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*Department of Zoology, Rand Afrikaans University, P. O. Box 524, Auckland Park, 2006 South Africa and Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria, 0001 South Africa*

# THE GENUS *XIPHINEMA* IN SOUTH AFRICA XXIV. MORPHOLOGY, VARIATION AND DISTRIBUTION OF *X. LOTENI* HEYNS, 1986 AND *X. BOURKEI* STOCKER *ET* KRUGER, 1987 (NEMATODA: LONGIDORIDAE)

by
J. HEYNS and A. SWART

**Summary**. Additional information is given on *Xiphinema loteni* Heyns, 1986 and *X. bourkei* Stocker *et* Kruger, 1987, two species known only from Southern Africa. Measurements of new populations are tabulated, with illustrations depicting morphological variation and new distribution records.

This paper presents new information on two Southern African *Xiphinema* species, viz. *X. loteni* and *X. bourkei*. All four juvenile stages of *X. bourkei* are recorded for the first time.

## Materials and methods

Specimens were extracted from soil by decantation or centrifugation, killed by gradual heating, fixed in FAA and processed into dehydrated glycerine by Cobb's slow method. Measurements and drawings were made with the aid of a drawing tube, and measurements of curved structures such as spicules and tail were made along the curved median line.

## *XIPHINEMA LOTENI* Heyns, 1986

(Table I; Fig. 1)

To date, *Xiphinema loteni* is known in the literature only from the type populations from the Loteni Nature Reserve in the eastern Drakensberg as well as the nearby Umkomaas Valley (Heyns, 1986). There is also a record of this species from sugar cane in the southern Midlands area of Kwazulu-Natal (Spaull and Heyns, 1991). The present paper reports on material in the collection of the Plant Protection Research Institute, all of which, with the exception of one population from indigenous forest near Nelspruit in Mpumalanga, are from the environs of the Drakensberg, either east on the Kwazulu-Natal side, or more northerly and north westerly in the Free State. All of these are from virgin veld or forest, mostly under grasses, but also in association with indigenous shrubs, ferns and trees. The above mentioned single record from sugarcane thus remains the only occasion where the species was associated with a cultivated crop.

Morphometric data of the various populations are presented in Table I in comparison with those of the type specimens. Study of the new collections and comparison with the type material revealed little more variation than was reported in the original description and rede-

TABLE I - *Morphometrics of several populations of* Xiphinema loteni *Heyns, 1986 (L in mm, other measurements in µm).*

