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A review of the genus *Impalaia* Mönnig, 1923

(Nematoda : Trichostrongyloidea)

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Summary.

Four species are considered valid for the genus *Impalaia:* — *I. tuberculata* Mönnig, 1923, *I. nudicollis* Mönnig, 1931, *I. okapiae* van den Berghe, 1937 and *I. taurotragi* (Le Roux, 1936) Travassos, 1937. *I. tuberculata* var. *longispiculata* Wetzel and Fortmeyer, 1960 and *I. aegyptiaca* Soliman, 1958 are considered synonyms of *I. tuberculata* Mönnig, 1923. *I. nudicollis* of Daubney, 1933, Yeh, 1956 and Pande *et al.* 1962 are tentatively considered synonyms of *I. tuberculata* Mönnig, 1923 and *I. dremomys* Yen, 1973 is transferred to the genus *Heligmonella* Mönnig, 1927 and becomes *Heligmonella dremomys* (Yen, 1973) n. comb. *Heligmonella dremomysi* Durette-Desset, 1974 becomes *Heligmonella moreli* nom. nov.

Résumé.

Révision du genre *Impalaia* Mönnig, 1923 (Nematoda : Trichostrongyloidea).

Quatre espèces du genre *Impalaia* sont considérées comme valides : *I. tuberculata* Mönnig, 1923, *I. nudicollis,* Mönnig, 1931, *I. okapiae* Van den Berghe, 1937, *I. taurotragi* (Le Roux, 1936) Travassos, 1937. *I. tuberculata* var. *longispiculata* Wetzel et Fortmeyer, 1960 et *I. aegyptiaca* Soliman, 1958 sont considérés comme synomymes de *I. tuberculata. I. nudicollis* sensu Daubney, 1933, sensu Yeh, 1956 et sensu Pande et coll., 1962 sont très probablement synonymes de *I. tuberculata. I. dremomys* Yeh, 1973 est transferré dans le genre *Heligmonella* Mönnig, 1927 et devient *Heligmonella dremomys* (Yeh, 1973) n. comb. Pour éviter l'homonymie, *Heligmonella dremomysi* Durette-Desset, 1974 est nommé *Heligmonella moreli* nom. nov.

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Introduction

Mönnig (1923) erected the genus *Impalaia* for specimens he described and figured from the intestine of *Aepyceros melampus* from the Transvaal, South Africa. Later (1924), he referred to the new genus *Impalaia* with *I. tuberculata* as type species, without including any description or illustrations. Yorke and Maplestone (1926) described and redrew *I. tuberculata.* Mönnig (1931) added the species *I. nudicollis* from the small intestine of *Damaliscus albifrons* from Pretoria Zoo in South Africa and included a description of the infective larvae of this species. Le Roux (1936) erected the genus *Minutostrongylus,* with *M. taurotragi* as type, recovered from the duodenum of *Taurotragus oryx* from near Mazabuka, Northern Rhodesia but Travassos (1937) synonymised this genus with the genus *Impalaia.* Yamaguti (1961) did not accept Travassos's synonymy. Daubney (1933) described *Impalaia nudicollis* in the abomasum and small intestine of *Ovis aries* from Mpapwa, Tanzania and Rift Valley and Athi Plain, Kenya and differentiated it from *I. tuberculata* by the length of the dorsal ray and spicules and the absence of tubercles in the cervical region. Soliman (1958) described the species *I. aegyptiaca* for specimens from the small intestine of *Camelus dromedarius* in Cairo, Egypt. Yeh (1956) reported and described *I. nudicollis* in the duodenum of *Gazella thomsonii* from Loliondo and Banagi regions, Tanzania. Wetzel and Fortmeyer (1960) described some specimens from *Lithocranius walleri* in the Frankfurt Zoological Gardens, West Germany as *Impalaia tuberculata* var. *longispiculata* which Round (1968) synonymised as *I. tuberculata.* Pande, Rai and Bhatia (1962) redescribed *Impalaia nudicollis* from specimens found in the intestine of camel from India. Croveri (1929) erected the genus *Anthostrongylus* for *A. somalilensis* from the intestine of a dromedary in Somalia. Travassos (1937) compared the description of *A. somalilensis* with *Impalaia tuberculata* and considered it a synonym of *I. tuberculata* and in the same year van den Berghe (1937) added the species *Anthostrongylus okapiae* from the small intestine of *Okapia johnstoni* from Epulu (Ituri, Belgian Congo). Pande *et al.* (1962), in their discussion of the two genera, agreed with Travassos's synonymy and transferred *Anthostrongylus okapiae* to *Impalaia* as a new combination. Durette-Desset (1972) described and figured the synlophe of *Impalaia tuberculata* and *I. nudicollis* and differentiated the two species. Yen (1973) added *I. dremomys* to the genus from the small intestine of *Dremomys r. rufigens* in Fenchiang Yunnan Province, China.

