THE GENUS *XIPHINEMA* IN SOUTH AFRICA XXVII. *XIPHINEMA ZYZY* SP. N. AND *X. LOUISI* HEYNS, 1979 (NEMATODA: LONGIDORIDAE)

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Summary. *Xiphinema zyzy* sp. n. is described from the Northern Province, South Africa. It is characterised by a medium-sized slightly ventrally curved body, didelphic sexual system with vulva slightly before or at middle of body, weakly developed pseudo-z-organ, spines in uterus, female tail elongate-conoid and male tail digitate. It belongs in Loof and Luc's (1990) group 5, and is compared with *X. rarum* Heyns, *X. theresiae* Stocker *et* Kruger and *X. malagasi* Luc. New information including descriptions of J2 and J3 as well as distribution records are given for *X. louisi* Heyns.

The authors are systematically working through the National Collection of Nematodes at the Plant Protection Research Institute, as well as the collection of the Rand Afrikaans University, both of which contain many unidentified or provisionally identified specimens of Longidoridae, and especially *Xiphinema*. The results are being published in the continuing series on the *Xiphinema* species of Southern Africa. This paper presents a description of *Xiphinema zyzy* sp. n., and new information on *X. louisi* Heyns, 1979.

Measurements and drawings were done with the aid of a drawing tube. All measurements in the tables are in µm, except body length, which is in mm. Ratio "a" was consistently calculated using the corrected body diameter, as described by Geraert (1961). As far as possible drawings were made from unflattened or minimally flattened specimens.

XIPHINEMA ZYZY sp. n.

(Table I; Figs. 1 and 2)

General description (10 ♀♀, 10 ♂♂). Body of heat-relaxed specimens moderately ventrally curved, but more strongly curved in posterior region of male. Lateral hypodermal cords 8.5-11 µm wide (19-22% of the corresponding body diameter) over greater part of body, but narrowing towards lip region. Lateral pores indistinct; apparently in an irregular, staggered double row. Cuticle 3-4 µm thick on front part of neck and 2.5-3.5 µm around midbody in both sexes, 4.5-6 µm dorsally on female tail, and 3.5-5 µm on male tail. Lip region somewhat rounded, and set off by a shallow depression. Amphids stirrup-shaped, with a 4-5 µm wide transverse slit located on the lip region near the shallow depression. Stylet and oesophagus (pharynx of some authors) typical for the genus. Gland nuclei fairly distinct in most specimens, their positions as follows: female (n = 8): DO = 7.3 (6.2-8.1); DN = 9.5 (7.8-11.8); SN1 = 58.6 (57.8-61.3); SN2 = 60.8 (59.4-62.3); SO = 83.5 (82.0-85.2); male (n = 8): DO = 7.1 (5.9-8.7); DN = 9.1 (7.7-10.7); SN1 = 55.8 (53.4-58.6); SN2 = 58.8 (57.1-62.9); SO = 87.6 (86.1-88.8). Oesophago-intestinal valve small, hemispherical.

Female. Reproductive system didelphic, with both branches equally developed. Vulva a transverse slit without cuticular ornamentation. Vagina 16 - 19 µm long, comprising 39-47% of the corresponding body diameter. Ovejector well-defined, kidney-shaped. Uterus relatively long, seldom with convolutions, its length, excluding the *pars dilatata*, 215 (170-265) µm; *pars dilatata*, 57 (48-67) µm long. Weakly developed pseudo-Z-organ in area adjoining the *pars dilatata*, containing a variable number of mostly inconspicuous, irregularly shaped, and mostly rather small inclusions. Rest of uterus with sparse, scattered spines, most of which are directed away from the vulva. Oviduct typical. Ovary 63 (50-78) µm long. Typical sperm cells present in distal part of *pars dilatata uteri* (see figs. 2 A and E), while in other specimens this area contains numerous small rounded bodies (see figs. 2 B and C), possibly degenerate sperm cells. In still other specimens (figs 2D, E and F), the distal part of the oviduct, adjacent to the *pars dilatata oviductus*, contains compact groups of larger rounded bodies. The reproductive systems of several females have been illustrated to demonstrate the variations observed. Some of these may be the result of normal intraspecific variation, while others are more likely the result of different stages in the reproductive cycle, e.g. in Fig. 2C the ovejector is either contracted through muscular action, or shrunken due to aging.

