

PARASITES OF SOUTH AFRICAN FRESHWATER FISH. II. REDESCRIPTION OF THE AFRICAN SPECIES OF THE GENUS *PHYLLODISTOMUM* BRAUN, 1899 (TREMATODA: GORGODERINAE) AND THE DESCRIPTION OF A NEW SPECIES

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ABSTRACT

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During 1980 a survey of the parasites of freshwater fish was conducted in the Sabie and Crocodile Rivers in the southern part of the Kruger National Park, Transvaal. A new species of *Phyllodistomum*, Braun, 1899, for which the name *Phyllodistomum bavuri* is proposed, was found in the urinary bladder of many of the catfish, *Clarias gariepinus* (Burchell, 1822), examined. The new species resembles *Phyllodistomum linguale* Odhner, 1902 and *Phyllodistomum vanderwaali* Prudhoe & Hussey, 1977, but may be differentiated from the former species in that the ovary and the vitellaria are smooth, while those of *P. linguale* are irregularly lobed. The ovary of *P. vanderwaali* is irregularly lobed while that of *P. bavuri* never has more than 3 indistinct lobes. In addition, *P. bavuri* is much larger than *P. vanderwaali*.

P. bavuri is readily differentiated from the other 4 African species of *Phyllodistomum*, namely, *Phyllodistomum spatula* (Odhner, 1902), *Phyllodistomum spatulaeforme* (Odhner, 1902), *Phyllodistomum ghanense* Thomas, 1958 and *Phyllodistomum symmetrorchis* Thomas, 1958. For comparative purposes the African species are briefly redescribed and illustrated.

P. bavuri occurred throughout the year and their numbers do not appear to fluctuate seasonally in the Kruger National Park.

INTRODUCTION

During 1980, a survey of the parasites of a number of species of freshwater fish was conducted in 2 major rivers, the Sabie and the Crocodile, in the southern part of the Kruger National Park, Transvaal. Both rivers form part of the eastern drainage system (Wellington, 1955, as cited by Jubb, 1967), and both arise in the mountains of the eastern Transvaal escarpment.

The object of the present study was to determine the various species of parasites that occur in fish in these rivers and also to determine their seasonal variation. This paper includes the description of a new species of the genus *Phyllodistomum* Braun, 1899 that was found in the urinary bladders of many of the catfish *Clarias gariepinus* (Burchell, 1822), as well as its prevalence.

To date, 6 species of this genus have been described from African freshwater fish. They are *Phyllodistomum linguale* Odhner, 1902, *Phyllodistomum spatulaeforme* (Odhner, 1902) and *Phyllodistomum spatula* (Odhner, 1902) from the Sudan, *Phyllodistomum ghanense* Thomas, 1958 and *Phyllodistomum symmetrorchis* Thomas, 1958 from Ghana, West Africa, and *Phyllodistomum vanderwaali* Prudhoe & Hussey, 1977 from South Africa. The 7th species, for which the name *Phyllodistomum bavuri* is proposed, was collected from catfish from both the Sabie and the Crocodile Rivers as well as from the Bangu River, a tributary of the Olifants River in the central part of the Park.

MATERIALS AND METHODS

All the fish were caught with baited handlines and the parasites collected as described by Boomker (1982).

After being opened with scissors, the entire urinary bladder was placed in 70% ethyl alcohol and vigorously shaken for about 1 min. The majority of the parasites were thus fixed in a flat plane and as they are very thin and leaf-like, fixation was almost immediate.

The parasites were stained with Mayer's haemalum, acid carmine and Grenacher's borax carmine. After dehydration in graded concentrations of ethyl alcohol and clearing in oil of cloves, the parasites were mounted in a synthetic resin.*

* Histoclad, Clay-Adams

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During the course of the study, specimens of *P. spatulaeforme*, *P. spatula* and *P. linguale* as well as the type specimens of *P. vanderwaali* and the holotypes of *P. ghanense* and *P. symmetrorchis* were loaned from the British Museum (Natural History), London, for comparison with each other and with *P. bavuri*.

REDESCRIPTION OF THE AFRICAN SPECIES OF THE GENUS *PHYLLODISTOMUM* BRAUN, 1899

Phyllodistomum bavuri n. sp. (Fig. 1, Table 1)

Type host

Clarias gariepinus from the Bangu River, Kruger National Park, Transvaal.

Material examined

Syntypes: 6 mounted, mature specimens from the type host from the type locality have been deposited with the Onderstepoort Helminthological Collection, No. T7.

Paratypes: 8 mounted, mature specimens from the type host from the Sabie River have been deposited with the British Museum (Natural History), London, No. 1983.7.5.1-8.

Additional material: Numerous specimens from the type host from both the Sabie and Crocodile Rivers have been examined. Additional material consisting of 40 specimens have been deposited with the syntypes and the paratypes.

Description

When alive, the trematodes form a pale brown film covering the white mucosa of the urinary bladder. If only a few worms are present, they may be difficult to find, as they are often hidden by the mucosal folds.

