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REMARKS ON SIX SPECIES OF HETERAKID NEMATODES PARASITES OF BRAZILIAN TINAMID BIRDS WITH A DESCRIPTION OF A NEW SPECIES

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Nematodes representing five species of the genus Heterakis, *namely:* H. inglisi *n. sp.,* H. alata, H. gallinarum, H. nattereri, H. spiculatus *and one species of the genus* Odontoterakis, O. multidentata, *were studied.* Heterakis inglisi *n. sp. closely resembles* H. spiculatus, *differing from it by smaller size of spicules, precloacal sucker and terminal spike of the tail in the males.* Heterakis arquata *and* H. brasiliana *are only listed, for they were not found during the present study.* Odontoterakis multidentata *is reported in Brazil for the first time. New host records are established for most of the species. These species are fully illustrated.*

Key words: Nematoda – Heterakidae – parasites Tinamidae – birds – Brazil

Travassos (1913) made a partial revision of the heterakid nematodes, based largely on the species occuring in Brazil. No complete study of the Heterakidae has ever been carried out, although several groupings have been proposed on basis on other published works. The classification used here is that suggested by Inglis (1967).

Most species of tinamid birds are of considerable economic importance. These birds are raised for food and representatives include partridges and the quail. The latter is regarded as one of the most profitable egg producers. Considering this fact, the analysis of the helminth fauna of these hosts appears to be very appropriate and the present investigation will supply useful data to veterinarians, raisers and ecologists. The results presented herein are related to heterakid nematodes included in the genera *Heterakis* Dujardin, 1845 and *Odontokerakis* Skrjabin & Shikhobalova, 1947 parasites of tinamid birds in Brazil.

MATERIALS AND METHODS

Fifty-three samples of nematodes recovered from Brazilian Tinamidae between the years of 1910 and 1956 in central and southern regions and deposited in the Helminthological Collection of the Oswaldo Cruz Institute (CHIOC), were studied. The number of samples from each host species was as follows: 2 from *Crypturellus noctivagus* (Wied); 1 from *C. parvirostris* (Wagler); 21 from *C. undulatus undulatus* (Temminck); 4 from *C. variegatus variegatus* (Gmelin); 1 from *Nothura maculosa* (Temminck); 1 from *Rhynchotus rufescens rufescens* (Temminck); 20 from *Tinamus solitarius* (Vieillot); 1 from *T. tao tao* (Temminck); 2 from a "jao", unidentified, probably *C. noctivagus*.

Nematodes were preserved in Railliet & Henry's solution, dehydrated in ethanol (70%-100%), studied unstained and cleared in beechwood creosote. Some were preserved in balsam as whole mounts. Illustrations were made with the aid of a drawing tube connected to an Olympus light microscope. Measurements are in micrometers, unless otherwise indicated. The NHR abbreviation refers to New Host Record. Common names of hosts presented herein follow Sick (1984).

DESCRIPTIONS

The adopted classification is that proposed by Chabaud (1978).

Heterakis inglisi n. sp.
(Figs 1-3)

Description (based on nine specimens, five males and four females from *Crypturellus v.*

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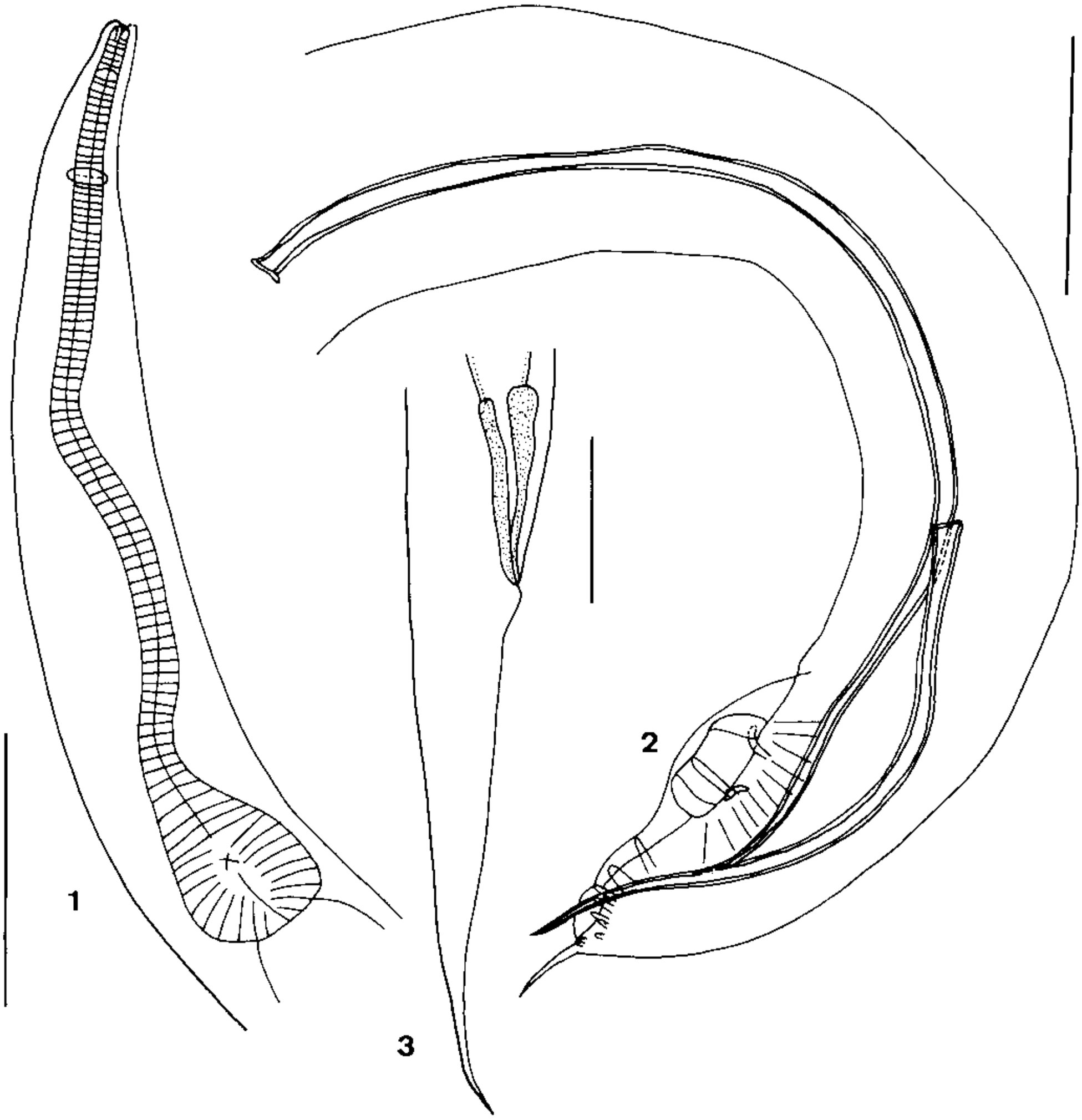


