Species of *Tyleptus*, *Proleptonchus*, *Aquatides* and *Afractinolaimus* from rivers in the Kruger National Park (Nematoda: Dorylaimida)

ANNELIZE BOTHA and J. HEYNS

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Descriptions are given of *Proleptonchus krugeri* spec. nov., *Afractinolaimus zairensis* (Baqri, Coomans & van der Heiden, 1975) and *Aquatides thornei* (Schneider, 1937), recorded here for the first time from South Africa. New distribution records are given for *Tyleptus striatus* Heyns, 1963. Additional information is given and morphometric data are tabulated, and where appropriate, illustrations are also given.

Keywords: *Tyleptus*, *Proleptonchus*, *Aquatides*, *Afractinolaimus*, Nematoda, taxonomy, South Africa, Kruger National Park.

Annelize Botha and J. Heyns, Department of Zoology, Rand Afrikaans University, P.O. Box 524, Johannesburg, 2000 Republic of South Africa.

Introduction

Our first two papers on nematodes from rivers in the Kruger National Park (Botha & Heyns 1991; Botha & Heyns 1992), dealt with species of the genera *Dorylaimus*, *Laimydorus*, *Lenonchium*, *Aporcelaimellus*, *Discolaimus*, *Xiphinema*, *Thornenema* and *Mesodorylaimus*. This paper reports on species of *Tyleptus*, *Proleptonchus*, *Aquatides* and *Afractinolaimus*.

Materials and Methods

For materials and methods see our previous paper (Botha & Heyns 1991). All specimens are in the collection of the Department of Zoology, Rand Afrikaans University. All measurements in micrometers, except body length in millimeters.

Descriptions

Family: Leptonchidae Thorne, 1935

Tyleptus striatus Heyns, 1963
Morphometric data in Table 1.

The original description of *Tyleptus striatus* was based on specimens collected from cultivated fields in Transvaal, South Africa. It was also reported from Pakistan by Timm

(1964), and from India by Jairajpuri (1964) and Jairajpuri & Siddiqi (1964). This is the first report of this species from the Kruger National Park. The two specimens are similar to the types, except for a slightly longer body ($L = 0,90-0,98$ mm compared with $L = 0,69-0,84$ mm), a slightly smaller b-ratio ($b = 3,6-4,0$ compared with $b = 3,9-4,2$) and a smaller c-ratio ($c = 56-58$ compared with $c = 65-84$). Radial refractive elements are also abundant in the cuticle of the present specimens.

Locality and Habitat

One female collected from the Sabie River, in sand near the weir at the Lisbon Estates, west of the Skukuza Camp, collected by A. Botha and J. Heyns in February, 1990. One female collected from river sediment in the Olifants River, near the western boundary of the park, collected by J. van Vuren in June, 1990.

Specimens

Specimen from Sabie River on slide W 2664; specimen from Olifants River on slide W 2691.

Table 1
Morphometric characters of *Tyleptus striatus* Heyns, 1963

Locality	Sabie River	Olifants River
<i>n</i>	1 Female	1 Female
L (mm)	0,90	0,98
a	23,7	30,6
b	4,0	3,6
c	56,3	57,7
c'	0,7	0,7
V%	33,3	34,2
Lip region width	10	11
Odontostyle length	7	8
Odontostyle width	1,5	2
Odontophore length	11	9,5
Stylet aperture length	2	2,5
Stylet aperture as % of stylet length	28,6	31,3
Guiding ring from anterior end	6,5	6,5
Amphid aperture	5	5,5
Nerve ring from anterior end	79,5	88
Oesophagus length	225	270
Body width	38	32
Distance from head to vulva	30	33,5
Tail length	6	17
Anal body diameter	24	23
Rectum length	-	19
Prerectum length	-	97
Cuticle width: on the neck	1,5	1,5
: at mid-body	1	1
: dorsal side of tail	4	3

***Proleptonchus krugeri* spec. nov.**

(Fig. 1A-I) Morphometric data in Table 2.

