

ARTÍCULO ORIGINAL

Helminths of the Spotted Nothura, Nothura maculosa (Temminck, 1815) (Aves, Tinamidae) in South America

ROBERTO MAGALHÃES PINTO****, MARCELO KNOFF*,
CLÁUDIA TORRES GOMES* and DELY NORONHA***

ABSTRACT

This study refers to the helminth fauna of the Spotted Nothura, *Nothura maculosa* (Temminck, 1815), on the basis of samples deposited in the Helminthological Collection of the Oswaldo Cruz Institute, and also on bibliographical data. The helminth survey of *N. maculosa* is represented by the digenetic trematode *Brachylaemus (Centrodes) centrodes* (Braun, 1901) Travassos & Kohn, 1964, by two cestode species, one included in *Hymenolepis* Weiland, 1858 and the other identified as *Fuhrmannetta elongata* (Fuhrmann, 1908), by the nematodes *Heterakis gallinarum* (Schrank, 1788) Freeborn, 1923, *Heterakis spiculatus* (Cobbold, 1861) Travassos, 1918, *Subulura olympioi* Barreto, 1918, *Eucoleus penidoi* Freitas & Lins, 1935, *Hadjelia curvata* Vaz & Pereira, 1935, *Hempelia hempelii* Vaz, 1936, *Tetracheilonema quadrilabiatum* (Molin, 1858), one species included in *Capillaria* Zeder, 1800, and another in *Trichostrongylidae* Leiper, 1912; the acanthocephalan is represented by *Mediorhynchus pintoi* Travassos, 1923. *Fuhrmannetta elongata* is referred for the first time in this host since its proposal in 1908. There is a report of the finding of the habronematid nematode *Procyrnea cameroni* Gupta & Kazim, 1978 from *N. maculosa* in Brazil; the species is not illustrated taking into account the status of the original reference. The probable occurrence of the digeneans *Prosthogonimus ovatus* (Rudolphi, 1803), *Athesmia heterolecithodes* (Braun, 1899) Looss, 1899, and the nematode *Heterakis brasiliensis* Linstow, 1899, is indicated.

Key words: *Nothura maculosa*, helminths, South America.

INTRODUCTION

The Spotted Nothura, *Nothura maculosa* (Temminck, 1815) (Tinamiformes) is of veterinary and commercial importance, since eggs of this bird are widely accepted and considered of high nutritional value. *Nothuras* are found from northeast Argentina, east of Paraguay, Uruguay and east Brazil, from the States of Rio

de Janeiro to Rio Grande do Sul, including the south of Mato Grosso (Campo Grande and Vacaria municipalities)¹; these birds inhabit savannahs, scrubs, caatingas as well as agricultural land. While eating seeds, they also feed on insects and ticks that are found near or on the cattle².

Specimens of this bird have been used in surveys of ectoparasites^{3,4}, bacteria, protozoa⁵,

* Laboratório de Helminthos Parasitos de Vertebrados, Departamento de Helminthologia, Instituto Oswaldo Cruz. Av. Brasil, 4365, 21040-900 Rio de Janeiro, Rio de Janeiro, Brasil.

** Curadora da Coleção Helminológica do Instituto Oswaldo Cruz.

*** Corresponding author: E-mail: rmpinto@ioc.fiocruz.br - CNPq research fellow.

in investigations related to anatomy, embryology^{6,7}, as live baits for the collection of mosquitoes in studies of host preference and stratification of insects⁸, and also in works focusing genetic approaches⁹. Despite of the fact that the Spotted Nothura is one of the better known of the tinamous, data on the helminths recovered from this host are remarkably scattered; thus, the present study aims to gather information regarding the helminth fauna of *N. maculosa* in order to provide the prompt identification of the species and promote further eventual epidemiological approaches.

