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New Trichostrongylids from the Red Deer (*Cervus elaphus* L.) in New Zealand*

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Abstract

THREE new species of trichostrongylid nematodes of the genera *Ostertagia* Ransom, 1907; *Skrjabinagia* Kassimov, 1942; and *Rinadia* Grigoryan, 1951, are described from the abomasum of the red deer (*Cervus elephus* L.) in New Zealand.

INTRODUCTION

DURING the course of a study on the parasites of red deer in New Zealand, six species of trichostrongylids were recorded from the abomasa of eleven hosts. The three new species described herein occurred in small numbers. Material was collected from the Kaingaroa district in the North Island and the Mt. Travers (Nelson), Taramakau River (Westland), and Lake Marchant (Fiordland) districts in the South Island.

I am indebted to Mr R. Forsyth and Mr H. Maunder for sending me material from Westland and Fiordland.

Family TRICHOSTRONGYLIDAE Leiper, 1912

Genus OSTERTAGIA Ransom, 1907

Ostertagia (Grosspiculagia) rubricervi n.sp. Pl. 1, figs. 1–3.

MATERIAL EXAMINED. Male specimens only were recovered from the abomasa of the following hosts: a female fawn from Red Creek, Horomanga (near Galatea) 10.5.61; a yearling male, Kaingaroa, 10.5.61; a three-year-old male, Taramakau River, Westland, 20.12.61; and an adult male, Lake Marchant, Fiordland, 20.4.62.

DIAGNOSIS. A translucent, white, filiform nematode without head capsule and with the anteriorly tapering body bearing approximately 30 longitudinal striations but no transverse striations. Spicules with a pectinate internal margin and three posterior offshoots. A gubernaculum is present.

DESCRIPTION. *Male*: The holotype and one paratype, both adult males, are held in the collections of the Zoology Department, Victoria University of Wellington. Body length

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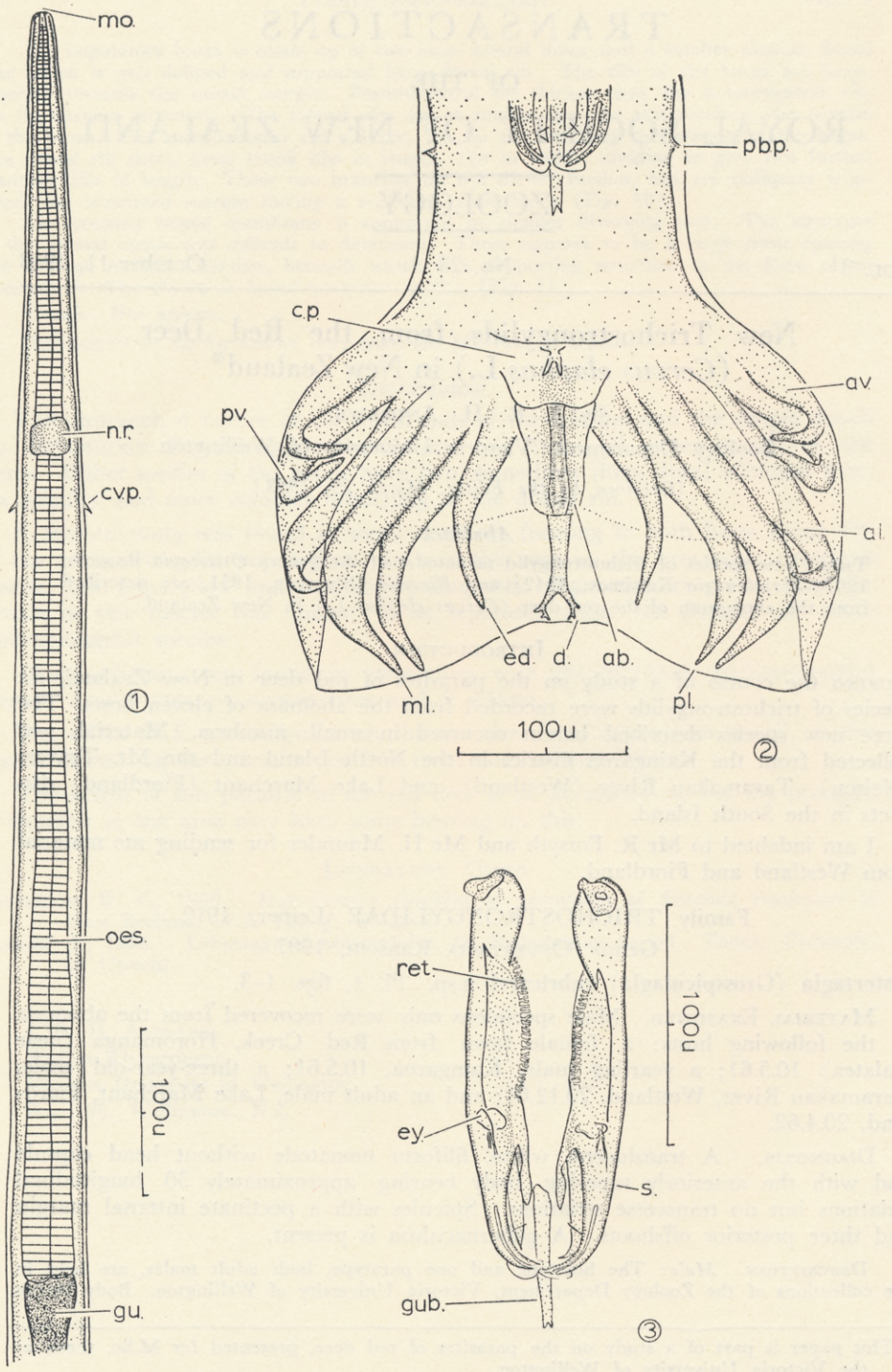
Plate I.



