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SPINITECTUS GORDONI N. SP (NEMATODA: SPIRUROIDEA)
FROM BROWN AND RAINBOW TROUTS IN NW SPAIN

by

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SUMMARY

Spinitectus gordonii n. sp. a parasite of the esophagus (larvae) and stomach (adults) of brown and rainbow trout in León (NW Spain) is described. Altogether, 3,139 larvae and 973 adult worms were collected, and up to 39.6% of trout were found infected in the enzootic area. The proposed new species seems to be quite specific for trout, for 227 specimens of Cyprinidae and 4 of the Centrarchidae fishes living in the same habitat were unaffected. Comparisons are made with 70 *Spinitectus* spp., 12 of which are related, 41 clearly different and 17 as yet insufficiently described. Drawings of eggs, L 3, L 4, males and females are given.

INTRODUCTION

Spinitectus sp. was first found in trout in León province (NW Spain) by CORDERO-DEL-CAMPILLO *et al.* (22). Other specimens were later found by ALVAREZ-PELLITERO (3) in the same area, it thereby being confirmed that they were of the same species, which may be considered new. We propose the name *Spinitectus gordonii* n. sp. in memory of the great veterinary surgeon Félix Gordón Ordás.

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MATERIAL AND METHODS

The first specimens of *S. gordonii* n. sp. were taken from two brown trout from the River Orbigo, which were sent to our laboratory (20th of April, 1970) for determination of the cause of death (furunculosis). Apart from this worm we also found *Crepidostomum farionis* (Müller, 1784) Lühe, 1909 and *Crepidostomum metoecus* (Braun, 1900) Braun, 1900. The remaining worms come from among those gathered by Alvarez-Pellitero (*ibid.*) found in brown and a few rainbow trouts, caught with natural baits and lures (wet fly, dry fly, spinning lures etc) in the period 1971-1973, including spawning seasons. Geographical data concerning the infected fish are to be found in Table I (see also map). Altogether, 547 trout of about two years old or over were studied.

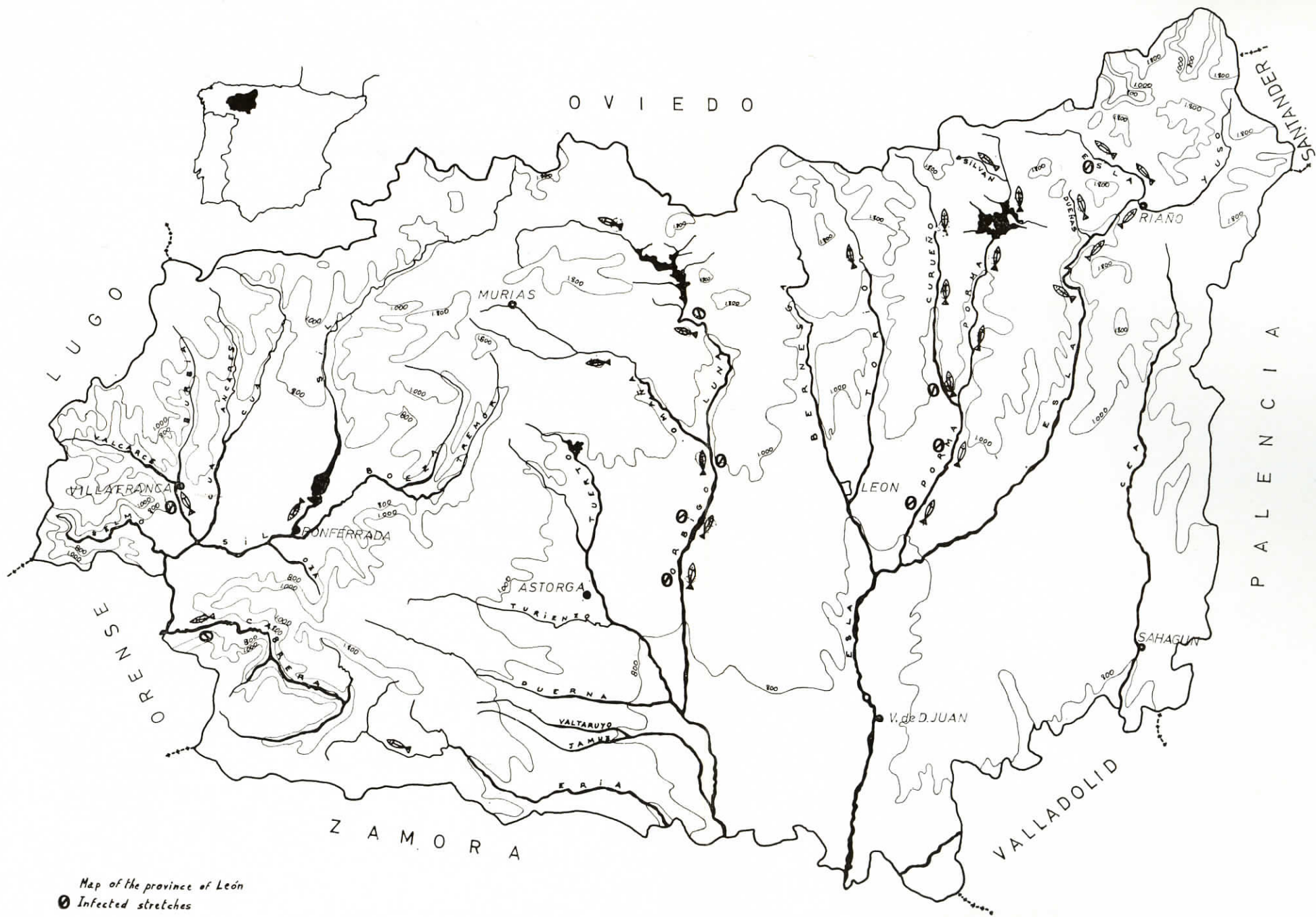
TABLE I

SPINITECTUS GORDONI n. sp.

PARASITIZED TROUTS WERE TAKEN FROM THE FOLLOWING PLACES:

Rivers	Stretches	Altitude (m)
Esla	Acebedo	1,160 - 1,125
Porma	Vegas del Condado	870 - 835
"	Puente Villarente	825 - 800
Curueño	Barrio de Ntra. Señora	890 - 875
Luna	Garaño	995 - 980
Omaña	El Castillo	1,075 - 1,010
Orbigo	Villarroquel	905 - 887
"	Carrizo de la Ribera	885 - 862
"	Sta. Marina del Rey	847 - 820
Burbia	Villafranca del Bierzo	520 - 480
Cabrera	Puente Domingo-Flórez	420 - 380

Notes: Rivers are ordered from E to W and higher to lower stretches. Altitude is that above the mean level of the Mediterranean off Alicante.



Map of the province of León
● Infected stretches

As other research was taking place simultaneously in the Department, other species of fish caught in the same places as the infected trouts were also examined so as to find out whether they harboured *S. gordonii*. They were of the following species: *Barbus barbus bocagei* Steind., 99 fishes; *Chondrostoma poly-lepis polylepis* Steind., 35; *Rutilus arcasi* (Steind.), 36; *Leuciscus cephalus cabeda* Risso, 29; *Cyprinus carpio* L., 15; *Cyprinus specularis* Lacep., 1; *Gobio gobio* (L.), 6; *Tinca tinca* (L.), 4; *Carassius carassius* (L.), 2 (all of them Cyprinidae, Cypriniforms) and *Micropterus salmoides* (Lacep.), 4 (*Centrarchidae*, Perciforms).

The digestive tracts of fish were dissected in Petri dishes with tap water or 0.9% salt solution, the worms being selected under the stereomicroscope. Fresh specimens were initially observed, followed by fixed extended ones (0.9% salt solution with 10% formalin). Special anatomic features were observed in specimens mounted in 70% ethyl alcohol with 10% glycerine and/or Amman's lactophenol, or gum arabic with choral. Other specimens were mounted *en face* in order to study the cephalic structures. Sections were made of material included in paraffin and stained with hematoxylin-eosin. Drawings were carried out by means of a *camera lucida* (Leitz, tube-S model). All measurements in mm. Hosts taxonomy is that of Golvan (29).

RESULTS

A total of 217 trouts (39.6%) harboured *S. gordonii* in numbers ranging from a single specimen up to 709 (one trout from River Forma, Puente Villarente stretch) and 924 (one trout from the Villafranca del Bierzo stretch of the River Burbia). In the former, the whole worm burden consisted of third and fourth stage larvae. In the latter, very few adults and many larval forms were found. Altogether, 3,139 larvae at various stages of development and 973 adults (316 males and 657 females; sex ratio: 1:2) were gathered. The average worm burden was 18.9.

The highest incidence was noticed in the lower reaches at altitudes of less than 900 m (at Acebedo alone -1,160-1,125 m-

two trout were found to harbour juvenile worms, but it cannot be ruled out that the fish had migrated upriver for spawning).

As far as the time of year is concerned, the highest rates of infection occurred in September and October.

Spinitectus gordonii is found in the esophagus (larvae) and stomach (adults).