Male. Sexual organs typical for *Xiphinema*, the spicules measuring 48.4 (46-50) µm along the curved median line, the lateral guiding pieces 10.2 (9-12) µm. Ventromedian supplements well-developed, mostly three, less often four in number (of ten males examined, seven had three supplements, only three had four). Tail much shorter than that of female, dorsally

Table I. Morphometrics of *Xiphinema zyzy* sp. n. compared with *X. malagasi.*

	Xiphinema zyzy				*Xiphinema malagasi* (acc. to Luc, 1973)	
	Holotype	Paratypes			Paratypes	Total range for all populations
	♀	10 ♀♀	10 ♂♂	10 J4	8 ♀♀	
L mm	2.81	2.81 (2.66-2.96)	2.79 (2.57-3.01)	2.06 (1.98-2.15)	2.83 (2.61-3.04)	2.48-3.04
a	74	70 (60-78)	73 (68-77)	57 (55-62)	67 (62-73)	59-73
b	7.8	7.9 (7.4-8.5)	7.4 (6.8-7.9)	6.3 (6.0-6.7)	7.9 (5.7-8.7)	5.7-9.9
c	23	23 (19-27)	58 (46-61)	19 (16-23)	25.5 (23-30)	21-34
c'	5.4	5.4 (4.3-6.5)	1.8 (1.5-2.5)	5.3 (5.0-6.2)	4.4 (3.9-4.8)	3.0-5.4
V	46.6	48.3 (45.5-52.0)			46.3 (43.3-49.1)	43.3-51.1
Width of lip region	14	13.4 (12-14)	13.0 (12.5-14)	12.2 (11.5-12.5)	11-12	
Odontostyle length	81	81 (75-83)	82 (78-88)	67 (62-70)	102 (100-106)	100-106
Odontophore length	61	62 (59-64)	62 (59-66)	55 (52-58)	63 (60-66)	58-74
Total stylet length	142	143 (137-146)	144 (140-150)	122 (114-128)	165 (162-170)	161-174
Replacement odontostyle				83(78-89)		
Width of flanges	11	11.7 (11-13)	11.4 (11-12.5)	10.9 (10-12)	12-14.5	
Front end to guide ring	77	79 (74-81)	79 (70-83)	64 (60-68)	90 (86-92)	
Front end to hemizonid	166	160 (151-168)	164 (163-170)	142 (140-144)	159 (154-166)	152-190
Front end to nerve ring	178	179 (172-184)	184 (174-191)	158 (153-161)		
Basal bulb length	112	107 (93-116)	108 (98-119)	96 (90-100)		
Basal bulb width	18	18.5 (17-20)	17.4 (17-18)	17 (15-19)		
Prerectum length	395	378 (340-430)				
Rectum length	37	38 (32-42)		28 (25-33)		
Length of tail	124	124 (106-153)	49 (40-63)	112 (90-123)	112 (100-127)	74-135
Length of hyaline tail tip	15	13.5 (12-15.5)	15.0 (12-16.5)	12.3 (11-15)	25.5 (20-29)	18-31
h %	12.1	11.1 (9.6-13.2)	31.2 (24.5-37.5)	11.0 (9.1-13.2)	23 (19-26)	16-30
Length of ovejector	57	55 (45-62)			88*	

* Calculated from Luc (1973) Fig.5 E

convex-conoid, digitate; with three or four caudal papillae.

Juvenile. Only fourth stage juveniles were found in the populations. These resemble females in general appearance and tail shape.

Type host and locality. Northern Province. Nylstroom (i). Farm of Mr. P. Vermaas, 1999-03-16, leg M. Marais, E. van den Berg, N. Buckley and A. Swart, collected among grass roots in natural vegetation (24°40'S, 28°29'E). Loamy sand (5% clay, 9%silt, 86% sand) with a pH of 5.2. Height above sea-level 1180 m. (ii). Farm of Mr. P. Vermaas, 1999-03-16, leg M. Marais, E. van den Berg, N. Buckley and A. Swart, collected among grass and tree roots in natural vegetation (24°40'S, 28°29'E). Loamy sand (8% clay, 6%silt, 86% sand) with a pH of 4.8. Height above sea-level 1180 m. (iii). Hoeksteen Farms of Mr. H.O.E. Crafford, 1999-03-18, leg M. Marais, E. van den Berg, N. Buckley and A. Swart, collected in natural vegetation (24°38'S, 28°26'E). Sandy soil (3% clay, 2%silt, 95% sand) with a pH of 5.9. Height above sea-level 1300 m.