Female

Relatively long nematode, with slender body. Heat-relaxed body almost straight, slightly curved ventrad posteriorly (Fig. 1I). Cuticle relatively thin: 2-2,5 µm on the neck; 2-3 µm at mid-body; 3 µm on dorsal side of tail; and 3,5-4,5 µm around tail tip. Cuticle with distinct transverse striations, rather more prominent towards tail region. Subcuticle coarsely striated, with radial striae, often irregularly separated from the outer cuticle. Refractive elements present; crystalloids beneath exocuticle abundant. Lateral chords about one fifth to one fourth body diameter at base of oesophagus, appearing granular and with small cells. Lateral body pores distinct in some specimens. Dorsal and ventral body pores obscure. Lateral body pores 23, distributed over entire length of body and arranged in two

irregularly spaced rows (3-5 to base of oesophagus, 10 between oesophagus and vulva, and 8-10 between vulva and anus).

Lip region set off by a weak constriction slightly less than one third as wide as body at base of oesophagus. Lips amalgamated and rather rounded in outline (Fig. 1A & B). Amphid stirrup-shaped (Fig. 1C); aperture slightly less than three fourths lip region width, situated in the constriction. Odontostyle very slender, its length slightly less than lip region width. Odontophore sclerotized, its length equal to or slightly more than lip region width. Stoma strongly sclerotized and flask-shaped. Guiding ring well developed, sclerotized and single. Nerve ring situated 81-96 µm from anterior end. Hemizonid opposite nerve ring. Anterior part of oesophagus which surrounds odontophore weakly expanded, seemingly not muscular. Oesophageal bulb constricted, pear-shaped (Fig. 1D); 18,2-20,5 % of oesophageal length and 18,5-20,5 µm wide, except in one

Fig. 1. *Proleptonchus krugeri* spec. nov. : A. Anterior region of female; B. Lateral view of paratype female head; C. Shape and position of amphid; D. Basal bulb of oesophagus; E & F. Anterior branch of reproductive system of female; G & H. Posterior region of female; I. Heat-relaxed body posture of two females.

Table 2
Morphometric characters of *Proleptonchus krugeri spec. nov.*

	Holotype Sabie River	Paratypes Sabie River	Olifants River
<i>n</i>	1 Female	3 Females	1 Female
L (mm)	1.63	1.52(1.47-1.56)	1.42
a	33.3	34.6(33.4-35.4)	36.4
b	8.2	7.6(7.4-7.6)	6.5
c	83.6	83.1(81-86.7)	83.5
c'	0.7	0.7(0.6-0.7)	0.6
V%	54.9	58.1(57.7-58.8)	59
Lip region width	11	11	11
Odontostyle length	7	8(7-9)	8.5
Odontostyle width	1	1	1
Odontophore length	15	10(8-11)	13
Stoma length	4	4(4-4.5)	4.5
Guiding ring from anterior end	8	7(7-7.5)	7.5
Amphid aperture	8	7.7(7-8.5)	8
Nerve ring from anterior end	86.5	88(81-96)	90
Oesophagus length	200	200(190-210)	220
Oesophageal bulb length	41	38.5(37-39.5)	41
Body width	49	44(43.5-44.5)	39
Distance from head to vulva	89.5	88.5(86.5-90)	84
Posterior uterine branch length	48	42(34-51)	42
Tail length	19.5	18(18-19)	17
Anal body diameter	27	27(26-28)	27
Rectum length	32	31(28-34)	26.5
Prerectum length	165	177(159-202.5)	189.5

female where it is only 15.5 μm wide. Cardia short and small, 6-9 μm in length and more or less heart-shaped. Dorsal oesophageal gland nucleus and opening as follows ($n = 2$): DO = 84.2 and 84.5; DN = 96.9 and 87.1. SO and SN obscure.

Intestinal cells packed with dark granules; intestine about eight cells in circumference. Junction between intestine and prerectum obscure in some specimens. Sphincter at junction of prerectum and rectum obscure. Prerectum length 6.0-7.8 times anal body diameter. Rectum length 1.0-1.3 times anal body diameter. Tail conoid, bluntly rounded (Fig. 1G & H). Three pairs of caudal papillae present, 2 pairs near terminus and one pair subdorsal, in region of anus. Anal muscles well developed.

Female reproductive system prodelphic (Fig. 1E & F). Ovary distinct and reflexed. Oviduct long with distinctly developed cells. *Pars dilatata oviductus* short, separated from uterus by a relatively well developed sphincter muscle. No clearly differentiated *pars dilatata uteri*. Uterus relatively short; a few small sperm cells observed in one specimen. Posterior uterine branch short, 34-51 μm long, no sperm cells observed. No distinct ovjector. Vagina strongly muscular, reaching 41-47.2 % of the corresponding body diameter. Vulva a transverse slit, without sclerotized labia. Uterus with one or two eggs; one female with an egg in the *pars dilatata oviductus*; eggs measuring 69-91 μm x 27-34 μm ($n = 6$).