No specimen of the Cyprinidae and Centrarchidae examined carried *Spinitectus* spp.

DESCRIPTION OF *SPINITECTUS GORDONII* N. SP.

(Adult worms, unless otherwise stated)

With characteristics of the genus *Spinitectus* Fourment, 1883. Medium size, males smaller than females. Cephalic end is tronco-conical, the caudal one narrowing after the cloaca (males) and the vulva (females), tapering more in the female than in the male.

Freshly caught specimens of both sexes are ivory in colour and opaque.

The cuticle has a pattern of rings (circlets, annules) formed by two independent symmetrical pieces, interrupted at the sides, which are very conspicuous towards the front of the body (the first 15-20 rings). Towards the rear part of the body the hemiannules tend not to meet exactly and become less conspicuous. The first two rings are closely set. The 3rd to 9-10th circlets are equidistant from one another, yet from the 11th onwards the distance gradually diminishes. In the 3rd and 4th larval stages the first 3 rings may be grouped together.

The rear edge of the annules bears spines directed posteriorly, whose basis is papilliform in appearance. The number of spines varies according to the position of the rings, and their size tends to decrease towards the posterior end where they become almost unnoticeable.

The oral aperture is terminal. On the cheilostoma two lateral pseudolips are to be observed, their free edges occasionally overlapping. Each lip has two small papillae, located one subdorsally and the other subventrally. Further from the centre there is also one amphid on each side, between the papillae. Am-

phids are also present in the 3rd and 4th larval stages. On the dorsal and ventral borders of the oral aperture a structure is to be observed, which some authors consider to be a lip (CAMPANA-ROUGET, 14), but which we do not consider to be worthy of the name.

The prostoma (oral cavity, pharynx, oral capsule, vestibulum etc., according to the author in question) is divided into a forward, slightly expanded part and a rear tubular one. This arrangement is quite evident when one examines the specimen from the side. When viewed lying dorsally or ventrally the walls (prorhabdion) seem parallel. This indicates that its anterior part is laterally flattened. The telostoma (glottoid apparatus) is evident even in juveniles. The entire cavity is sclerotized as may be seen when the worm is in ecdysis, as it is sloughed off together with the cuticle. The structure does not seem to be very rigid, as it bends in different directions.

The cephalic region may appear invaginated in such a way that the first circlet of spines might vary in its distance from the anterior end. The measurements given below were obtained from relaxed specimens.

The nervous ring is situated at the level of the 2nd spiny ring or a little behind it. The excretory pore opens near the 4th ring.

The esophagus is comprised of two well-differentiated parts: a short, narrow muscular one, and a glandular one ending in the esophago-intestinal valve. There are no cervical papillae.

MALE (Description arrived at from 10 mature specimens) (Fig. 1: A, B, C. Fig. 2: D, E, F, G, H).

Length: 2.660-4.650; width: 0.046-0.065 at head, 0.114-0.213 in anal region. Stoma: 0.039-0.054 by 0.013-0.016 (widest part) or 0.006-0.009 (tubular part). Distance from anterior end to nerve ring: 0.089-0.133; to excretory pore: 0.165-0.204. Muscular esophagus: 0.190-0.290 long by 0.023-0.026.

Glandular esophagus 0.912-1.481 by 0.056-0.066. Muscular/glandular ratio: 1:4.9. Esophagus/total length ratio: 1:2.4. Tail spirally coiled. Caudal alae beginning shortly before the cloaca and extending 0.290-0.330 long (0.023-0.052 at their maximal width) supported by ten pairs of pedunculated papillae: 4 preanal, 1 adanal, and 5 postanal. The preanal, adanal, and two an-

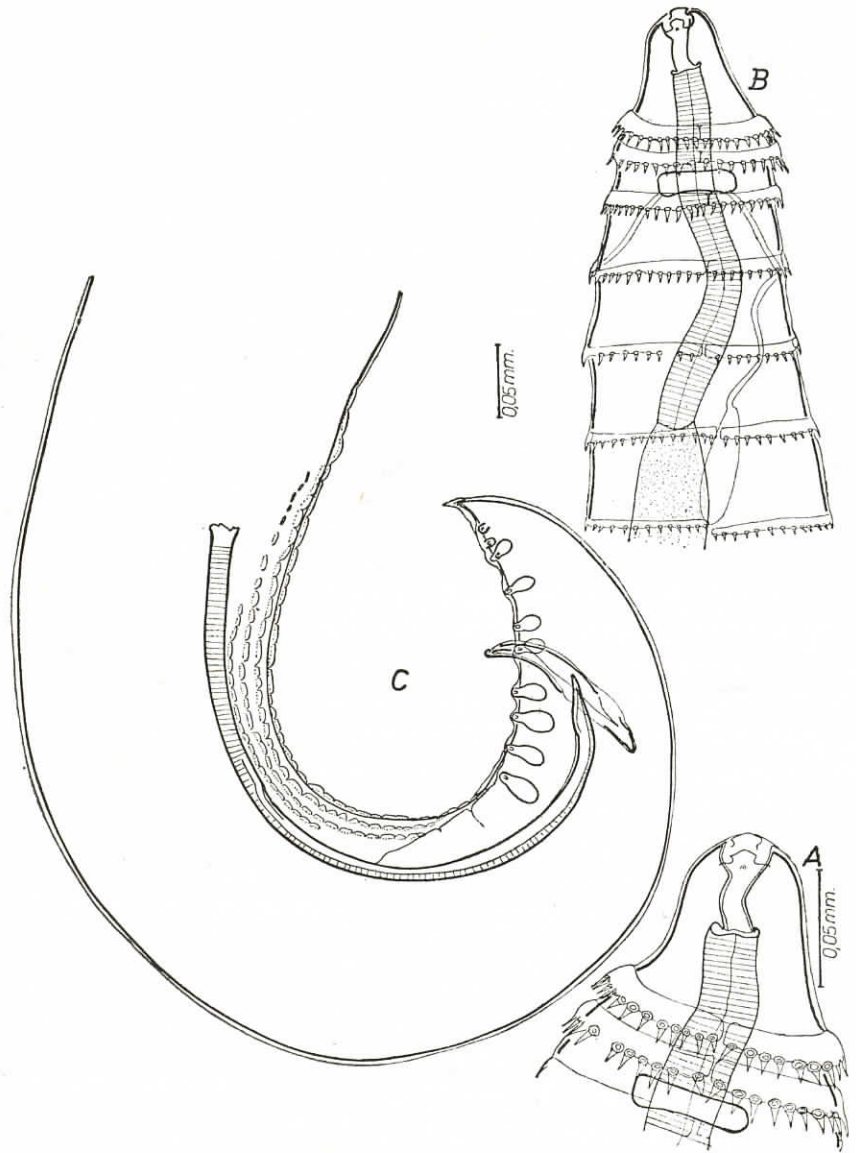


Fig. 1: A, cephalic end of an adult male (lateral view); B, same, showing esophageal region; C, caudal end of and adult male (lateral view)

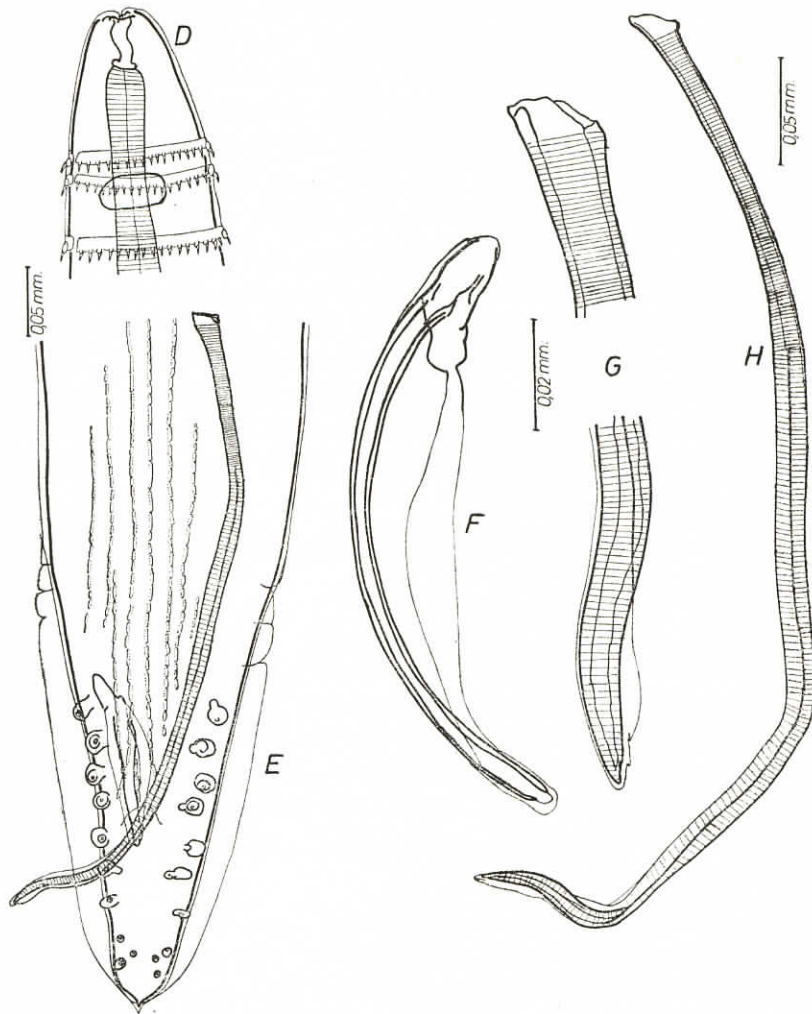


Fig. 2: D, cephalic end of an adult male (ventral view); E, caudal end of an adult male (ventral view); F, right spicule; G and H, left spicule

terior pairs of postanal papillae are bottle-shaped and equidistant. The last 3 pairs are more distant and smaller, and the penultimate one ventrally located. Size of caudal papillae is as follows: first to seventh pairs: 0.019-0.033, eight pair 0.016-0.020, ninth and tenth pairs: 0.006-0.008. Up to nine parallel cuticular ridges present, extending cephalad from the precloacal region.