I. - Redescription of the species

Impalaia tuberculata Mönnig, 1923.

Material: 1 ♂, 1 ♀ (types) Onderstepoort helminth collection No. 2100.

Host: Aepyceros melampus Licht.

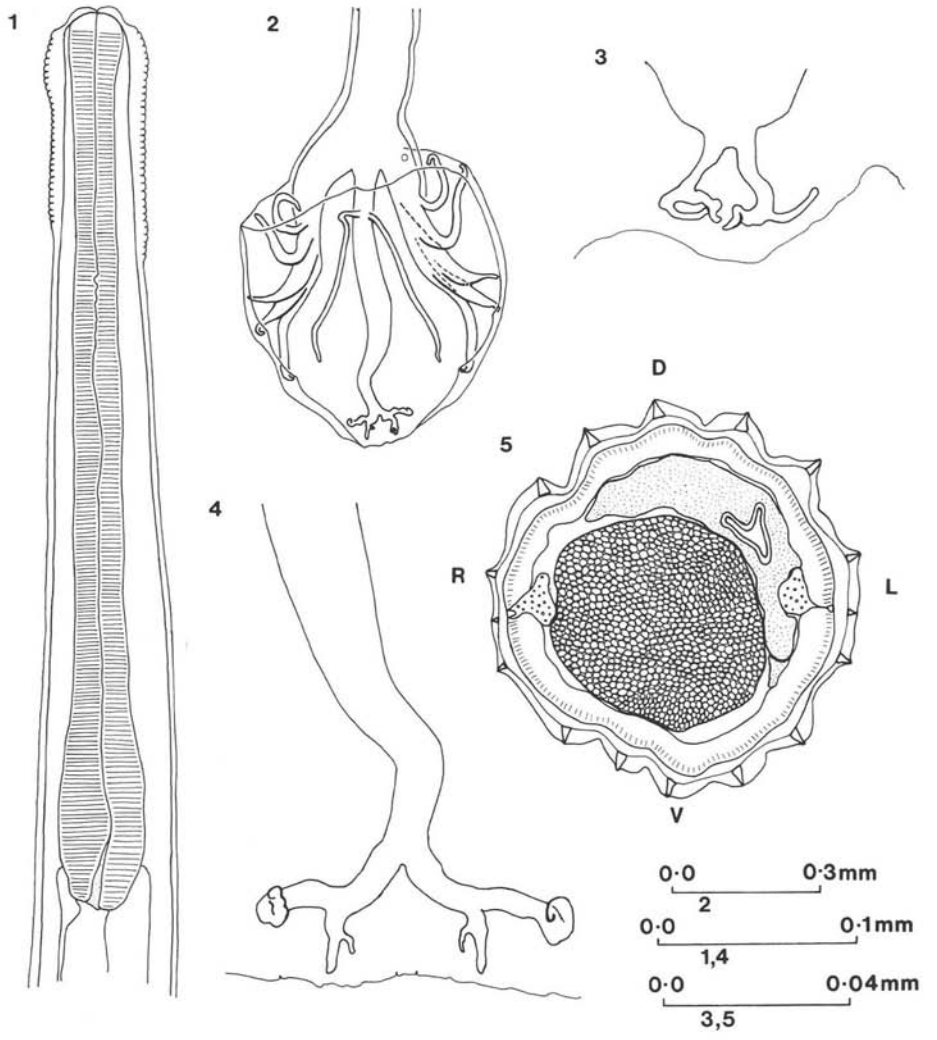

FIG. 1. — *Impalaia tuberculata:*
1, 2, 3 from *Giraffa camelopardalis;* 4 from *Rhynchotragus kirkii;* 5 from *Gazella thomsonii.* 1. Anterior end of male. 2. Bursa, ventral view. 3. Genital cone, ventral view. 4. Distal end of dorsal ray. 5. Cross section of male.

Habitat: intestine.

Locality: Transvaal, South Africa.

Other material: 6 ♂, 8 ♀ from the small intestine of *Taurotragus oryx* in the Serengeti region, Tanzania collected by Dr. R. Sachs, 2 ♂, 2 ♀ from the small intestine of