Heterakis inglisi n. sp. – Fig. 1: anterior extremity (lateral view). Fig. 2: posterior extremity of male (lateral view). Fig. 3: posterior extremity of female (lateral view). (Bar = 0.2 mm in Figs 1, 3; bar = 0.3 mm in Fig. 2).

variegatus). Heterakoidea, Heterakidae, Heterakinae. Males: body 5.10-7.14 mm long, 220-350 wide. Esophagus 1.26-147 mm long, including the bulb, which is 240-330 long by 190-280 wide. Nerve ring and excretory pore 250-290 and 280-360 from anterior end, respectively. Precloacal chitinous-rimmed sucker 120 in diameter, 120-140 from cloacal aperture. Spicules unequal in size, similar in shape, 1.28-1.42 and 0.60-0.72 mm long. Thirteen pairs of caudal papillae, 6 pre- and 7 postcloacal. Cloacal aperture 100-120 from posterior end. Spike of the tail 61-64 long. Females: body 6.80-7.54 mm long, 260-420 wide. Esophagus 1.47-1.54 mm long, including the bulb, which is 320-390 long and 210-300 wide. Nerve ring and excretory pore 280-330 and 330-370 from posterior end, respectively. Vulva 3.71-4.15 mm from anterior extremity; ovijector 540 long. Anus 460-590 from posterior end.

Taxonomic summary

Type host: *Crypturellus variegatus variegatus* (Gmelin); common name: variegated tinamou ("inambu-onça", "chororão").

Other host: *C. parvirostris* (Wagler); common name: small-billed tinamou ("inambu xororó").

Site: intestine.

Type locality: state of Espirito Santo, Brazil.

Specimens studied: CHIOC no. 32.850 a: holotype; 32.850 b-j; 32.851 a-d: paratypes (whole mounts); 11.753: vouchers (wet material).

Etymology: *inglisi* – after Dr. William G. Inglis, a specialist on Heterakidae.

Remarks: Freitas (1956), in an attempt to organize the Heterakidae, erected two subgenera in the genus *Heterakis*, namely *Heterakis* and *Raillietakis*, to include those species in Heterakinae with unequal and equal/subequal spicules, respectively. Although this criteria has not been fully accepted, it may be applied as a tool for the proper identification of samples with the characters related to the size of the spicules. Based on this fact, specimens recovered from *Crypturellus variegatus variegatus* are included in the former group with unequal spicules and considered as a new species. *Heterakis inglisi* n. sp. resembles mainly *H. spiculatus* from which it differs by: (1) the small size of the spicules: 0.60-0.72/1.28-1.42 mm in *H. inglisi* n. sp., compared to 1.02-1.05/2.36-2.56 mm in *H. spiculatus;* (2) the size of precloacal sucker 120, compared to 180-190; and (3) the length of the terminal spike of the male tail, 61-64, compared to 100. This comparison is based on the fact that the structure and relative lengths of the spicules afford good characters in the delimitation of species within *Heterakis,* when used in conjunction with the number of caudal papillae, the relative size and position of the precloacal sucker and the relative length of the male tail, according to Inglis (1967).

Heterakis alata Schneider, 1866
(Figs 4-7)

Description (based on seven specimens, four males and three females from *Crypturellus u. undulatus*). Heterakoidea, Heterakidae, Heterakinae. Males: body 17.51-27.81 mm long, 710-748 wide. Esophagus 1.68-2.38 mm long, including the bulb, which is 180-280 long by 210-230 wide. Nerve ring and excretory pore 420-490 and 470-580 from anterior end, respectively. Precloacal chitinous-rimmed sucker 210-260 in diameter, 210-320 from cloacal aperture. Spicules equal in size, similar in shape, 720-770 long. Thirteen pairs of caudal papillae, 3 pre-, 4 ad- and 6 post-cloacal. Cloacal aperture 340-370 from posterior end. Spike of the tail 54-68 long.

Females: body 20.57-34.13 mm long, 680-780 wide. Esophagus 1.54-2.42 mm long, including the bulb, which is 190-280 long by 220-250 wide. Nerve ring and excretory pore 370-490 and 560-580 from anterior end, respectively. Vulva 10.37-22.27 mm from anterior extremity. Eggs 61-72 long by 39-46 wide. Rectum 350-460 long. Anus 700-910 from posterior end.

Taxonomic summary

Hosts: *Crypturellus undulatus undulatus* (Temminck); common name: undulated tinamou ("jaó"); *Crypturellus noctivagus* (Wied); common name: yellow-legged tinamou ("jaó, zabelê"); "jaó", unidentified.

Site: intestine.