MATERIALS AND METHODS

Thirteen analyzed samples (11 of nematodes, 01 of cestodes, and 01 of acanthocephalans), deposited in the Helminthological Collection of the Oswaldo Cruz Institute (CHIOC) were collected from Brazilian specimens of *N. maculosa* between 1916-1970, in the States of Bahia, São Paulo, and Minas Gerais. The material was preserved either as whole mounts or wet material. Specimens under the latter condition were processed for study as described elsewhere¹⁰. Additional samples of helminths (one trematode and two nematode species) previously referred in nothuras but recovered from other tinamid hosts and deposited in the CHIOC were also analyzed. Classification of the helminths is in accordance with taxonomic keys for the parasites¹¹⁻¹³ and data about their host is based on the literature^{1,14,15}. Most of the figures were reproduced from original papers. Values are in millimeters (mm).

RESULTS AND REMARKS

PLATYHELMINTHES,

TREMATODA, DIGenea

Brachylaemidae Joyeux & Folley, 1930

Brachylaemus (Centrodes) centrodes (Braun, 1901) Travassos & Kohn, 1966

(Figure 1)

Remarks: This species was originally described as *Harmostomum centrodes* parasitizing specimens of *N. maculosa* and other tinamids in Brazil¹⁶. Later, a new name was proposed the new combination *Brachylaemus (Centrodes) centrodes*^{17,18} in Brazilian specimens of *N. maculosa*, *Crypturellus variegatus* (Gmelin,

1789) (Variegated Tinamou, “inambu-chororão”), *C. obsoletus* (Brown Tinamou, “inambuquaçu”), *Tinamus solitarius* (Solitary Tinamou, “macuco”). The illustrated specimen represents CHIOC no. 17502 (whole mount), recovered from an unidentified tinamid¹⁹. Concerning other digeneans, personal communication refers to *Prosthogonimus ovatus* and *Athesmia heterolecithodes*, parasitizing specimens of *N. maculosa* in Argentina²⁰. Nevertheless, taking into account that these occurrences have not been confirmed so far, these species were not included in the present survey.

EUCESTODA, ORDER CYCLOPHYLIDAE

Davaineidae Braun, 1900

Fuhrmannetta elongata (Fuhrmann, 1909) (= *Davainea elongata*, *Raillietina elongata*)

(Figures 2-4)

Remarks: this is the second report of a cestode species in *N. maculosa*, taking into account that investigators refer to the finding of specimens, (not properly figured) allocated in *Hymenolepis* parasitizing Spotted Nothuras captured in Argentina⁵. In the present investigation, although some rostellar hooks were lacking in the studied specimens of *F. elongata*, other morphological aspects permitted the diagnosis of the species. *Fuhrmannetta elongata* was described as *Davainea elongata* from South American tinamids, namely *Rhynchotus rufescens* (Red-winged Tinamou, “perdiz”), *Nothura minor* [= *Nothura media*] (Lesser Nothura, “codorna mineira, codorniz”) and *Tynamus* sp. (?) in Paraguay, Uruguay and Argentina²¹. The species was listed later as *Raillietina elongata*²². This is a new host record for *F. elongata*. Original figures of the species presented here, are based on the sample CHIOC no. 30261 (wet material).