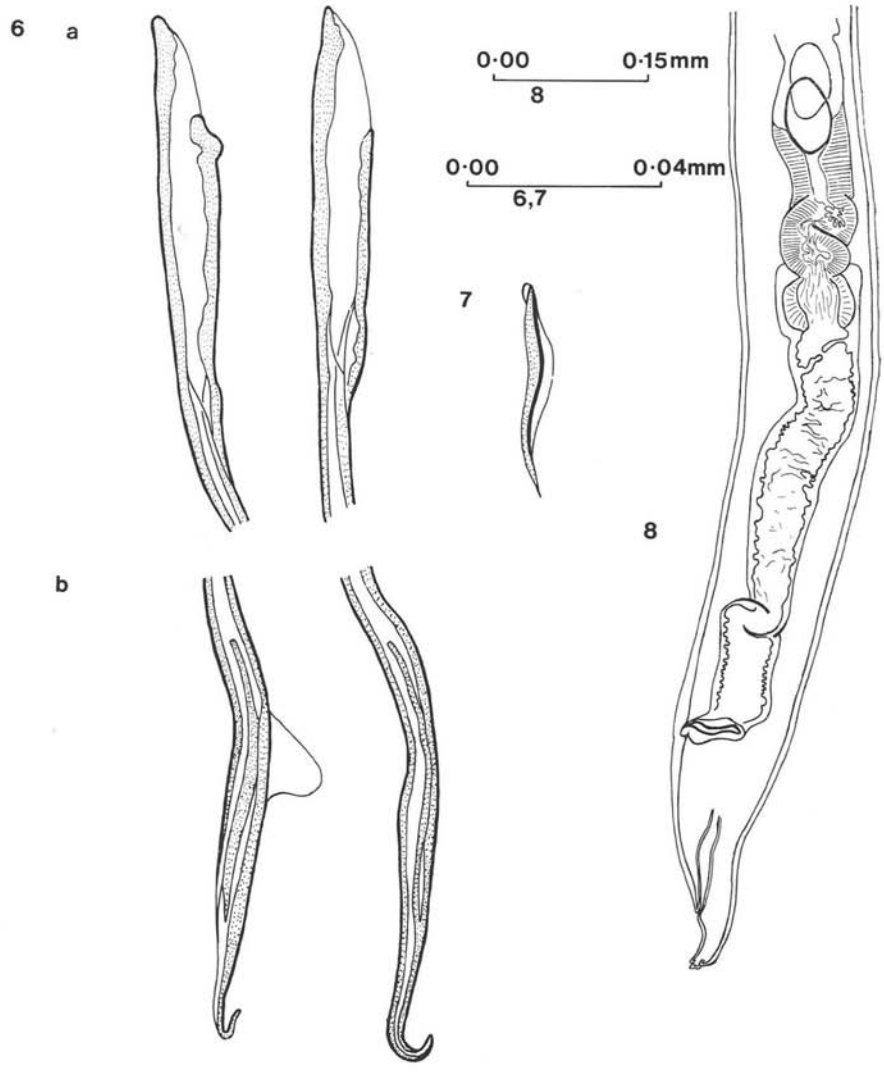

FIG. 2. — *Impalaia tuberculata:*
6, 7 from *Giraffa camelopardalis;* 8 from *Rhynchotragus kirkii.* 6. Spicules: *a.* proximal end, *b.* distal end. 7. Gubernaculum. 8. Posterior end of female.

Aepyceros melampus Suguroi Estate, Kenya and 1 ♂, 1 ♀ from the small intestine *Gazella thomsonii* Gilgil, Kenya collected by Dr. J. Grootenhuis, 3 ♂ from the small intestine of *Giraffa camelopardalis* in Marwell Zoological Park, England collected by Mr. Scudamore, 1 ♂ from *Camelus dromedarius* in Agadis, Niger collected by Dr. R.

Delavenay, M.N.H.N. Paris No. 51 MA, numerous ♂ and ♀ from the same host species collected by Dr. Daynès in the slaughterhouses of Negele Borana, Addis-Abeba, Ethiopia, M.N.H.N. Paris No. 380 CA and 381 CA.

Redescription (*fig. 1, 2, 3*).

Synlophe: in both sexes there are 16 symmetrically arranged longitudinal cuticular ridges.

Male: body 7.90-9.81 mm long, 0.103-0.169 mm wide anterior to bursa. Cephalic vesicle 0.106-0.134 × 0.035-0.054 mm. "Tubercles" present only on type male. Excretory pore and cervical papillae are 0.362-0.555 and 0.359-0.457 mm from the anterior end respectively. Œsophagus 0.437-0.512 mm long. Nerve ring not seen. Prebursal papillae present. Spicules alate, 0.920-1.32 mm long with slightly curved, pointed ends and with a transparent knob, 0.049-0.066 mm from the distal end of one spicule, not seen in the type specimen as the spicules were withdrawn within the body. Gubernaculum 0.076-0.107 mm long. Dorsal ray 0.495-0.640 mm long. Genital cone with two bifid rays.

Female: body 11.28-17.64 mm long, 0.089-0.165 mm wide at level of vulva. Cephalic vesicle 0.095-0.115 mm × 0.035-0.044 mm. "Tubercles" present only on type female. Excretory pore opens 0.409-0.534 mm from anterior end. Cervical papillae and nerve ring not seen. Œsophagus 0.432-0.531 mm long. Monodelphic. Ovejector including sphincter 0.348-0.611 mm long. Distal muscular section of uterus anterior to sphincter 0.183-0.280 mm long. Eggs, in ovejector, 0.059-0.074 × 0.031-0.046 mm. Vulva 0.188-0.240 mm from the posterior end. Tail 0.031-0.060 mm long and has one terminal and two subterminal papillae.

