Ann. Parasitol. Hum. Comp.,
1984, t. 59, nº 3, pp. 253-261.

NEMATODA : TRICHOSTRONGYLOIDEA PARASITES OF VENEZUELAN WILD MAMMALS. III. The genus *Vexillata* Travassos, 1937

R. GUERRERO*

SUMMARY. Two new species of the genus *Vexillata* Travassos, 1937 parasitizing *Heteromys anomalus* of Venezuela are described, *V. tejerai* n. sp. and *V. scorzai* n. sp., both close to *V. petteri* Durette-Desset, 1970 and *V. chabaudi* Yoyotte-Vado, 1972, by possessing of 4 dorsal ridges and the dorsal rib divided near the tip. Both new species are differentiated from *V. chabaudi* by having the dorsal rib much shorter than rib 8 ; they are distinguished from *V. petteri* by having ribs 2 and 3 nearly the same size. The two new species are separated by the significantly greater size of *V. tejerai* and by the form of the copulatory bursa.
A brief historical review of the genus is given, together with considerations on its origin and its probable relation to the Pudicinae or Brevistriatinae. A key to the 8 known species is also given.

Nematoda : Trichostrongyloidea parasites de Mammifères sauvages du Venezuela. III. Le genre *Vexillata* Travassos, 1937

RÉSUMÉ. Description de deux nouvelles espèces du genre *Vexillata* Travassos, 1937 : *V. tejerai* n. sp. et *V. scorzai* n. sp. parasites d'*Heteromys anomalus* du Vénézuéla. Toutes deux sont proches de *V. petteri* Durette-Desset, 1970 et *V. chabaudi* Yoyotte-Vado, 1972, avec 4 arêtes dorsales et une côte dorsale divisée à l'apex. Elles se différencient de *V. chabaudi* par une côte dorsale beaucoup plus courte que la côte 8 et de *V. petteri* par des côtes 2 et 3 de longueur équivalente.
V. tejerai n. sp. se différencie de *V. scorzai* n. sp. par sa taille plus élevée de façon significative et par la forme de la bourse caudale.
— Bref historique des différentes espèces du genre, origine possible et relations probables avec les Pudicinae-Brevistriatinae.
— Une clé dichotomique des 8 espèces connues est donnée.

Introduction

The genus *Vexillata* was introduced by Travassos (1937) as a subgenus of *Longistriata* Schulz, 1926 — not by Hall (1916) as has been claimed by Durette-Desset (1978) and Durette-Desset and Chabaud (1981) — for that species of *Longistriata* possessing a pair of accessory small ribs in the dorsal lobe, and the copulatory bursa opaque and

* *Instituto de Zoologia Tropical, Facultad de Ciencias, Universidad Central de Venezuela, Apartado 47058, Caracas 1041-A, Venezuela.*

Accepté le 27 juillet 1983.

slightly asymmetrical. This species had originally been described as *Heligmosomum vexillatum* Hall, 1916, a parasite of *Thomomys fossor* from the United States. Later, Durette-Desset (1970) described the species *Vexillata petteri*, a parasite of *Heteromys* sp of North America, redefining *Vexillata* and elevating it to the genus rank. Yoyotte-Vado, in 1972, described the third species of the genus, *Vexillata chabaudi*, a parasite of *Heteromys australis* in Colombia.

Durette-Desset (1971), in her great revision of the Heligmosomidae, included within this genus *Vexillata convoluta* (Caballero and Cerecero, 1943) a parasite of *Crateogeomys merriami* in Mexico, and divided the genus into 2 groups, one with the dorsal rib divided to the midpoint of its length and in which the points of the cuticular ridges are directed from the line on the right, right-ventral of the worm toward the left, this group containing the species *V. vexillata* and *V. convoluta;* the other group, comprising *V. chabaudi* and *V. petteri*, has the dorsal rib divided at the distal end and the ridges are oriented more toward the front. A year later, the same author (Durette-Desset, 1972) complemented the description of *V. convoluta* given by Caballero and Cerecero (1943).