Ostertagia (*Grosspiculagia*) *rubricervi* n.sp. Fig. 1—Anterior region. Fig. 2—Copulatory bursa, male, ventral view. Fig. 3—Copulatory spicules, ventral view.

Abbreviations: ab., accessory bursal membrane; al., anterolateral rib; av., anteroventral rib; c.p., cloacal papillae; cv.p., cervical papilla; d., dorsal rib; ed., externodorsal rib; ey., eyelet; gu., gut; gub., gubernaculum; ml., mediolateral rib; mo., mouth; n.r., nerve ring; oes., oesophagus; pb.p., prebursal papilla; pl., posterolateral rib; pv., posteroventral rib; ret., reticulate margin; s., spicule.

is 6.4mm; mid-body width 90μ; head diameter 12μ. Oesophagus 750μ long, club-shaped, expanding posteriorly. Diameter of the oesophagus at anterior end 6μ, at the mid-portion 18μ, at the posterior end 30μ (maximum diameter). Diameter of the body immediately in front of the bursa 95μ (Fig. 1).

The nerve ring surrounds the oesophagus approximately 240μ from the anterior end of the body. Cervical papillae occur 300μ and the excretory pore 240μ from the anterior extremity respectively. Prebursal papillae are located 55μ in front of the bursa (Fig. 1).

Paired copulatory spicules are equal in size and configuration, light yellow brown in colour, and 168μ in length. Greatest width 25μ in the region anterior to the spicule offshoots where the colouring of the chitin is less dense (a region named by Assadov as the "eyelet"). The median margin of the spicule is lighter in colour and is bordered by a series of delicate short processes which branch at their distal ends. This pectinate margin extends along the middle third of the spicule. Each spicule bears an externo-lateral, interno-lateral and median offshoot. The externo-lateral offshoot is the largest, curving in towards the mid-line, is bifid at the tip each bifurcation running parallel into a transparent, thin-walled, pouch-like structure at the distal end of each spicule. The median offshoot is smaller but follows a similar course, ending in a hook-like process which curves in towards the mid-line. A transverse diagonal ridge occurs a short distance before the tip of this offshoot. The interno-lateral offshoot is half the length of the other two, expanding slightly towards its distal end (Fig. 3).

Gubernaculum present, 60μ long and 8μ wide at the anterior end, oblong in shape, tapering towards its distal end where it forks into two small processes (Fig. 3).