Type specimens. Holotype female on slide 34969 in the National Collection of Nematodes, Biosystematics Division, Plant Protection Research Institute, Pretoria. Paratypes on slides 34968-34975 and 34977 in the same collection.

Diagnosis and relationships. *Xiphinema zyzy* sp.n. is characterized by the moderately curved body of medium length; slightly offset lip region; didelphic sexual system with vulva mostly slightly anterior to middle of body; pseudo-z-organ with a small but variable number of inconspicuous inclusions; spines in the uterus; elongate ventrally arcuate tail in female and short digitate tail in male.

The code in Loof and Luc's (1990 and 1993) polyto-

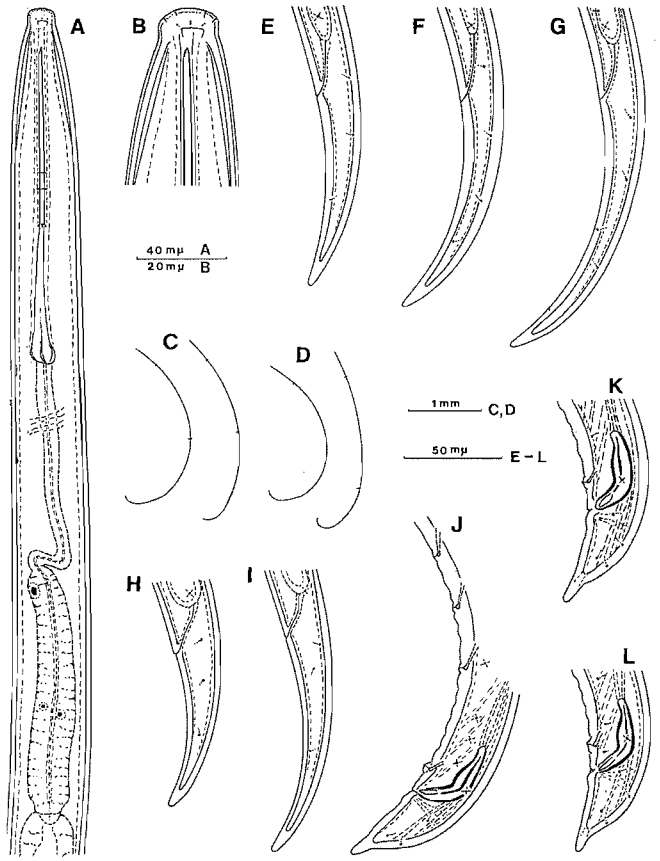

Fig. 1. *Xiphinema zyzy* sp. n.: A, anterior body region; B, anterior end; C and D, body posture of female and male respectively; E-G, variation in female tail length and shape; H and I, variation in tail of J4; J-L, tails of three male specimens.