Spicules unequal, dissimilar, on the left 0.370-0.450 in length with proximal end somewhat widened, and distant part provided with a very narrow aliform expansion on its ventral edge, ending with two cuts. Final part of this spicule curved into an S. Right spicule boat-shaped, 0.082-0.119 in length, hollowed so as to allow the slipping of the left spicule. No gubernaculum. Tail 0.099-0.115 long with small fine spine.

Spinous annules 80-100 in number, the first of which is at 0.072-0.119 from the anterior end. Distance between the first and second circlet of spines 0.014-0.022, from the third up to the tenth 0.042-0.050, from the tenth onwards 0.028 or less. The number of spines varies according to the situation of the annules, being 32-40 in the first, 36-52 in the second, and 44-58-60 at the seventh or eight. The free part of the spines is 0.007-0.008 long by 0.003 at their bases.

FEMALE (Description arrived at from 10 mature specimens). (Fig. 3: I, J, K).

Length: 3.125 to 5.07; width: 0.057 to 0.079 at head, 0.190 to 0.370 in vulvar region. Stoma: 0.046-0.065 by 0.023-0.026 (widest anterior part) or by 0.011-0.013 (tubular part). Distance from anterior end to nerve ring: 0.099-0.138; to excretory pore: 0.170-0.240. Muscular esophagus 0.240-0.310 long by 0.026-0.029 wide. Glandular esophagus 1.060-1.540 long by 0.059-0.078 wide. Muscular/glandular ratio: 1:4.7. Esophagus to body length ratio: 1: 2.5.

The vulva has slightly prominent lips, in the second half of the body, at 0.690-0.980 from the tip of tail. Pre-vulva/post-vulva ratio: 3.8:1. Vagina strongly muscular, anterior, 0.096 long in nonfertile females and 0.115-0.165 in gravid ones, ovejector included. Uteri initially anterior and parallel, shortly afterwards amphidelphic extensively coiled, filling almost entire width of nematode, usually full of eggs. The anterior uterus is loosely coiled, looping anterior up to the junction of muscular and glandular esophagus or even further anterior; posterior uterus in coiled loops in posterior preanal part of the body. Eggs elliptical with thick, smooth wall, without polar filaments, containing coiled embryo at oviposition and measuring 0.039-0.045 by 0.023-0.033. Tail 0.089-0.115, slenderly tapering.

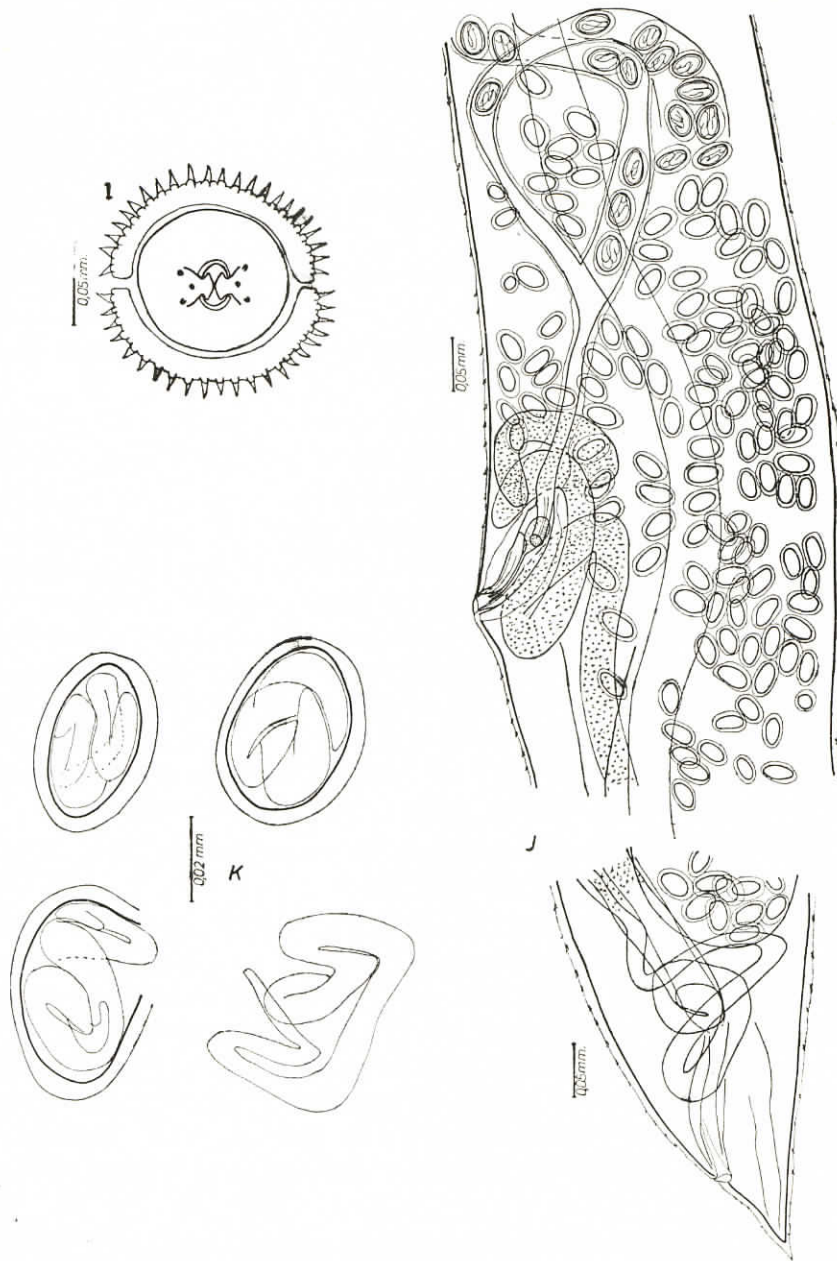


Fig. 3: I, *en face* view of an adult female; J, vulvar and caudal part of a gravid female; K, embryonated eggs and a first stage larva

The circlets of spines varied in number from 174 to 250, the first one at 0.099-0.133 from the anterior end, the last annules reaching practically the caudal end. The number of spines ranging from 40 to 48 (first annule), 42-52 (3rd annule), 56-62 (7th) and 64-68 (8th to 18th).

The distance between the first and second circlet of spines is 0.016-0.022 and thenceforth 0.039-0.049 up to the 9th, and thereafter 0.019-0.025 or less.

Length of free part of spines: 0.006-0.011 by 0.005 at their bases.

3rd STAGE LARVAE (Description arrived at from 10 specimens). (Fig 4: L, M, N.)

Given that these larvae were recovered from trout, it was assumed that they were in transition to the 4th stage.

Length: 1.26-2.39; width: 0.033-0.042 at head, 0.066-0.148 at widest part. Stoma provided with conspicuous lateral pseudolabia. Labial papillae and amphids evident. Stoma: 0.033-0.049 long by 0.009-0.013 (widest anterior part) or 0.003-0.004 (tubular part). Telostoma evident. Nerve ring at the level of the 3rd annule, 0.062-0.112 from the anterior end. Excretory pore not very evident, at the level of the 5th annule, 0.180-0.181 from anterior tip. Muscular esophagus: 0.108-0.224 long by 0.013-0.016. Glandular esophagus: 0.469-0.877 by 0.066-0.082. Tail straight, conical, 0.049-0.079 long, ending with a small caudal spine.

The genital primordium occupies an extension from 0.798-1.390 to 1.260-2.190 from anterior tip.

Spinous annules 54-56 in number (0.006 thick), 12-14 of them clearly visible and regularly located, whereas from there onwards some are dislocated or incomplete. First annule at 0.042-0.082 from the anterior tip. All first three circlets are closer together with a uniform distance between them (0.009-0.013). From the 3rd onwards, distance becomes greater (0.029-0.042). Number of spines varies, first annule bearing 14-22, 3rd 24-26, 5th 27-34 and 7th 30-42. Length of free part of spines: 0.003-0.004.

Some specimens were undergoing ecdysis, with new spines already formed inside the old cuticle.