| | Loteni Nature Reserve and Umkomaas Valley: Paratypes (After Heyns, 1986) | | Harrismith | | Golden Gate | | Clarens | | | Giant's Castle | Nelspruit | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ♀ | ♂ | ♀ | ♂ | ♀ | ♂ | ♀ | ♂ | ♂ | ♂ | ♀ | ♂ |
| n | 9 | 9 | 12 | 10 | 10 | 3 | 6 | | | | 7 | 3 |
| L (mm) | 3.09 (2.77-3.51) | 2.90 (2.52-3.30) | 2.87 (2.68-3.33) | 2.98 (2.65-3.40) | 3.01 (2.66-3.39) | 2.95 (2.83-3.18) | 3.09 (2.81-3.31) | 2.78 | 3.17 | 2.86 | 2.95 (2.84-3.06) | 2.89 (2.73-3.12) |
| a | 56 (48-64) | 57 (51-62) | 38 (33-42) | 39 (37-42) | 42 (35-52) | 49 (43-55) | 42 (37-46) | 50 | 40 | 43 | 36 (34-38) | 36 (34-40) |
| b | 7.0 (6.4-7.4) | 6.6 (6.0-7.2) | 7.0 (6.3-7.7) | 7.4 (6.6-8.1) | 6.9 (6.1-7.9) | 7.1 (6.4-7.9) | 7.1 (6.7-7.7) | 6.5 | 7.5 | 6.4 | 6.8 (6.5-7.0) | 7.4 |
| c | 73 (68-80) | 64 (56-70) | 69 (58-79) | 62 (52-70) | 74 (60-81) | 67 (60-71) | 70 (58-85) | 68 | 70 | 65 | 69 (53-75) | 63 (57-69) |
| c' | 1.02 (0.88-1.11) | 1.07 (0.91-1.25) | 1.01 (0.86-1.19) | 1.02 (0.92-1.13) | 0.97 (0.90-1.08) | 1.01 (0.87-1.15) | 1.00 (0.90-1.17) | 1.00 | 0.87 | 0.96 | 0.88 (0.86-0.90) | 0.96 (0.92-1.00) |
| V | 50.6 (48-52) | | 51.0 (48.8-53.9) | | 49.0 (47.6-50.5) | | 50.4 (47.4-54.1) | | | | 51.7 (50.1-53.0) | |
| Odontostyle | 120 (108-131) | 121 (110-135) | 120 (114-131) | 120 (113-125) | 118 (112-126) | 119 (117-122) | 122 (118-126) | 118 | 123 | 117 | 148 (143-153) | 145 (141-150) |
| Odontophore | 87 (78-98) | 83 (77-90) | 88 (81-96) | 88 (82-95) | 88 (82-94) | 87 (81-93) | 89 (85-92) | 87 | 85 | 84 | 87 (84-89) | 89 (85-91) |
| Stylet | 207 (187-227) | 205 (190-221) | 207 (197-227) | 207 (195-220) | 206 (195-216) | 206 (198-212) | 211 (204-218) | 205 | 208 | 201 | 235 (232-242) | 234 (226-240) |
| Lip width | 14.9 (14-16) | 14.9 (14-16) | 16.2 (15-18) | 16.3 (15-17.5) | 16.0 (15-17) | 16.2 (16-16.5) | 16.3 (15-18) | 17 | 16.5 | 17 | 15.6 (15-16.5) | 15.2 (14.5-16) |
| Guide ring to anterior | 104 (92-113) | 106 (94-124) | 117 (111-130) | 118 (105-124) | 111 (103-123) | 106 (99-111) | 98 (90-102) | 118 | 100 | 106 | 135 (119-145) | 129 (110-139) |
| Basal bulb *l* | 112 (98-124) | | 109 (100-115) | 117 (106-129) | 107 (101-114) | 109 (109-110) | 118 (113-124) | 115 | 115 | 112 | 106 (98-114) | 108 (101-116) |
| *w* | 27 (21-35) | | 27 (22-30) | 28 (25-32) | 26 (22-29) | 26 (23-28) | 26 (23-28) | 25 | 27 | 37 | 26 (22-33) | 26 (22-30) |
| Tail length | 43 (36-51) | 45 (42-49) | 43 (39-51) | 49 (42-51) | 40 (37-44) | 44 (40-47) | 45 (39-48) | 41 | 45 | 44 | 44 (40-54) | 49 (48-51) |
| Length of peg | 7.3 (5-11) | | 6.8 (0-9.5) | 8.0 (0-12) | 6.0 (3-8) | 3.3 (0-5) | 6.4 (5-8) | 6 | 4 | 9 | 7.6 (7-9) | 8.2 (7-10) |
| Hyaline part | 11.7 (11-16.5) | | 11.9 (9.5-15) | 14.0 (11-20) | 13.9 (11-16) | 12.7 (12-14) | 12.5 (11-13) | 11 | 17 | 15 | 13.4 (10-15) | 15.0 (14-17) |
| Cuticle (tail dorsal) | 8-12 | | 10.3 (8.5-12) | 10.4 (8-12) | 10.9 (10-12) | 9.7 (9-10.5) | 11.3 (10-13) | 9.5 | 10 | 9.5 | 11.1 (10-12) | 11.2 (10-12) |
| Spicule | | 68.4 (62-77) | | 77.8 (72-84) | | 73.0 (71-75) | | 76 | 72 | 79 | | 81.7 (78-85) |
| Lat. g. piece | | 16.1 (14-18.5) | | 14.8 (13-18) | | 15.0 (14-16) | | 17 | 16 | 16 | | 17.8 (17-19) |
| Ventrom. suppl. | | 3 (once 4) | | 3 or 4 (once 2) | | 3 or 4 | | 3 | 3 | 4 | | 4 or 5 |