Impalaia nudicollis Mönnig, 1931.

Material : 4 ♂, 5 ♀ collected by Mönnig, London School of Hygiene and Tropical Medicine collection * No. 236.

Host: Damaliscus albifrons Burch.

Habitat: unknown.

Locality: South Africa.

Redescription (*fig. 3-4*).

Synlophe: a female was sectioned and examined. There are 16 symmetrically arranged longitudinal cuticular ridges similar to the type species *I. tuberculata.*

Male: body 4.95-7.48 mm long, 0.082-0.108 mm wide anterior to bursa. Cephalic vesicle 0.082-0.122 × 0.033-0.043 mm. Excretory pore and nerve ring are 0.292-0.451 and 0.210 mm from the anterior end respectively. Cervical papillae not seen. Oesophagus 0.251-0.365 mm long. Prebursal papillae present. Spicules, alate, 0.81-0.86 mm long with pointed tips. Gubernaculum 0.074-0.089 mm long. Dorsal ray 0.225-0.231 mm long. Genital cone with two undivided rays.

(*) Collection now housed at the Commonwealth Institute of Helminthology, St. Albans, Herts, England.

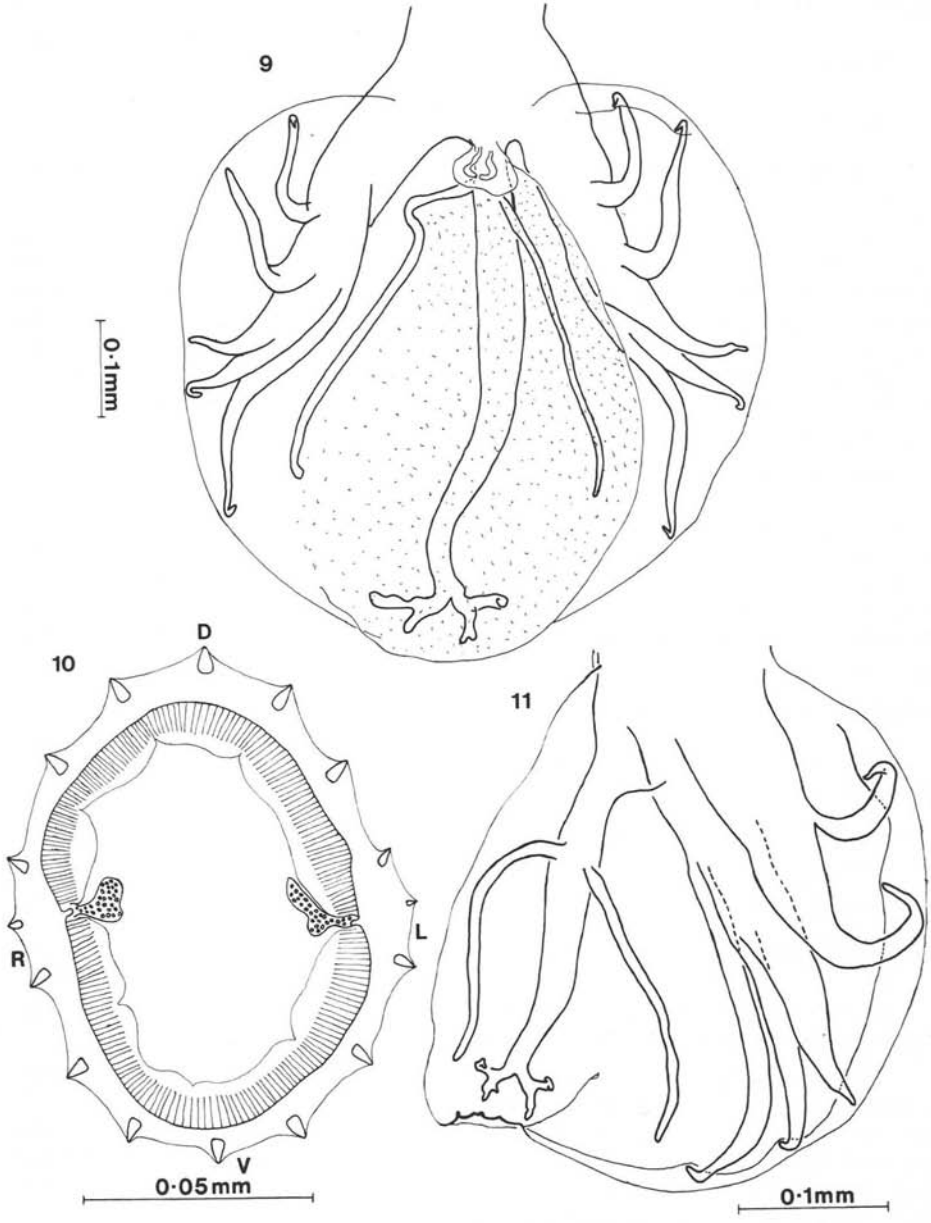

FIG. 3. — *Impalaia tuberculata* from *Camelus dromedarius:*
9. Bursa. 10. Cross section of male.
Impalaia nudicollis from *Damaliscus albifrons:*
11. Bursa, dorsal view.

