

Checklist of the helminth parasites of vertebrates in Costa Rica

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Abstract: Helminth parasites of vertebrates have been studied in Costa Rica for more than 50 years. Survey work on this group of parasites is far from complete. We assembled a database with all the records of helminth parasites of wild and domestic vertebrates in Costa Rica. Information was obtained from different sources such as literature search (all published accounts) and parasite collections. Here we present a checklist with a parasite-host list as well as a host-parasite list. Up to now, 303 species have been recorded, including 81 species of digeneans, 23 monogeneans, 63 cestodes, 12 acanthocephalans, and 124 nematodes. In total, 108 species of vertebrates have been studied for helminths in Costa Rica (31 species of fishes, 7 amphibians, 14 reptiles, 20 birds, and 36 mammals). This represents only 3.8% of the vertebrate fauna of Costa Rica since about 2,855 species of vertebrates occur in the country. Interestingly, 58 species (19.1 %) were recorded as new species from Costa Rica and most of them are endemic to particular regions. Considering the valuable information that parasites provide because it is synergistic with all the information about the natural history of the hosts, helminth parasites of vertebrates in Costa Rica should be considered within any initiatives to accomplish the national inventory of biological resources. Starting with this compilation work, the Colección de Helmintos de Costa Rica (CHCR), hosted at the Facultad de Microbiología, Universidad de Costa Rica, has re-emerged and it is our hope that it will have the standards of quality to assure that it will become the national depository of helminths in the country.

Key Words: Helminths, Costa Rica, Biodiversity, Biological inventories, Parasites, Vertebrates.

Costa Rica possesses a strong tradition in the study of parasites of domestic and wildlife vertebrates. For more than 50 years the helminth fauna of these hosts has been studied by national parasitologists and microbiologists (see for example Jiménez-Quirós and Brenes-Madrigal 1957, Brenes-Madrigal and Bravo-Hollis 1959, Lamothe-Argumedo and Brenes-Madrigal 1983). A first attempt to compile the information of the helminth parasites of Costa Rica was made by Brenes-Madrigal (1961) who presented up to that year a checklist of about 150 species described as helminth parasites of wild and domestic vertebrates as well as human beings.

However, the extraordinary biological richness of Costa Rica has attracted the attention of several foreign parasitologists who have

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contributed, more recently, to increase the amount of information about the helminths of vertebrates in Costa Rica and in fact, a group of parasitologists led by Dr. Daniel Brooks have developed a research program to inventory the parasites of particular regions of the country, i.e. the Área de Conservación de Guanacaste (ACG), in the province of Guanacaste (further information about the data base of parasites of vertebrates in the ACG can be obtained at: <http://brooksweb.zoo.utoronto.ca>) (see for example Marques *et al.* 1996, Pérez-Ponce de León *et al.* 1998, Brooks *et al.* 1999, Platt 2000, Zelmer and Brooks 2000, Carreño *et al.* 2001, León-Régagnon *et al.* 2001, Choudhury *et al.* 2002).

Of all the helminth specimens collected from Costa Rican hosts, only a few were saved in the collection of the Facultad de Microbiología, University of Costa Rica and most of them have been deposited in foreign parasite collections, i.e. the Colección Nacional de Helminths, Mexico City, Mexico, the U.S. National Parasite Collection, Beltsville, Maryland, U.S.A., and in the Harold W. Manter Laboratory of Parasitology, Lincoln, Nebraska, U.S.A., since there was not a national parasite collection in Costa Rica. However, this is changing. Recently, the University of Costa Rica has issued an initiative to support biological collections, among other kind of collections. This interest is completely congruent with the initiative developed by Costa Rica to establish an inventory of the biological diversity within its territory, and to facilitate their efforts to preserve biodiversity. The starting point for planning the conservation and use of biodiversity is the compilation of information through biological surveys and inventories. Biological collections are one of the most important components of this inventory work, considering both the specimens preserved with high standards of quality and the information associated with each specimen (database) (Reaka-Kudla *et al.* 1997). So the objective of this paper is two-fold, to update all the available information about helminth parasites of vertebrates in Costa Rica, and to set the basis for the re-establishment of the Colección Helminológica de la Facultad de

Microbiología as the Colección de Helminths de Costa Rica which should have the status of National Collection, and will become the depository of the helminth parasites of vertebrates and invertebrates in the near future, calling the attention to all national and foreign parasitologists, that some of the specimens collected in the country, and their published accounts should be deposited in this re-emerged collection.