The copulatory bursa is a bell-shaped structure composed of one dorsal and two lateral lobes. The dorsal lobe is not well defined and appears almost as part of the lateral lobes. The ribs of the bursa are long, gradually tapering distally, with the anteroventral and posteroventral approximately the same size, but the posteroventral rib usually more robust, with its tip turning up to almost meet the tip of the anteroventral rib. The tips of all the lateral ribs reach the margin of the bursa. The mediolateral rib is slightly more robust than the anterolateral and posterolateral. The externodorsal rib slender, almost reaching the margin of the bursa. The dorsal rib long, 145μ in overall length, thick in its proximal portion, bifurcating 20μ from its distal end and each bifurcation which is 15μ in length divides to form two short processes, the innermost of which again bifurcates into two smaller processes (Fig. 2).

The accessory bursal membrane is 65μ long and 45μ wide, and instead of being supported by the usual slender rays it is supported by a stout longitudinal median rib, which bears faint transverse striations. Two small supporting rays occur distal to the cloaca.

Female: Not known.

DISTRIBUTION. Known so far only from the Kaingaroa district in the North Island, and the Westland and Fiordland districts in the South Island of New Zealand.

DISCUSSION

This species has some resemblance to *Ostertagia* (*Grosspiculagia*) *lyrata* Sjöberg, the only other known representative of this sub-genus in New Zealand. The general form of the copulatory spicules in the two species is rather similar, but the spicules of *O. lyrata* are somewhat broader. The main difference arises from the form of the offshoots at the distal ends of the spicules. The externo-lateral offshoot appears bifid in both species, however *O. lyrata* does not have a diagonal ridge on the median process, nor does the interno-lateral process have the oar-like configuration of *Ostertagia rubricervi* n.sp. Instead the interno-lateral process of *O. lyrata* bears a cap-like formation at its distal end. The gubernaculum of *O. lyrata* is divided into two processes of different lengths, whereas the gubernaculum of *O. rubricervi* forks slightly at the distal end, the resulting processes being of equal size. *O. lyrata* has a typical lyre-shaped accessory bursal membrane support differing from the longitudinal rib-like support of *O. rubricervi.*

Ostertagia lasensis Assadov, found from the abomasum of roe deer and red deer in Europe, bears some resemblance to *O. rubricervi* in the formation of the spicules, but the following differences were noted. The median offshoot of the spicules of *O. lasensis* has a diagonal ridge, but this occurs at a greater distance

from the tip of the offshoot and the continuation of this offshoot is thinner and more hook-like than that of *O. rubricervi*. The interno-lateral process of *O. lasensis* is not oar-shaped, neither do the spicules of this species bear the pectinate interno-lateral margin. The gubernaculum of *O. lasensis* bears a handle-like expansion at its proximal end and tapers distally to a point. The gubernaculum of *O. rubricervi* lacks this expansion and forks distally.

O. rubricervi was always found in small numbers forming, at the most, 5% of the trichostrongylid population. For this reason and because they lacked sufficient diagnostic characteristics, it was found impossible to isolate the female of this species, thus the only adult specimens recovered were males.

O. rubricervi was found to occur in association with the following trichostrongylids: *Spiculopteragia asymmetrica, S. böhmi, Ostertagia leptospicularis,* and *Rinadia quadrifurcata.*

O. rubricervi appears to have little or no effect on its red deer host as the stomach wall was free from nodules and lesions, and the host animals showed no signs of anaemia.

By reason of its presence in both North and South Islands, and the fact that there is no interchange of deer between these two Islands, the occurrence of *O. rubricervi* in red deer can only be the result of one of the following; either its presence in red deer before introduction into New Zealand, or, transmission from another infected introduced feral mammal, or, transmission from domestic stock, common to, and frequently interchanged between the North and South Islands. Of these three possibilities the first and second are the most likely as the nematode parasites of domestic stock have been well studied (Brunsdon, 1960), and this parasite was not found.

Genus RINADIA Grigoryan, 1951

Rinadia quadrifurcata n.sp. Pl. II, figs. 4–8.

MATERIAL EXAMINED. Male specimens only were recovered from the abomasum of an adult male red deer from Lake Marchant, Fiordland, 20.4.62.