4th STAGE LARVAE (Transitory stage to juveniles)

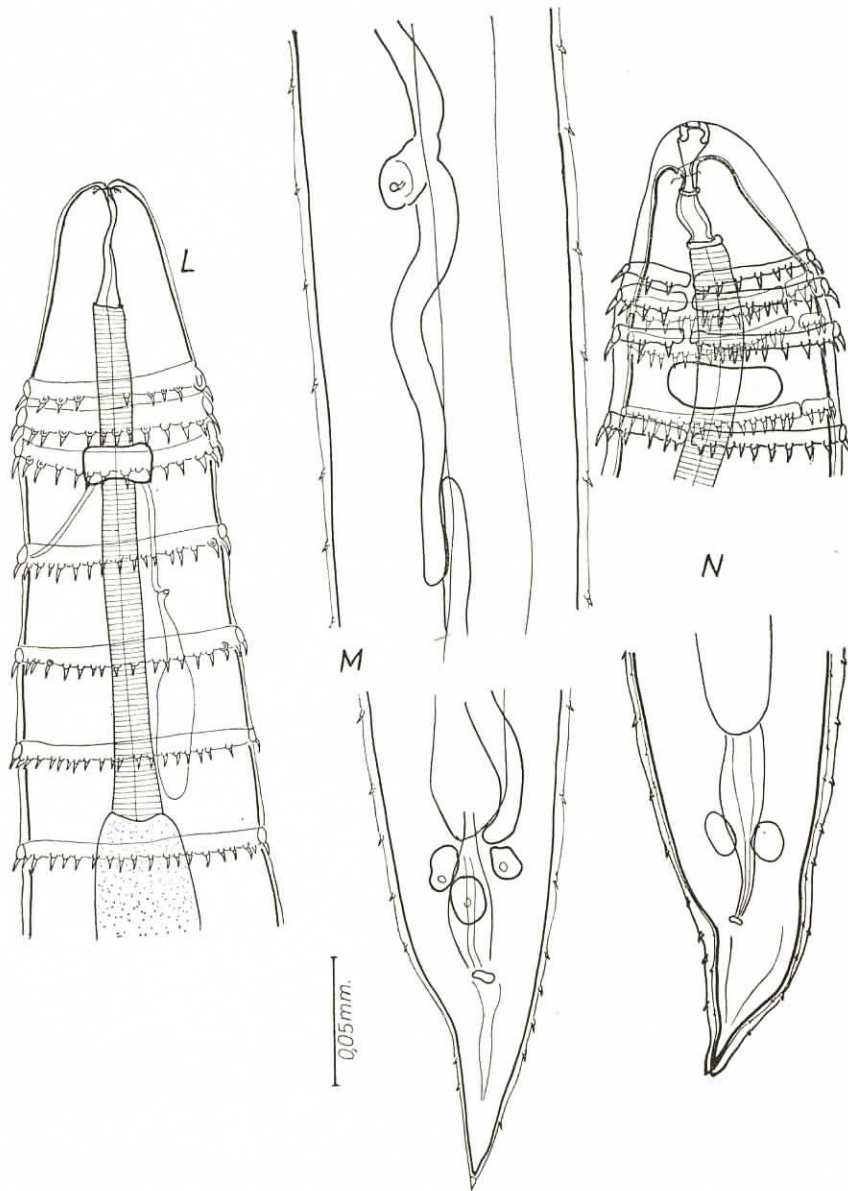


Fig. 4: L, III stage larva, transitory to IV (cephalic end); M, same (L), genital and caudal parts (Ventral view); N, III stage larva, on the way of undergoing ecdysis (ventral view)

MALE (Description arrived at from 8 specimens). (Fig. 5: O, P, Q, Fig. 6: R, S.)

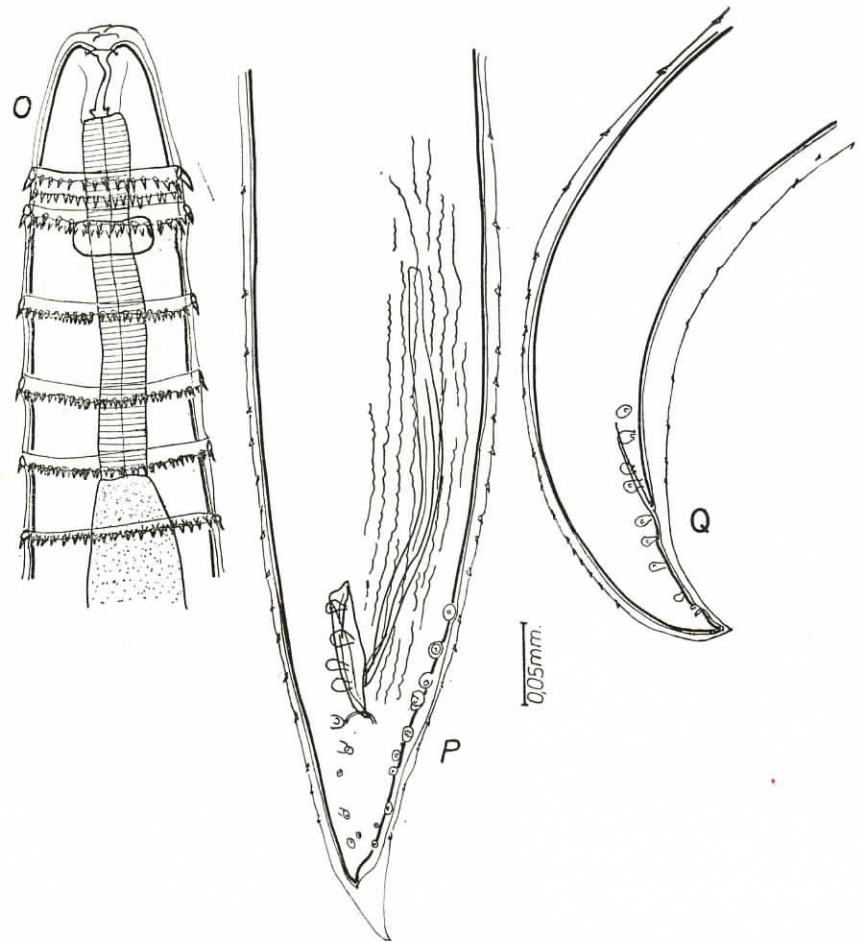


Fig. 5: O, cephalic end of IV stage larva, undergoing ecdysis (ventral view); P, caudal end (ventral view) of male; Q, same (lateral view).

Length: 2.069-2.660; width: 0.042-0.056 at head, 0.115-0.165 at widest part. Conspicuous lateral pseudolabia, bearing labial papillae and amphids. Stoma: 0.036-0.039 long by 0.018 (widest anterior part) or 0.006-0.009 (tubular part). Telostoma evident. Nerve ring between 2nd and 3rd annules, at 0.082-0.092 from

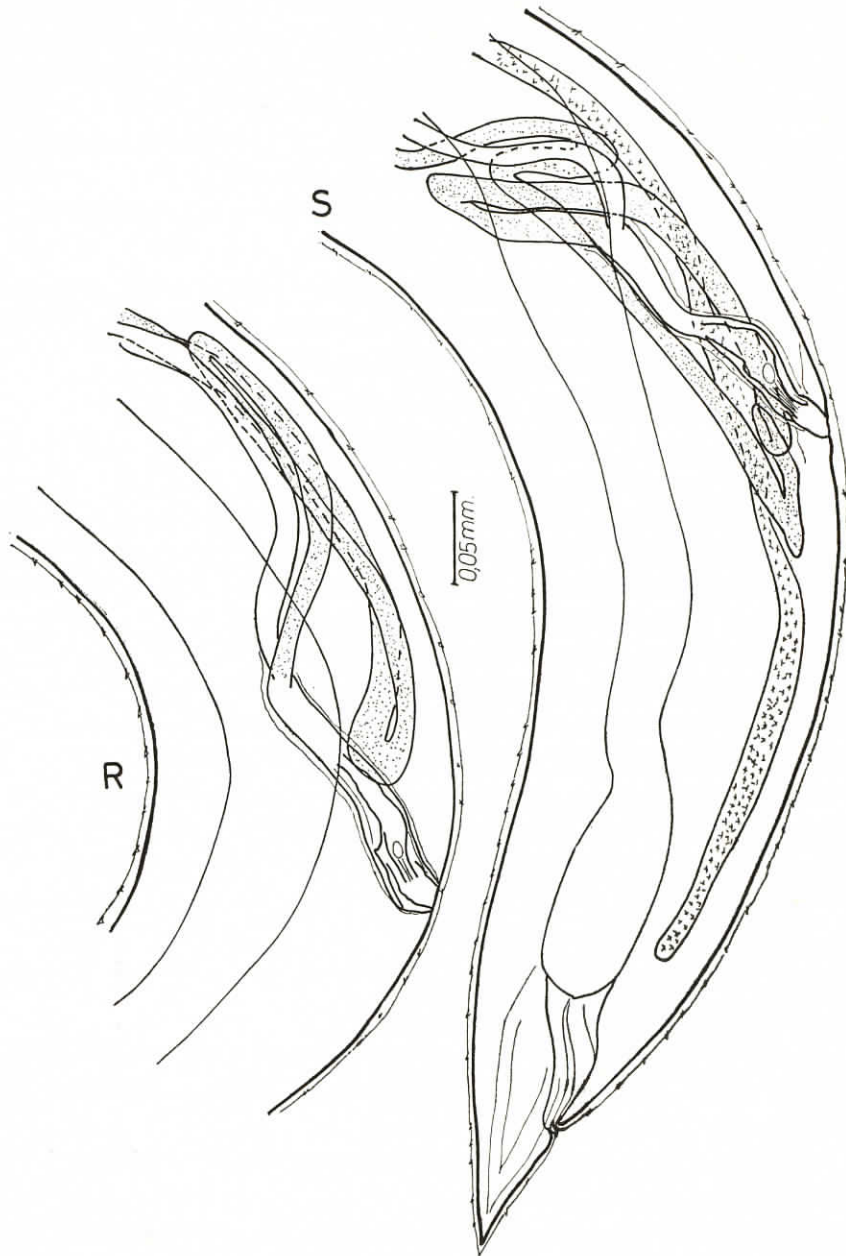


Fig. 6: R, vulvar zone of larva IV; S, caudal end of larva IV more developed than (R).