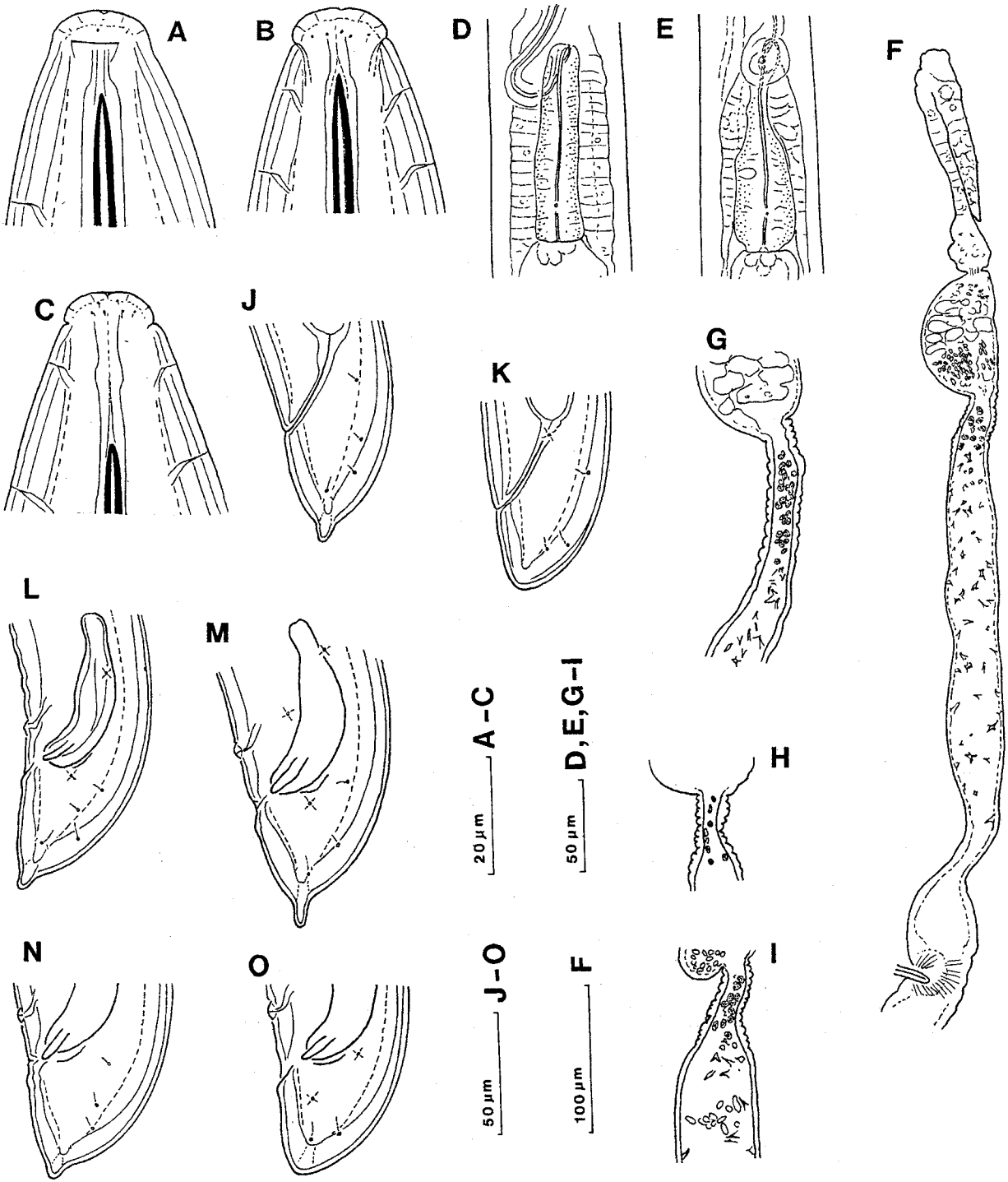


Fig. 1 - *Xiphinema loteni*: A and B, anterior end of female in lateral and dorso-ventral view, respectively; C, anterior end of male, dorso-ventral; D and E, posterior part of pharynx with accompanying glandular tissue, dorsoventral view; F, subventral view of anterior branch of reproductive system; G-I, variation in pseudo-z-organ in three specimens; J and K, typical and pegless female tails, respectively; L-O, variation in size of peg in male: typical, long, short and pegless, respectively (all specimens from Harrismith except C and M from Nelspruit, H, I and O from Golden Gate and N from Clarens).

scription of the species is not deemed necessary in view of the detailed description by Heyns (1986).

The only population deviating appreciably from the original description is that from Nelspruit, in which the odontostyle and total stylet length is greater than in any other population, and the guide ring located further posteriad. The mean length of the spicules and lateral guiding pieces is also somewhat more than in other populations. Ratio's a, c and c' appear to be different as seen in Table I, but this is caused mainly by the flattened condition of the Nelspruit specimens. The reproductive system, pseudo-Z-organ and uterine spines are remarkably similar to the type population.

In several specimens from Harrismith and Nelspruit what appear to be glandular organs lie next to the basal bulb on either side of the body, most obvious in a dorso-ventral view (Fig. 1 D and E). These structures consist of large discoid cells (resembling those in the slender part of the oviduct, but larger) and seem to be specialized areas of the lateral chords. Dorsal and especially subventral pharyngeal gland nuclei were rarely seen in any population.

The length of the peg in both male and female specimens is quite variable, as shown in Fig. 1 as well as Fig. 1 of Heyns (1986), and rare pegless specimens occur in the Harrismith and Golden Gate populations.

The length of the pseudo-Z-organ as well as the number and size of the inclusions vary both within and among populations, even in the two branches of the same specimen, as seen in Fig. 1 F, G, H and I.