The body is aspinose and ampullate in shape. The anterior part is subcylindrical and amounts to about $\frac{1}{4}$ of the total body length. The posterior $\frac{3}{4}$'s of the body is thin and flattened dorsoventrally and the various internal structures are microscopically visible without prior staining.

The oral sucker is round and situated subventrally, while the ventral sucker is situated at or slightly behind the junction of the anterior and posterior parts of the

body. The oral sucker is smaller than the ventral one, giving an oral to ventral sucker ratio that varies from 1:1.55–1:2.06.

A pharynx is absent and the oesophagus is short. The intestine bifurcates about halfway between the oral and ventral suckers, or in some specimens, slightly more towards the oral sucker. The intestinal caecae almost reach the posterior margin of the body. The excretory vesicle and pore could not be seen.

The genital pore lies in the midline of the body, between the bifurcation of the gut and the ventral sucker. A cirrus sac is absent and the cirrus and the opening of the vagina in the genital atrium were indistinct.

The testes are fairly large, deeply and irregularly lobed structures lying in the middle of the body on either side of the midline. They are usually opposite one another but may be slightly displaced so that the one lies in front of the other. In a single specimen only, 1 of the testes appeared more degenerate than the other.

The vitellaria are compact bodies that are oval to roughly triangular in outline, or they may occasionally be slightly lobed. They are situated near the posterior margin of the ventral sucker. In one of the paratype specimens, only 1 vitellarium was seen. The shell-gland lies between the vitellaria and is ill-defined.

The ovary may be situated either to the left or to the right of the midline, between the vitellaria and the testes. It stains intensely and is round to oval in shape, sometimes weakly trilobed.

The uterus consists of numerous tortuous loops that occupy the area between the intestinal caecae and the testes, and only a few loops extend laterally and posteriorly beyond the caecae. It runs anteriorly and passes between the testes and the vitellaria to reach the genital pore. The metroterm could not be seen. The uterine loops are filled with eggs, and those closest to the genital pore contain miracidia.

***Phyllodistomum linguale* Odhner, 1902 (Fig. 2, Table 1)**

Material examined: One mounted mature specimen from *Gymnarchus niloticus*, Egypt.

The body was the characteristic shape of the genus. The forebody constitutes about $\frac{1}{3}$ of the total body length. The suckers are round and the oral to ventral sucker ratio is 1:2.3.

The oesophagus is short and the intestine bifurcates at the junction of the 1st and 2nd thirds of the distance between the oral and the ventral suckers. The intestinal caecae terminate some distance away from the posterior margin. The excretory vesicle and pore could not be seen.

The genital pore lies between the gut bifurcation and the rim of the ventral sucker, in the midline of the body. A cirrus sac is absent and the cirrus and opening of the vagina were indistinct.

The testes are fairly large, deeply indented and irregularly lobed structures, lying in the middle of the body on either side of the midline. In the specimen examined by me, the testes were slightly displaced so that the one was situated in front of the other.

The vitellaria are compact, oval to roughly triangular bodies that lie immediately behind the posterior rim of the ventral sucker. They lie opposite each other and in front of the ovary.

The ovary is situated on the left side of the body, between the vitellaria and the testes. It is deeply indented and irregularly lobed.

The uterus consists of numerous loops that lie in the area between the caecae laterally and the testes anteriorly, and only a few loops extend laterally beyond the caecae. The uterus runs anteriorly between the testes and the vitellaria to reach the genital pore. The loops are filled with eggs, of which the ones closest to the genital pore contain miracidia.

***Phyllodistomum spatulaeforme* (Odhner, 1902) (Fig. 3, Table 1)**

Material examined: Two mounted mature specimens from *Malopterurus electricus*, Egypt.

The body has the characteristic shape of the genus and its margin is thrown into folds. The forebody constitutes about $\frac{1}{2}$ of the total body length. The suckers are round and the oral to ventral sucker ratio is 1:1.

The oesophagus, intestine and genital pore have the same positions as described for *P. linguale* and, as was the case with *P. linguale*, the excretory vesicle, the excretory pore and the cirrus and the opening of the vagina could not be seen. The intestinal caecae are inflated and bulge anteriorly.

The testes are comparatively small, shallowly indented and irregularly lobed structures, lying on either side of the midline in the middle of the body. In one of the 2 specimens they were opposite each other but in the other specimen the one testis was slightly in front of the other.

The vitellaria are small compact bodies, round to oval, sometimes slightly indented, situated behind the posterior margin of the ventral sucker. In one of the 2 specimens examined they were situated between the ovary on the one side and one of the testes on the other side, but in the other specimen, they were lateral to the ovary only, as the testis on that side was displaced posteriorly.

The ovary is situated either on the left or on the right side of the body. It is round to kidney-shaped.

The uterus consists of loops situated in the space between the testes anteriorly, the intestinal caecae laterally and the terminations of the intestinal caecae posteriorly. They do not extend beyond the caecae either laterally or posteriorly.

