spiruridae) from *Hydrchoerus isthmus* Goldman.  
The Proc. of the Helmin. Soc. of Washington, Vol. 4, No. 2.
- 7.—GENDRE, E. ... 1923 Sur quelques espèces d'“*Habronema*” parasites des Oiseaux.  
Procès Verbaux de la Soc. Linnéenne de Bordeaux, Vol. 74.

- MAPLESTONE, P. A. ... 1929 Rec. Ind. Mus. Calcutta 31, p. 90.
- MAPLESTONE, P. A. ... 1930 Ibid 32, p. 406.
- MAPLESTONE, P. A. ... 1932 Ibid 34, p. 238.
- MONNIG, H. O. ... 1931 Two new Nematodes from the Suri-  
cat 17th Report of the Direct. of  
Vet. Serv. and Animal Ind.  
Union of South Africa, August,  
p. 277.
- NEVEU-LEMAIRE, M. ... 1927 *Protospirura hamospiculata* n. sp.  
Nematode parasite d'un Pangolin  
Africain.  
Ann. de Parasitologie, Tome 5,  
p. 107.
- ORTLEPP, R. J. ... 1934 On *Habronema marrayi* sp. n.  
from the barn owl *Tyto alba*. Jl.  
Onderstepoort of Vet. Sc. and  
Animal Ind., Vol. 3, No. 2, p. 351.
- SEURAT, L. G. ... 1913 Sur deux Spiroptères du Chat ganté.  
C.R. Soc. Biol. Vol. 74, p. 676.
- SEURAT, L. G. ... 1914 Sur un nouveau parasite de la Cigo-  
gne blanche.  
Bull. Soc. d'Hist. Nat. de  
l'Afrique du Nord Vol. 5, p. 65.
- SEURAT, L. G. ... 1914 Sur un nouveau parasite du Per-  
ceptère.  
Bull. Soc. d'Hist. Nat. de l'Afri-  
que du Nord, Vol. 5, p. 149.
- SEURAT, L. F. ... 1914 Sur un nouveau Spiroptère du Chat  
ganté.  
C. R. Soc. Biol. Vol. 77, p. 344.
- SEURAT, L. G. ... 1915 Nematode parasites. Expedition de  
M. M. Walter Rothschild, E. Har-  
tet et C. Hilgert dans le Sud  
Algerien (Mars et Mai 1914).  
Novitates Zoologicae, Vol. 22,  
p. 1.
- SEURAT, L. G. ... 1919 Nematode de la Panthere.  
Bul. Soc. d'Histoire Nat. de l'Afri-  
que du Nord, Vol. 10, p. 47.
- SKRJABIN, K. J. ... 1917 Sur quelque Nematodes des Oiseaux  
de la Russie.  
Parasitology, Vol. 9, p. 59.

- 21.—THEILER, G. ... 1924 The Strongylids and other Nematodes parasitic in the intestine tract of South African Equines. Thèse présenté à la Faculté de Sciences de l'Université de Natal, Natal, Pretoria, p. 91.
- 22.—TSCHERNIKOWA, CH. ... 1934 Un nouveau Nématode *Habronema skrjabini* n. sp. du Chat sauvage. Annal de Parasitologie, Vol. 12, p. 29.
- 23.—VUYLSTEKE, Cl. ... 1936 Un Nématode Nouveau du Pangolin d'Afrique. Rev. Zool. Bot. Afri. 29, p. 12.
- 24.—VUYLSTEKE, Cl. ... 1937 Ibid 30, p. 140.
- 25.—WALTON, A. C. ... 1923 Some new and little known Nematodes. Jl. of Parasitology, Vol. 10, p. 59.
- 26.—WEHR, E. E. ... 1931 A new species of Nematode from the sage grouse. The Proc. of the U.S. National Mus., Vol. 79, Art. 3, pp. 1-3.
- 27.—YORKE, W. & MAPLESTONE, P. A. ... 1926 The Nematode Parasites of Vertebrate, p. 296.