NEMATODA

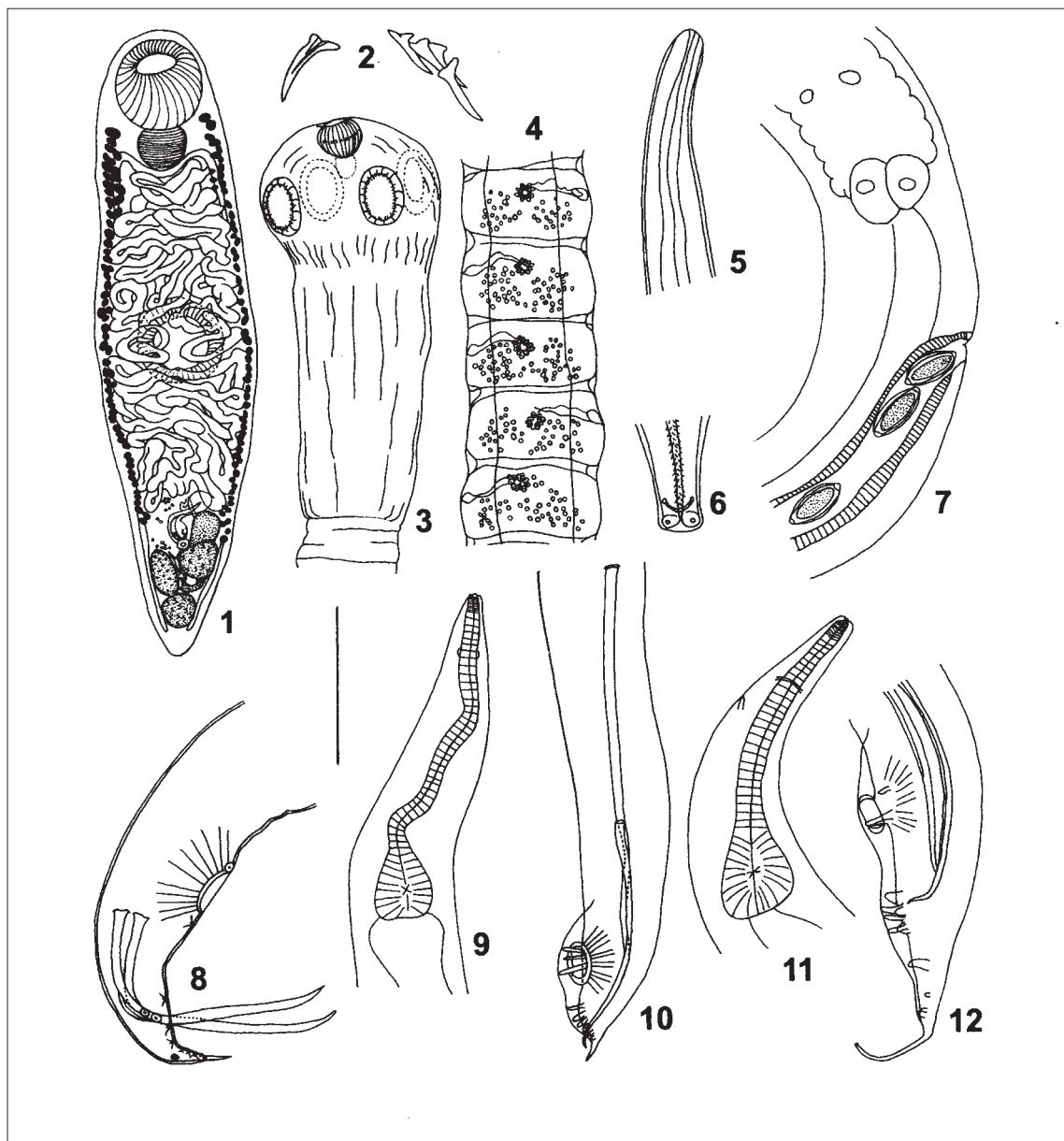
TRICHINELLOIDEA

Trichuridae Railliet, 1915

Eucoleus penidoi (Freitas & Almeida, 1935) Lopez-Neyra, 1947 (= *Capillaria penidoi* Freitas & Almeida, 1935, *Ritaklossia penidoi* Freitas, 1959)

(Figures 5-7)

Remarks: the species was proposed as *Capillaria penidoi*²³ on the basis of nematodes recovered from the crop of a specimen of *N. maculosa*



Figures 1-12. 1. *Brachylaemus (Centrodes) centrodes*. total. 2-4. *Fuhrmannetta elongate*. 2. rostellar hooks. 3. scolex. 4. mature proglottids. 5-7. *Eucoleus penidoi*. 5. anterior portion of male. 6. posterior extremity of male. 7. vulvar region. 8. *Subulura olympioi*, posterior portion of male. 9-10. *Heterakis spiculatus*. 9. anterior portion of female. 10. posterior portion of male. 11-12. *Heterakis gallinarum*. 11. anterior portion of female. 12. posterior extremity of male. Bar common to Figures 1-12 (= 1.5 in figure 1; 0.02 in figure. 2; 0.1 in figures 3, 7; 0.5 in figure. 4; 0.09 in figures 5, 6; 0.6 in figure. 8; 0.3 in figures 9, 10, 11; 0.06 in figure 12).