### *XIPHINEMA BOURKEI*
### Stocker *et* Kruger, 1987

(Table II; Figs 2 and 3)

This species was described from Bourke's Luck in Mpumalanga, based on ten females, four males and some third and fourth stage juveniles. In addition, morphometrics were given for fifteen further populations (Stocker and Kruger, 1987, Table 6). For only one of these other populations was a male recorded, viz. a solitary male from Newcastle.

No further information on this species appeared in the literature except for a record, with measurements and some illustrations, from Piggs Peak in Swaziland (Heyns and Luc, 1987, under the name *X. mluci* Heyns, 1976 *sensu lato*). Examination of these specimens confirmed that they in fact represent yet another population of *X. bourkei*. This prompted us to re-examine the type specimens as well as most of Stocker and Kruger's (1987) material, along with more recent collections at the Plant Protection Research Institute and the Rand Afrikaans University. We found a few more male specimens, among others one in Stocker and Kruger's Groblersdal material, which they apparently overlooked, and another one in a recent collection from Mkuzi.

Three of the new populations, viz. from Mont Pelaan, Harrismith and Mapoteng (Lesotho) were studied in more detail, and their morphometrics are presented in Table II. All four juvenile stages were found in the Mont Pelaan population, and measurements and illustrations of these are given in Table II and Fig. 3.

*Morphology.* As already described by Stocker and Kruger (1987), that part of the uterus adjoining the *pars dilatata* is thicker-walled and muscular, and contains a varying number of irregularly shaped, small crystalline structures. We found that these crystalline structures are often accompanied by small granular inclusions, also varying in size and number. The larger rod-shaped crystalline structures which occur in the *pars dilatata* (as shown by Stocker and Kruger, 1987 in their fig. 6B) were seen very rarely and in only a few populations, among other the Mont Pelaan population (see Fig. 2 B and C).