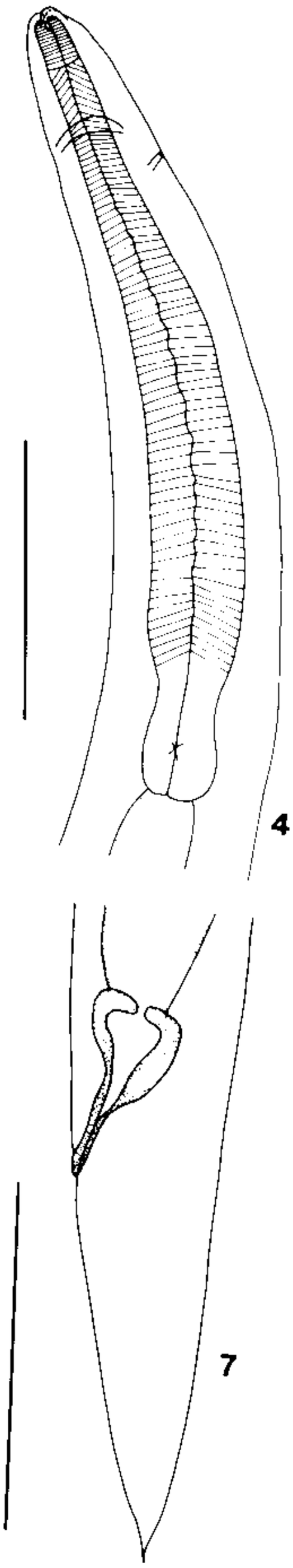
Localities: states of Mato Grosso do Sul and Minas Gerais, Brazil.

Specimens studied: CHIOC no. 32.856 a-c; 32.857 a-d; 32.858 a-b (whole mounts), 853; 2.459; 8.150; 11.387; 11.547; 11.606; 11.772; 11.773; 12.493; 13.002; 13.139; 13.250; 15.110; 15.111; 15.113; 15.115; 15.117; 15.119; 15.295; 15.530 (wet material).

Remarks: Concerning *H. alata,* during the revision of the original samples of this species figured by Travassos (1913), it was verified that the proper spicular structure was misinterpreted, since the illustrations lack the very thin posterior portion of the spicules, indicated in Figs 5-6.

Heterakis gallinarum (Schrank, 1788)
Freeborn, 1923
(Figs 8-9)

Description (based on three males from *Nothura maculosa*). Heterakoidea, Heterakidae, Heterakinae. Males: body 6.46-6.97 mm long, 360-490 wide. Esophagus 910-960 long, including the bulb, which is 250-320 long by 210-330 wide. Nerve ring and excretory pore 290-320 and 420-490 from anterior end, respectively. Precloacal chitinous rimmed sucker 90-93 in diameter, 150-180 from cloacal aperture. Spicules unequal in size, similar in shape, 2.24-2.31 and 0.67-0.70 mm long. Thirteen pairs of caudal papillae, 5 pre-, 2 ad- and 6 post-cloacal. Cloacal aperture 410-440 from posterior end. Spike of the tail 220 long.



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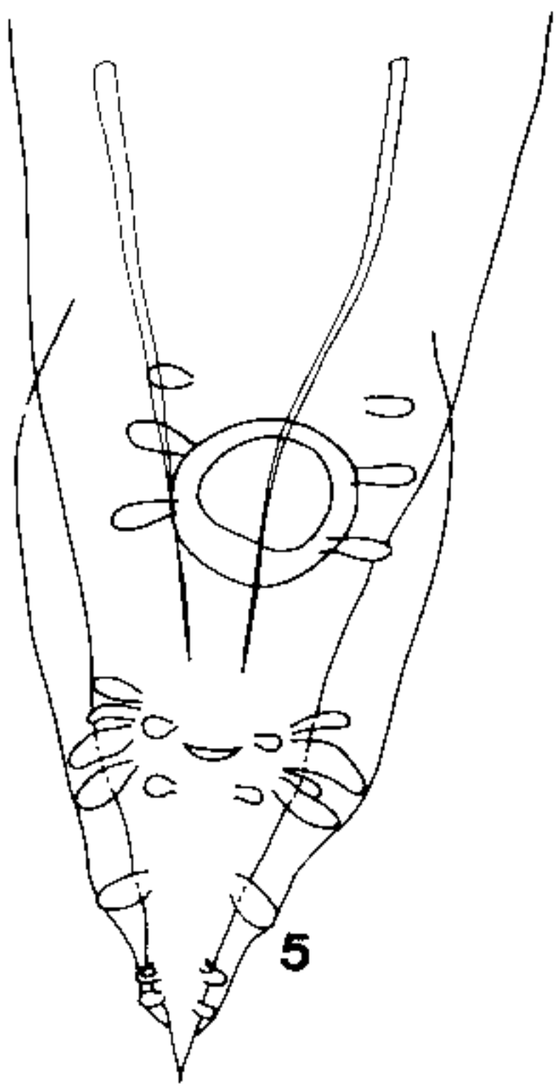

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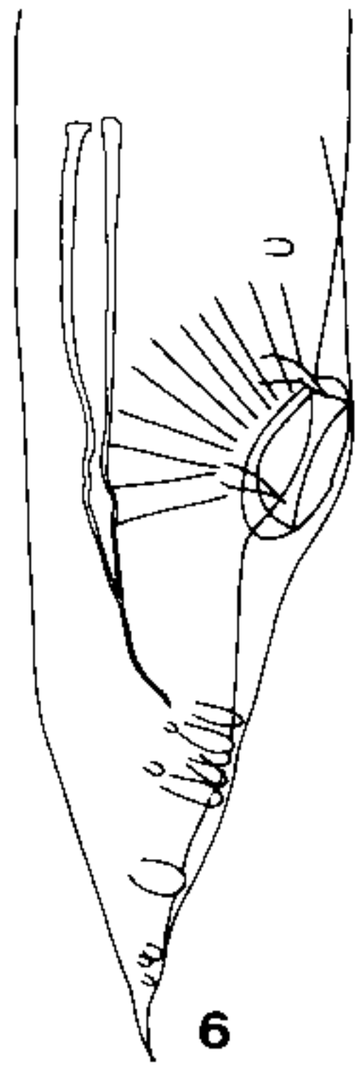