Figure. 1. after Travassos & Kohn¹⁷; figures 2-4: original; figures 5-7. after Freitas & Almeida²³ figure 8. after Barreto²⁹; figures 9-12. after Vicente et al³⁰.

captured in Avaré, State of São Paulo. Although since the early 40's²⁴ the combination of the species refers to *Eucoleus*, the species was

referred in *Capillaria*²⁵ in a survey of nematodes recovered from Argentinean specimens of *N. maculosa*. Previously has been⁵ reported to the

finding of specimens of *Capillaria* from *N. maculosa* in Argentina; the nematodes probably represent *E. penidoi*. The species was also included in *Ritaklossia*²⁶, that was also considered a synonym of *Eucoleus*²⁷. The type material (CHIOC no. 7502, wet material) was presently revised and included as whole mounts under the no. 36509 a-c, on which the figures presented here are based.

SUBULUROIDEA

Subuluridae Yorke & Maplestone, 1926

Subulura olympioi Barreto, 1918

(Figure. 8)

Remarks: *S. olympioi* seems to be the most prevalent nematode species in *N. maculosa*, in Brazil and in Argentina. In the present survey, 54.5% of the nematode samples were represented by *S. olympioi*. Nascimento *et al.*²⁸ referred to a prevalence of 66.5%, whereas in Argentina this value was of 45.0%²⁵. The species also occurs in other tinamid birds, namely *Rhynchotus rufescens*, *Crypturellus parvirostris* (Small-billed Tinamou, “nambu-chororó” “nambuzinho”) and *C. undulatus* (Undulated Tinamou, “jaó”)^{28, 29}. Deposited samples CHIOC no. 1118, 4611, 6217, 7794, 10485 (wet material), 30725 a-f (whole mounts). The specimen illustrated here, derives from the sample CHIOC no. 1118.

HETERAKOIDEA

Heterakidae Railliet & Henry, 1914

Heterakis spiculatus (Cobbold, 1861) Travassos, 1918 (= *Heterakis valvata* Schneider, 1866)

(Figures 9-10)

Remarks: although not recorded so far from Brazilian specimens of *N. maculosa*, the species is commonly found infecting other tinamids in Brazil [*Crypturellus tataupa*, (Tataupa Tinamou, “nambu-chintã”), *C. noctivagus*, (Yellow-legged tinamou, “jaó, zabelê” and *C. variegatus*]; *H. spiculatus* was referred^{5, 25} as *Heterakis valvata* occurring in *N. maculosa* in Argentina. Samples of this nematode species deposited in the CHIOC were either recovered from *C. variegatus* or from unidentified specimens of the tinamou *Crypturellus* sp., captured in São Paulo in the early 1900's (CHIOC no. 9, 1415, wet material). Samples recovered from *C. variegatus* and *C. noctivagus*: CHIOC no. 32855 a-c (whole mounts) and 15879 (wet material), respectively. Specimens illustrated now represent the sample 32855 a.

Heterakis gallinarum (Schrank, 1788) Freeborn, 1923

(Figures 11, 12)

Remarks: *H. gallinarum* is a common and widespread nematode species, found parasitizing a wide range of hosts represented by the Galliformes, Anseriformes and Timamiformes. Specimens illustrated here represent the sample CHIOC no. 32853 a-c (whole mounts), derived from the sample 20092 (wet material) recovered from the ceca of *N. maculosa* in 1943.