Finally, Denke (1977) described 2 new species, parasites of *Heteromys lepturus* in Mexico, *V. dessetae* and *V. legallae*, assigning them to the first group of Durette-Desset (1971) and complementing the study of the synlophe of *V. petteri*. Also Durette-Desset (1978) complemented the description of *V. vexillata* by study of its synlophe.

From this historical review, we find that the genus *Vexillata* is composed of 6 well known species: *V. vexillata, V. convoluta, V. petteri, V. chabaudi, V. dessetae,* and *V. legallae*, distributed from North America to Colombia, parasiting rodents of the superfamily Geomyoidea. During an intensive study of the Trichostrongyloidea of Venezuela we have found 2 new species which are described forthwith.

Vexillata tejerai n. sp.

Type material : 74 ♂♂ and 91 ♀♀

Host : *Heteromys anomalus* Thompson, 1815

Organ : Intestine

Locality : Los Canales, Naiguatá, D.F.

Other material : Many ♂♂ and ♀♀ (> 1,000) with the same data and 97 ♂♂ and 105 ♀♀, with lesser data.

Locality : Las Aguaditas, Hda. El Limón, D.F.

All in the author's collection.

Description: Nematodes of medium size ; pale rose in color ; not rolled into spiral ; tail of female curved ventrally to the level of the vulva ; left lateral ala well developed *(fig. 1)*.

Synlophe: Composed of 11 cuticular ridges beginning exactly at the end of the cephalic vesicle and the most developed reaching the copulatory bursa in the male and the