anterior tip. Excretory pore not always visible, at 0.154-0.190 from anterior end, about the level of 4th annule. Muscular esophagus: 0.211-0.227 long by 0.019-0.026. Glandular esophagus: 0.811-0.950 long by 0.046-0.092. Tail slightly ventrally curved, 0.082-0.108 long. Spicules are in process of development and therefore not always conspicuous. When visible, the left one is 0.244-0.247 long and the right one 0.075-0.085. Caudal papillae are also developing.

Spinous annules are 75-98 in number (0.009 thick), bearing 34-38 spines the first, 38-42 the 3rd, 40-50 the 7th one. Spines are 0.005-0.007 in length (free part).

Female (Description arrived at from 8 specimens)

Length: 2.99-3.32; width: 0.049-0.059 at head, maximum 0.148-0.230 anterior to vulvar (at vulva: 0.138-0.198). Stoma with evident lateral pseudolabia, bearing papillae and amphids. Stoma: 0.039-0.052 long by 0.009-0.016 (anterior part) or 0.006 (tubular part). Telostoma well developed. Nerve ring at the level of 2nd and 3rd annules (0.095-0.132 from anterior tip), and excretory pore at the level of 4th circlet (0.165-0.210 from anterior end). Muscular esophagus: 0.220-0.263 long by 0.023-0.029. Glandular esophagus: 0.983-1.098 by 0.059-0.079. Tail: 0.066-0.082 long, tapering to a point. Rectum: 0.082-0.085 long.

Vulva obliterated, at 0.475-0.617 from posterior end. Vagina 0.049-0.072 long, well developed. Uteri initially parallel anteriorly directed, but soon amphidelphic as in the adult female.

Spinous annules are 135-178 in number, 0.009-0.013 thick, bearing 34-42 spines (first), 44-48 (3rd), and 54-62 (7th). The free part of the spines is 0.008 long. Only the first two annules are close together, as in the adult.

Several specimens, both male and female, were undergoing ecdysis, with the same characteristics already described for larva 3.

HOSTS: *Salmo trutta* m. *fario* L. and *Salmo gairdneri* RICHARDSON.

LOCALITIES: Acebedo (River Esla), Vegas del Condado and Puente Villarente (River Porma), Barrio de Nuestra Señora (River Curueño), Garaño (River Luna), El Castillo (River Omaña), Villarroquel, Carrizo de la Ribera and Santa Marina del Rey

(River Orbigo), Villafranca del Bierzo (River Burbia) and Puente Domingo Flórez (River Cabrera).

All localities in León (NW Spain).

LOCATION: Esophagus (larvae) and stomach (adult).

HOLOTYPE MALE: Departamento de Patología infecciosa y parasitaria, Facultad de Veterinaria and Estación Agrícola Experimental, León (Spain). Collection No. PA-1. (From River Orbigo, Carrizo de la Ribera).

ALLOTYPE: Collection No. PA-2 (same locality as Holotype).

PARATYPES: Collection No. PA-3 (same locality).

DISCUSSION

The criteria used for distinguishing the species of the genus *Spinitectus* Fourment, 1883 vary greatly depending on the authors. In the first place, quite a number of species have been described as a result of studying a single specimen, even an incomplete or sexually immature one. Occasionally, different parts of the body, with no consideration being made of normal variation within the species. Furthermore, it has not always been taken into account whether the worms were studied properly extended or contracted.

Under such conditions, it is no wonder that there has been a tendency to reduce certain species to synonymy (Sood, 72; KALYANKAR, 35) and that such proposals have been criticized (SAHAY, 66). A revision of *Spinitectus* spp. is, therefore, needed as Kalyankar's work (38) for example covers only 31 species.

In our opinion absolute values of measures are important only after the study of sufficient specimens, or when the measures differ greatly. We consider to be far more valid the size relationships of anatomical structures, such as the total length of the body compared with that of the esophagus; the ratio of the muscular to the glandular part of the esophagus the pre-vulva/postvulva ratio; the direction of the vagina; shape, size, and the stage of development of eggs; the spicule ratio; the number, shape, and position of the anal papillae; the presence or absence of caudal alae. Finally, to all these data there should be added and adequate description of the cheilostoma which,

for many species, has been poorly described, if at all; and the hosts and the location of the parasites, together with the geographical distribution, should be mentioned.

Using these criteria we have compared *Spinitectus gordonii* n. sp. with all hitherto known species which, for convenience, will be arranged in alphabetical order.

In addition to the above special mention is required by *Neospinitectus ophiocephali* Kalyankar, 1971. This new genus has been established owing to the presence of three pairs of forwardly directed dent-like structures in front of the first circlet of spines, and one simple single ring, anteriorly with annulations between it and the first ring of spines. Host: *Ophiocephalus punctatus* (Ophiocephalidae, Perciforms). Location: stomach although, the author states in the summary "a single male was once recovered from the wall of the oesophagus" (*sic!*). Distribution: Aurangabad, Maharashtra, India.

In relation to *Spinitectus gordonii* n. sp. the *Spinitectus* spp. may be divided into three groups: a) Those clearly different from it; b) Those more akin to it; and c) Those which are incompletely described.

a) Differences from *S. gordonii* n. sp. are as follows:

Spinitectus agonostomi Moravec et Barus, 1971 (Description from a single male!). Larger stoma, muscular/glandular esophagus ratio, spicule ratio, tail length, and number of rings. Host: *Agonostomus monticola* (Mugilidae, Mugiliforms). Location: intestine. Distribution: Cuba.

S. agrawali Gupta et Verma, 1970

Symmetrical spicules. Host: *Notopterus notopterus* (Notopteridae, Clupeiforms). Location: intestine. Distribution: Lucknow, India.

S. asperus Travassos, Artigas et Pereira, 1928

(Description from a single female!). Longer, with elongated stoma; vulvar situation, tail length and size of spines and eggs. Host: *Prochilodus scrofa*. (Anostomidae, Cypriniforms). Location: intestine. Distribution: Sao Paulo, Brazil.

S. bancrofti Johnston et Mawson, 1940

Males larger with shorter stoma, esophagus/total length of the body ratio, larger spicules with different ratio, number of anal papillae; females were immature, with different vulvar situation. Host: *Mogurnda adspersa* (Eleotridae, Perciforms). Location: Intestine. Distribution: Australia.

S. batrachi Lal, 1966

Four lips (!), big muscular esophagus, spicule ratio and postanal papillae; females are longer and thinner, with different situation of vulva and tail length; eggs smaller, and fewer spines in both sexes. Host: *Clarias batrachus* (Clariidae, Cypriniforms). Distribution: India.

S. beaveri Overstreet, 1970

Longer, thinner with large stoma, fewer spines, spicule ratio, number and position of anal papillae, vulva position, and anterior vagina. Host: *Albula vulpes* (Albulidae, Clupeiforms). Distribution: Florida, USA.

S. bengalensis Chakravarty, Sain et Majumdar, 1961.

Females smaller with fewer spines; esophagus and spicule ratios, number and position of postanal papillae, vulva position. Host: *Notopterus notopterus* (Notopteridae, Clupeiforms). Distribution: Calcutta, India.