MATERIALS AND METHODS

To accomplish the goals of this paper, we conducted a search in two kinds of sources: Parasite collections and bibliographic references. Information from the Colección Nacional de Helminths in Mexico City, from the U.S. National Parasite Collection, and the Parasitological Collection of the Harold W. Manter Laboratory of Parasitology, University of Nebraska-Lincoln, both in the U.S.A., was obtained with permission of their curators. All records from Costa Rican hosts were then extracted and entered in a database built on Microsoft Access 2000. At the same time, a bibliographical search was conducted in sources such as Helminthological Abstracts and Biological Abstracts. We did put special attention to all published accounts done in Costa Rican journals where some records have also been published. These records were also entered in the database. The database will be available upon request to B.R.O., curator of the Colección de Helminths de Costa Rica.

The checklist is divided in two parts. First we present a parasite-host list. It is presented in phylogenetic order starting with Platyhelminthes (Digenea, Monogenea and Cestoda), and following with Acanthocephala and Nematoda. Within each phylum and class, families are presented alphabetically and within family, species are also presented in alphabetical order. To allocate species in families we followed taxonomical treatments such as Yamaguti (1963, 1971), Amin (1985, 1992), Schmidt (1986), Khalil *et al.* (1994), and Anderson *et al.* (1973-1984). Each record contains the information about the

species name, authority and year, habitat, host(s) with the group to which it belongs in parentheses (see symbology section), locality (particular locality when possible and province), and bibliographical reference. In those cases where specimens were deposited in some parasite collection, the collection acronym is mentioned. Finally, in most cases we present notes to point out possible taxonomical changes, synonyms, and new combinations of names. In all cases, we tried to consider the inclusion of the most well accepted taxonomical name following authorities. Most records are made from adults, but when larval forms were recorded, it is pointed out after the parasite name in parentheses.

The second part is the host-parasite list. This list is ordered following a traditional classification of vertebrates (Pisces, Amphibia, Reptilia, Aves, and Mammalia). Within each vertebrate group, host species are presented in alphabetical order, with the list of helminths parasitizing each of them ordered in the same way, indicating the group to which each helminth parasite belongs (see symbology). We used the name of the host as described in the original papers, however we recognize that some of them may have changed after taxonomical revisions or more accurate determinations.

RESULTS

In this checklist we present records for 303 species included in 206 genera of helminths. Eighty-one of the 303 species are digeneans, 23 are monogeneans, 63 are cestodes, 12 are acanthocephalans and finally, 124 are nematodes. Next we present the information for each species of helminth.

Parasite-Host List

Symbology: A= amphibian; B= bird; F= fish; M= mammal; R= reptile; (NP)= not published; (NA)= information not available; CMNPA refers to Canadian Museum of Nature,

Invertebrate Zoology Collection, Ottawa, Canada; CHCR to the Colección de Helminthos de Costa Rica, San José, Costa Rica; CNHE to the Colección Nacional de Helminthos, Mexico City, Mexico; HWML to the Harold W. Manter Laboratory, University of Nebraska-Lincoln, Nebraska, U.S.A.; IOC to the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil; USNPC to the U.S. National Parasite Collection, Beltsville, Maryland, U.S.A., and MNHG to the Muséum de Histoire Naturelle, Geneva, Switzerland.

PLATYHELMINTHES

Gegenbaur, 1859

Digenea

(Van Beneden, 1858)

Acanthocolpidae Lühe, 1909

1. *Manteria brachydera* (Manter, 1940) Caballero, 1950.
Stomach, *Caranx caballus*, *Oligoplites altus*, *Oligoplites refulgens* (F), Golfo de Nicoya, Puntarenas (Ponciano-Rodríguez 1986). Specimens: CNHE.
2. *Stephanostomum casum* (Linton, 1910) McFarlane, 1934.
Intestine, *Caranx caballus* (F), Playa Ocotol, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.