Nematodes included in *Heterakis*, found in tinamid birds share great similarities; concerning *H. spiculatus* and *H. gallinarum* that occur in *N. maculosa*, the prompt differentiation between these two species is mainly based on the size of the esophagus and spicules. In *H. spiculatus* the esophagus is 1.26-1.75 long and the spicules 2.36-2.56, 1.02-1.05, compared to 0.91-0.96 (esophagus) and 2.24-2.31, 0.67-0.70 (spicules) in *H. gallinarum*.

There is a reference of *Heterakis brasiliana*, occurring in an unidentified species of the genus *Nothura*. Taking into account that three species of this bird are referred in Brazil, namely *N. maculosa*, *N. minor* and *N. boraquira* [White-bellied *Nothura*, “codorna-do-nordeste, codorna, codorna-baiana, codorna-buraqueira, codorna-de-cabeça-preta, codornil”, *H. brasiliana* is only cited^{13, 30}, considering the lack of reliable data on the specific host identification.

HABRONEMATOIDEA

Habronematidae (Chitwood & Wehr, 1932)

Ivashkin, 1961

Hadjelia curvata Vaz & Pereira, 1935

(Figures 13,14)

Remarks: the species was proposed³¹ on the basis of nematodes recovered from proventriculus and gizzard of a specimen of *N. maculosa* captured in the State of Goiás, Brazil and the types were deposited in the Helminthological Collection of the Instituto Biológico de São Paulo under the number 1685. Vicente *et al.*¹³, do not present illustrations of *H. curvata* despite of the inclusion of data after Vaz & Pereira³¹, referred erroneously as 1933 in Table XXVIII (page 179). Thus, the original figures of *H. curvata* are reproduced in a Brazilian periodical for the first time, since the species was proposed in an article issued in the *Transactions of the American Microscopical Society*, misunderstood with *Transactions of the*

Microscopical Society of Washington (?)¹³.

There is a report of the finding of the habronematid nematode *Procyrnea cameroni* from *N. maculosa* in Brazil³⁹. This species was not figured in the present study, considering the status of the results (unpublished data, reported by the senior author in a PhD thesis).

THELAZOIDEA

Thelaziidae Skrjabin, 1915

Hempelia hempeli Vaz, 1936

(Figures 15,16)

Remarks: *H. hempeli* was described³² from the eyes of *Rynchotus rufescens* and *N. maculosa*. To the date, the species was not found again in Brazil. The only specimen deposited in the CHIOC (no. 32682, wet material) is darkened, broken and derived from the type material described³², formerly deposited in the Helminthological Collection of the Instituto Biológico de São Paulo, no. 232; the material was recovered from the eyes of a specimen of *N. maculosa*, captured in Itararé, State of São Paulo. Taking into account the poor conditions of the sample, original figures of *H. hempeli* are reproduced here.

APROCTOIDEA

Aproctidae Skrjabin & Shikhobalova, 1945

Tetracheilonema quadrilabiatum (Molin, 1858)

Diesing, 1861 [= *Filaria hoffmanni* (Mazza & Fiora, 1932)]

(Figures 17-19)

Remarks: this species was well redescribed³³ on the basis of samples recovered from two Brazilian tinamid birds, *N. maculosa* and *Rynchotus rufescens*. This material is deposited in the Helminthological Collection of the Instituto Biológico de São Paulo no. 1409. The present illustrations are based on this sample. Specimens of *T. quadrilabiatum* from *N. maculosa* are deposited in the CHIOC no. 36846 a-c (whole mounts), formerly 9592 (wet material) erroneously identified as *Pelecitus* sp and also, with the site of infection misunderstood (wing musculature); the corrections were included in the original file, since this nematode (*T. quadrilabiatum*), differently from specimens of *Pelecitus* that commonly parasitize muscles, tendons and nodules of the legs and feet or footpads of birds¹⁰, is found in the body cavity of the hosts. This is probably a case of contamination

during the necropsy, when the site of the infection was not correctly determined. In Argentina, *T. quadrilabiatum* was referred^{5, 25, 35} in *N. maculosa* (the species was reported³⁴ as *Filaria hoffmanni*). This species was the most prevalent (40%) in one investigation⁵.