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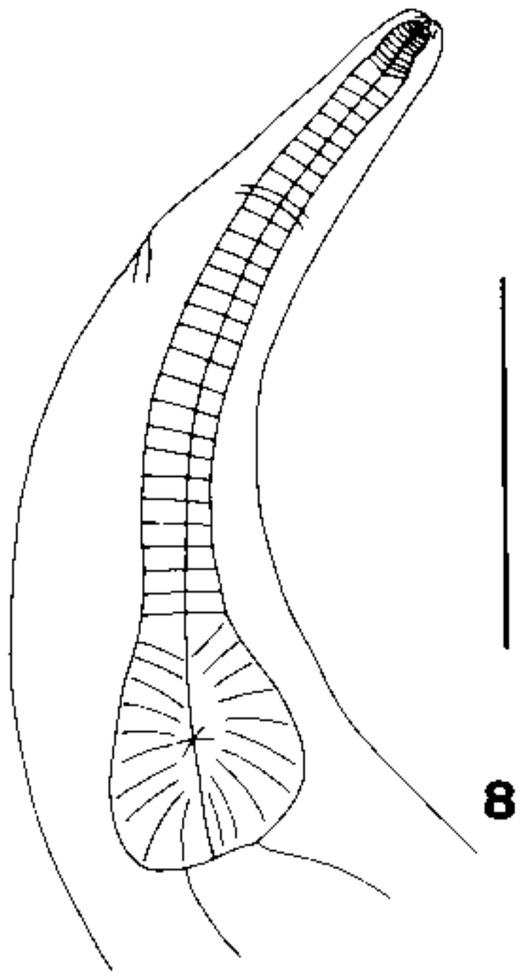

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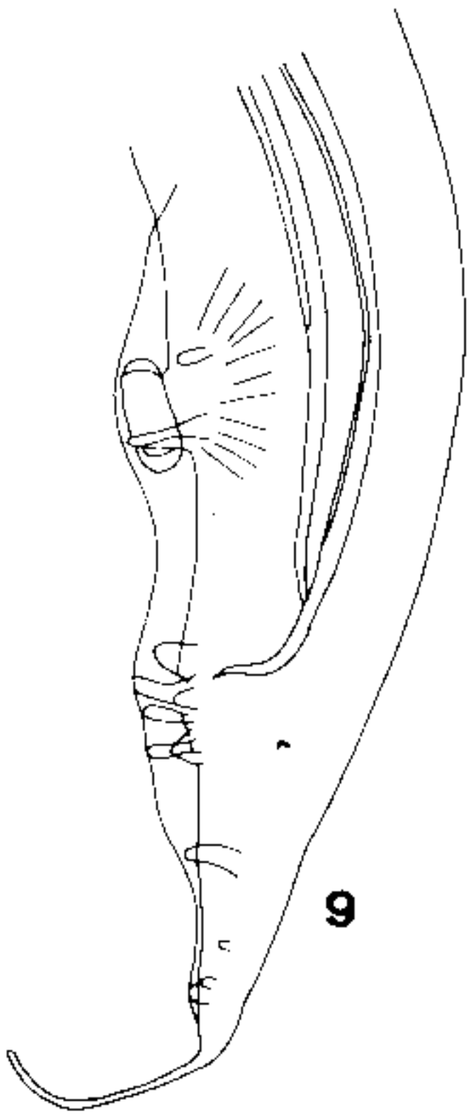