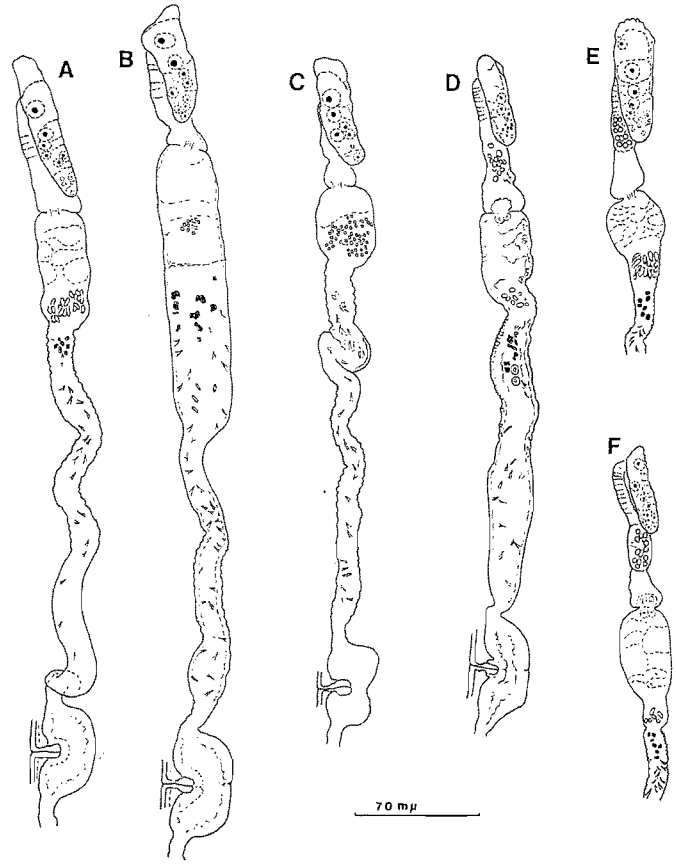

Fig. 2. *X. zyzy* sp. n.: A-D, anterior branch of reproductive system in four females; E and F, part of anterior branch in two other females.

mous key is A4; B2+3; C2; D2(3); E5(6); F3; G1; H2; I3; J2; K?; L2, placing it in group 5, where its code most closely agrees with that of *X. rarum* Heyns, 1979, *X. theresiae* Stocker *et* Kruger, 1988 and *X. malagasi* Luc, 1973. From *X. theresiae* it can immediately be distinguished by the sexually dimorphic tails, less conspicuous pseudo-z-organ, much smaller and fewer uterine spines, smaller size and shorter stylet. From *X. rarum* it likewise differs in having sexually dimorphic tails, digitate male tails and much longer female tails viz. 106-153 μm compared with 55 μm (*X. rarum* holotype, Heyns, 1979) and 64-83 μm (*X. rarum* specimens from Bourke's Luck, Kruger and Heyns, 1987). Furthermore, the bodies of both females and males are only slightly ventrally curved *vs* strongly spiraled in *X. rarum*. Superficially the new species closely resembles *X. malagasi*, to the extent that we considered calling the South African specimens an amphimictic population of *X. malagasi*. Closer scrutiny, however, revealed several significant differences apart from the presence of males: In *X. zyzy* sp. n. spines occur throughout the length of the uterus, whereas they are limited to the area adjacent to the pseudo-z-organ in *X. malagasi* (compare figs 2A-D in this publication with fig. 5E in Luc (1973) and fig. 41A in Coomans *et al.*, 2001); size and shape of the ovejector (compare figs 2A and D) with fig. 5A in Luc and fig. 41A in Coomans *et al.*, 2001; differences in tail length, and ratio's c and c' as seen in Table I; significant difference in length of hyaline tail tip and h% (see Table I); odontostyle length (75-83 μm in *X. zyzy* female *vs* 100-106 μm in *X. malagasi*) and slight difference in the lip region, which is lower in *X. zyzy* sp. n. than in *X. malagasi* (compare fig. 1B with fig. 5A in Luc and fig. 39J in Coomans *et al.*, 2001).

Remark. Description of this new species makes the status of the two females from Aldabra, identified as *X. malagasi* by Hutsebaut *et al.* (1987) rather uncertain. The uterus with numerous spines throughout agrees with *X. zyzy* sp. n. rather than with *X. malagasi*, even though the spines seem to be more numerous than in *X. zyzy* sp. n. (see Hutsebaut *et al.*, 1987, figs. 2G and H). On the other hand, most other characters are in closer agreement with *X. malagasi*, except odontostyle length (118-123 μm), which agrees with neither *X. malagasi* (100-106 μm) nor *X. zyzy* (75-88 μm).

Etymology. Xiphinema zyzy sp. n. is named after Zyzy, mother of Aaba, the mythological god of the worms.

XIPHINEMA LOUISI Heyns, 1979
(Table II; Fig. 3)

The description of this species was based on specimens from five collections made in widespread areas with rather different climatic conditions, in the present day Eastern Cape Province, Northern Cape Province, Northern Province and Mpumalanga. As yet, there have been no further reports of this species, except in distribution map number 6 in Hutsebaut and Heyns (1989) its presence is indicated in three additional localities, although these were not mentioned or discussed in the text. However, they were apparently based on collections made by Dr. E. van den Berg in virgin veld under grasses and trees at Zoutpan, on the inner wall of the meteorite crater (Gauteng Province), Abel Erasmus Pass (Northern Province), Blyderivierspoort Nature Reserve and Longtom Pass (both in Mpumalanga). M. Marais made one further collection in virgin veld near Nelspruit (Mpumalanga).