Female: body 11.65-12.89 mm long, 0.083-0.094 mm wide at the level of the vulva. Cephalic vesicle 0.093-0.125 × 0.036-0.047 mm. Excretory pore and cervical papillae are 0.432-0.453 and 0.437-0.449 mm from the anterior end respectively. Nerve ring could not be seen. Oesophagus 0.306-0.362 mm long. Monodelphic. Ovejector including sphincter 0.141-0.235 mm long. Distal muscular section of uterus anterior to sphincter 0.084-0.120 mm long. Eggs, in uterus, 0.038-0.055 × 0.029-0.033 mm. Vulva 0.207-0.249 mm from the posterior end. Tail 0.048-0.065 mm long and appears to have a single terminal and two subterminal papillae.

Impalaia taurotragi (Le Roux, 1936) Travassos, 1937.

Material: fragments of 2 ♂, 1 ♀ (types) London School of Hygiene and Tropical Medicine collection * Nos. 187-189.

Host: Taurotragus oryx Pallas.

Habitat: duodenum.

Locality: Northern Rhodesia.

Redescription (*fig. 5*).

Synlophe: all the fragments are permanently mounted on slides and no further specimens are available for sectioning.

Few measurements are available as the specimens are fragmented.

Male: spicules, alate, 0.569-0.590 mm long with pointed tips. Gubernaculum 0.065 mm long. Prebursal papillae present. Dorsal ray 0.047 mm long. Genital cone with two rays, which bifurcate close to the distal end.

Female: monodelphic. Ovejector including sphincter 0.333 mm long. Distal muscular section of the uterus not clear. Eggs, in ovejector, 0.075 × 0.033 mm. Vulva 0.170 mm from posterior end. Tail 0.050 mm long with one terminal and two subterminal papillae.

II. - Discussion

According to Mönnig (1923) the type species *Impalaia tuberculata* has numerous irregularly arranged tubercles on the anterior end and its spicules are 0.60 mm long with bifid proximal ends. However, Mönnig (1932) considered these tubercles to be artefact and distinguished this species from *I. nudicollis* by its shorter spicules, its larger bursa and dorsal ray. Examination of the type male of *I. tuberculata* showed that the spicules are 0.920 mm long and do not have bifid ends, suggesting the possibility that the spicule length of 0.6 mm given in the original description is a printing error.

Travassos (1937) synonymised *Anthostrongylus somalilensis* with *I. tuberculata* on the basis of the morphology of the dorsal ray but Baer (1950), did not accept this synonymy because of the differences in size of the spicules and eggs of the two species.