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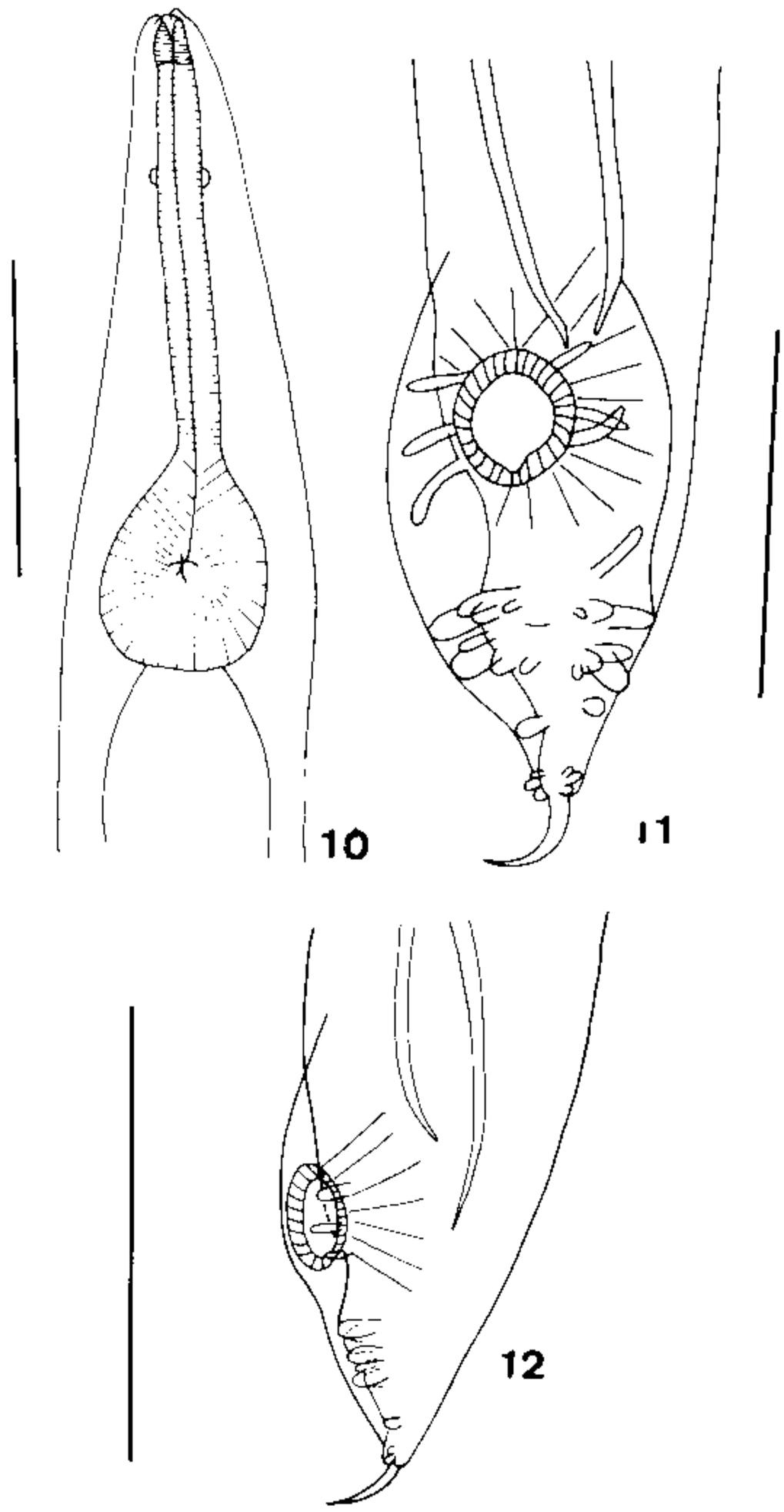
Heterakis alata – Fig. 4: anterior extremity (lateral view). Fig. 5: posterior extremity of male (ventral view). Fig. 6: posterior extremity of male (lateral view). Fig. 7: posterior extremity of female (lateral view). *Heterakis gallinarum* – Fig. 8: anterior extremity (lateral view). Fig. 9: posterior extremity of male (lateral view). (Bar = 0.15 mm in Fig. 9; bar = 0.2 mm in Figs 5-8; bar = 0.4 mm in Fig. 4).

Taxonomic summary

Hosts: *Nothura maculosa* (Temminck); common name: spotted nothura ("codorna"), NHR; *Rhynchotus rufescens rufescens* (Temminck); common name: red-winged tinamou ("perdiz"), NHR.

Site: intestine.

Locality: state of São Paulo, Brazil.



Heterakis nattereri – Fig. 10: anterior extremity (lateral view). Fig. 11: posterior extremity of male (ventral view). Fig. 12: posterior extremity of male (lateral view). Fig. 13: posterior extremity of male (ventral view). Fig. 14: posterior extremity of female (lateral view). (Bar = 0.1 mm in Fig. 11; bar = 0.15 mm in Fig. 14; bar = 0.3 mm in Figs 10, 13; bar = 0.4 mm in Fig. 12).

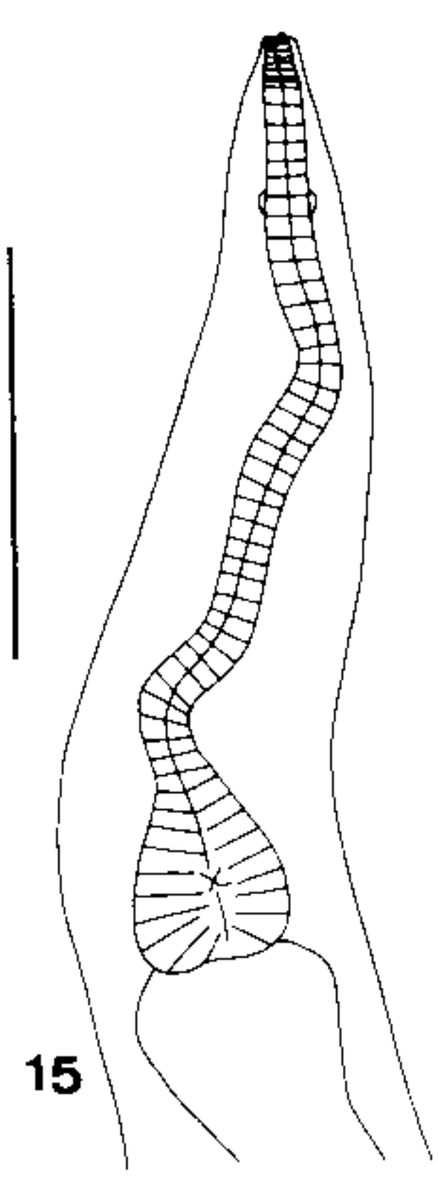
Specimens studied: CHIOC no. 32.853 a-c (whole mounts); 1.310 (wet material).

Remarks: *Heterakis gallinarum* has been found in a wide range of hosts and is a cosmopolitan species. Mendonça (1953) investigated the occurrence of nodular typhlitis in pheasants due to *H. gallinarum* and *H. isolonche* in Brazil. The latter study of this species of a Brazilian host, was that of Santos (1969), when variations in number, form and distribution of caudal papillae of males were analyzed.

Heterakis nattereri Travassos, 1923
(Figs 10-14)

Description (based on four specimens, two males and two females from *Tinamus solitarius*). Heterakoidea, Heterakidae, Heterakinae. Males: body 5.78-5.95 mm long, 300-420 wide. Esophagus 770-860 long, including the bulb which is 230-290 long by 180-250 wide. Nerve ring and excretory pore 210-280 and 250 from anterior end, respectively. Precloacal chitinous-rimmed sucker 79-90 in diameter, 72-110 from cloacal aperture. Spicules equal in size, similar in shape, 1.21-1.27 mm long, Fifteen pairs of caudal papillae, 3 pre-, 4 ad- and 8 post-cloacal. Cloacal aperture 150-190 from posterior end. Spike of the tail 54-82 long.