Male unknown.

Diagnosis

Proleptonchus krugeri spec. nov. has a long and slender body, with a short oesophagus. Oesophageal bulb pear-shaped and set off by a constriction. Posterior uterine branch short without sperm cells. Tail short, conoid and bluntly rounded.

Differential diagnosis

Proleptonchus krugeri spec. nov. combines characteristics of *P. aestivus* Lordello, 1955 and *P. clarus* Timm, 1964. *P. krugeri* spec. nov. corresponds with *P. aestivus* in having a distinctly striated cuticle, refractive elements and crystalloids beneath the exocuticle and a short and reduced posterior uterine branch. It can be distinguished from *P. aestivus* by a longer body ($L = 1,42-1,63$ mm compared with $L = 1,18-1,31$ mm); a slightly larger a-ratio ($a = 33,3-36,4$ compared with $a = 27,4-32,5$); a larger b-ratio ($b = 7,4-8,2$, one female with $b = 6,5$, compared with $b = 5,8-6,5$) and a larger c-ratio ($c = 81-86,7$ compared with $c = 71,5-75$).

P. krugeri spec. nov. corresponds with *P. clarus* by having a similar body length and b-ratio, and by the set off and pear-shaped oesophageal bulb. It can be distinguished from *P. clarus* by having a shorter posterior uterine branch ($34-51\ \mu\text{m}$ compared with $98-129\ \mu\text{m}$, according to Jana & Baqri 1981), and by the absence of a posterior ovary.

Type locality and habitat

Holotype female and three female paratypes from sand among *Phragmites* in the Sabie River, just east of Skukuza Camp, collected by A. Botha and J. Heyns in February, 1990. One female paratype from river sediment in the Olifants River near the western boundary of the Kruger National Park, collected by J. van Vuren in June, 1990.

Type specimens

Holotype from Sabie River on slide W 2644; paratypes from Sabie River on slide W 2647

and paratype from Olifants River on slide W 2701.

Family: Nygolaimidae (Thorne, 1935) Meyl, 1961

Aquatides thornei (Schneider, 1937) Thorne, 1974

Syn: *Nygolaimus thornei* Schneider, 1937
Nygolaimus (Aquatides) thornei Schneider, 1937 (Heyns, 1968)

(Fig. 2A-J). Morphometric data in Table 3.

Female

Medium-sized nematode, with relatively slender body. Heat-relaxed body almost straight, sometimes slightly curved ventrad (Fig. 2I). Cuticle relatively thin: $2-2,5\ \mu\text{m}$ on the neck, $2-2,5\ \mu\text{m}$ at mid-body; $3-3,5\ \mu\text{m}$ on dorsal side of tail and $3-4\ \mu\text{m}$ around tail tip. Exocuticle appears smooth, mesocuticle with faint transverse striae more prominent towards tail region. Lateral chords about one fourth to one third body diameter at base of oesophagus, appearing granular with small cells. Lateral, ventral and dorsal body pores not observed.

Lip region confluent with the body, and slightly narrower than adjoining body, about one third as wide as body at base of oesophagus. Lips amalgamated and somewhat rounded in outline (Fig. 1A & C). Amphid wineglass-shaped (Fig. 1B), its aperture slightly more than one third lip region width. Tooth linear, its length slightly less than or equal to lip region width. Guiding ring single. Pharynx wide behind tooth, with weakly sclerotized walls, narrowing gradually towards its junction with the oesophageal lumen, its length about three times the lip region width. Anterior part of oesophagus surrounding base of pharynx slightly swollen and weakly muscular; basal expanded part slightly more than half oesophagus length. The sheath surrounding the enlarged part of the oesophagus forms prominent basal pockets (Fig. 2D). Cardia conoid but mostly not observed, cardiac glands well developed and oval, measuring $6,5-8,5\ \mu\text{m} \times 6,5-7\ \mu\text{m}$ (Fig. 2D).