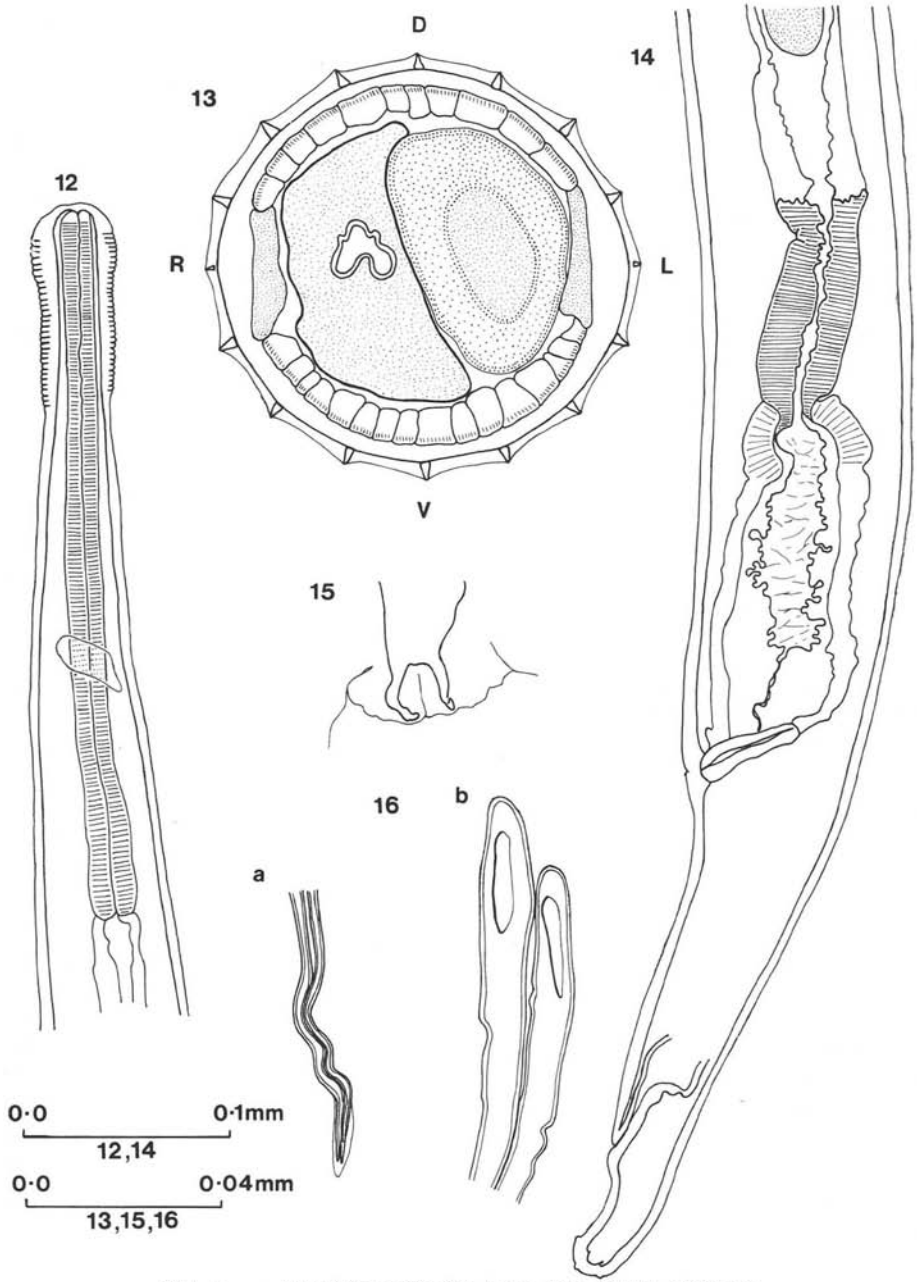

FIG. 4. — *Impalaia nudicollis* from *Damaliscus albifrons:*
12. Anterior end of male. 13. Cross section of female. 14. Posterior end of female.
15. Genital cone. 16. Spicules : *a*. distal end, *b*. proximal end.