***Phyllodistomum spatula* (Odhner, 1902) (Fig. 4, Table 1)**

Material examined: One mounted mature specimen from *Bagrus bayad*, Egypt.

The body is ampullate in shape. The forebody constitutes about $\frac{1}{2}$ of the total body length. The suckers are round and the oral to ventral sucker ratio is 1:1.26–1.35.

The oesophagus and intestine have the same position and configuration as those of *P. spatulaeforme*. The excretory vesicle is ampullate in shape and appears to open through the excretory pore situated in a notch in the posterior margin of the body. The genital pore lies in the midline of the body behind the bifurcation of the gut in the posterior $\frac{1}{2}$ of the distance between the oral and ventral suckers. The cirrus and opening of the vagina in the genital atrium could not be seen.

The testes are large, irregularly lobed and variably indented. The one testis lies in front of the other.

The vitellaria are compact bodies that are pear-shaped to round with occasional shallow indentations. They are situated some distance posterior to the margin of the ventral sucker and lie lateral to the ovary. One vitellarium is situated slightly in front of the other.

The ovary is oval and lies opposite the vitellaria on the left side of the body.

The uterus consists of numerous tortuous loops that occupy the space between the testes anteriorly, the intestinal caecae laterally and the ends of the intestinal caecae posteriorly. They extend beyond the caecae laterally, but do not pass the ends of the caecae posteriorly.

***Phyllodistomum ghanense* Thomas, 1958 (Fig. 5, Table 1)**

Material examined: The holotype mounted specimen from *Mastacembelus nigromarginatus*, Ghana.

The body has the characteristic shape of the genus. The forebody constitutes about $\frac{1}{2}$ of the total body length and the suckers are round. The oral to ventral sucker ratio is 1:1.3. The oesophagus is short and the intestine bifurcates in the anterior third of the distance between the suckers. The intestinal caecae terminate some distance away from the posterior margin of the body. The excretory bladder and pore could not be seen.

The genital pore lies behind the gut bifurcation, in the midline of the body. A cirrus and cirrus pouch are lacking. The vesicula seminalis is large and is situated posterior to the genital opening. The opening of the vagina could not be seen.

The testes are diagonally arranged, with the one testis well in front of the other. They are irregularly lobed and the indentations are shallow. The posterior testis is slightly larger than the anterior one.

The vitellaria are approximately round or bean-shaped structures lying close to the posterior rim of the ventral sucker. They are opposed and are flanked by the ovary on one side and the anterior testis on the other.

The ovary lies on the left side of the body, opposite the vitellaria. It is roughly oval in shape.

The uterus consists of dense coils that occupy the entire space behind the vitellaria that is not occupied by the gonads. Laterally and posteriorly, they extend to the margin of the body and anteriorly they are situated laterally to the caecae and extend to the posterior rim of the ventral sucker. The uterine coils are filled with eggs, the ones closest to the genital pore containing miracidia.

***Phyllodistomum symmetrorchis* Thomas, 1958 (Fig. 6, Table 1)**

Material examined: The mounted holotype specimen from *Auchenoglanis occidentalis*, Ghana.

The body has the characteristic shape of the genus and the margin of the posterior part has a wrinkled appearance. The forebody constitutes about $\frac{1}{4}$ of the total body length. The oesophagus is very short and the intestine bifurcates a short distance behind the oral sucker. The caecae bulge anteriorly and appear inflated, and posteriorly they end in blind sacs some distance from the margin of the body. The excretory vessel was not seen but the excretory pore opens in a distinct notch.

The suckers are round. The oral sucker is situated subventrally and is slightly smaller than the ventral sucker. The ratio of the size of the oral sucker to that of the ventral sucker is 1:1.4.

The genital pore lies halfway between the oral and ventral suckers. The vesicula seminalis is distinct and is next to the genital atrium. A cirrus and cirrus sac are absent, and the vaginal opening was not seen.

The testes are large, round, symmetrical structures lying opposite each other on either side of the midline.

The vitellaria are small, deeply indented and irregularly lobed structures, lying on either side of the midline posterior to the ovary. They are directly opposed. The shell gland is distinct and lies immediately in front of the vitellaria.

The ovary is comparatively small and lies on the left side of the body, opposite the shell gland, and in front of the vitellaria. It is round in shape.

The uterine coils are sparsely distributed in the space behind the testes and occasionally extend beyond the caecae laterally and posteriorly.

***Phyllodistomum vanderwaali* Prudhoe & Hussey, 1977 (Fig. 7, Table 1)**

Material examined: Three mounted syntype specimens from *Clarias gariepinus*, South Africa.

The body is pear-shaped and the forebody constitutes about $\frac{1}{2}$ of the total length. The suckers are round and the oral to ventral sucker ratio is 1:1.5–1.8.

The oesophagus is very short and the intestine bifurcates immediately behind the oral sucker. The caecae bulge somewhat anteriorly and terminate near the posterior body margin. The excretory vesicle and opening could not be seen.