Table 3
Morphometric characters of *Aquatides thornei* (Schneider, 1937)

Locality	Sabie River	Olifants River
<i>n</i>	11 Females	5 Females
L (mm)	1.43(1.25-1.54)	1.31(1.12-1.48)
a	37(33.3-43.9)	37.4(35-39.4)
a'	39.4(36.6-46)	40.4(38.1-43.2)
b	4.2(3.8-4.7)	3.7(3.3-4.1)
c	66.4(60.4-70.5)*	66.7(63.1-70.5)
c'	0.8(0.8-1.0)*	0.8
V%	47.9(44.4-50)	48.4(45.6-50)
Lip region width	12.8(12-13.5)	13.6(13-14)
Tooth length	11.7(11-12)	11.5(11-12)
Pharynx length	38.3(34.5-42)	37.6(31.5-41)
Amphid aperture	4.9(4.5-5)	5(4-5)
Guiding ring from anterior end	8.2(7.5-9)	7.5(5-8.5)
Nerve ring from anterior end	112(104.5-121)	114.3(104-117.5)
Oesophagus length	338.6(300-370)	353(335-370)
Body width	38.6(33-42)	34.9(32-38.5)
Distance from head to vulva	68.3(60.5-76.5)	63.2(55-67.5)
Tail length	21.8(20-23.5)*	19.6(17.5-21)
Anal body diameter	26.2(23-28)*	24.3(22-26.5)
Rectum length	21.9(18-24.5)*	21.2(19-24)
Prerectum length	47.4(33.5-55.5)	43(35-46)

* *n* = 10

Hemizonid observed in only one specimen, situated opposite nerve ring which is rather prominent and situated 104-121 μ m from anterior end. Dorsal oesophageal gland nucleus and opening distinct, situated as follows (*n* = 4): DO = 60.5(59.5-61.2); DN = 66.1(65.4-66.5). S₁N, S₁O., S₂N and S₂O obscure.

Intestinal cells large, packed with medium to large greenish granules; intestine about eight cells in circumference. Junction between intestine and prerectum relatively distinct. Sphincter at junction of prerectum and rectum obscure. Prerectum short, its length 1.2-2.1 times anal body diameter. Rectum length 0.7-1.1 times anal body diameter. Tail short, sub-hemispherical (Fig. 2G & H). Anal muscles very well developed, consisting of 4-6 bands. Two pairs of caudal papillae present, situated near terminus. Body usually somewhat narrowed in the region of the prerectum.

Female didelphic, amphidelphic (Fig. 2E & F). Ovaries very prominent, reflexed. *Pars dilatata oviductus* short, separated from

uterus by a prominent sphincter muscle. Oviduct long and broad, with very well developed cells. Uterus extremely short, not differentiated into ovijector and *pars dilatata*. Vagina muscular, reaching 48.2-53.8% of the corresponding body diameter. Vulva a transverse slit, without sclerotized labia. No eggs observed.

Male unknown.

Remarks

The original description of *Aquatides thornei* was based on specimens collected among brown algae at Lake Toba, North Sumatra. Heyns (1968) described specimens from Maniknagar and Mirpur, East Pakistan (now Bangladesh). It was also reported from the Karnal District, India, by Bajaj & Bhatti (1981).

The present specimens agree with the type population except for a slightly larger a-ratio (*a* = 33.3-43.9 compared with *a* = 25 and 31); a larger c- ratio (*c* = 60.4-70.5 compared with

Fig. 2. *Aquatides thornei* (Schneider, 1937): A. Anterior region of female; B. Shape and position of amphid; C. Lateral view of female head; D. Glands at base of oesophagus; E. Female reproductive system; F. Anterior branch of reproductive system of female; G & H. Posterior region of female; I. Heat-relaxed body posture of three females.

c = 42 and 56); a more anterior vulva (V = 44,4-50% compared with 55%); a shorter tooth (11-12 μm compared with 16,5 μm and 17 μm); a narrower lip region (12-14 μm compared with 15 μm and 17 μm) and by having two caudal papillae.

Our specimens agree much more closely with those from Mirpur, Bangladesh, from which they differ only in a slightly larger c-ratio (c = 60,4-70,5 compared with c = 48-66).