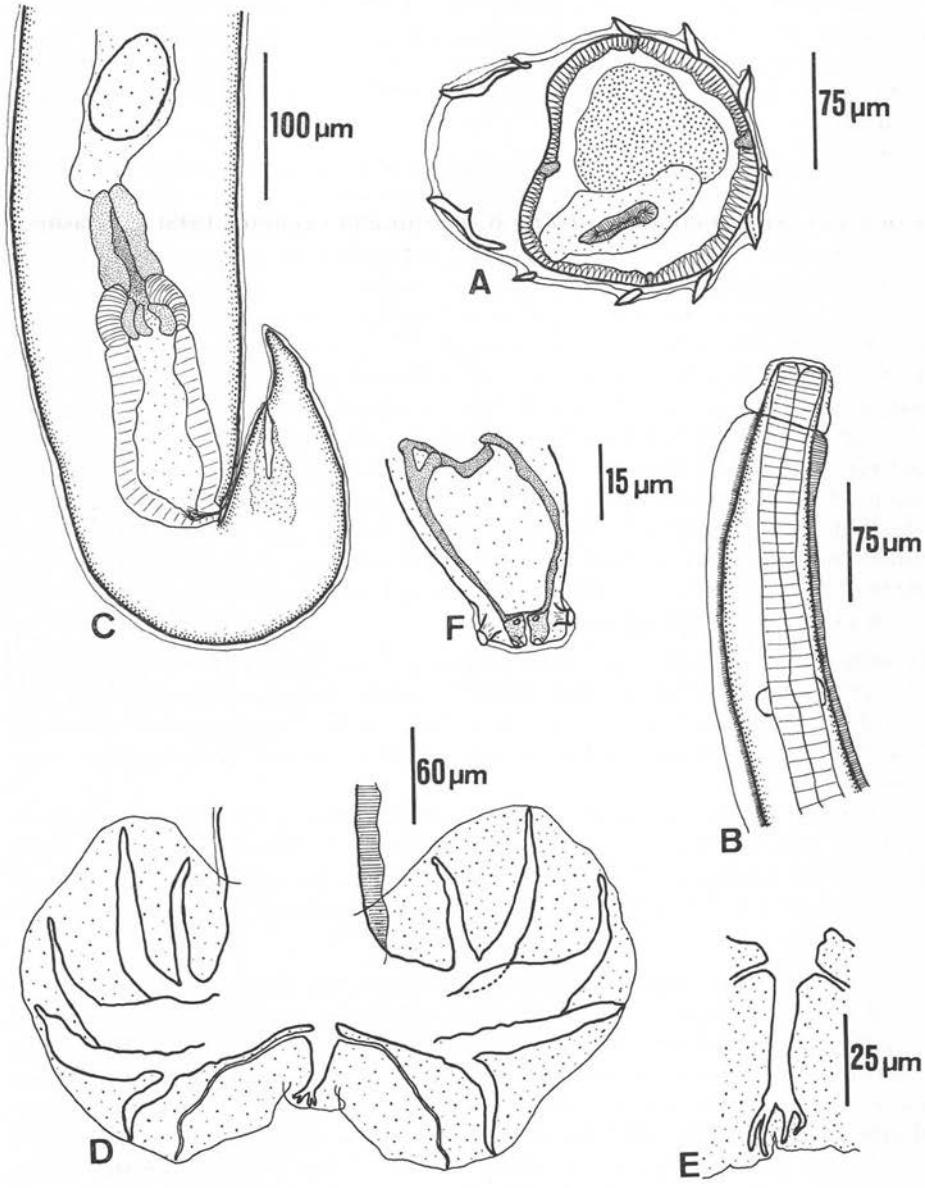

FIG. 1. — *Vexillata tejerai* n. sp.

A) Synlophe ; B) ♀ anterior region ; C) ♀ posterior end ; D) ♂ copulatory bursa ; E) ♂ dorsal rib ; F) ♂ copulatory cone, ventral view.

vulva in the female. There are 4 dorsal ridges, 4 ventral, 1 lateral right, and 2 lateral left. The 2 left ridges are larger, forming a definitive *carena;* the right ridge is very small and oriented ventral; the dorsal and ventral ridges form a gradient from the right side to the left, and in both cases the ridge toward the left is clearly smaller than the rest.

Males (15 specimens) : Smaller than the females with a length of 5,533 (4,189-7,014)μ[1] and maximum width of 124 (92-154)μ. Cephalic vesicle longer than wide, 47 (40-51)μ long with a maximum width of 44 (36-51)μ near the base. Oesophagus somewhat claviform with a length of 366 (282-500)μ. Nerve ring and excretory pore situated at 209 (186-249)μ and 347 (277-458)μ, respectively from the apical end.

The copulatory bursa is granular, rectangular, and measures 83 (55-108)μ in length by 389 (296-431)μ in maximum width. The rib pair 4-5 is longer than the pair 2-3 ; rib 3 is slightly larger than rib 2 ; rib 4 is the longest, and rib 5 is shortest and widest. Rib 6 is inserted in the middle or more outside of lobe 4-5. Ribs 8 originated at the dorsal base and end in the form of a long "s" ; they are twice as long as the dorsal and very thin, 1.5-2 μ in width, thus being difficult to distinguish among the granulations of the copulatory bursa ; the dorsal lobe is cut into the posterior quarter and ribs 9 and 10 are well individualized. The copulatory cone is well developed and cuticularized, with the 7th ribs easily visible ; it is 32 (28-36)μ long and has a maximum width of 21 (19-26)μ. The spicules are filiform and equal and are 431 (392-463)μ long by 2μ wide. There is no gubernaculum.

Females (15 specimens): Larger than the males, 9,214 (6,635-11,919)μ in length and 183 (149-223)μ in maximum width. Cephalic vesicle generally wider than long, with 50 (42-57)μ length and 51 (43-58)μ maximum width. Oesophagus 454 (319-596)μ long. Nerve ring and excretory pore at 238 (174-310)μ and 398 (304-471)μ respectively from anterior end.