The genital pore opens halfway between the oral and ventral suckers. The vesicula seminalis opens into the genital atrium, which is large. A cirrus and cirrus sac are absent, and the opening of the vagina in the genital atrium could not be seen.

The testes are small, shallowly indented and irregularly lobed structures lying on either side of the midline in the middle of the body. They may be opposed or one testis may be slightly in front of the other.

The vitellaria are compact bodies, roughly triangular and diagonally opposed. They lie directly behind the posterior rim of the ventral sucker, in front of the ovary.

The ovary is situated either on the left or the right side of the body, between the testes and the vitellaria. It is shallowly indented and irregularly lobed. The shell gland is small and situated between the vitellaria.

The uterus consists of numerous loops that occupy the area between the intestinal caecae and the testes. They may extend beyond the ends of the caecae, but do not cross the caecae laterally. The uterine coils are filled with eggs, of which the ones closest to the genital pore contain miracidia.

SEASONAL INCIDENCE OF *P. BAVURI*

One hundred and three catfish from the Sabie and Crocodile Rivers were examined from April 1980–March 1981. The numbers of *P. bavuri* recovered from those fish that harboured them are listed in Table 2.

P. bavuri was recovered from only 31 (30.1%) of the catfish, and the size of the fish did not noticeably influence the number or the size of the parasites.

From these results it is apparent that there is no seasonal fluctuation in the numbers of *P. bavuri* and that infestation of the catfish seems to take place erratically.