Locality and habitat

Eleven females collected from three different localities in the Sabie River: in sand between *Phragmites* sp. near the weir east of Lower Sabie Camp, from sediment in the river slightly beyond the confluence of the Sabie River and Nwatinlopfu Spruit and in sand between *Phragmites* sp. just east of Skukuza Camp, collected by J. Heyns and A. Botha in February, 1990. Five females from river sediment in the Olifants River near the western border of the park, collected by J. van Vuren in June, 1990.

Specimens

Specimens from Sabie River on slides W 2589-W 2592, W 2604, W 2608-W 2610 and W 2650; specimens from Olifants River on slides W 2681, W 2692-W 2694.

Family: Actinolaimidae Thorne, 1939

Afractinolaimus zairensis (Baqri, Coomans & Van der Heiden, 1975) Vinciguerra & Heyns, 1984

Syn: *Paractinolaimus zairensis* Baqri, Coomans & Van der Heiden, 1975

(Fig. 3 A-J) Morphometric data in Table 4.

Female

Relatively large nematode, with slender body. Heat-relaxed body almost straight (Fig. 3J). Cuticle relatively thick: 3 μm on the neck, 4-4,5 μm at mid-body and 3,5-4,5 μm on dorsal side of tail. Cuticle with faint transverse striae, rather more prominent towards

lip region. Lateral chord about one fifth of body diameter at base of oesophagus, granular and with small cells. Dorsal, ventral and lateral body pores obscure.

Lip region slightly set off by a shallow constriction (Fig. 3A). Lips amalgamated and rounded. Amphid stirrup-shaped, the aperture occupying slightly less than half the lip region width (Fig. 3B). Cheilostom armed with four distinct onchia, cheilostom walls with numerous denticles, irregularly spaced. Odontostyle long and relatively slender, slightly longer than the lip region width. Aperture of odontostyle equal to or slightly more than half stylet length. Stylet width about one seventh stylet length. Odontophore rod-like, very slightly expanded at its base, its length slightly more than lip region width. Guiding ring appearing double. Hemizonid situated opposite or posterior to nerve ring. One pair of endolids situated anterior to nerve ring. Anterior part of oesophagus which surrounds odontophore spindle-shaped, non-muscular and set off from rest of oesophagus by a constriction. Nerve ring well developed and situated at 180,5-182 μm from anterior end. The sheath surrounding the enlarged part of the oesophagus forms relatively prominent basal pockets (Fig. 3C & D). Cardia elongate-conoid, basal two thirds surrounded by intestinal tissue (Fig. 3C & D). S₁N and S₂N obscure, DN observed but not very well developed; oesophageal gland orifices conspicuous. Position of oesophageal gland nuclei and their orifices as follows ($n = 2$): DO = 44,9 and 48,1; DN = 46,7 and 50,1; S₁O₁ = 68,0 and 71,1; S₁O₂ = 72,2 and 74,9; S₂O₁ = 83,1 and 84,6; S₂O₂ = 83,8 and 85,0.

Intestinal cells obscure due to the great number of small brownish granules. Junction between intestine and prerectum distinct. Sphincter at junction of prerectum and rectum obscure. Prerectum length 6,8-8,0 times anal body diameter. Rectum length 1,3-1,8 times anal body diameter. Tail filiform with acute terminus (Fig. 3G). Anal muscles well developed, consisting of 6 bands. Two pairs of caudal papillae present; one pair subdorsally about one and a half anal body diameters posterior to anus and the other pair laterally

Fig. 3. *Atractinolaimus zairensis* (Baqri, Coomans & Van der Heiden, 1975): **A**. Sublateral view of female head; **B**. Shape and position of amphid; **C & D**. Cardiac region; **E**. Sperm cells; **F**. Posterior region of male; **G**. Female tail; **H**. Anterior branch of female reproductive system; **I**. Muscular chamber in uterus of female, showing the z-differentiation; **J**. Heat-relaxed body posture of one male and female.