Posterior end has, sometimes, inflated cuticle. Vulva at 153 (132-189)μ, followed by 29 (24-40)μ *vagina vera,* a long vestibule of 116 (105-132)μ, a sphincter of 39 (34-47)μ and an infundibulum of 91 (57-140)μ. The uterus contains 48 (30-65) eggs, measuring 69 (65-73)μ in length and 38 (32-42)μ maximum width. The tail is 53 (50-67)μ long.

Discussion : Our specimens belong to the group with 4 dorsal ridges and with the dorsal lobe of the copulatory bursa divided at the point, to which group also belong *V. petteri* Durette-Desset, 1970 and *V. chabaudi* Yoyotte-Vado, 1972. Our species differs from *V. chabaudi* in having the dorsal lobe much shorter than the 8th rib pair, and from *V. petteri* in that the synlophe of this species shows the 2 left dorsal ridges clearly smaller than the right dorsal ridges, while our specimens show only one left dorsal ridge to be clearly smaller than the other 3. Also *V. petteri* has the 2nd rib very much smaller than the 3rd, in our species it is only slightly smaller.

We dedicate this species to Dr Enrique Tejera, founder of Nematology in Venezuela.

1. Mean, minimum and maximum values.

Vexillata scorzai n. sp.

Type material: 77 ♂♂ and 76 ♀♀
Host : *Heteromys anomalus* Thompson, 1815
Organ : Anterior small intestine
Locality : La Azulita, Edo. Mérida
All in the author's collection

Description: Small nematodes, pink in color curled coil ventral. Tail of female curved to height of vulva *(fig. 2)*.

Synlophe: Formed by 11 cuticular ridges, beginning at the base of the cephalic vesicle and extending to the copulatory bursa in the male. In the female, the less developed extend to the ovojector, and the more developed to the vulva. The 2 left lateral ridges are highly developed, forming a distinct *carena*. There is 1 right lateral, very small, slightly ventral ; there are 4 dorsal and 4 ventral, each forming a series diminishing in size leftward, so that the leftmost ridge, in both ventrals and dorsals, is far smaller than the rest.

Males (10 specimens) : Slightly smaller than the females, total length 3,451 (3,084-3,750)μ and 94 (81-106)μ maximum width. Cephalic vesicle longer than wide, 40 (35-49)μ in length and 36 (31-39)μ maximum width near the base. Oesophagus 336 (314-356)μ in length. Nerve ring and excretory pore located at 199 (168-224)μ and 312 (287-343)μ, respectively from the anterior end. Lateral ala 17 (16-18)μ in width.

Copulatory bursa rectangular, 93 (81-105)μ in length and 275 (242-299)μ maximum width. The lobe formed by the 4th and 5th ribs longer than the rest ; rib 2 hardly shorter than rib 3 ; rib 7 small but visible ; rib 8 originating from the base of the dorsal lobe, thin and less than twice the length of the dorsal lobe which is divided in the posterior fourth and may occasionally have two branchlets beginning neat the origin of rib 8 ; ribs 9-10 are small but well defined. Copulatory cone developed but not cuticularized, 24 (20-26)μ long. Spicules simple, filiform, 300 (271-327)μ long. There is no gubernaculum.

Females (10 specimens) : Length 4,990 (4,473-5,865)μ by 111 (98-137)μ maximum width. Cephalic vesicle generally wider than long 40 (35-43)μ in length and 42 (39-44)μ maximum width. Oesophagus 360 (274-430)μ long. Nerve ring and excretory pore at 191 (176-205)μ and 314 (265-354)μ, respectively, from anterior end. Lateral ala 20 (18-24)μ wide.

Vulva located in the curve of the tail at 125 (108-139)μ from the caudal end, followed by a *vagina vera* 28 (23-34)μ long, a vestibule of 74 (54-88)μ, a sphincter 32 (27-38)μ long, and an infundibulum of 70 (40-101)μ. Rectilinear uterus containing 13 (9-17) eggs of 66 (59-74)μ length and 35 (34-38)μ maximum width. Tail 46 (40-51)μ long.