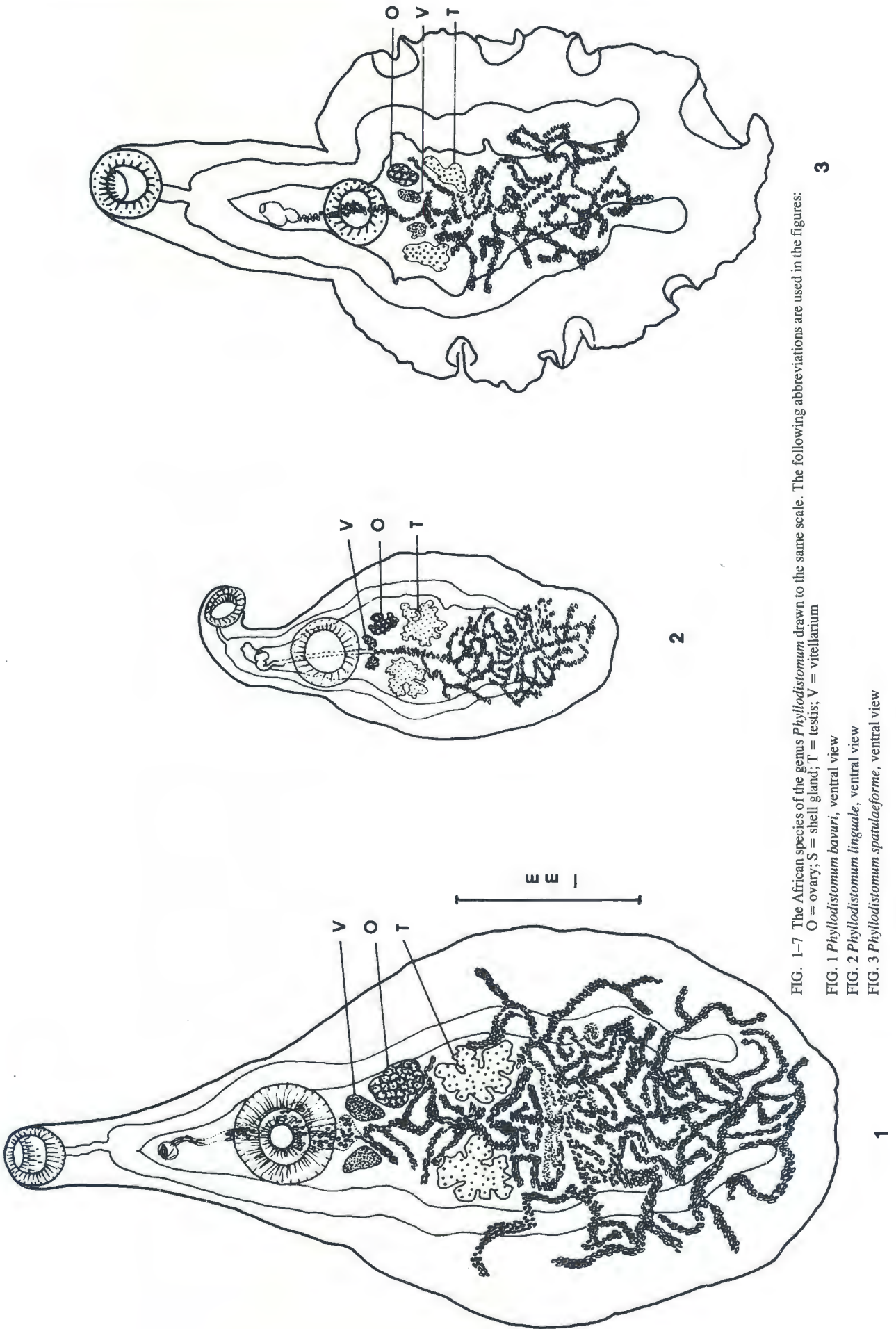


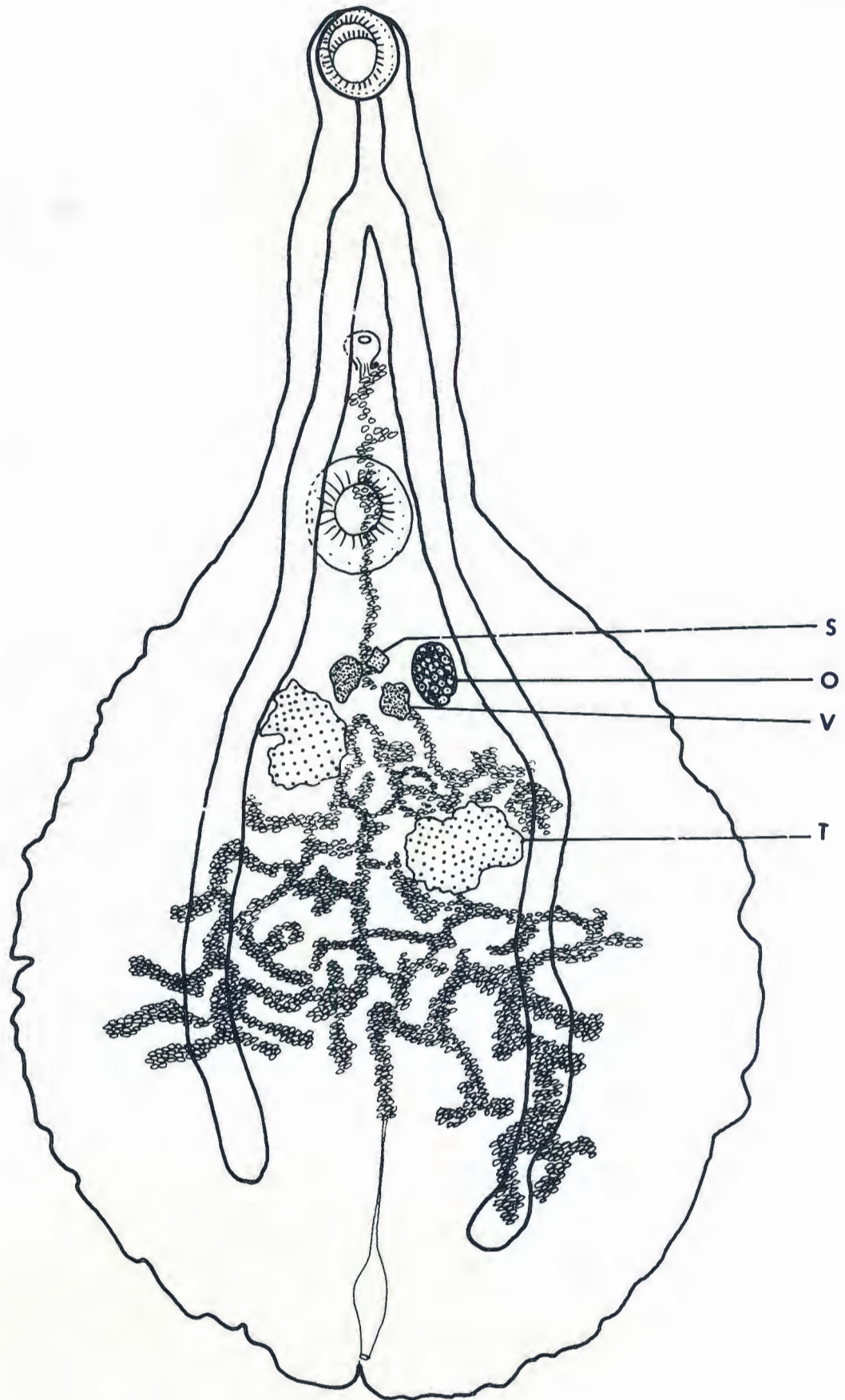
FIG. 1-7 The African species of the genus *Phyllodistomum* drawn to the same scale. The following abbreviations are used in the figures:

O = ovary; S = shell gland; T = testis; V = vitellarium

FIG. 1 *Phyllodistomum baviuri*, ventral view

FIG. 2 *Phyllodistomum linguale*, ventral view

FIG. 3 *Phyllodistomum spatulaeforme*, ventral view



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FIG. 4 *Phyllodistomum spatula*, ventral view