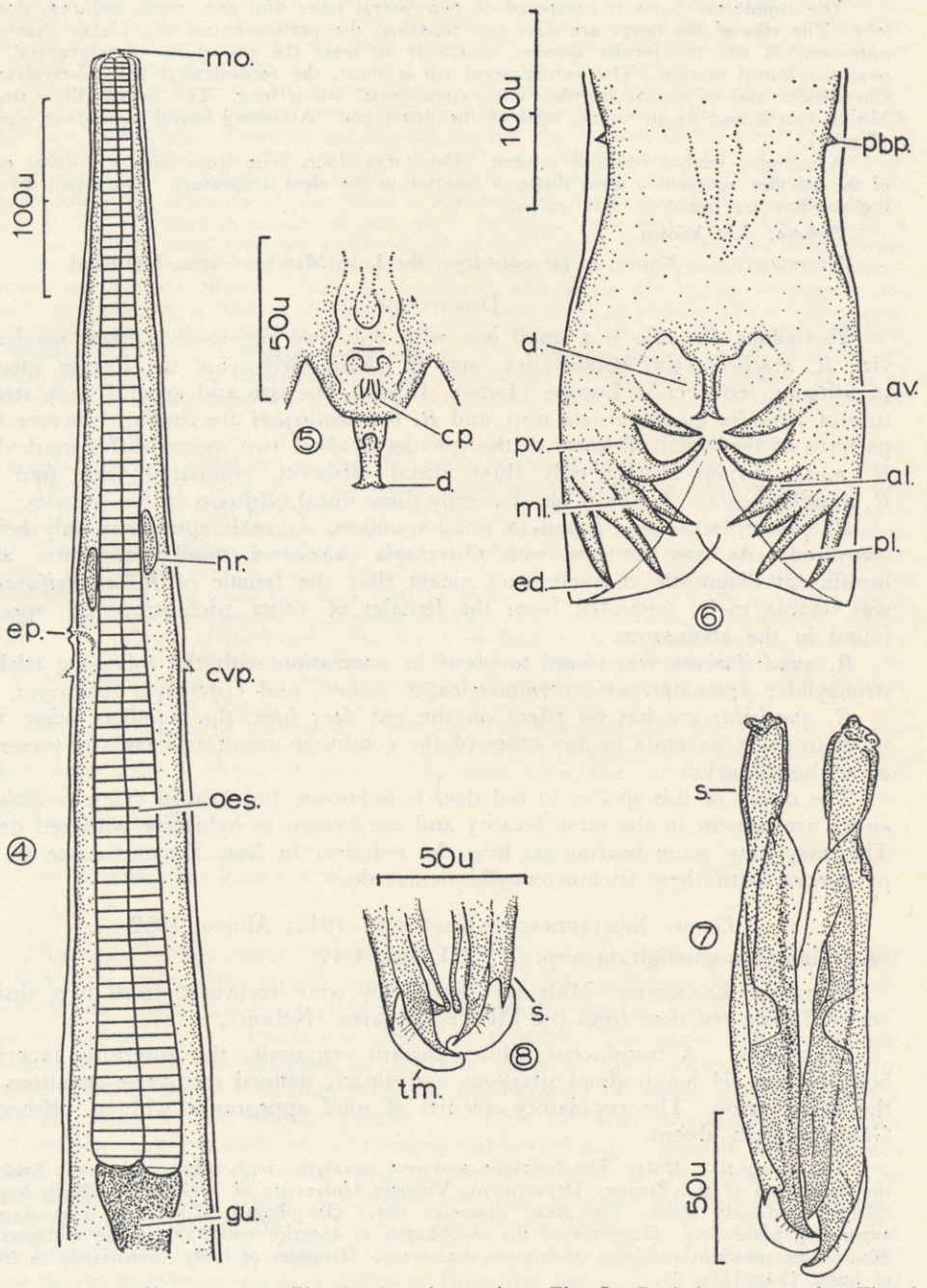
DIAGNOSIS. A translucent, white, filiform nematode with the body cuticle bearing approximately 30 longitudinal striations but no transverse striations. Spicules with four distal offshoots, gubernaculum absent.