*PHYSOCEPHALUS SEXALATUS* (Molin. 1860) Diesing. 1861

PL. LX (Fig. 119)

From the alimentary tract of *Rhinoceros bicornis*, black African rhinoceros, bottle No. 1094. One male and one female only were encountered among a large number of bursate nematodes.

This nematode is rather a common parasite in the stomach of pigs, yet it has been recorded from stomach of donkeys, dromedaries, peccary and tapir. It seems that this species is an occasional parasite in the last mentioned mammals. From the rhinoceros, it has never been recorded before.

The present specimens are much longer than those previously recorded. The male measures 25 mm. and the female 38 mm. in length. The longest are those recorded by Seurat 1912 from asses and dromedaries, the male measures 13 mm. and the female 22 mm. in length.

The cervical papillae are symmetrical, situated 0.2 mm. from the anterior extremity in the region of the vestibule (fig. 117). They have a broad base with a blunt distal end which does not project beyond the surface of the cuticle.

In other anatomical details, the present specimens agree with Foster's and Seurat's descriptions.

The following is a table of measurements in millimetres of the two specimens encountered.

Total length	Max. Br.	Diam. of head	Nerving to ant. end	Cervical papillae to ant. end	Length & Br. of vestibule	Length of Oesoph.	Spicules		Cloaca
							Long	Short	
25	0.5	72 $\mu$	0.38	0.2	0.26 × 0.046	3	2.4 × 3 $\mu$	0.54 × 13 $\mu$	52 $\mu$

Total length	Max. Br.	Diam. of head	Nerving to ant. end	Cervical papillae to ant. end	Length & Bread. of Vesti.	Length of Oesoph.	Vulva to enter. extrem.	Anus to Poster. extremity
38	0.75	73 $\mu$	0.36	0.221	0.24 × 0.049	3.6	20	0.187

Eggs. 29-31  $\mu$  × 13-15  $\mu$ .

### Discussion.

Foster, 1912, stated that there is only one cervical papillae on the side, situated 281 $\mu$  from the anterior end.

Railliet and Henry, 1911, reported the presence of two asymmetrical situated cervical papillae, the left being 0.22 mm., and the right 0.42 mm. from anterior extremity.

In the present specimens, the cervical papillae as already mentioned are symmetrical. The present statement cannot be doubted as the cervical papillae are so distinct to be overlooked or mistaken.

Therefore, the definition of the genus *Physocephalus* Dies. 1861 given by Yorke and Maplestone 1926, p. 30 should be emmended as regards the position of the cervical papillae.

### References to *Physocephalus Sexalatus*

1. BAYLIS, H. A. ... 1929 A manual of Helminthology Medical and Veterinary, p. 230.
2. BAYLIS, H. A. ... 1939 Nematode of India 2, p. 104.
3. BAYLIS, H. A. & DAUBNEY, R. ... 1926 A Synopsis of the families and Genera of Nematoda, p. 215.
4. FOSTER, W. D. ... 1912 The round worms of Domestic Swine U.S. Dept. Ag. Bur. of Animal Indus. Bull. 158.
5. HALL, M. C. ... 1916 Nematode parasites of Mammals of the Orders Rodentia, Lagomorphs and Hyraccidea. Proc. U.S. Nat. Mus., Vol. 50, p. 1.
6. RAILLIET, A. & HENRY, A. 1911 Helminthes du Prore recueillis par M. Bauche en Annam. Bull. Soc. Path. Exot., Vol. 4, p. 693.
7. SEURAT, L. G. ... 1912 Sur le presence en Algerie du Spirocerca sexalata Molin, chez le dromadaire et chez l'âne. C.E. Soc. Biologique, Vol. 72, p. 174.
8. SEURAT, L. G. ... 1913 Sur l'evolution du Physocephalus (Molin). Ibid. Vol. 75, p. 517.
9. YORKE, W. K. & MAPLESTONE, P. A. ... 1926 The Nematode Parasites of Vertebrates p.