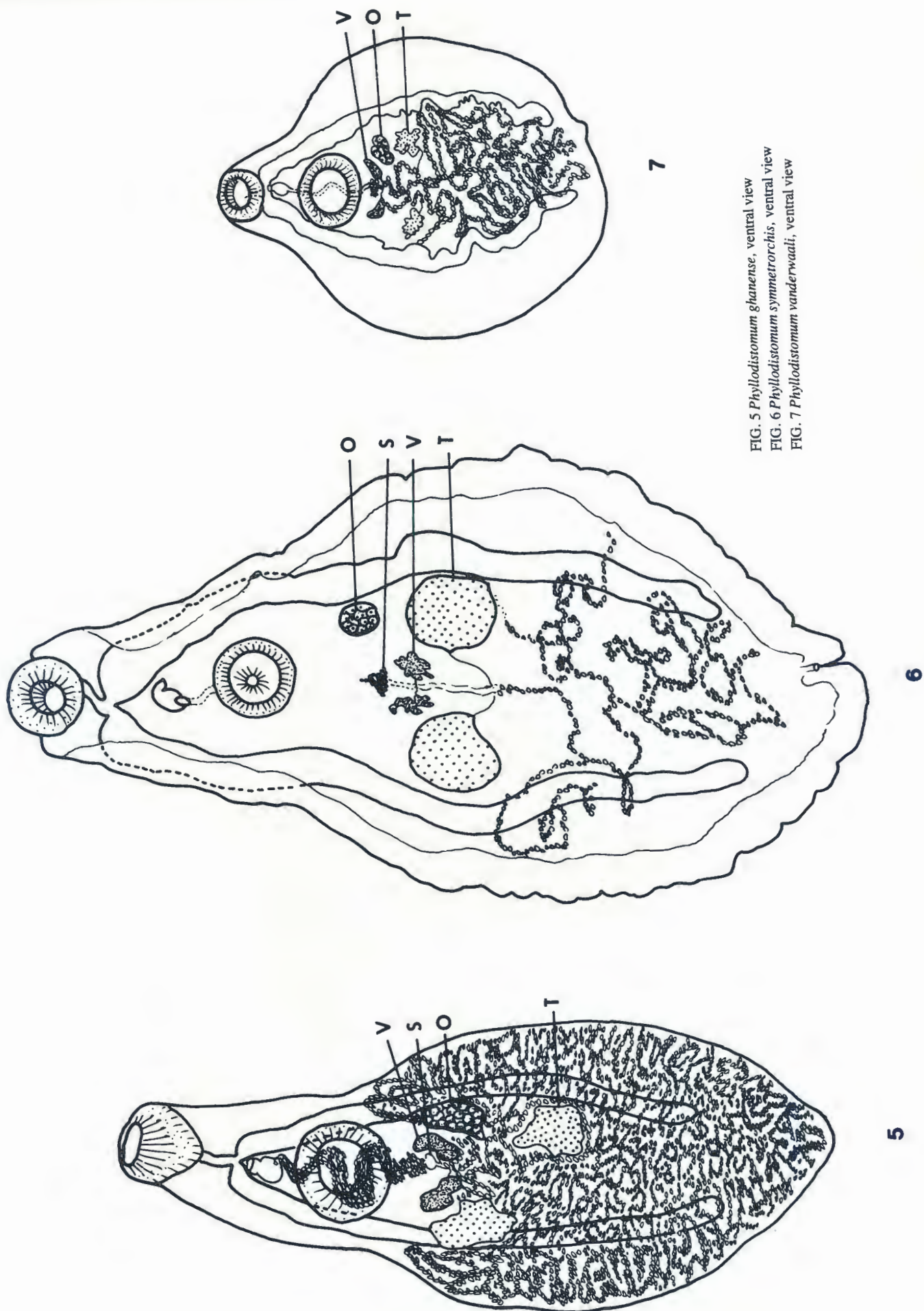


FIG. 5 *Phyllodistomum ghanense*, ventral view
FIG. 6 *Phyllodistomum symmetricrarchis*, ventral view
FIG. 7 *Phyllodistomum vanderwaali*, ventral view

TABLE 1 The principal measurements of the 7 African species of the genus *Phyllodistomum*⁽¹⁾

Species	Author	Length	Width	Diameter of oral suckers	Diameter of ventral suckers	Distance between suckers
<i>P. bavayi</i>	—	3,49-5,18	0,99-2,54	0,27-0,36	0,41-0,63	0,99-1,71
<i>P. linguale</i>	Odhner, 1902	5,30	2,30	0,43	0,73	—
	Lewis, 1935	5,36	2,35	0,43	0,73	—
	This paper	2,99	1,48	0,18	0,41	0,78
<i>P. spatulaeforme</i>	Odhner, 1902	4,75	2,80	0,35	0,40	—
	Lewis, 1935	4,75	2,80	0,35	0,40	—
	This paper	4,05	2,20	0,40	0,40	1,25
<i>P. spatula</i>	Odhner, 1902	5,0-5,75	3,3-3,6	0,48	0,52	—
	Lewis, 1935	5,0-5,75	3,3-3,6	0,48	0,52	—
	This paper	5,31-6,35	3,19-3,42	0,36-0,38	0,49	2,07-2,16
	Thomas, 1958	3,65	1,50	0,39	0,50 × 0,53*	—
<i>P. ghanense</i>	This paper	3,69	1,53	0,41	0,54	1,04
	Thomas, 1958	4,34-4,35	2,16-2,69	0,37-0,40 × 0,38-0,42*	0,41-0,45 × 0,41-0,43*	—
<i>P. symmetrorchis</i>	This paper	4,40	2,39	0,40	0,45	1,08
	Prudhoe & Hussey, 1977	1,9-2,5	1,3-1,6	0,23-0,25	0,35-0,40	—
<i>P. vanderwaali</i>	This paper	1,82-2,27	0,63-1,65	0,22-0,25	0,38-0,40	0,36-0,47