Specimens from these new collections were measured and studied, and compared with the types and the original description. Unfortunately, the type specimens from Louis Trichardt have become quite flattened, affecting the appearance of the anterior neck area and tail shape. Even so, the large variation in tail length and shape, with some tails much more prominently digitate (see fig. 48 in Heyns, 1979) is still evident. In two specimens from the Abel Erasmus Pass, this pegged condition is even more pronounced.

We consider the original description accurate and detailed enough, eliminating the need for a redescription. All specimens from the new populations are in close agreement with the types.

Juveniles. The type population contained only one juvenile, viz. a pre-adult, of which the tail was illustrated. Juveniles were found in all the new populations, but mostly in the pre-adult and third stage, and no first stage. Tails of the juvenile stages are illustrated here, showing considerable variation in length and shape, as also evident in the adults. However, there are no marked changes during ontogeny, thus agreeing with the general pattern seen in species with elongate-conoid, ventrally arcuate conoid, and conoid-subdigitate tails (Coomans *et al.*, 2001).

Table II. Compound morphometrics of five new populations of *Xiphinema louisi* compared with type specimens.

	New populations						Type specimens(Heyns,1979)	
n	J2	J2	6 J3	10 J4	10 ♀♀	10 ♂♂	8 ♀♀	8 ♂♂
L mm	1.31	1.54	1.50 (1.35-1.63)	1.98 (1.73-2.32)	2.74 (2.62-3.05)	2.84 (2.52-3.13)	3.09 (2.79-3.35)	3.13 (2.84-3.23)
a	57	61	50.2 (45-55)	60.2 (53-67)	64.2 (59-71)	68.8 (61-76)	53 (45-58)	61 (55-72)
b	5.7	6.2	5.3 (4.5-6.2)	5.7 (4.8-7.3)	7.9 (7.1-8.8)	7.5 (6.6-8.4)	8.0 (7.3-8.7)	8.0 (7.4-8.4)
c	26	28	27.7 (20-32)	36.4 (33-45)	60.3 (47-66)	55.1 (49-68)	71 (59-85)	67 (57-72)
c'	2.6	3.0	2.5 (2.0-3.1)	2.1 (1.9-2.4)	1.5 (1.4-1.8)	1.6 (1.4-2.0)	1.4 (1.2-1.7)	1.4 (1.3-1.7)
V					48.3 (45.6-51.3)		49 (47-51)	
Width of lip region	8.5	9	9.9 (9.5-10.5)	11.6 (11-12)	13.7 (13-14)	13.7 (13-14)	13 (12-14)	13 (12-14)
Odontostyle length	50	53	66.2 (63-70)	80.3 (71-86)	100.2 (96-105)	99.8 (93-109)	104 (101-107)	103 (98-111)
Odontophore length	36	34	48.2 (46-52)	58.4 (55-61)	70.3 (65-75)	69.8 (67-73)	73 (67-76)	73 (67-75)
Total stylet length	86	87	114 (108-118)	139 (126-145)	171 (163-179)	170 (161-181)	177 (169-182)	173 (164-182)
Replacement odontostyle	60	60	83 (79-86)	101 (95-107)				
Front-end to guide ring[1]	43	44	52.0 (42-60)	65.8 (57-75)	86.9 (74-108)	88.5 (78-96)	89 (85-97)	93 (85-99)
Length of tail	50	55	55.3 (42-68)	54.2 (47-60)	46.1 (41-58)	51.6 (45-60)	43 (36-51)	46 (38-52)
Length of peg	-	-	-	9.6 (8-11)[2]	11.5 (8-18)[3]	12.1 (10-18)	10 (8-11)	11 (8.5-13)
Length of hyaline tip	9	8	14.1 (9.5-16.5)	15.6 (14-17)	14.8 (11.2-25)	16.4 (14-22)	19 (17-21)	17 (15-18)
h%	18	14.5	25.2 (22.5-28)	28.8 (23-34)	32.9 (27-43)	32.3 (26-44)	45 (39-47)	36 (32-39)
Spicule length						56.2 (51-62)		52-72
Lateral guiding pieces						11.0 (10-12)		13-17

[1] The large variation in the position of the guiding ring partly stems from the extruded position of the odontostyle in several specimens.
[2] A more or less well-defined peg present in four specimens only.
[3] Two specimens without a definite peg.