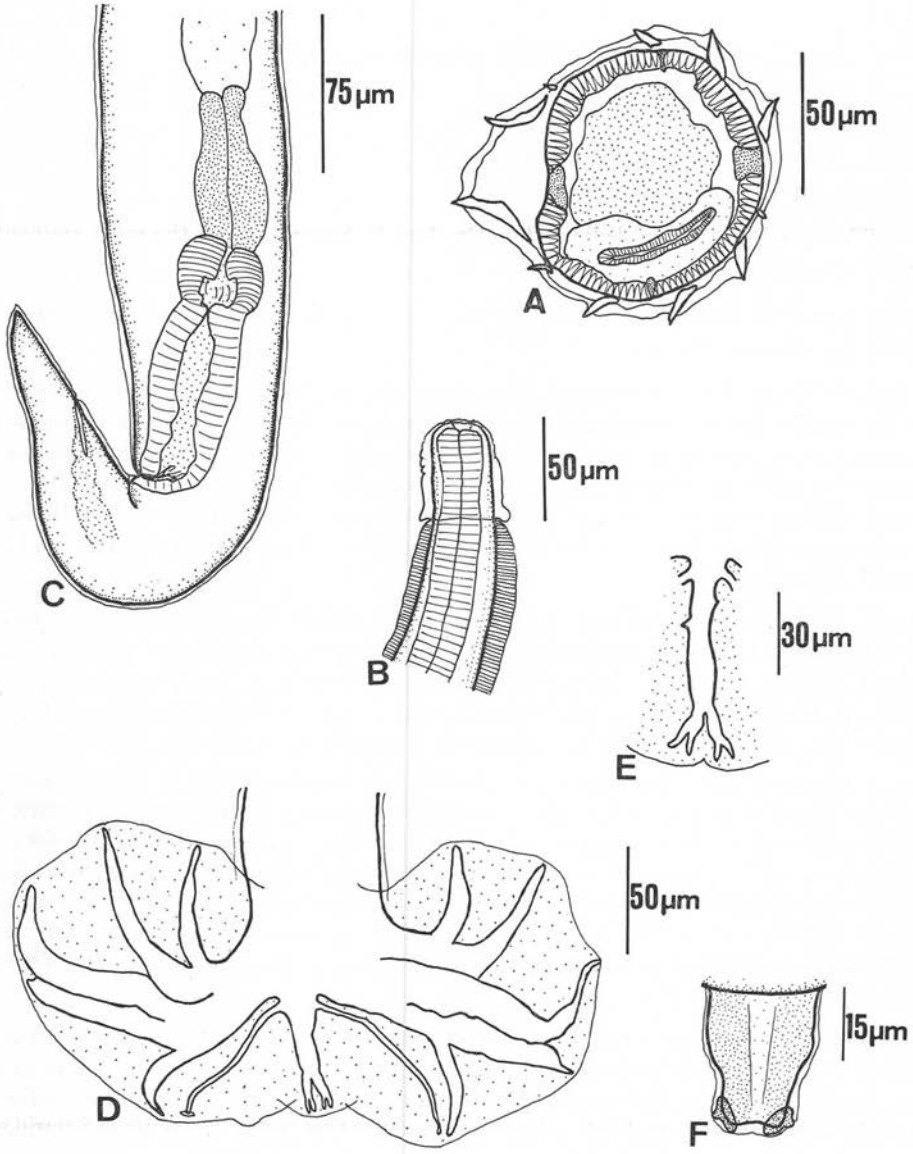

FIG. 2. — *Vexillata scorzai* n. sp.

A) Synlophe; B) ♀ anterior region; C) ♀ posterior end; D) ♂ copulatory bursa; E) ♂ dorsal rib with branchlets; F) ♂ copulatory cone, ventral view.