⁽¹⁾ All measurements given in mm

* Ventral sucker not round according to Thomas (1958)

TABLE 1 The principal measurements of the 7 African species of the genus *Phyllostomum*⁽¹⁾ (continued)

Species	Author	Testes						Ovary	
		Left		Right		Length	Width	Length	Width
		Length	Width	Length	Width				
<i>P. bavari</i>	—	0,33-0,67	0,21-0,47	0,31-0,61	0,16-0,43	0,19-0,38	0,15-0,32		
<i>P. linguale</i>	Odhner, 1902 Lewis, 1935 This paper	— 1-1,5 times size of ovary** 0,27	— 0,30	— 0,25	— 0,26	— 0,285 0,14	— 0,212 0,18		
<i>P. spatulaeforme</i>	Odhner, 1902 Lewis, 1935 This paper	— 1-2 times size of ovary** 0,27	— 0,18	— 0,31	— 0,13	— 0,22 0,20	— 0,163 0,14		
<i>P. spatula</i>	Odhner, 1902 Lewis, 1935 This paper	— 2-3 times size of ovary** 0,52-0,54	— 0,38-0,43	— 0,49-0,61	— 0,36-0,41	— 0,562 0,27-0,29	— 0,462 0,20-0,25		
<i>P. ghanense</i>	Thomas, 1958 This paper	0,42 0,49	0,30 0,32	0,50 0,45	0,40 0,27	0,40 0,40	0,27 0,20		
<i>P. symmetrorchis</i>	Thomas, 1958 This paper	0,43-0,49** 0,47	0,40-0,41** 0,43	—	0,47	—	0,14-0,18 0,20		
<i>P. vanderwaali</i>	Prudhoe & Hussey, 1977 This paper	— 0,11-0,27	— 0,09-0,15	— 0,09-0,16	— 0,09-0,15	— 0,12-0,17 0,13-0,15	— 0,08-0,12 0,09-0,11		

(1) All measurements given in mm

** Measurements of both the organs

TABLE 1 The principal measurements of the 7 African species of the genus *Phyllodistomum*⁽¹⁾ (Continued)

Species	Author	Vitellaria						Eggs	
		Left		Right		Length	Width	Length	Width
		Length	Width	Length	Width				
<i>P. bavuri</i>	—	0,13-0,25	0,08-0,16	0,13-0,23	0,08-0,16	0,036-0,043	0,018-0,032		
<i>P. linguale</i>	Odhner, 1902 Lewis, 1935 This paper	— ½-½ of size of ovary** 0,11	—	—	—	0,033 0,033 0,043-0,054	— 0,033 0,021-0,028		
<i>P. spatulaeforme</i>	Odhner, 1902 Lewis, 1935 This paper	— ½ of size of ovary** 0,16	—	—	—	0,028 0,028 0,020-0,032	— 0,028 0,018-0,022		
<i>P. spatula</i>	Odhner, 1902 Lewis, 1935 This paper	— ½-½ of size of ovary** 0,18-0,25	—	—	—	0,030 0,030 0,018-0,020	— 0,030 0,014		
<i>P. ghanense</i>	Thomas, 1958 This paper	0,27-0,33** 0,32	0,12** 0,11	—	—	0,028-0,032 0,021-0,032	0,018 0,018-0,021		
<i>P. symmetricorthis</i>	Thomas, 1958 This paper	0,19-0,24** 0,20	0,10-0,15** 0,11	—	—	0,022-0,024	0,016-0,018		
<i>P. vanderwaaii</i>	Prudhoe & Hussey, 1977 This paper	0,11-0,16** 0,12-0,16	0,042-0,058** 0,04-0,05	—	—	0,016-0,028 0,036	0,01-0,017 0,022		

⁽¹⁾ All measurements given in mm

** Measurements of both the organs

TABLE 2 Variations in the numbers of *Phyllodistomum bavuri* recovered from catfish from the Kruger National Park