Acanthostomidae Poche, 1926

3. *Proctocaecum acuti* (Caballero and Brenes-Madrigal, 1958) Lamothe-Argumedo and Ponciano-Rodríguez, 1985.
Intestine, *Crocodylus acutus* (R), Los Chiles de Grecia, Alajuela (Caballero and Brenes-Madrigal 1958). Specimens: CHCR, CNHE.
Notes: This species was described as *Acanthostomum acuti* by Caballero and Brenes-Madrigal (1958) and transferred to *Atrophecaecum* by Groschaft and Barus (1970). Synonym of *Acanthostomum*

scyphocephalum (Nasir 1974),
Caimanicola marajoara (Brooks 1980),
and *A. americanum* (Moravec 2001).

4. *Stunkardiella minima* (Stunkard, 1938) Lamothe-Argumedo and Ponciano-Rodríguez, 1985.
Intestine, *Rhamdia rogersi* (F), Río Tiribí, Paso Ancho, San José (Caballero and Brenes-Madrigal 1957). Specimens: CHCR, CNHE, HWML.
Notes: Specimens originally recorded as *Acanthostomum gnerii* Szidat, 1954 by Caballero and Brenes-Madrigal (1957). Lamothe-Argumedo and Ponciano (1985) transferred this record to *S. minima*, however this criterion was not accepted by Brooks and Holcman (1993).

Brachycoeliidae (Looss, 1899)
Johnston, 1912

5. *Mesocoelium travassosi* Pereira and Cuocolo, 1940.
Intestine, *Bufo marinus* (A), Tilarán, Guanacaste (Caballero and Brenes-Madrigal 1958). Specimens: CHCR, CNHE, HWML.

Bucephalidae Poche, 1907

6. *Bucephalopsis* sp.
Intestine, *Caranx caballus* (F), "Fish Oceanographic Region No. 77" (NP). Specimens: HWML.
7. *Bucephalus introversus* Manter, 1940.
Stomach, *Caranx hippos* and *Seriola* sp. (F), Puerto Culebra, Guanacaste (Manter 1940).

Cephalogonimidae (Looss, 1899)
Nicoll, 1914

8. *Cephalogonimus americanus* Stafford, 1902.
Intestine, *Rana pipiens* (A), Corís, Cartago (Brenes-Madrigal *et al.* 1959b). Specimens: CHCR.

Cyclocoelidae Kossack, 1911

9. *Haematotrephus facioi* (Brenes-Madrigal and Arroyo-Sancho, 1962).
Aerial sacs, *Jacana spinosa* (B), Aranjuez, Puntarenas (Brenes-Madrigal and Arroyo-Sancho 1962). Specimens: CHCR.
Notes: This species was described as *Cyclocoelum facioi* Brenes-Madrigal and Arroyo-Sancho, 1962, however it is listed within the genus *Haematotrephus* Stossich, 1902 by Yamaguti (1971).
10. *Hyptiasmus costaricense* (Brenes-Madrigal and Arroyo-Sancho, 1962)
Aerial sac and thoracic cavity, *Momotus momotus* (B), Quepos, Puntarenas (Brenes-Madrigal and Arroyo-Sancho 1962). Specimens: CHCR.
Notes: Originally recorded as *Cyclocoelum costaricense* Brenes-Madrigal and Arroyo-Sancho, 1962 and listed as a member of the genus *Hyptiasmus* Kossack, 1911 by Yamaguti (1971).

Dicrocoeliidae Odhner, 1910

11. *Controrchis biliophilus* Price, 1928
Bile ducts, *Alouatta palliata palliata* (M), Tilarán, Guanacaste (Jiménez-Quirós and Brenes-Madrigal 1957), La Pacífica, Guanacaste (Stuart *et al.* 1990). Specimens: CHCR, CNHE, HWML.
Notes: Jiménez-Quirós and Brenes-Madrigal (1957) determined his specimens as *Controrchis caballeroi* Jiménez-Quirós and Brenes-Madrigal, 1957, a species that was later synonymized with *C. biliophilus* by Jiménez-Quirós and Brenes-Madrigal (1958).
12. *Lubens lubens* (Braun, 1901) Strom, 1940
Gall bladder, *Calocitta formosa* (B), Tilarán, Guanacaste (Brenes-Madrigal *et al.* 1966). Specimens: CHCR.
Notes: Species described as *Lubens centroamericanus* Brenes-Madrigal, Arroyo-Sancho and Muñoz-Montoya, 1966 and