Table 4
Morphometric characters of *Afractinolaimus zairensis* (Baqri, Coomans & Van der Heiden, 1975)

	Locality			Sabie River
<i>n</i>	3 Females			1 Male
L (mm)	3,61	4,10	3,69	3,64
a	82	83,7	79,4	72
b	4,7	5,1	4,8	4,5
c	7,8	7,1	9,2	145,6
c'	17,1	19,5	14,6	0,73
V%	44	41	44	-
Lip region width	23,5	23,5	22,5	23
Odontostyle length	28	27	27,5	28
Odontostyle width	4	4	4	4,5
Odontophore length	28	27	27,5	26,5
Stylet aperture length	15	14,5	14	14,5
Stylet aperture as % of stylet length	53,6	52,7	50,9	51,8
Amphid aperture	-	10	-	-
Guiding ring from anterior end	20,5	22	23	21
Nerve ring from anterior end	182	180,5	182	192
Oesophagus length	775	805	775	805
Distance from head to vulva	160	169,5	160	-
Vagina length	18	23	22	-
Body width	44	49	46,5	50,5
Tail length	461	574	400,5	25
Anal body diameter	27	29,5	27,5	34
Rectum length	35,5	51	49,5	-
Prerectum length	215	230	187	388
Spicule length	-	-	-	63,5
Lateral guiding pieces	-	-	-	18,5
Number of supplements	-	-	-	16

about two anal body diameters posterior to anus. Hyaline part of tail 58,5 μ m.

Female didelphic amphidelphic (Fig. 3H). Ovaries reflexed, relatively distinct. *Pars dilatata oviductus* separated from uterus by a weakly developed sphincter muscle. Oviduct short, cells well developed. Uterus long, divided into three parts: first part nearest to vagina long and wide with polygonal cells, second part forms a weakly developed z-differentiation (Fig. 3I), with strongly muscular walls and weakly sclerotized structures in the lumen (Fig. 3J) and the third part a very weakly developed *pars dilatata uteri*. Ovijector not clearly differentiated. Vagina muscular, reaching 41-48 % of corresponding body diameter. Sclerotized pieces pres-

ent between vagina and vulva. Vulva a small longitudinal slit. No eggs or sperm cells observed.

Male

Male similar to female except posterior part of body strongly curved ventrad in the shape of the letter J (Fig. 3I). Male diorchic, testes opposed and outstretched; posterior and anterior testes 582 μ m and 501 μ m respectively. Sperm cells ovoid (Fig. 3E), 6-7 μ m long. Spicules typically dorylaimoid, 63,5 μ m long. Lateral guiding pieces well developed and long. Supplements consisting of an adanal pair and 16 ventromedians, the latter arranged in two distinct fascicles with a solitary supplement between the fascicles; the ante-

rior fascicle consisting of seven and the posterior fascicle of eight contiguous supplements. The adanal and ventromedian supplements are situated on a distinct mid-ventral ridge bordered by subventral grooves which extend far beyond the anterior fascicle. Subventral papillae 13 pairs, spaced irregularly, reaching just beyond anterior end of midventral ridge. Copulatory muscles obscure. Tail convex-conoid, with bluntly rounded terminus (Fig. 3F). Six pairs of caudal papillae present, two pairs situated near the terminus, two pairs ventrally, one pair dorsally and one pair sublaterally. Prerectum length 11,4 times anal body diameter.

Remarks

The Kruger National Park specimens of *Afractinolaimus zairensis* agree with the description of type specimens from Zaïre (Baqri, Coomans & Van der Heiden, 1975). They are long and thin like the population from Gando, whereas the c-ratio agrees with that of the Keshero population. On the other hand, they differ from the specimens previously described from South Africa by Vinciguerra & Heyns (1984) (Maitland River near Port Elizabeth, Wondergat at Mafeking, Emmerentia Dam in Johannesburg and Vaalwater) in the larger a-ratio (79,4-82 compared with 51-67); smaller b-ratio (4,7-5,1 compared with 4,8-6,7) and smaller c-ratio (7,1-9,2 compared with 12,5-17). Furthermore, the lip region is slightly set off in stead of confluent with the body and the tail is mostly somewhat longer. Baqri *et al.* (1975) and Vinciguerra & Heyns (1984) did not mention a z-differentiation in their descriptions of the female reproductive system, although Fig. 10 of Vinciguerra & Heyns does show a part of the uterus with weakly muscular walls.

Considering the magnitude of the variation found in different populations of *A. zairensis*, and the possibility that we may be dealing with a group of closely related species, we thought it wise to give a full description of our specimens.

Locality and habitat

Three females collected from sand among *Phragmites* sp. in the Sabie River near the confluence of the Sabie and Sand rivers and one male collected in river sediment near the weir of the Lisbon Estates in the Sabie River, collected by A. Botha and J. Heyns in February, 1990.

Specimens

Specimens on slides W 2636 and W 2655.

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