S. carolini Holl, 1928

3 lips (!), shape, size and ratio of spicules; fewer postanal papillae and preanal cuticular ridges; more rings with more spines; vulvar position, and posterior vagina; eggs smaller. Hosts: *Eupomotis gibbosus*, *Chaenobryttus gulosus*, *Ambloplites rupestris*, *Micropterus dolomieu*, (Centrarchidae Perciforms) in Lake Oneida, North Carolina, USA, Holl (32) recorded it also in *Triturus viridescens* (Salamandridae, Urodela). Odlaug, Arsenau and Brownell (59) found it in *Esox lucius* (Esocidae, Clupeiforms) and *Stizostedion vitreum* (Percidae, Perciforms) in Lake Basswood, Minnesota, USA. Becker et al. (11) enlarged the host list including *Micropterus punctulatus* and *M. salmoides* (Centrarchidae, Perciforms) in the Beaver Reservoir, White River, Arkansas, USA, as did McGraw and Allison (49) with *Lepomis cranellus* and *L. macrochirus* (Centrarchidae, Perciforms) in the Little River System, Texas, USA. Voth and Larson (79) also re-

corded it in North Dakota, USA, in *Lepomis macrochirus*. Spall (73) reported it in *Apeodinotus grunniens* (Sciaenidae, Perciforms) at Lake Clark Blackwell, Oklahoma, USA. Dechtiar (24) observed it in *Ameiurus nebulosus* (= *Ictalurus nebulosus*) (Ameiuridae, Cypriniforms) and *Ambloplites rupestris* (Centrarchidae, Perciforms) in the Lake of the Woods, Ontario, Canada. Lastly, Hoffman (31) adds to the list of hosts and localities with *Amia* spp. (= *Apogon* spp., Apogonidae, Perciforms) and *Roccus* spp. (Moronidae, Perciforms) in Wisconsin, Ohio, Tennessee and Maine, USA.

S. clariasi Xa-Ky, 1971

Longer and thinner, with shorter esophagus, smaller spicules with different ratio, more postanal papillae which are differently arranged; vulva further back and smaller eggs. Host: *Clarias fuscus* (Clariidae, Cypriniforms). Location: gastro-intestinal. Distribution: North Viet-Nam.

S. corti Moorthy, 1938

Smaller and with fewer rings, bearing fewer spines, inconspicuous lips, shorter esophagus with different muscular/glandular ratio; also different spicule ratio and situation of vulva; smaller eggs. Host: *Ophiocephalus gachua* (Ophiocephalidae, Perciforms). Distribution: Hyderabad Deccan, India.

S. echeneis Parukhin, 1967

(Description from males!). Longer and wider, without conspicuous lips; smaller oral cavity, more circlets bearing more spines; spicule ratio and postanal papillae different. Host: *Echeneis naucrates* (Echeneidae, Perciforms). Location: Intestine. Distribution: Gulfs of Tongking and Siam.

S. fossili Lal, 1966

Longer but thinner with four lips (!) and larger oral cavity; fewer spines, different spicule ratio and number and position of postanal papillae; position of vulva and smaller eggs; tail length. Host: *Heteropneustes fossilis* (Clariidae, Cypriniforms). Distribution: India. Kalyankar (35) considers this species as a synonym of *S. major* Khera, 1954.

S. gigi Fujita, 1927

Larger, with fewer but longer spines; spicule ratio, smaller eggs and different vulvar location. Host: *Pelteobagrus nudiceps*

(Fujita, 1927). Distribution: Lake Biva (Japan). Bielous (12) mentions it in *Pseudobagrus nudiceps* and *Ps. fulvidraco* from River Iman (Far-East USSR).

S. guntheri Baylis, 1929

Comparatively very large; spicule ratio, distribution and number of anal papillae, situation of vulva. It has a peculiar spine arrangement, as in the first rings they are anterior and then posterior. Host: fish of undetermined species, living at a depth of about 1,000 m caught off the coast of south-west Africa. Campana-Rouget (13) considers that it may be a *Metabronema* sp.

S. indicus Verma et Agrawal, 1932

Male with symmetrical spicules; arrangement and number of anal papillae, no caudal alae, situation of vulva and posterior vagina. Host: *Pseudotropius garua* (Schilbeidae, Cypriniforms). Khan and Yaseen (43) found it also in *Wallago attu* (Siluridae, Cypriniforms). Distribution: Mathura and Gorakhpur (Verma and Agrawal, 78) and Dacca (Khan and Yaseen, *ibid.*), India.

S. komiyai Sahay et Prasad, 1965

Much greater length, fewer rings, inconspicuous lips, shorter oral cavity, spicule ratio, number and distribution of anal papillae and vulva situation. Host: *Eutropichthys vacha* (Schilbeidae, Cypriniforms). Location: intestine. Distribution: Patna, Bihar, India.

S. longipapillatus Ali, 1956

Fewer spines, spicule ratio, number and distribution of anal papillae, situation of vulva. Eggs are more elongated. Host: *Rita hastata* (Bagridae, Cypriniforms). Distribution: Hyderabad Deccan, India.

S. major Khera, 1954

Longer and thinner, lipless, with fewer spines, spicule ratio, no caudal alae and different distribution of postanal papillae; vulva situation and smaller eggs. Host: *Mastacembelus armatus* (Mastacembelidae, Mastacembeliforms). Location: intestine. Distribution: India.

S. mastacembeli Karve et Naik, 1951

Somewhat larger, with fewer but larger spines, spicule ratio, and postanal papillae, smaller eggs. Hosts: *Mastacembelus armatus* (Mastacembelidae, Mastacembeliforms), *Notopterus notopterus* (Notopteridae, Clupeiforms), in Poona and Nagpur, India. Sood (72) adde *Bagarius bagarius* (Bagridae, Cypriniforms) from River Gomti in Lucknow, India. Cood (*ibid.*) considers that *S. corti*, *S. major*, *S. thapari*, *S. armatus*, *S. singhi* and *S. bengalensis* are synonyms of this species.

S. micracanthus Christian, 1972

Longer but thinner, length of the esophagus, spicule ratio only two preanal cuticular ridges, vulva position, tail length. Host: *Lepomis macrochirus* (Centrarchidae, Perciforms), Location: intestine. Distribution: Ohio, USA. This species was described under the name of *S. microspinus* Christian, 1969.

S. minor (Stewart, 1914) Baylis, 1929

(Only males!). Shorter and thinner with fewer but longer spines, very short esophagus; spicule ratio, and distribution of anal papillae. The original description and Ali's (1956) differ as regards spicules and distribution of caudal papillae. Hosts: *Wallago attu* (Siluridae, Cypriniforms). Distribution: Lucknow and Hyderabad Deccan, India.

S. mogurndae Yamaguti, 1935

(Only females!). Thinner, with fewer spines and different esophagic and vulvar ratios; smaller eggs and shorter tail. Host: *Mogurnda obscura* (Electridae, Perciforms). Location: gastrointestinal. Distribution: India and Japan (Lake Ogura-Ko).

S. mollis Mamaev, 1968

Longer; spicule ratio, number and distribution of postanal papillae, vulva situation; smaller eggs with polar plugs, these perhaps with filaments. Host: *Euthynnus affinis* (Thunnidae, Perciforms). Distribution; South China Sea. Mamaev (48) provisionally included this species in the genus.

S. neilli Karve et Naik, 1951

Larger but thinner, with smaller oral cavity, fewer spines; spicule ratio, number and distribution of postanal papillae, vul-

var ratio, posteriad vagina and larger eggs. Host: *Barbus neilli* (Cyprinidae, Cypriniforms). Distribution: India.

S. notopteri Karve et Nait, 1951

(Description from a single male!). Fewer spines and different spicule ratio, number and position of anal papillae. Host: *Notopterus notopterus* (Notopteridae, Clupeiforms). Distribution: Poona, India.

S. ophiocephali Xa-Ky, 1971

Female somewhat larger but thinner, with bigger oral capsule. Vulvar and spicular ratios; female's tail length and egg size different. Host: *Ophiocephalus maculatus* (Ophiocephalidae, Perciforms). Location: gastro-intestinal. Distribution: Ko-Bi, Reservoir, North Viet-Nam.

S. oviflagellis Fourment, 1884

Male longer but thinner, with fewer but longer spines. Stoma provided with 4-5 tooth-like projections, larger oral cavity and shorter esophagus; spicule ratio. Eggs with polar filaments. Host: *Merlangus vulgaris* (= *Gadus merlangus*) (Gadidae, Gadiforms). Distribution: Western Scotland and English Channel (Schuermans-Stekhoven, 69; Skrjabin *et al.*, 70; Rahman, 63).

S. pacificus Sobolev et Belogurov, 1969

Much larger but finer, with ring differently arranged and having fewer spines; spicule ratio and vulva location different; Host: *Cololabis saira* (Scombresocidae, Beloniforms). Distribution: Pacific Ocean, 41° N, 164° E.

S. palawanensis Schmidt et Kuntz, 1969

Larger, with spinous rings progressively more distant, spicule ratio and distribution of caudal papillae. Host: *Euthynnus yaito* (Thunnidae, Perciforms). Location: intestine. Distribution: Puerto Princesa, Philippines.

S. pandei Rai, 1969

Longer, with fewer circlets bearing fewer but larger spines; spicule ratio and position of postanal papillae, vulvar ratio and narrower eggs. Host: *Eutropichthys vacha* and *Pseudeutropius garua* (Schilbeidae, Cypriniforms). Location: intestine. Distribution: Gorakhpur, India.

S. pandharinathi Kalyankar, 1973

Smaller, with fewer but longer spines, inconspicuous lips, shorter esophagus; spicule ratio anal papillae, and vulva position. Host: *Ophiocephalus striatus* (Ophiocephalidae, Perciforms). Distribution: Aurangabad, India.