- synonymized with *L. lubens* by Lamothe-Argumedo (1979).
13. *Lutztrema obliquum* (Travassos, 1917) Travassos, 1941
Bile ducts, *Gymnostinops montezuma* (B), Chitaria, Cartago (Jiménez-Quirós and Arroyo-Sancho 1960b). Specimens: CHCR.
14. *Platynosomum costaricense* Brenes-Madrugal, Arroyo-Sancho and Muñóz, 1966.
Gall bladder, *Buteo nitidus* (B), Tilarán, Guanacaste (Brenes-Madrugal *et al.* 1966). Specimens: CHCR.
15. *P. illiciens* (Braun, 1901) Travassos, 1916.
Gall bladder, *Leucopternis semiplumbea* (B), Sarapiquí, Heredia (Brenes-Madrugal and Arroyo-Sancho 1962). Specimens: CHCR.
16. *Robertdigenea dollfusi* Caballero and Caballero-Rodríguez, 1970.
Bile ducts and liver, *Procyon lotor crassidens* (M), Balsa de Mora, San José (Caballero and Caballero-Rodríguez 1970). Specimens: CNHE.
17. *Zonorchis costaricensis* Brenes-Madrugal and Jiménez-Quirós, 1959.
Gall bladder, *Gymnostinops montezuma* (B), Peralta, Cartago (Brenes-Madrugal and Jiménez-Quirós 1959). Specimens: CHCR.
18. *Z. macroovaricus* Jiménez-Quirós and Arroyo-Sancho, 1960.
Bile ducts, *Pteroglossus torquatus* (B), Tilarán, Guanacaste (Jiménez-Quirós and Arroyo-Sancho 1960b). Specimens: CHCR.
- Didymozoidae Poche, 1907
19. Didymozoidae gen. sp. (metacercariae).
Intestine, *Haemulon maculicauda* (F), Bahía Culebra, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.
- Diplostomidae Poirier, 1886
20. *Alaria nasuae* La Rue and Townsend, 1927
Intestine, *Canis latrans* (M), San José, San José (NP). Specimens: USNPC.
- Eucotylidae Skrjabin, 1924
21. *Tanaisia freitasi* Brenes-Madrugal and Arroyo-Sancho, 1962
Kidneys, *Gymnostinops montezuma* (B), Orosi, Cartago (Brenes-Madrugal and Arroyo-Sancho 1962). Specimens: CHCR.
22. *T. winteri* Brenes-Madrugal and Arroyo-Sancho, 1962.
Kidneys, *Jacana spinosa* (B), Aranjuez, Puntarenas (Brenes-Madrugal and Arroyo-Sancho 1962). Specimens: CHCR.
- Eumegacetidae Travassos, 1922.
23. *Eumegacetes macroorchis* Brenes-Madrugal and Arroyo-Sancho, 1962.
Cloaca, *Crotophaga sulcirostris* (B), Aranjuez, Puntarenas (Brenes-Madrugal and Arroyo-Sancho 1962). Specimens: CHCR.
- Fasciolidae Railliet, 1895
24. *Fasciola hepatica* Linneo, 1758.
Liver, *Bos taurus* (M), Cerrillos, Cartago (Brenes-Madrugal 1961), Santa Cruz de Turrialba (Chang-Díaz and Cartin-González 1983), San Pedro Montes de Oca, San José (NP). Specimens: CHCR, USNPC.
- Fellodistomidae (Nicoll, 1909)
Nicoll, 1913
25. *Tergestia laticollis* (Rudolphi, 1819) Stossich, 1899.
Intestine, *Caranx caballus* (F), Playa Ocotol, Guanacaste (Pérez-Ponce de León *et al.* 1998), Puerto Culebra, Guanacaste (Manter 1940). Specimens: CNHE, HWML.
- Gorgoderidae Looss, 1901
26. *Gorgoderina megalorchis* Bravo-Hollis, 1948.
Urinary bladder, *Bufo marinus* (A), Piedad de Santa Ana, San José (Caballero *et al.* 1957). Specimens: CHCR, CNHE.

Haematoloechidae Odening, 1964

27. *Haematoloechus meridionalis* León-Règagnon, Brooks and Zelmer, 2001. Lungs, *Rana vaillanti* (A), Río Pizote, Guanacaste (León-Règagnon *et al.* 2001). Specimens: CNHE, USNPC.
28. *Neohaematoloechus helibravae* Caballero-Rodríguez, 1989. Lungs, *Rana palmipes* (A), NA (NP). Specimens: CNHE. Notes: This species is considered *nomina nuda*.