Discussion : Our specimens correspond to group B of Durette-Desset (1971), which also contains *V. petteri* Durette-Desset, 1970, *V. chabaudi* Yoyotte-Vado, and 1972, *V. tejerai* n. sp. Our species can be differentiated easily from *V. tejerai* by its smaller size and by the form of the dorsal lobe of the copulatory bursa, which is more rectangular in form. It can be distinguished from *V. chabaudi* by the dorsal rib being much shorter, in relation to rib 8, and can be distinguished from *V. petteri* by the structure of the synlophe and by having ribs 2 and 3 nearly the same size.

This species has been dedicated to Dr. José V. Scorza, one of the most eminent venezuelan parasitologists at present.

General discussion

The present work increases to 8 the number of known species of the genus *Vexillata* ; taking into account that they have been collected from only 7 species of Geomyoidea, 2 of Geomyidae, and 5 of Heteromyidae, this must be a small portion of the number of species existing in nature, especially, as with *Longistriata* Schulz, 1926 and *Viannaia* Travassos, 1914 (Guerrero 1982a, 1982b), information from Central America is lacking. However, the information at present available is sufficient to show that the genus is highly homogenous. Thus, the characters used for tracing the phylogeny of a genus, such as the morphology of the spicules and the copulatory bursa (Chabaud, 1959 ; Guerrero, 1982b) or the structure of the synlophe (Durette-Desset, 1971) are difficult to interpret for this particular genus, since the spicules are unvaryingly simple and filiform in the 8 known species. Moreover, the other two characters appear to be contradictory, since group A of Durette-Desset (1971) is characterized by 5 dorsal ridges with the dorsal rib deeply divided, while group B has 4 dorsal ridges with the dorsal rib divided only at the tip. Thus group A appears to be the more advanced, according to the form of the dorsal lobe and concurrent increase of the number of dorsal ridges, as also occurs, rarely, in genus as *Trichostrongylinstowia* Travassos, 1937, for example (Durette-Desset and Vaucher, 1974). However, we believe that group A is the more primitive, having originated in North American Geomyidae in the Oligocene, later parasitizing the Heteromyidae when this group evolved, and accompanying them in their recent colonization of South America, undergoing morphological changes such as the lengthening of the rib 8 and the loss of a dorsal ridge, which has also occurred in other groups (Durette-Desset, 1971).

The Nearctic origin of the genus in the Geomyoidea (Sciuromorpha) suggests its possible common or very closely related origin with other genera parasitic in Sciuridae (s.l.) and not in the Didelphidae (Marsupialia) through the genus *Travassostrongylus* Orloff, 1933, as has been suggested by Durette-Desset (1971). This hypothesis would be sustained by the presence of a *carena* and the well-developed dorsal and ventral ridges, a synlophe characteristic of the Pudicinae and Brevistriatinae (both subfamilies parasitizing Holoarctic Sciuridae) wherein we believe the genus *Vexillata* should be placed, not among the Ornithostrongylinae as has recently been done by

Durette-Desset and Chabaud (1981) since these forms lack the *carena* and ridges in the synlophe.

The morphological homogeneity and the low number of known species forbid a stricter phylogenetic analysis of the genus, however, we here propose a key to the known species, based more upon the morphological than the morphometric characters, since, for the species *V. petteri, V. chabaudi, V. dessetae* and *V. legallae,* measurements are given for only 1 male and 1 female each.

1.	— Synlophe composed of 5 dorsal ridges	2
	— Synlophe composed of 4 dorsal ridges	5
2.	— Dorsal rib with supplementary branches	3
	— Dorsal rib without supplementary branches	4
3.	— Ribs 5 and 6 approximately equal length. Small (♂ = 2,5-3,5 mm. ♀ = 3,9 mm.)	*vexillata*
	— Rib 5 clearly shorter than rib 6. Medium size (♂ = 7,2 mm. ♀ = 9,7 mm.)	*dessetae*
4.	— Dorsal lobe divided in posterior third	*legallae*
	— Dorsal lobe divided half its length	*convoluta*
5.	— Dorsal lobe long, nearly length of rib 8	*chabaudi*
	— Dorsal lobe much shorter than rib 8	6
6.	— Rib 2 much shorter than rib 3	*petteri*
	— Rib 2 only slightly shorter than rib 3	7
7.	— Spicules medium in length (> 390 μ). Rib 8 filiform	*tejerai*
	— Spicules shorter (< 330 μ). Rib 8 slender but not filiform	*scorzai*

ACKNOWLEDGEMENTS .The author thanks Lic. J. Silva and J. Valdés for providing many of host and Mr. I. McLure for the English translation.