S. petrowi Bielous, 1965

Males somewhat shorter, but females larger, both sexes finer, shorter esophagus; spicule ratio, caudal papillae and vulva situation different; smaller eggs, Host: *Pseudobagrus fulvidraco* (Bagridae, Cypriniforms). Distribution: River Iman, Amur Basin (Far-East USSR). Finogenova (25) considers this species as probable synonym of *S. gigi*.

S. percalates Johnston et Mawson, 1940

Larger, with shorter esophagus, different spicule ratio and anal papillae. Host: *Percalates colonorum* (Serranidae, Perciforms). Distribution: River Murray, Australia. Khera (44) considers this species as synonym of *S. plectroplites*.

S. plectroplites Johnston et Mawson, 1940

(Only females!). Longer, with shorter esophagus and different vulvar situation. Host: *Plectroplites ambiguus* (Serranidae, Perciforms). Location: gill mucus. Distribution: Australia.

S. pseudeutropii Agrawal, 1965

Longer, with fewer but longer spines; cervical papillae present; spicule ratio, distribution of anal papillae and position of vulva different. Phasmids evident; smaller eggs. Host: *Pseudeutropius garua* (Schilbeidae, Cypriniforms). Location: intestine. Distribution: River Gomti, Lucknow, India.

S. ranae Morishita, 1926

With fewer circlets bearing also fewer spines. The 2nd-5th annules closer together. Esophagus, spicules, anal papillae, preanal cuticular ridges, position of vulva, egg size and tail length different. Hosts: *Rana nigromaculata* (Ranidae, Anura). Distribution: Japan.

S. rodolphieringi Vaz et Pereira, 1934

With fewer annules; esophagus, spicule ratio, number and distribution of anal papillae, situation of vulva (only one imma-

ture specimen!) different. Hosts: *Pimelodella lateristriga* (Pimelodidae, Cypriniforms) and *Salminus hilarii* (Characidae, Cypriniforms). Location: intestine. Distribution: Rio Grande, Brazil.

S. tamari Naidenova, 1966

Longer, with fewer spines and different spicules and situation of vulva; eggs provided with double filament on one polar plug. Hosts: *Gobius batrachocephalus* (Gobiidae, Perciforms) and *Gaidropsarus mediterraneus* (Gaidropsaridae, Gadiforms). Location: intestine. Distribution: Black Sea (USSR).

S. yorkei Travassos, Artigas et Pereira, 1928

It is thicker and the female larger. Both sexes with fewer spines. Oral cavity larger, spicules smaller, although the spicule ratio is similar to that of *S. gordonii*. Anal papillae both different in number and distribution, as is the vulvar position. Host: *Pimelodella lateristriga* (Pimelodidae, Cypriniforms). Location: intestine. Distribution: Sao Paulo, Brazil.

Spinitectus sp. Baeva, 1965

Larger, but thinner, with fewer spines; esophagous, spicules, and anal papillae different. Host: *Cololabis saira* (Scombresocidae, Beloniforms). Location: intestine. Distribution: SE coast of Honshu, E. of Hokkaido and open Pacific Ocean (Japan).

b) *Spinitectus* spp. more akin to *S. gordonii* n. sp.

In order to facilitate comparison of *Spinitectus gordonii* n. sp. with the more related species the most significant data are summarized in table II below.

In addition, the following details are also significant:

S. alii Kalyankar, 1970

Is a parasite of *Notopterus notopterus* (Notopteridae, Clupeiforms) found in Nanded, Maharashtra, India.

S. allaeri Campana-Rouget, 1961

Lives in the following hosts: *Lates albertianus* and *L. niloticus* (Serranidae, Perciforms); *Mormyrus cashire* (Mormyridae, Clupeiforms); *Alestes dentex* (Characidae, Cypriniforms); *Bagrus bayad* and *B. docmac* (Bagridae, Cypriniforms); *Eutropius*

niloticus (Schilbeidae, Cypriniforms); *Malapterurus electricus* (Malapteruridae, Cypriniforms); *Clarias lazera* and *Xenoclaris eupogon* (Clariidae, Cypriniforms); *Synodontis schall* (Mochocidae, Cypriniforms). Distribution: Lakes Kivu, Edward and Albert, Central Africa (Campana-Rouget, 14); Lake Victoria, Uganda, (Khalil and Thruston, 42); Cairo, Egypt (Moravec, 52).

S. armatus Ali, 1956

Parasite of *Mystus tengara* (Bagridae, Cypriniforms). Distribution: Hyderabad Deccan, India.

S. cristatus Railliet et Henry, 1915

Has been described in *Phycis tenuis* and *Molva molva* (Gadidae, Gadiforms) off Nantucket Island and Porcupine Bank, Massachusetts, USA; and *Lophius piscatorius* (Lophiidae, Lophiiforms) off the British Isles (Williams, 81).

S. gracilis Ward et Magath, 1917

Inhabits the intestine of many species. Skrjabin *et al.* (70) mentioned it in *Esox lucius*, *E. niger* and *E. vermiculatus* (Esocidae, Clupeiforms), *Lota maculosa* (Gadidae, Gadiforms), *Pomoxis sparoides* (Centrarchidae, Perciforms), *Salmo trutta m. fario* (Salmonidae, Clupeiforms), *Ameiurus nebulosus* and *A. m. melas* (Ameiuridae, Cypriniforms), *Leucichthys artedi tullibae* (Coregonidae, Clupeiforms), *Ambloplites rupestris*, *Eupomotis gibbosus* (Centrarchidae, Perciforms), *Aplodinotus grunniens* (Sciaenidae, Perciforms), *Coregonus clupeiformis* (Coregonidae, Clupeiforms), *Eucalia inconstans* (= *Culaea* sp., Gasterosteidae, Gasterosteiforms), *Ictalurus punctatus* (Ameiuridae, Cypriniforms), *Lepomis cyanellus* (Centrarchidae, Perciforms), *Noturus flavus* (Ameiuridae, Cypriniforms), *Stizostedion vitreum* (Percidae, Perciforms). In their turn, Dechtiar (24) and Cannon (15) found it in *Coregonus artedi* (Coregonidae, Clupeiforms), *Pomoxis nigromaculatus* (Centrarchidae, Perciforms), *Perca flavescens* (Percidae, Perciforms), *Percopsis omiscomayeus* (Percopsidae, Percopsiforms), *Moxostoma anisurum* (Catostomidae, Cypriniforms) and *Lota lota* (Gadidae, Gadiforms) in Lake of the Woods and Lake Opeongo, Ontario, Canada. Becker, Dear and Holmes (11) found it in *Micropterus punctulatus* (Centrarchidae, Perciforms) from Beaver Reservoir, in Arkansas, USA. Hoffman (31) reports several hosts, including a new one (Cy-

Characteristics (1)	<i>Spinitectus gordonii</i> n. sp.	<i>S. alii</i> KALI-ANKAR, 1970	<i>S. allaeri</i> CAM-PANA-ROUGET, 1961
Length of mature males	2.66-4.65	4.53 (*)	3.32
Length of mature females	3.125-5.07	5.41 (*)	5.3
First circelet	Behind end stoma	0.07 cephalic end	More posterior than <i>S. poli</i>
Nr. spines per circelet	32-40 (m) 40-48 (f)	14-16	28-36 (1st circelet)
Stoma length	0.039-0.065	0.045	0.035-0.045
Esophagus/ body length	1:2.4 (m) 1:2.5 (f)	1:13.3 (m) 1:15.8 (f)	1:3.5 (m)
Muscular/glandular esophagus	1:4.9 (m) 1:4.7 (f)	1:1.4	1:2.8 (m)
Rows of cuticular ridges	9	—	—
Nr. of preanal papillae	4	4	4
adanal papillae	1	—	—
postanal papillae	5	5	6
Long spicule	0.37-0.45	0.37	0.545
Short spicule	0.082-0.119	0.08	0.070
Spicule ratio	4:1	4.6:1	7.7:1
Width of caudal alae	0.290-0.330x 0.023-0.052	Absent	—
Preulva/postulva ratio	3.8:1	14:1	13: 1
Direction of vagina	anteriad	—	—
	0.039-0.045	0.028-0.030	
Size of eggs	x 0.023-0.033	x 0.018-0.020	0.038 x 0.022

Notes: (1) Measures from original descriptions, unless otherwise stated

(2) Linton's data (1901)

(3) Mueller and van Cleave's data (1932)