Females: body 6.63-7.48 mm long, 370-420 wide. Esophagus 710-850 long, including the bulb which is 260-290 long by 220-240 wide. Nerve ring and excretory pore 250-280



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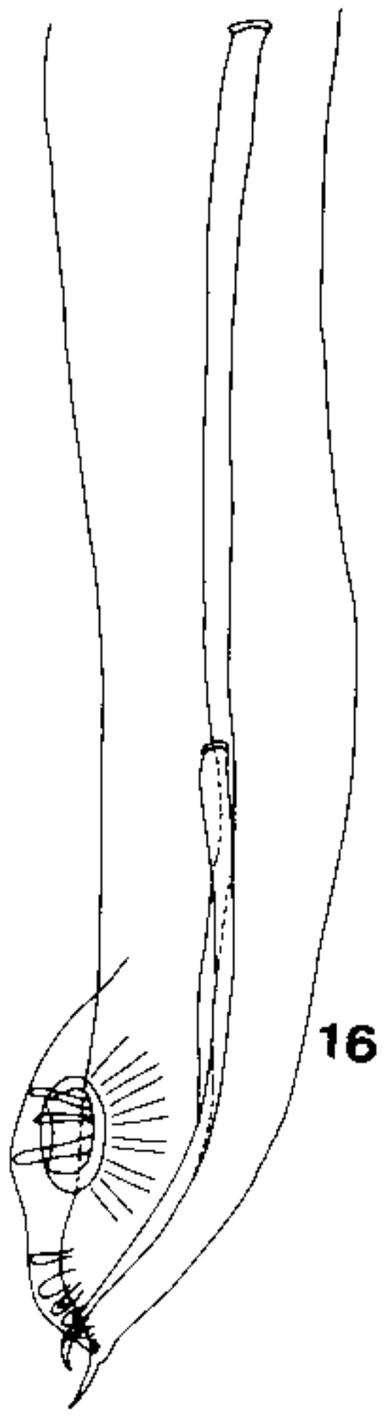

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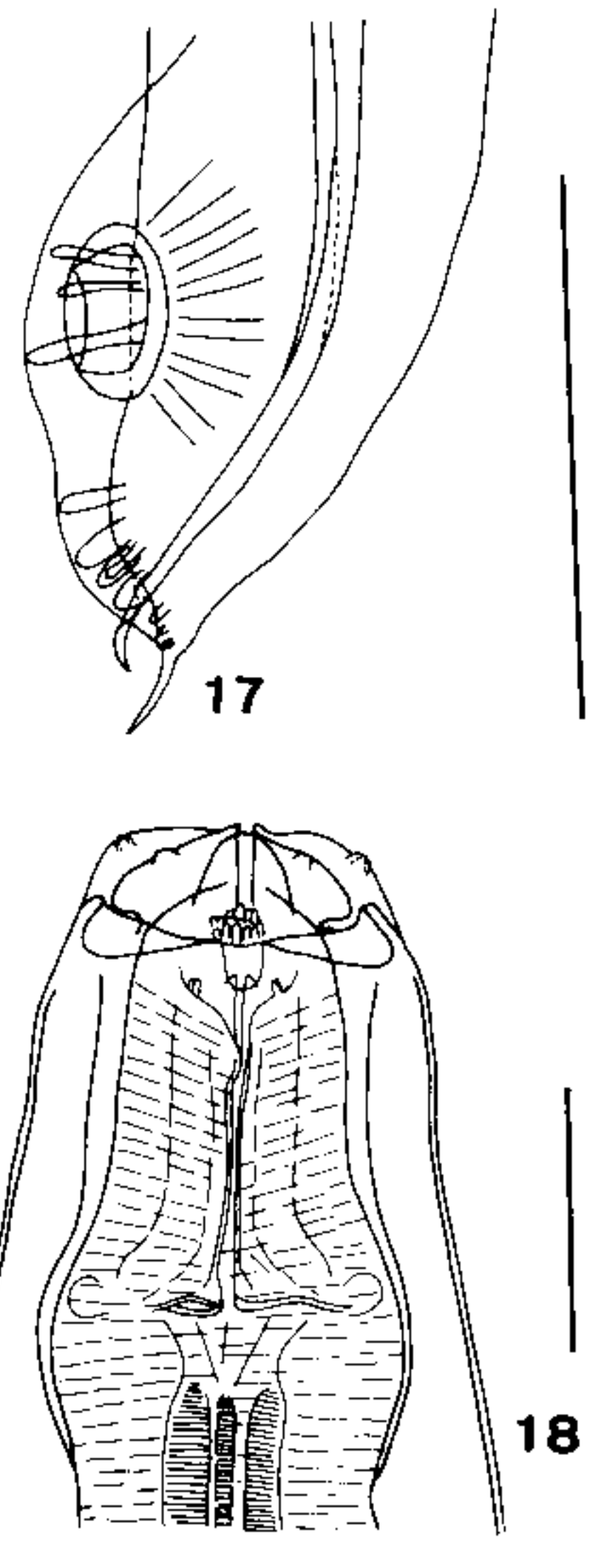