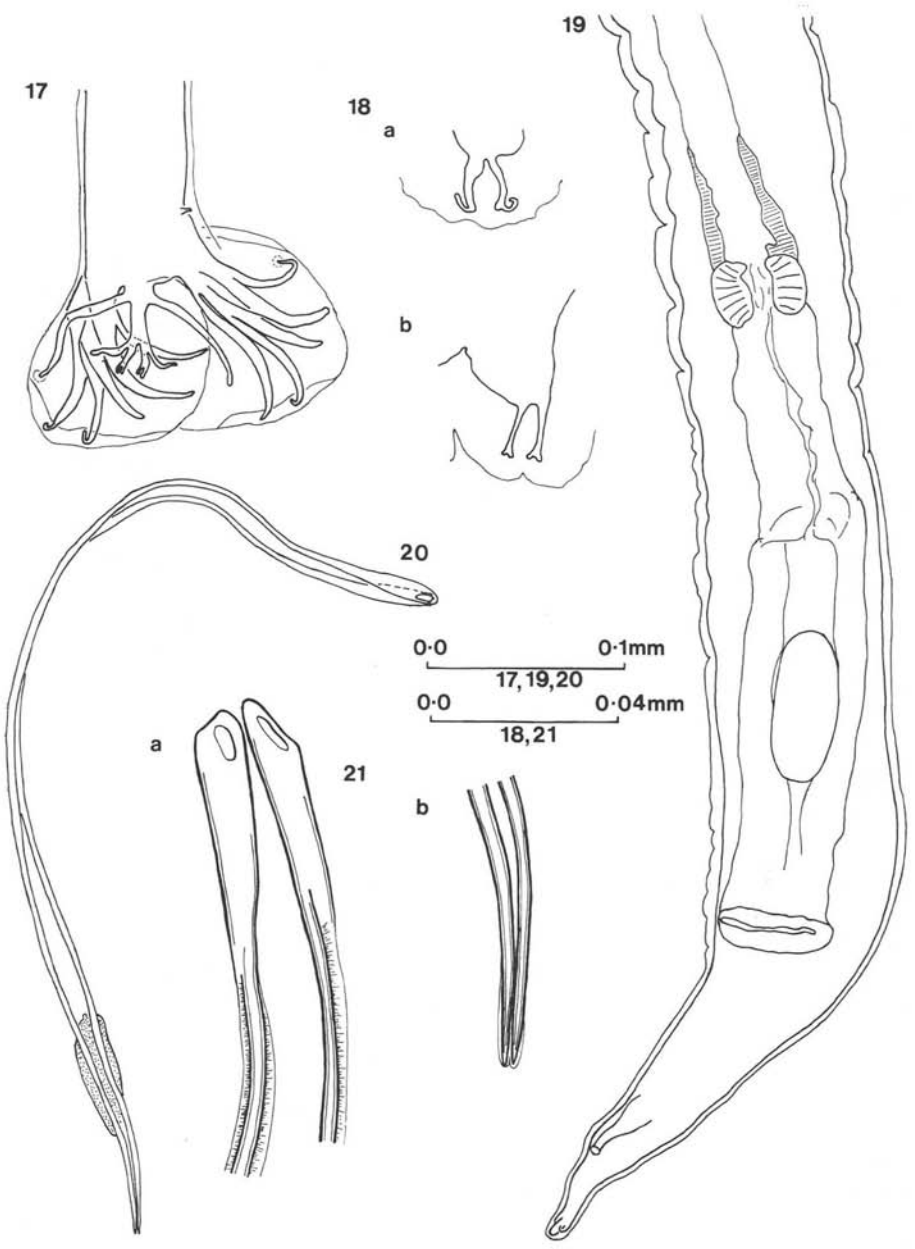

FIG. 5. — *Impalaia taurotragi* from *Taurotragus oryx:*
17. Bursa. 18. Genital cone, dorsal view. 19. Posterior end of female. 20. Spicules. 21. Spicules: *a.* proximal end, *b.* distal end.

A comparison of the measurements and synlophe of material collected from the same host species *Camelus dromedarius* from Ethiopia, a geographical locality near to the original locality, Somalia confirms Travassos's synonymy.

According to Yamaguti, 1961 the genus *Minutostrongylus* Le Roux, 1936 should be maintained as a separate genus from *Impalaia* as its type species has a short dorsal ray and an uncoiled body. Re-examination of the type species shows that the morphological characters of both the male and female are similar to those described for the genus *Impalaia* and Travassos's synonymy of 1937 is accepted.

Daubney (1933), Yeh (1956) and Pande *et al.* (1962) redescribed *I. nudicollis* and from their descriptions, the size of the bursa, length of the spicules and morphology of the females are very similar to those described here for *I. tuberculata.* As the specimens described by these authors were not available for re-examination they can only tentatively be assigned to *I. tuberculata.*

I. tuberculata var. *longispiculata* was erected by Wetzel and Fortmeyer (1960) for specimens with a greater spicule length than *I. tuberculata* Mönnig, 1923. The spicule length of 0.838-1.202 mm comes within the range for this species as described here and the synonymy of the variety by Round (1968) is confirmed.

Soliman (1958) considered his *I. aegyptiaca* a new species « until the range of variability in the previously mentioned species (*I. tuberculata, I. nudicollis*) is more accurately studied and a comparative examination of the original type specimens », made. He distinguished his species from those previously described by the greater spicule length, the presence of a sclerotised knob-like structure joining the spicules near their distal ends and the greater length of the dorsal ray. Comparison of the types of this species with *I. tuberculata* has shown that these characters together with the morphology of the females are similar in both species and consequently *I. aegyptiaca* is considered here as a synonym of *I. tuberculata* Mönnig, 1923.

Impalaia okapiae was distinguished by van den Berghe (1937) from *Anthostrongylus somalilensis* by the presence of 14 longitudinal cuticular ridges, greater length of spicules and the position of the posterolateral ray in relation to the other lateral rays. Baer (1950) in his study of the parasites of the okapi commented that the size of the spicules and eggs immediately distinguished *I. somalilensis* and *I. okapiae* from the other species. However, in the absence of material he was unable to comment any further on the position of these two species. Although no specimens of *I. okapiae* could be traced for this study the size of the spicules and eggs confirm its validity.

Although the types of *Impalaia dremomys* Yen, 1973, from *Dremomys r. rufigens* in China are not available for examination, from the description the structure of the dorsal ray and lobe separate it from the other species of *Impalaia* and suggest that it should be placed in a different genus. It is very close to the species *Heligmonella dremomysi* Durette-Desset, 1974, described from *Dremomys lokriah* in Nepal and is transferred to the genus *Heligmonella* as *Heligmonella dremomys. Heligmonella dremomysi* Durette-Desset, 1974, now becomes a homomyn of Yen's species and a new name *Heligmonella moreli* is proposed in honour of Dr. Morel. *H. dremomys* can be

distinguished from *H. moreli* by the body length, the size of the spicules and the width of the bursal rays.