REFERENCES

CABALLERO E., CERECERO C. : *Longistriata convoluta* n. sp. (Nematoda : Trichostrongylidae) parasito del intestino de una tuza, *Crateogeomys merriami* (Thomas). *An. Inst. Biol.* México, 1943, *14,* 201-205.

CHABAUD A. : Remarques sur la systématique des Nématodes Trichostrongyloidea. *Bull. Soc. Zool.* France, 1959, *84,* 473-483.

DENKE M. A. : Quatre nouveaux Nématodes Héligmosomes parasites de Rongeurs du Mexique. *Bull. Mus. Nat. Hist. Nat.*, 3e sér., 1977, nº 470, Zool. *327,* 777-787.

DURETTE-DESSET M.-C. : Description de *Vexillata petteri* n. sp., Nématode Héligmosome parasite d'un Rongeur néarctique. *Ann. Parasitol. Hum. Comp.*, 1970, *45,* 289-293.

DURETTE-DESSET M.-C. : Essai de Classification des Nématodes Héligmosomes. Corrélations avec la Paléobiogéographie des Hôtes. *Mem. Mus. Nat. Hist. Nat.*, sér. A, 1971, *69,* 1-226.

DURETTE-DESSET M.-C. : Compléments morphologiques à l'étude de quelques Nématodes Héligmosomes, parasites de Rongeurs américains. *Ann. Parasitol. Hum. Comp.*, 1972, *47*, 243-249.
DURETTE-DESSET M.-C. : Nouvelles données morphologiques sur des Nématodes Trichostrongylides des collections du United States National Museum. *Bull. Mus. Nat. Hist. Nat.*, 3e sér., 1978, nº 513, Zool. *352*, 135-147.
DURETTE-DESSET M.C-., CHABAUD A. : Nouvel essai de Classification des Nématodes Trichostrongyloidea. *Ann. Parasitol. Hum. Comp.*, 1981, *56*, 297-312.
DURETTE-DESSET M.-C., VAUCHER C. : Nématodes Héligmosomes parasites d'Insectivores Talpidés de la région Holarctique. *Ann. Parasitol. Hum. Comp.*, 1974, *49*, 191-200.
GUERRERO R. : Nematoda : Trichostrongyloidea parásitos de mamíferos silvestres de Venezuela I. Los géneros *Bradypostrongylus* Price, 1928 ; *Longistriata* Schulz, 1926 y *Durettestrongylus* n. gen. *Acta Biol. Venez.*, 1982a, *11*, 111-131.
GUERRERO R. : Nematoda : Trichostrongyloidea parásitos de mamíferos silvestres de Venezuela. II. Revisión del género *Viannaia* Travassos, 1914. *Mem. Soc. Cien. Nat. La Salle*, 1982b, *117* (in press).
HALL M. C. : Nematodes parasites of Mammals of the orders *Rodentia, Lagomorpha* and *Hyracoidea. Proc. U. S. nat. Museum*, Washington, 1916, *50*, 258 p.
TRAVASSOS L. : Revisao da familia *Trichostrongylidae* Leiper, 1912. *Monogr. Inst. O. Cruz.*, 1937, *1*, 512 p.
YOYOTTE-VADO E. : Étude de huit Nématodes parasites de Vertébrés du Venezuela et de la Colombie. *Bull. Mus. Nat. Hist. Nat.*, 3e sér., 1972, nº 41, Zool. *35*, 477-497.