Two other nematode species (neither specifically identified nor properly figured), allocated in *Capillaria* and in Trichostrongylidae, respectively, parasitizing Argentinean spotted nothuras were reported⁵.

PHYLUM ACANTHOCEPHALA,

ARCHIACANTHOCEPHALA,

GIGANTORHYNCHIDA

Gigantorhynchidae Hamann, 1892

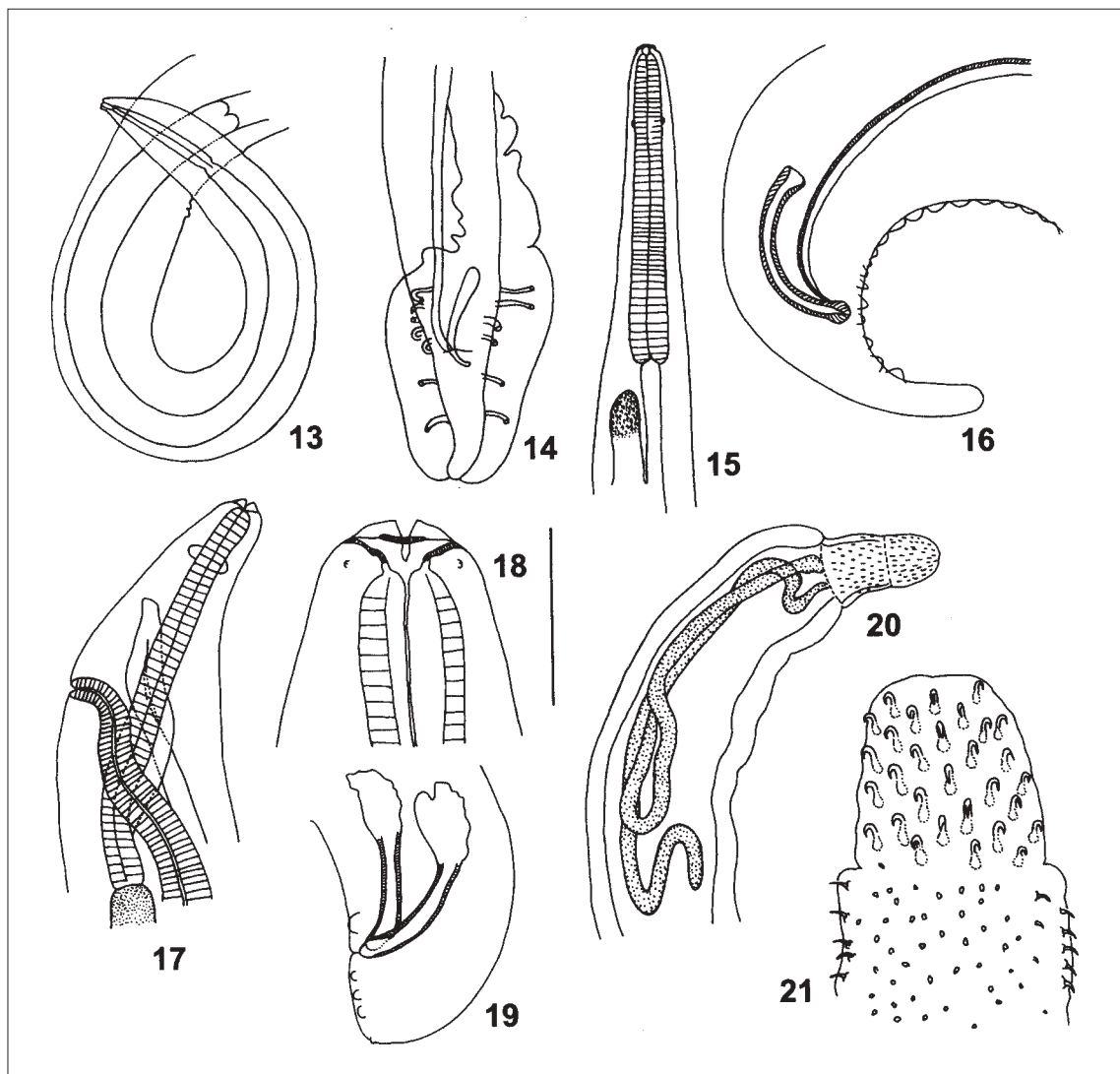
Mediorhynchus pinto Travassos, 1923

(Figures 20, 21)