Key to the species of the genus *Impalaia*

1. Males with transparent knob on one spicule:

   Dorsal ray 0.495-0.640 mm long and distinctly curved near its distal end. Genital cone with two bifid rays.
   Female tail narrow ..... *I. tuberculata*

   Males without transparent knob on one spicule. 2

2. Males with spicules over 1 mm long:

   Posterolateral ray thin, separated from the other lateral rays.
   Eggs 0.082 × 0.065 mm ..... *I. okapiae*

   3

3. Males with spicules under 1 mm long:

   Dorsal ray 0.225-0.231 mm long and straight.
   Spicules 0.81-0.86 mm long.
   Genital cone with two individed rays.
   Female tail broad ..... *I. nudicollis*

   Dorsal ray 0.047 mm long.
   Spicules 0.569-0.590 mm long.
   Genital cone with two rays which bifurcate only near their distal ends ....
   ..... *I. taurotragi*

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References

BAER (J.-G.), 1950. — Etude critique des helminthes parasites de l'okapi. *Acta Tropica, 7,* 164-186.

BERGHE (L. van den), 1937. — Contribution à l'étude des parasites de l'okapi (troisième partie). *Rev. Zool. Bot. Afr. Belgium, 30,* 117-139.

CROVERI (P.), 1929. — Un nuovo strongylide : *Anthostrongylus somalilensis* Croveri, 1917 (n.g. n.s.) Parassita dei dromedari somali a la strongilosi intestinale epizootica dei dromedari : Ber Cursu. *Arch. Ital. Sci. Med. Coloniali, 10,* 145-171.

DAUBNEY (R.), 1933. — Trichostrongylid nematodes from sheep in Kenya. *Parasitology, 25,* 224-241.

DURETTE-DESSET (M.-C.), 1972. — Compléments à l'étude morphologique de quelques Nématodes Héligmosomes parasites de Rongeurs et de Ruminants. *Bull. Mus. Nat. Hist. Nat. Zool.,* 3e série, 42, Zool., *36,* 501-508.

DURETTE-DESSET (M.-C.), 1974. — Description de deux nouveaux Nématodes Héligmosomes chez un Sciuridé (*Dremomys lokriah*) du Népal. *Bull. Mus. Nat. Hist. Nat.* 3e série, 232, Zool., *156,* 819-825.

LE ROUX (P. L.), 1936. — A new trichostrongylid (*Minutostrongylus taurotragi* g. et sp. n.) of the subfamily Heligmosominae from an african antilope. *J. Helminthol., 14,* 73-76.

MÖNNIG (H. O.), 1923. — On some new South African parasitic nematodes. *Trans. R. Soc. S. Africa, II,* 105-117.

MÖNNIG (H. O.), 1924. — South African parasitic nematodes. *9th and 10th Reports of the Director of Veterinary Education and Research, Department of Agriculture, Pretoria, Union of South Africa,* 435-478.

MÖNNIG (H. O.), 1931. — Wild antelopes as carriers of nematode parasites of domestic ruminants. Part I. *17th Report of the Director of Veterinary Services and Animal Industry. Union of South Africa,* 233-254.

MÖNNIG (H. O.), 1932. — Wild antelopes as carriers of nematode parasites of domestic ruminants. Part II. *18th Report of the Director of Veterinary Services and Animal Industry, Union of South Africa,* 153-172.

PANDE (B. P.), RAI (P.) et BHATIA (B. B.), 1962. — On two new records of trichostrongylid and a heligmosomatid nematode hitherto unknown from *Camelus dromedarius* L. in India with remarks on the genus *Impalaia* Mönnig. *Indian J. Veterinary Science Animal Husbandry, 32* (1), 27-32.

ROUND (M. C.), 1968. — Checklist of the helminth parasites of african mammals of the orders Carnivora, Tubulidentata, Proboscidea, Hyracoidea, Artiodactyla and Perissodactyla. *Tech. Com. Commonw. Bur. Helminthol.,* n° 38, vi + 252 pp.

SOLIMAN (K. N.), 1958. — On a new species of the nematode genus *Impalaia* from the camel (*Camelus dromedarius*) in Egypt. *Br. Vet. J., 112,* 507-512.

TRAVASSOS (L.), 1937. — Revisão da familia Trichostrongylidae Leiper, 1912. *Monographias do Instituto Oswaldo Cruz, 1,* 512 pp.

WETZEL (R.) et FORTMEYER (H. P.), 1960. — Zur kenntnis von *Impalaia tuberculata* Mönnig, 1924. *Z. Parasitenkd', 20,* 138-145.

YAMAGUTI (S.), 1961. — Systema Helminthum, vol. III. The nematodes of vertebrates. *New York and London : Interscience Publishers,* vi + 1261 pp.

YEH (L. S.), 1956. — On a collection of helminths from Thomson's gazelle, *Gazella thomsonii,* from Tanganyika. *J. Helminthol., 29,* 203-228.

YEN (W. C.), 1973. — Helminths of birds and wild animals from Lin-tsan Prefecture, Yunnan Province, China II. Parasitic nematodes of mammals. *Acta Zool. Sinica, 19,* 354-364.

YORKE (W.) and MAPLESTONE (P. A.), 1926. — The nematode parasites of vertebrates. *J. and A. Churchill,* edit., London, 536 p.