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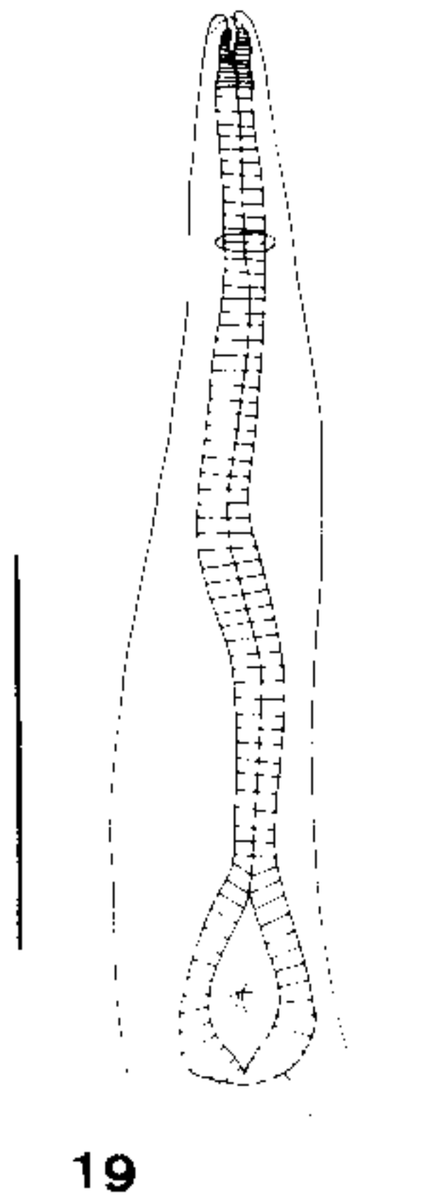

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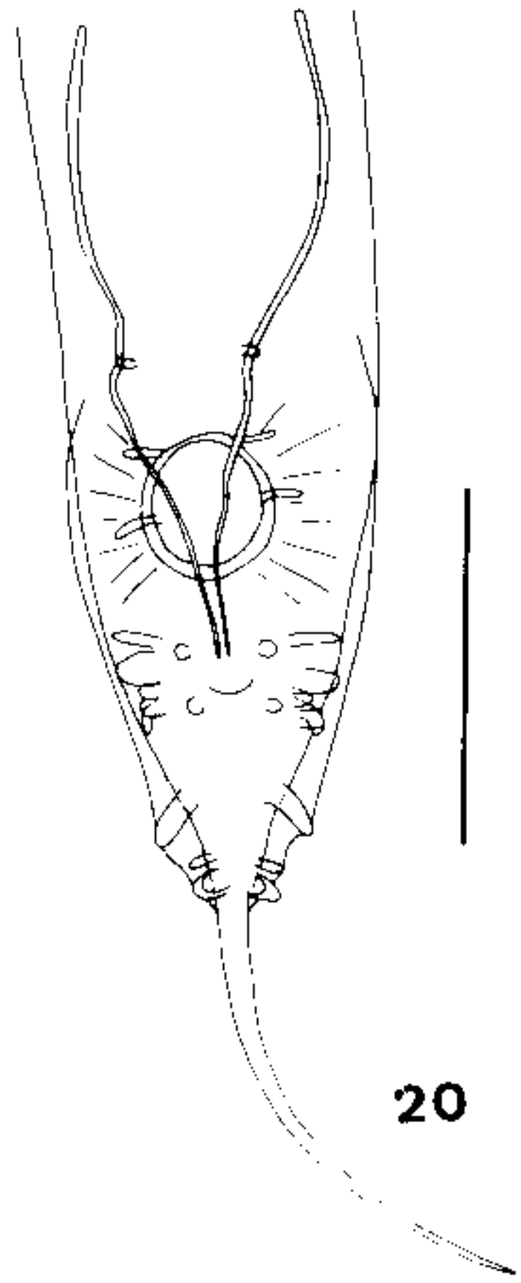

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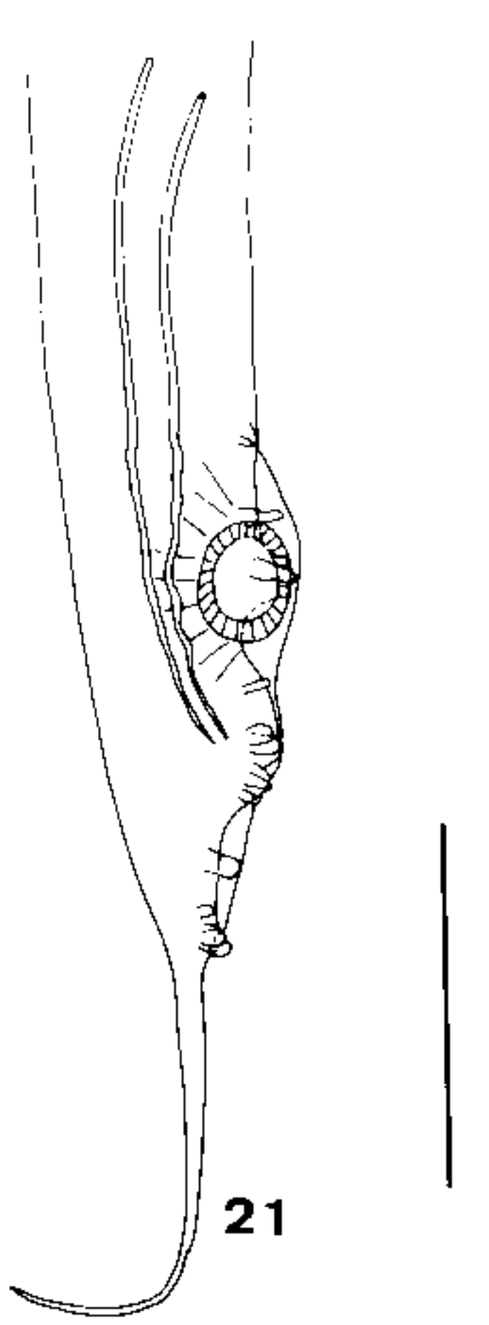

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Heterakis spiculatus – Fig. 15: anterior extremity (lateral view). Fig. 16: posterior extremity of male (lateral view). Fig. 17: posterior extremity of male (lateral view). *Odontoterakis multidentata* – Fig. 18: anterior extremity (after Baylis, 1944, adapted). Fig. 19: anterior extremity (lateral view). Fig. 20: posterior extremity of male (ventral view). Fig. 21: posterior extremity of male (lateral view). (Bar = 0.05 mm in Fig. 18; bar = 0.2 mm in Figs 15, 17, 20, 21; bar = 0.3 mm in Fig. 19; bar = 0.4 mm in Fig. 16).

and 280-350 from anterior end, respectively. Vulva 3.38-3.57 mm from anterior extremity; ovijector 1.96-2.34 mm long. Eggs 61-64 long by 32-36 wide. Rectum 180-210 long. Anus 590 from posterior end.