Date and locality	Fish			<i>P. bavuri</i> recovered	
	No.	Sex	Length (cm)	No./fish	Monthly mean
Sabie River					
Apr. 80	24	♂	70	26	26
Aug. 80	60	♂	61	37	
Aug. 80	61	♂	52	25	
Aug. 80	62	♂	44	20	27
Sept. 80	70	♂	64,5	4	
Sept. 80	75	♂	70	12	
Sept. 80	84	♂	49,5	22	13
Nov. 80	94	♂+♀	51	5	
Nov. 80	95	♂	55,5	13	
Nov. 80	96	♂	44,5	1	6
Dec. 80	100	♂+♀	46	71	
Dec. 80	101	♂	50	95	83
Jan. 81	107	♂+♀	73	11	
Jan. 81	108	♂+♀	50	28	
Jan. 81	109	♂	40	10	
Jan. 81	110	♂	58	15	
Jan. 81	116	♂	?	5	14
Feb. 81	117	♂	65,5	60	
Feb. 81	118	♂+♀	63,5	36	
Feb. 81	119	♂	49	29	42
March 81	120	♂+♀	90,5	32	
March 81	121	♂+♀	57,5	154	
March 81	122	♂	44,5	56	
March 81	123	♂	49,5	6	62
Apr. 81	130	♂	65	7	7
Crocodile River					
Apr. 80	32	♂	52,5	2	2
May 80	38	♂	60	1	1
Aug. 80	65	♂	85	27	
Aug. 80	66	♂	54	65	
Aug. 80	67	♂	50,5	4	32
Jan. 81	111	♀	36	1	1

DISCUSSION

There are several characteristics on which the African species of the genus *Phyllodistomum* may be differentiated from one another, but the most convenient one appears to be the position of the ovary relative to the vitellaria, i.e. whether the ovary lies anterior, opposite or posterior to the vitellaria.

The only species in which the ovary lies in front of the vitellaria is *P. symmetrorchis*. This is a distinctive species in that the testes are large and round and that there are few uterine coils.

In *P. spatula* and *P. ghanense* the ovary lies opposite or slightly posterior to the vitellaria and in *P. spatulaeforme* it lies opposite or slightly anterior to the vitellaria. Of these 3 species, *P. ghanense* is distinctive in that it is the only species in which the uterine coils fill the entire posterior 2/3 of the body, apart from the space occupied by the testes, ovary and vitellaria. The ovary of *P. spatula* is almost round and the excretory pore opens in a distinct notch in the posterior extremity of the body. In *P. spatulaeforme* the ovary is kidney-shaped, the testes are very small in relation to the body size and the vitellaria are close to the posterior rim of the ventral sucker.

The species in which the ovary lies behind the vitellaria are *P. vanderwaali*, *P. linguale* and *P. bavuri*. *P. vanderwaali* may be differentiated from the other 2 species in that the testes are weakly lobed, the vitellaria lie immediately behind the ventral sucker, the oesophagus is very short and the intestine bifurcates almost immedi-

ately behind the oral sucker. Furthermore, the body is pear-shaped and the forebody is very short. These trematodes are the smallest of the African species and do not exceed 2,5 mm in length.

P. linguale and *P. bavuri* are both large trematodes, measuring from 3-5,2 mm. *P. bavuri* may be differentiated from the former species in that the ovary is smooth, round or, at most, weakly bilobed and that the vitellaria are also smooth and oval to triangular in outline. The uterine coils often cross the intestinal caecae laterally, and the intestinal caecae terminate close to the posterior body margin. In *P. linguale*, the ovary and the vitellaria are irregularly lobed, the uterine coils seldom cross the intestinal caecae laterally and the intestinal caecae terminate some distance from the posterior body margin.

The various species of *Phyllodistomum* described prior to 1932 were revised by Lewis (1935), who also examined a co-type of *P. linguale*. The measurements given by Odhner (1902, 1911) and Lewis (1935) differ considerably from those of the single specimen examined in this study. The shape and position of the various internal organs, however, are similar and it can only be assumed that the specimen examined by me was an abnormally small one.

The data presented in Table 2 indicate that there is no seasonal variation in the numbers of the parasite. This can be explained when the life cycles of members of the genus are considered. In his study of the life cycles of

Phyllodistomum lohrenzi Löwen, 1935 and *Phyllodistomum caudatum* Steelman, 1938, Beilfuss (1954) found that miracidia of *P. lohrenzi* entered a mussel passively through the incumbent siphon and transformed to sporocysts in the gills of the mussel. A single generation of daughter sporocysts were produced which gave rise to cercaria that either left the mussel through the excurrent siphon, or remained inside the daughter sporocysts where they lost their tails and encysted. The released cercaria were unable to swim and attracted the attention of caddisfly larvae (Trichoptera) through movement of their tails. They were subsequently eaten by the insects and developed into metacercaria. The cercaria of *P. caudatum*, however, were able to swim, and a second intermediate host was not found (Beilfuss, 1954).

As freshwater mussels, *Unio* spp., were regularly found in the stomach and intestinal contents of the catfish throughout the year it can be assumed that catfish became infested by eating infested shell-fish. Furthermore, in the warmer areas of the country, such as the Lowveld, where this study was conducted, water temperatures remain fairly high during winter and both the 1st and 2nd intermediate hosts remain active for most of the year. Infestation of catfish therefore probably takes place throughout the year, with the result that there is no seasonal variation in the numbers of *P. bavuri*.

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