Remarks: the original description of the species³⁶ was based on a broken female (CHIOC no. 4501, wet material) and males remain unknown so far. The type material was recovered from a specimen of *N. maculosa* captured in Minas Gerais. *Mediorhynchus pinto* was referred in a survey of acanthocephalans³⁷ when data³⁸ were reproduced. Thus, other reports or new findings related to the species, since the original description, are unavailable. The sample CHIOC no. 4.501 with the type broken female was presently re-examined but no further data could be accomplished on the basis of this damaged material. Figures of *M. pinto* are reproduced in accordance with Travassos³⁶.

RESUMO

Este estudo diz respeito à fauna helmintológica da codorna-comum *Nothura maculosa* (Temminck, 1815) e é baseado em amostras depositadas na Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC) e, também, em dados bibliográficos. A helmintofauna de *N. maculosa* é representada pelo trematódeo digenético *Brachylaemus (Centrodes) centrodes* (Braun, 1901) Travassos & Kohn, 1964, por duas espécies de cestóides, uma incluída em *Hymenolepis* Weinland, 1858, e a outra identificada a *Fuhrmannetta elongata* (Fuhrmann, 1908), por nematóides identificados a *Heterakis gallinarum* (Schrank, 1788) Freeborn, 1923, *Heterakis spiculatus* (Cobbold, 1861) Travassos, 1918, *Subulura olympioi* Barreto,



Figures 13-21. 13-14. *Hadjelia curvata*. 13. anterior portion of female, 14. posterior portion of male. 15-16. *Hempelia hempeli*. 15. anterior portion of female. 16. posterior portion of male. 17-19. *Tetracheilonema quadrilabiatum*. 17. anterior portion of female. 18. anterior extremity of male. 19. posterior extremity of male. 20-21. *Mediorhynchus pintoii*. 20. anterior portion of female. 21. proboscis of female. Bar common to Figures 13-21 (= 0.6 in figures 13, 15; 0.3 in figures 14, 19, 21; 0.1 in figures 16, 18; 0.06 in figure 17; 1.5 in figure. 20).

Figures 13, 14. after Vaz & Pereira³¹; figures 15, 16. after Vaz³²; figures 17-19. after Vaz³³; figures 20, 21. after Travassos³⁷.

1918, *Eucoleus penidoi* Freitas & Lins, 1935, *Hadjelia curvata* Vaz & Pereira, 1935, *Hempelia hempeli* Vaz, 1936, *Tetracheilonema quadrilabiatum* (Molin, 1858), uma espécie incluída em *Capillaria* Zeder, 1800 e outra em Trichostrongylidae Leiper, 1912; o acantocéfaló é representado por *Mediorhynchus pintoii* Travassos, 1923. *Fuhrmanneta elongata* é

referida pela primeira vez neste hospedeiro desde a sua proposição em 1908.

A possível ocorrência dos trematódeos digenéticos *Prosthogonimus ovatus* (Rudolphi, 1803), *Athesmia heterolecithodes* (Braun, 1899) Looss, 1899 e dos nematóides *Heterakis brasiliana* Linstow, 1899, *Procyrnea cameroni* Gupta & Kazim, 1978 é indicada. Há um registro

do encontro de um nematóide habronematídeo *Procyrnea cameroni* Gupta & Kazim, 1978 de *N. maculosa* no Brasil, espécie que não é ilustrada, considerando-se a informalidade da citação.

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ANNOUNCEMENT

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