DESCRIPTION. *Male*: The holotype and one paratype, both adult males, are held in the collections of the Zoology Department, Victoria University of Wellington. Body length is 6.1mm; mid-body width 80μ; head diameter 25μ; body width just anterior to the copulatory bursa 130μ. Oesophagus 560μ long, club-shaped, expanding posteriorly. Diameter of oesophagus at the anterior end 15μ; mid-portion 25μ; posterior end 45μ (maximum diameter), (Fig. 4).

The nerve ring surrounding the oesophagus is situated 260μ from the anterior end of the body. Cervical papillae are found 310μ, and the excretory pore 290μ, from the anterior extremity respectively. Prebursal papillae 65μ anterior to the copulatory bursa (Fig. 4).

Paired copulatory spicules are equal in size and configuration except for slight asymmetry in the distal region. They are brown in colour and 185μ in length, expanding in the region of the eyelet to a maximum width of 25μ. The left spicule is generally 10μ longer than the right. Distally the left spicule branches into four offshoots. The externo-lateral offshoot is short and pointed, its distal end being continuous with a transparent membrane. Next to the externo-lateral offshoot are the median dorsal and ventral offshoots. The dorsal median offshoot is the larger of the two, curves in towards the mid-line, expands distally, and terminates in a transparent membrane. The ventral median offshoot is shorter, curves in towards the mid-line and terminates 20μ from the distal end of the spicule. The interno-lateral offshoot is long and slender, 50μ in length, originating in the region of the eyelet and terminating as a blunt expansion in the region of termination of the ventral median offshoot. The right spicule is similar in most details but the median dorsal offshoot is shorter, and the median ventral offshoot terminates bluntly and curves in towards the interno-lateral offshoot (Figs. 7 and 8). Gubernaculum absent.

PLATE II.



Rinadia quadrifurcata n.sp. Fig. 4—Anterior region. Fig. 5—Genital conus, male. Fig. 6—Copulatory bursa, male, dorsal view. Fig. 7—Copulatory spicules, dorsal view. Fig. 8—Distal ends of copulatory spicules, ventral view.

Abbreviations: al., anterolateral rib; av., anteroventral rib; cp., cloacal papillae; cvp., cervical papilla; d., dorsal rib; ed., externodorsal rib; ep., excretory pore; gu., gut; ml., mediolateral rib; mo., mouth; nr., nerve ring; oes., oesophagus; pbp., prebursal papilla; pl., posterolateral rib; pv., posteroventral rib; tm., transparent membrane; s., spicule.

The copulatory bursa is composed of two lateral lobes and one, much reduced, dorsal lobe. The ribs of the bursa are slim and tapering, the posteroventral rib thicker than the anteroventral rib, the former turning anteriorly to meet the tip of the anteroventral rib near the bursal margin. The anterolateral rib is short, the mediolateral and posterolateral ribs slender and of similar length. The externodorsal rib is long. The dorsal rib is small, 25μ in length and 8μ in width, bifid at the distal end. Accessory bursal membrane absent (Fig. 6).

A complex genital conus is present. Two large ducts arise from near the distal ends of the spicules and join a short distance anterior to the cloacal aperture. Two small diverging papillae are found in this region.

Female: Not known.

Distribution. Known so far only from the Lake Marchant area, Fiordland.

Discussion

The genus *Rinadia* is a small one with only two previously known species—viz., *R. mathevossjani* Rukhlyadev, and *R. shulzi* Grigoryan, the former species parasitizing red deer in Europe (Jansen, 1958). The size and general body structure of *Rinadia quadrifurcata* n.sp. and *R. mathevossjani* are similar, however the patterns of the distal offshoots of the spicules of these two species differ markedly, *R. mathevossjani* having only three distal offshoots, compared with four in *R. quadrifurcata*. *R. shulzi* also has only three distal offshoots in the spicules.

R. quadrifurcata was found in small numbers, six male specimens only being recovered. As was the case with *Ostertagia rubricervi*, small population and insufficient diagnostic characteristics meant that the female of *R. quadrifurcata* was unable to be separated from the females of other trichostrongylid species found in the abomasum.

R. quadrifurcata was found to occur in association with the following trichostrongylids: *Spiculopteragia asymmetrica*, *S. böhmi*, and *Ostertagia rubricervi*.