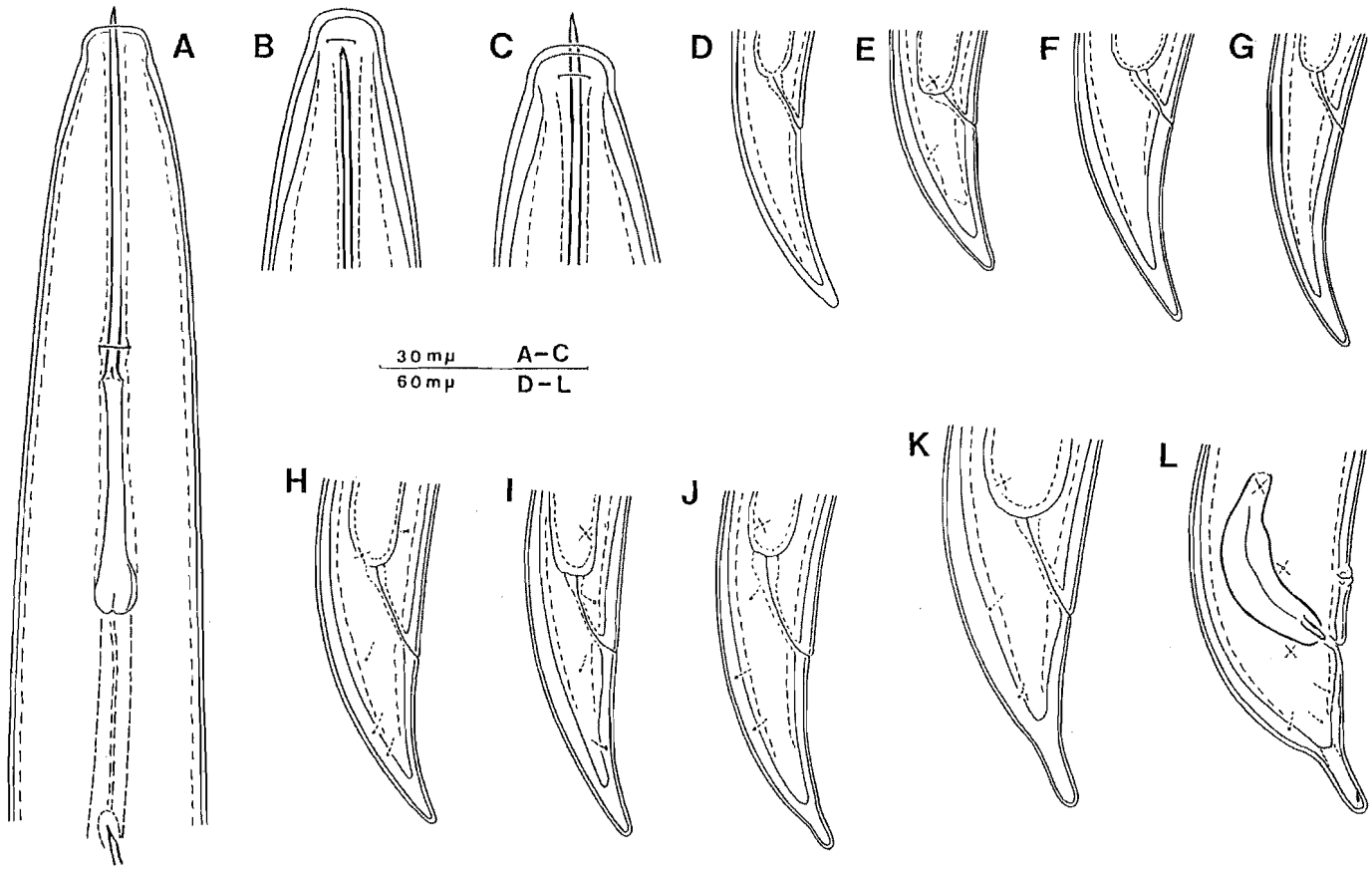

Fig. 3. *X. louisi*: A-C, head end of J2, J3 and J4 respectively; D, tail of J2; E-G, variation of tail length and shape in J3; H-J, tails of three J4 specimens; K and L, tail of female and male from Abel Erasmus Pass.

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