Taxonomic summary

Hosts: *Tinamus solitarius* (Vieillot); common name: solitary tinamou ("macuco"), NHR; *Tinamus tao tao* (Temminck); common name: gray tinamou ("inambu-açu"; "azulona"), NHR.

Site: intestine.

Localities: states of Espirito Santo, Para and Rio de Janeiro, Brazil.

Specimens studied: CHIOC no. 38.854 a-d (whole mounts); 9.109; 9.110; 15.802; 15-804; 15.805; 15.806; 15.808; 15.794; 15.795; 15.796; 15.797; 15.798; 15.799; 15.800; 15.863; 15.891; 16.911; 16.938; 21.049 (wet material).

Remarks *Heterakis nattereri* was proposed by Travassos (1923) from *Crax blumenbachii* (sic) captured in the state of Mato Grosso. Its diagnosis was reproduced by Cram (1927) and Skrjabin et al. (1961). This species is fully illustrated for the first time since its original description.

Heterakis spiculatus (Cobbold, 1861)
Travassos, 1918
(Figs 15-17)

Description (based on three specimens, two males and one female from *Crypturellus noctivagus*). Heterakoidea, Heterakidae, Heterakinae. Males: body 6.69-8.22 mm long, 570 wide. Esophagus 1.26-1.75 mm long, including the bulb which is 350 long by 290 wide. Nerve ring and excretory pore 320-350 and 460-530 from anterior end, respectively. Precloacal chitinous-rimmed sucker 180-195 in diameter, 190-200 from cloacal aperture. Spicules unequal in size, similar in shape, 2.36-2.56 and 1.02-1.05 mm long. Thirteen pairs of caudal papillae, 7 pre-, 2 ad- and 4 post-cloacal. Cloacal aperture 180 from posterior end. Spike of the tail 100 long. Female: body 9.86 mm long, 610 wide. Esophagus 1.30 mm long, including the bulb which is 370 long by 290 wide. Nerve ring and excretory pore 320 and 510 from anterior end, respectively. Vulva 5.40 mm from anterior extremity; ovijector 1.98 mm long. Eggs 64 long by 32-36 wide. Rectum 210 long. Anus 740 from posterior end.

Taxonomic summary

Hosts: *Crypturellus variegatus variegatus* (Gmelin); common name: undulated tinamou ("jaó"), NHR; *C. noctivagus* (Wied); common name: yellow-legged tinamou ("Jaó", "zabelê"), NHR.

Site: intestine.

Locality: state of Espirito Santo, Brazil.

Specimens studied: CHIOC no. 32.855 a-c (whole mounts); 15.879 (wet material).

Remarks: *Heterakis spiculatus* was originally described as *Strongylus spiculatus* by Cobbold (1861). Travassos (1918) considered *H. valvata* Schneider, 1866 from *Crypturus cupreus* (sic) identical to *H. spiculatus* and Freitas (1956) agreed.

Odontoterakis multidentata (Baylis, 1944)
Skrjabin & Shikhobalova, 1947
(Figs 18-21)

Description (based on nine specimens, five males and four females). Heterakoidea, Heterakidae, Heterakinae. Males: body 4.25-5.95 mm long, 180-300 wide. Esophagus 1.00-1.17 mm long, including the bulb which is 220-250 long by 140-190 wide. Nerve ring and excretory pore 210-250 and 250-280 from anterior end, respectively. Precloacal chitinous-rimmed sucker 64-79 in diameter, 50-72 from cloacal aperture. Spicules equal in size, similar in shape 290-330 long. Fourteen pairs of caudal papillae, 5 pre-, 5 ad- and 4 post-cloacal. Cloacal aperture 290-340 from posterior end.

Females: body 5.10-6.12 mm long, 220-290 wide. Esophagus 1.17-1.26 mm long, including the bulb which is 250-270 long by 160-190 wide. Nerve ring and excretory pore 250-280 and 300-360 from anterior end, respectively. Vulva 2.80-3.22 mm from anterior extremity; ovijector 1.11-1.18 mm long. Eggs 50-57 long by 32-36 wide. Rectum 97-130 long. Anus 590-720 from posterior end.

Taxonomic summary

Host: *Crypturellus variegatus variegatus* (Gmelin) (= *Crypturus variegatus*); common name: variegated tinamou ("inambu-onça").

Site: intestine.

Locality: state of Espirito Santo, Brazil.

Specimens studied: CHIOC no. 32.852 a-i (whole mounts); 15.792, 15.793 (wet material).

Remarks: *Odontoterakis multidentata* was described as *Heterakis multidentada* by Baylis (1944), on the basis of specimens collected from a variegated tinamou, *Crypturus variegatus* captured in the upper Cuyuni River, British Guiana. Later, this species was included in the genus *Odontoterakis* by Skrjabin & Shikhobalova (1947). This is the first report of the species occurring in a Brazilian bird of the same species. The other reference of the genus in Brazil is related to *O. fariai* (Travassos, 1914) Inglis, 1957, originally described as *Heterakis fariai,* from the *Phasianidae Odontophorus* capueira, the spot-winged wood-quail (Inglis, 1957).

Other species

Another two Heterakidae recovered from Tinamidae, *Heterakis arquata* Schneider, 1866 from *Crypturellus cupreus* and *Psophia viridis* and *Heterakis brasiliana* Linstow, 1899 from *Rhynchotus rufescens* have already been reported from Brazil, but were not found during the present study.

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