R. quadrifurcata has no effect on the red deer host, the numbers being too small to cause anaemia or any other of the conditions resulting from the presence of trichostrongylids.

The origin of this species in red deer is unknown, but Wapiti (*Cervus canadensis*) are present in the same locality and are known to hybridize with red deer. This may have some bearing on how the red deer in New Zealand came to be parasitized with these trichostrongylid nematodes.

Genus Skrjabinagia Kassimov, 1942; Altaev, 1952

Skrjabinagia monodigitata n.sp. Pl. III, figs. 9–12.

Material Examined. Male specimens only were recovered from two, three-year-old male red deer from the Mt Travers area (Nelson).

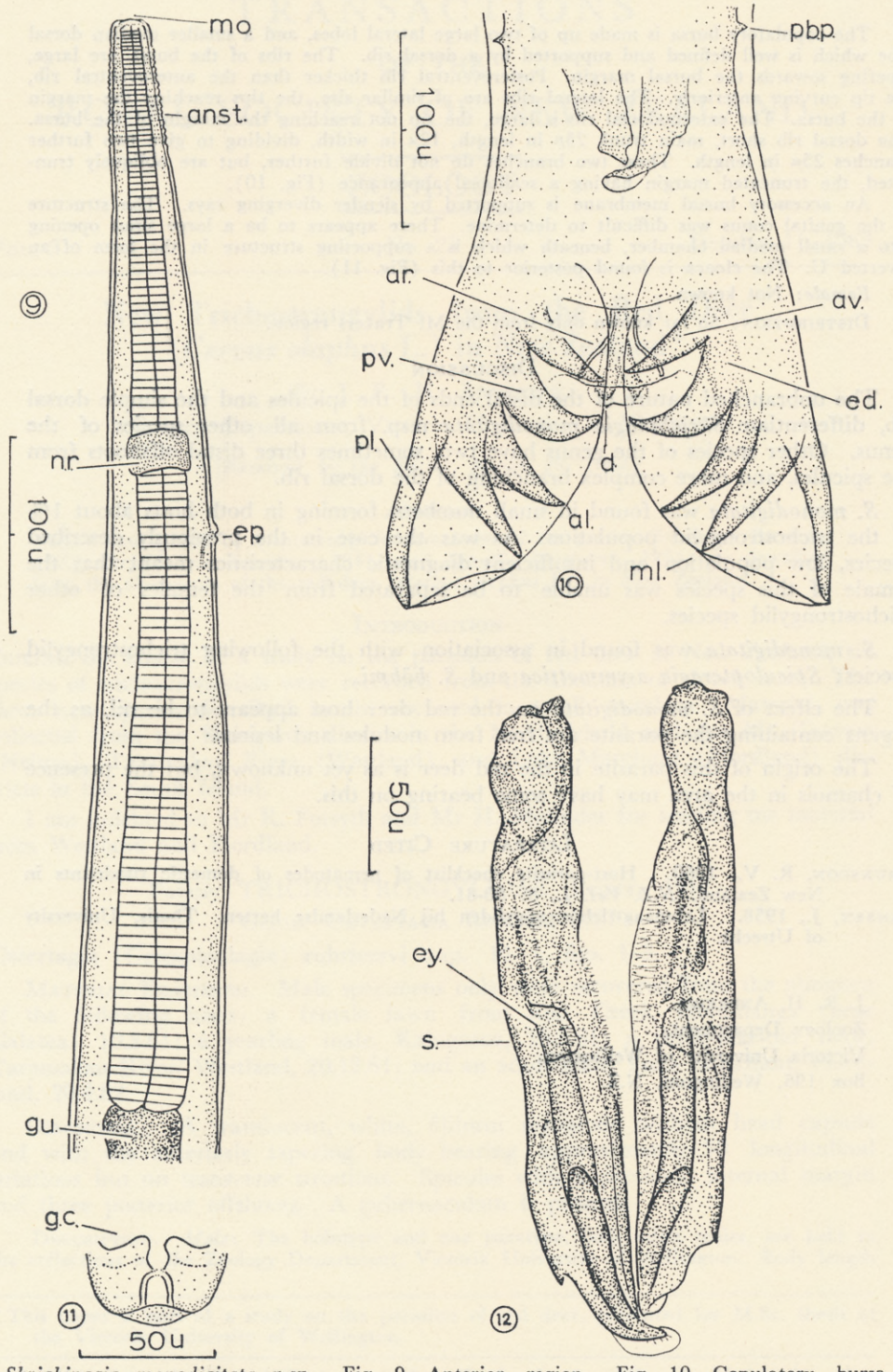
Diagnosis. A translucent, white, filiform nematode, the anteriorly tapering body bearing 34 longitudinal striations and clearly defined transverse striations in the head region. The copulatory spicules of solid appearance without offshoots. Gubernaculum absent.