(4) Skrjabin's *et al.* data (1971) and Campana-Rouget (1961). In brackets Chul

TABLE II

<i>S. armatus</i> ALY, 1956	(2) <i>S. cristatus</i> RAILLIET et HENRY, 1915	(3) <i>S. gracilis</i> WARD et MA- GATH, 1917	(4) <i>S. inermis</i> (ZE- DER, 1800)	<i>S. mormyri</i> CAMPANA-ROU- GET, 1961	S P
3.95 (*)	5.8	8-10	10 (5.2-6.5)	3.25	
4.092 (**)	6.5 (***)	10-15	13-19 (12)	4.5	
—	0.01 cepha- lic end	—	0.034-0.084 ce- phalic end	At the level end stoma	B
30-34 (m)	—	35-50 (1st cir- clet)	56-58 (m)	18	
32-36 (f)	—	—	56-60 (f)	—	
0.033 (m)	—	0.025	end at the le- vel 1.° 2.° circlet	0.057 (m)	
0.045 (f)	—	1:9-10	1:4.2	0.060 (f)	
1:3	—	—	—	1:2.7 (f)	
1:3	—	1:3	1:3.3	1:4 (f)	
—	4	—	—	—	
3	4	4	4 (4)	4	
1	—	—	— (1)	—	
6	6	6	5-6 (4)	6	
0.493	0.06	0.6	0.960 (0.65-0.8)	0.6	
0.080	0.03	0.15	0.142 (0.128-0.148)	0.12	
6.2:1	2:1	4:1	6.7:1 (5.2:1)	5:1	
wide (long. 0.144)	—	wide	—	—	
11:1	—	3:1	7.6:1	9:1	
—	—	anteriad	—	—	
—	—	0.040 x 0.024	0.020-0.034	0.043 x 0.022	

m = male
f = female

(*) A sir
(**) Imma
(***) Inco

ib's (1961)

<i>S. polli</i> CAM- NA-ROUGE, 1961	<i>S. singhi</i> ALI, 1956	<i>S. thapari</i> ALI, 1956	<i>S. thurstonae</i> OGDEN, 1967	<i>S. sp.</i> NIKOLAEVA et NAIDENOVA, 1964
3.96	6.97 (*)	4.08-4.09	3.04-3.09	—
4.38	3-94-4.47 (**)	5.50-5.51	5.53-5.62	2.89
before ending stoma	Behind begi ning esoph.	—	—	0.189 ceph. end
48-52 (1st circlet)	24-28 (m) 26-30 (f)	24-28 (both sexes)	18	52
0.070 (f)	0.051 (m) 0.041 (f)	0.046-0.049 (m) 0.049-0.051 (f)	0.053-0.056 (m) 0.055-0.063 (f)	0.062
1:3.8 (f)	1:2.5 (m) 1:2.8 (f)	1:3.2 (m) 1:3.8 (f)	1:1.8 (m) 1:2.3 (f)	1:1.97
1:4.3 (f)	1:5.6 (m) 1:2.8 (f)	1:3.3 (m) 1:3.9 (f)	1:4 (m) 1:5 (f)	1:10.5 —
—	—	—	6	—
4	4	4	4	—
—	—	1	1	—
6	5	5	5	—
0.5	0.64	0.73-0.77	0.368-0.421	—
0.125	0.081	0.11	0.082-0.096	—
4:1	8:1	6.8:1	4.4:1	—
—	wide (0.38 long)	well devel (0.23 long)	—	—
4:1	14:1	13.4:1	8.7:1	2.9:1
—	—	—	—	—
0.038 x	—	0.054-0.056 x	0.038-0.043 x	—
0.022-0.025	—	0.036-0.038	0.024-0.029	—

single specimen
 mature specimen
 complete specimen

pinus sp.), and localities in several American States: Wisconsin, Ohio, Tennessee, Kansas, Maine, Massachusetts and New York.

As far as we know, this is the only species infecting trout which has been previously described, although its distribution is limited to America.

S. inermis (Zeder, 1800)

Inhabits the stomach of *Anguilla anguilla* (Anguillidae, Anguilliforms). In addition to the Baltic Sea where it was first found, Chubb (21) described it from Bala Lake, Merioth, and Kennedy (40) in River Almond, Perth, Scotland, all from the same host. Davies (23) mentions this worm from *Esox lucius* (Esocidae, Clupeiforms) in River Lugg, Hereford, England.

S. mormyri Campana-Rouget, 1961

Is a parasite of *Mormyrus cashire* (Mormyridae, Clupeiforms) in Lakes Kivu, Edward and Albert, Central Africa.

S. polli Campana-Rouget, 1961

Parasitizes *Synodontis schall* (Mochocidae, Cypriniforms), from Lakes Kivu, Edward and Albert, Central Africa.

S. singhi Ali, 1956

Has been found in *Mastacembelus armatus* (Mastacembelidae, Mastacembeliforms) in Hyderabad Deccan, India.

S. thapari Ali, 1956

Was described from specimens taken from *Notopterus notopterus* (Notopteridae, Clupeiforms) in Hyderabad Deccan, India.

S. thurstonae Ogden, 1967

Is a parasite of *Morbyrus kannumae* in Uganda (Khalil and Thurston, 42).

Spinitectus sp. Nicolaeva et Naidenova, 1964.

Was found in *Scomberesox saurus* (Scombresocidae, Beloniforms) in the Ionian Sea.

c) Incompletely described species

Spinitectus echinatus (Linstow 1878) from the stomach and intestine of *Alburnus alburnus* (Cyprinidae, Cypriniforms) in

Europe, was described using juveniles specimens. Yorke and Maplestone (84) considered it as a larval stage of *S. inermis* (Zeder, 1800), although Morishita (54) identified it as *S. oviflagellis*.

Other *Spinitectus* spp. offering problems in comparison with *S. gordonii* n. sp., owing to the lack of specific diagnosis are:

Spinitectus sp. Trowridge et Hefley, 1934 in the intestine of *Rana catesbiana* (Ranidae, Anura) in Oklahoma, USA.

Spinitectus sp. I Johnston et Mawson, 1940 in *Maccullocheilla macquarensis* (Serranidae, Perciforms) and *Pseudaphritis australasica* (Trachinidae, Perciforms) in Australia.

Spinitectus sp. II Johnston et Mawson, 1940 in *Macquaria australasica* (Serranidae, Perciforms), in Australia.

Spinitectus sp. Bangham, 1941 in *Perca flavescens* (Percidae, Cypriniforms) from lakes in the Algonquin Park, Ontario, Canada.

Spinitectus sp. Bargham, 1944 in *Perca flavescens* and *Stizostedion vitreum* (Percidae, Perciforms), *Ambloplites rupestris* and *Pomoxis nigromaculatus* (Centrarchidae, Perciforms) and *Ameiurus nebulosus* (Bagridae, Cypriniforms) in the lakes of Wisconsin, USA.

Spinitectus sp. I Karve et Naik, 1951 in *Calichrous bimaculatus* (Siluridae, Cypriniforms) in India.

Spinitectus sp. II Karve et Naik, 1951 in *Rita hastata* (Bagridae, Cypriniforms) in India.

Spinitectus sp. Campana-Rouget, 1961 (juveniles) in *Hydrocyon forkali* (Characidae, Cypriniforms) from lakes Kivu, Edward and Albert, in Africa.

Spinitectus sp. Campana-Rouget, 1961 (juveniles and one adult male) in *Alestes macrolepidotus* (Characidae, Cypriniforms) in the same lakes as the previous species.

Spinitectus sp. Anthony, 1963 in various freshwater fishes in Wisconsin, USA. Hoffman (31) summarizes Anthony's contribution (5) and adds to it Bangham's work (9) concerning Lake Huron and Meyer's (50) regarding Maine. Other than above host-species, mention is also made of *Roccus* spp. (Moronidae, Perciforms).

Spinitectus sp. Myers et Kuntz, 1967a, in *Fistularia petimba* (Fistularidae, Aulostomiforms) in the Philippines.

Spinitectus sp. Spall, 1970 in *Pylodictis olivaris* (Bagridae, Cypriniforms) in the Lake Carl Blackwell, Oklahoma, USA.

Spinitectus sp. Khalil, 1970 in *Alestes macrolepidotus* (Characidae, Cypriniforms) in Ghana, Africa.

Spinitectus sp. Christian, 1971 in *Rana catesbiana* (Ranidae, Anura) in Tennessee, USA.

Spinitectus sp. Khalil et Thurston, 1973 in *Gnathonemus victoriae* (Mormyridae, Clupeiforms), from Lake Victoria, Uganda, Africa.

Spinitectus sp. Anthony, 1974 in *Acipenser fulvescens* (Acipenseridae, Acipenseriforms) in Ontario, Canada.

Of course, *Spinitectus* sp. mentioned by Cordero-del-Campillo *et al.* (22) is identical to *S. gordonii* n. sp.

RESUMEN

Se describe *Spinitectus gordonii* n. sp., nematode parásito del esófago (larvas) y estómago (adultos) de las truchas común y arco iris de León (NW de España).

Se comprobó que el 39,6 por ciento de las truchas examinadas estaban infectadas, reuniéndose en conjunto 3.139 larvas y 973 adultos del parásito.

La nueva especie propuesta parece ser bastante específica para la trucha, puesto que 227 ejemplares de Cyprinida y cuatro de Centrarchidae del mismo habitat no estaban afectados.

Se hacen comparaciones con 70 *Spinitectus* spp., 12 de los cuales están relacionados con la nueva especie propuesta, 41 son claramente diferentes y 17 están insuficientemente descritos.

Se incluyen dibujos de huevos, larvas (L3 y L4), machos y hembras.

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