Only a few uterine eggs were seen. One paratype contained an egg measuring 193 µm x 40 µm; two females from Piggs Peak each contained two eggs (one in each uterus) measuring 249

TABLE II - *Morphometrics of several populations of* X. bourkei *Stocker et Kruger, 1987 (L in mm, other measurements in µm).*

| | Mont Pelaan | | | | | Mapoteng | Harrismith | Potgietersrust | | Grobler-sdal | New-castle | Mkuzi | Bourke's Luck (After Stocker and Kruger, 1987) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ♀ | J1 | J2 | J3 | J4 | ♀ | ♀ | ♀ | ♂ | ♂ | ♂ | ♂ | ♂ |
| n | 10 | 1 | 1 | 3 | 5 | 10 | 4 | 1 | 1 | 1 | 1 | 1 | 4 |
| L (mm) | 3.63 (3.39-3.95) | 1.12 | 1.50 | 1.96 (1.76-2.06) | 2.84 (2.57-3.01) | 3.58 (3.21-3.88) | 3.30 (2.84-3.59) | 3.22 | 3.06 | 4.64 | 4.34 | 3.90 | 3.67 (3.49-3.87) |
| a | 71 (61-85) | 45 | 51 | 61 (60.5-62) | 68 (63-72) | 66 (62-78) | 62 (60-65) | 49 | 49 | 94 | 77.5 | 79 | 80 (73-80) |
| b | 7.8 (6.9-8.4) | 4.4 | 5.1 | 5.6 (5.3-6.1) | 6.9 (6.3-7.5) | 8.3 (7.0-8.8) | 8.0 (7.5-8.6) | 8.3 | 8.1 | 11.0 | | 8.7 | 8.0 (7.5-8.5) |
| c | 34 (28-37) | 12 | 14 | 18 (16.5-19) | 25 (21-27) | 31 (27-36) | 29 (26-32) | 30 | 41 | 74 | 66.8 | 70 | 51 (45-65) |
| c' | 3.63 (3.13-4.72) | 5.81 | 6.11 | 4.94 (4.86-5.05) | 4.36 (3.89-5.50) | 3.68 (3.12-4.04) | 3.74 (3.50-4.00) | 3.41 | 2.03 | 1.80 | 1.65 | 1.84 | 2.1 (1.7-2.4) |
| V | 48.1 (46.2-49.6) | | | | | 48.9 (47.1-50.5) | 48.2 (46.8-49.3) | 46.6 | | | | | |
| Odontostyle | 109 (102-114) | 48.5 | 58 | 73 (71-74) | 89 (87-91) | 103 (96-108) | 104 (100-106) | 101 | 87 | 124 | 107 | 97 | 98 (95-100) |
| Odontophore | 77 (73-82) | 42 | 48 | 55 (52-57) | 68 (66-69) | 78 (76-82) | 75 (74-77) | 76 | 68 | 75 | 78 | 70 | 78 (75-81) |
| Stylet | 186 (178-195) | 90.5 | 106 | 128 (126-131) | 156 (155-159) | 181 (172-186) | 180 (174-182) | 177 | 155 | 199 | 185 | 167 | 172 (167-175) |
| Replacement od. | | 61 | 74 | 87 (81-90) | 107 (103-110) | | | | | | | | |
| Lip width | 15.4 (15-16) | 9.5 | 10.5 | 11.7 (11-12) | 13.1 (12.5-14.5) | 15.8 (15-16.5) | 15.6 (15-16) | 13 | 13 | 14 | 16 | 15 | 15.0 (14.5-15.5) |
| Guide ring to anterior | 97 (88-111) | 48.5 | 49 | 62 (55-69) | 80 (70-98) | 79 (71-88) | 100 (96-106) | 107 | 76 | 116 | 103 | 95 | 88 (85-92) |
| Basal bulb *l* | 147 (138-152) | | | | | 146 (138-156) | 133 (127-138) | 105 | 104 | 111 | 142 | 111 | 130 (121-136) |
| *w* | 20.5 (19-24) | | | | | 22.8 (21-26) | 22.8 (20-26) | 21 | 25 | 15 | 21 | 18 | 21 (20-21) |
| Tail length | 108 (97-137) | 93 | 107 | 107 (106-108) | 116 (105-143) | 118 (103-133) | 113 (103-128) | 109 | 75 | 63 | 65 | 56 | 73 (59-80) |
| Hyaline part | 18.7 (14-24) | 9 | 12 | 14 (13-16) | 16 (14-18) | 21 (18-23) | 22 (20-26) | 15 | 29 | 26 | 24 | 19 | 27 (20-33) |
| Cuticle (tail dorsal) | 7.3 (6-8) | 3 | 3 | 3.5 (3.5-4.5) | 5.3 (4-6) | 6.9 (6-8) | 7.0 (6-8) | 6 | 6.5 | 8 | 10 | 6 | |
| Spicule | | | | | | | | | 59 | 54 | 68 | 56 | 65 (63-67) |
| Lat. g. piece | | | | | | | | | 12 | 14 | 18 | 12 | 14 (13-15) |
| Ventrom. Suppl. | | | | | | | | | 4 | 3 | 3 | 4 | 4 or 5 |