Description. *Male*: The holotype and one paratype, both adult males, are held in the collections of the Zoology Department, Victoria University of Wellington. Body length 8.1mm; mid-body width, 95μ; head diameter 20μ. Oesophagus 570μ long, club-shaped, expanding posteriorly. Diameter of the oesophagus at anterior end 15μ, at the mid-portion 30μ, at the posterior end 40μ (maximum diameter). Diameter of body immediately in front of bursa 134μ (Fig. 9).

The nerve ring surrounds the oesophagus 210μ from the anterior extremity and the excretory pore is found 265μ from the anterior end (Fig. 9).

Paired copulatory spicules are equal in size and configuration, dark brown in colour, of solid appearance and 225μ in length. Greatest width 30μ in the region of the eyelet. A short tube-like structure runs distally from the eyelets opening into a groove 50μ from the distal end. The left spicule curves distally, in towards the mid-line. The gubernaculum is absent (Fig. 12).

PLATE III.



Skrjabinagia monodigitata n.sp. Fig. 9—Anterior region. Fig. 10—Copulatory bursa, ventral view. Fig. 11—Genital conus. Fig. 12—Copulatory spicules, dorsal view. Abbreviations: an. st., anterior striations; al., anterolateral rib; ar., accessory rays; av., anteroventral rib; d., dorsal rib; ed., externodorsal rib; e.p., excretory pore; ey., eyelet; g.c., genital conus; gu., gut; ml., mediolateral rib; mo., mouth; nr., nerve ring; pb.p., prebursal papilla; pl., posterolateral rib; pv., posteroventral rib; s., spicule.

The copulatory bursa is made up of two large lateral lobes, and a smaller median dorsal lobe which is well defined and supported by a dorsal rib. The ribs of the bursa are large, tapering towards the bursal margin. Posteroventral rib thicker than the anteroventral rib, the tip curving anteriorly. The lateral ribs are of similar size, the tips reaching the margin of the bursa. The externodorsal rib is large, the tip not reaching the margin of the bursa. The dorsal rib short, main trunk 25μ in length, 12μ in width, dividing to give two further branches 25μ in length. These two branches do not divide further, but are obliquely truncated, the truncated margin having a scalloped appearance (Fig. 10).

An accessory bursal membrane is supported by slender diverging rays. The structure of the genital conus was difficult to determine. There appears to be a large sinus opening into a small median chamber, beneath which is a supporting structure in the form of an inverted U. The cloaca is found posterior to this (Fig. 11).

Female: Not known.

DISTRIBUTION: So far known only from the Mt Travers region.

DISCUSSION

The unbranched nature of the distal ends of the spicules and the simple dorsal rib, differentiate *Skrjabinagia monodigitata* n.sp. from all other species of the genus. Other species of the genus have two, sometimes three distal offshoots from the spicules, and more complex branching of the dorsal rib.

S. monodigitata was found in small numbers, forming in both hosts about 1% of the trichostrongylid population. As was the case in the previously described species, low population and insufficient diagnostic characteristics meant that the female of this species was unable to be separated from the females of other trichostrongylid species.

S. monodigitata was found in association with the following trichostrongylid species: *Spiculopteragia asymmetrica* and *S. böhmi.*

The effect of *S. monodigitata* on the red deer host appears to be nil, as the organs containing the parasite are free from nodules and lesions.

The origin of this parasite in the red deer is as yet unknown, but the presence of chamois in the area may have some bearing on this.

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