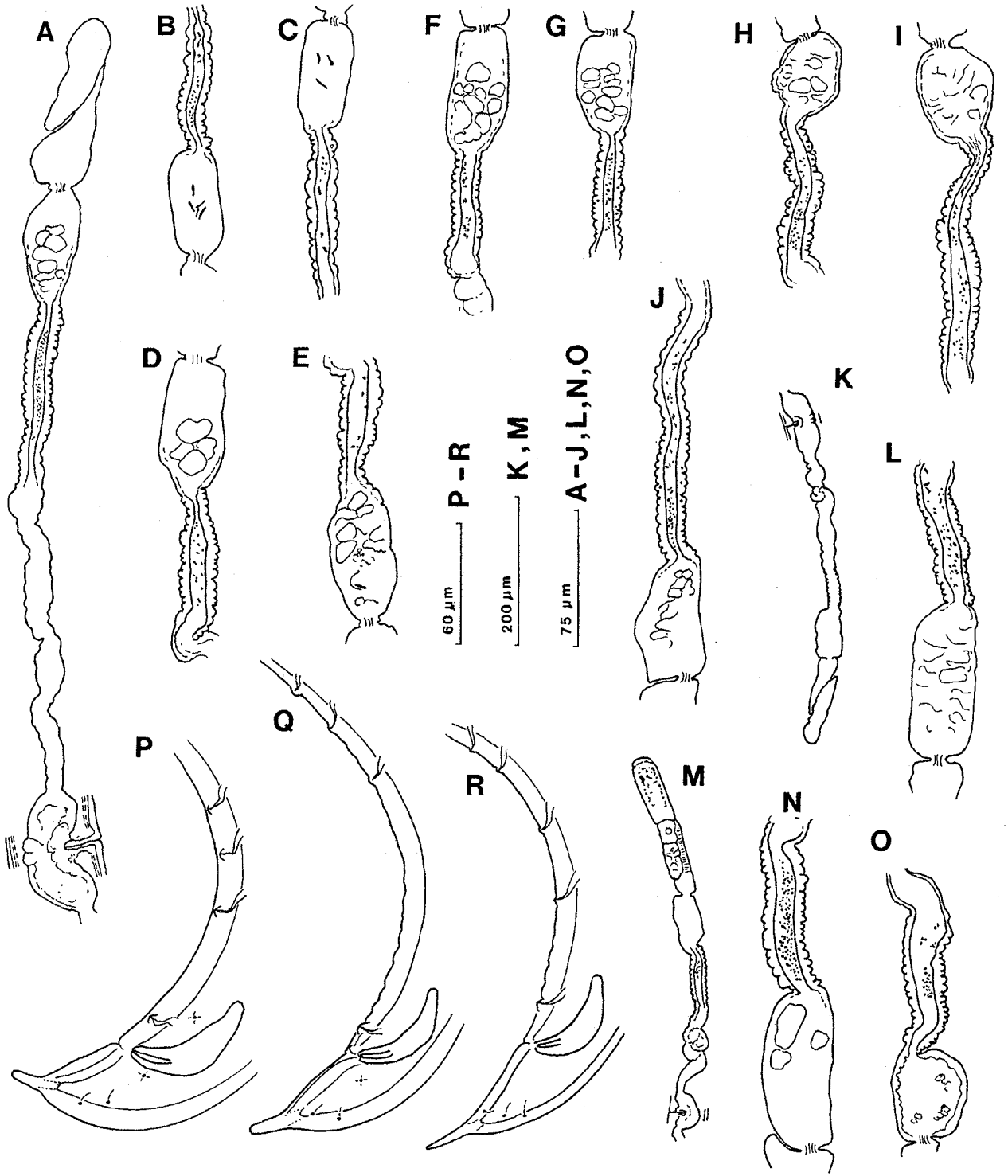


Fig. 2 - *X. bourkei*: A, anterior branch of reproductive system, female from Mont Pelaan; B-J, L, N and O, modified section of the uterus, plus the *pars dilatata uterus* in specimens from Mont Pelaan (B-E), Harrismith (F and G), Giant's Castle (H and I), Mapoteng (J), Groblersdal (L), Piggs Peak (N) and Underberg (O); K, posterior branch of reproductive system, female from Groblersdal; M, anterior branch, female from Piggs Peak.

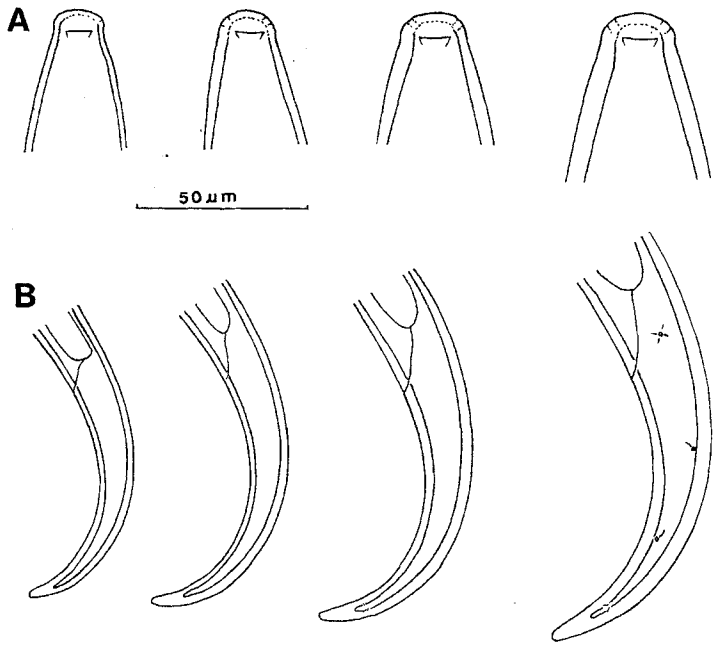


Fig. 3 - *X. bourkei*: A, anterior end of J1, J2, J3 and J4; B, tail of J1, J2, J3 and J4.

(235-273) µm x 38 (36-41) µm; and an egg in a female from Mapoteng measured 225 µm x 45 µm.

We suggest that the code for *X. bourkei* in Loof and Luc's (1990) polytomous key be emended as follows:

| A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 2/4 | 2 | 3 | 5 | 4 | 2 | 2 | 3 | 2 | 2 | 1/2 |

This would place *X. bourkei* in either or both groups 5 and 7. The reason for the changes in items B and L are as follows: B should be 2/4, since the modified, thick-walled muscular section of the uterus may be interpreted as a rudimentary pseudo-Z-organ, especially as small granular inclusions are sometimes present. For the purpose of identification this will be safer as B could be coded as 2 or 4. Item L should read 1/2, because in the majority of populations (except of course the type population) no males were found.

*Distribution.* The following new localities should be added to those recorded by Stocker and Kruger (1987): Piggs Peak (Swaziland); Mapoteng (Lesotho); Potgietersrust (Northern Province); Kroonstad, Harrismith and Mont Pelaan (Free State); and Giant's Castle (KwaZulu-Natal).

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