Hemiuridae Lühe, 1901

29. *Ectenurus virgulus* Linton, 1910. Intestine, *Fistularia commersonii* (F), Playa Ocotal, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.
30. *Halipegus eschi* Zelmer and Brooks, 2000. Esophagus, *Rana vaillanti* (A), Río Pizote, Guanacaste (Zelmer and Brooks 2000). Specimens: USNPC.
31. *Lecithochirium microstomum* Chandler, 1935. Intestine, *Fistularia commersonii* (F), Playa Ocotal, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.
32. *L. monticelli* (Linton, 1898) Crowcroft, 1946. Stomach, *Synodus* sp. (F), Puntarenas (Bravo-Hollis and Arroyo-Sancho 1962a). Specimens: CNHE. Notes: According to Yamaguti (1971) this material may belong to a different species.
33. *Mecoderus oligoplites* Manter, 1940. Stomach, *Oligoplites* sp. (F), Puntarenas (Bravo-Hollis and Arroyo-Sancho 1962a), *Oligoplites altus* and *Oligoplites refulgens* (F), Golfo de Nicoya, Puntarenas (Ponciano-Rodríguez 1986). Specimens: CNHE.
34. *Pseudolecithaster* sp. Intestine, *Echidna nocturna* (F), Playa Cuajiniquil, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.
35. *Theletrum lamothei* Pérez-Ponce de León, León-Règagnon and Monks, 1998.

Intestine, *Echidna nocturna* (F), Playa Cuajiniquil, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE, USNPC.

Heronimidae Ward, 1917

36. *Heronimus mollis* (Leidy, 1856) Stunkard, 1964. Lungs, *Kinosternon cruentatum* (R), Santa Ana, San José (Caballero *et al.* 1957). Specimens: CNHE. Notes: Species originally recorded as *Heronimus chelydrae* MacCallum, 1902.

Heterophyidae Odhner, 1914

37. *Euryhalmis costaricensis* Brenes-Madrigal, Arroyo-Sancho and Jiménez-Quirós, 1960. Intestine, *Mustela frenata* (M), Tres Ríos, Cartago (Brenes-Madrigal *et al.* 1960a). Specimens: CHCR.

Homalometridae (Cable and Hunnien, 1942)

38. *Crassicutis cichlasomae* Manter, 1936. Intestine, *Cichlasoma* sp. (F), Liberia, Guanacaste (Bravo-Hollis and Arroyo-Sancho 1962b). Specimens: CNHE.
39. *C. opisthoseminis* Bravo-Hollis and Arroyo-Sancho, 1962. Intestine, *Cichlasoma* sp. (F), Liberia, Guanacaste (Bravo-Hollis and Arroyo-Sancho 1962b). Specimens: CNHE.

Lecithodendriidae (Lühe, 1931) Odhner, 1910

40. *Castroia silvai* Travassos, 1928. Intestine, *Micronycteris hirsutus* (M), Río Grande de Atenas, Alajuela (Caballero and Montero-Gei 1963). Specimens: CNHE. Notes: According to Martin (1969), morphology of the specimens differs from the original description.
41. *Langeronia provitellaria* Sacks, 1952. Intestine, *Rana warchewitschii* and *Bufo marinus* (N), Corís, Cartago (Brenes-

Madrigal *et al.* 1959a). Specimens: CHCR.

Notes: Specimens originally determined as *Langeronia macrocirra* Caballero and Bravo-Hollis, 1949 and later transferred to *L. provitellaria* by Christian (1970).

42. *Limatulum costarricensis* (Caballero, y Brenes-Madrigal, 1957) Caballero, 1964. Intestine, *Eptesicus propinquus* (M), Finca Monte de Heredia (Caballero and Brenes-Madrigal 1957). Specimens: CHCR, CNHE. Note: Originally recorded as *Ochoterena-trema costarricensis* Caballero and Brenes-Madrigal, 1957 and later transferred to the genus *Limatulum* Travassos, 1921 by Caballero (1964).

43. *Prosthodendrium cordiforme* (Braun, 1900) Macy, 1936. Intestine, *Eptesicus propinquus* (M), Finca Monte de Heredia (Caballero and Brenes-Madrigal 1957). Specimens: CHCR, CNHE.

44. *Pseudosonsinotrema chabaudi* (Caballero and Caballero-Rodríguez, 1969). Intestine, *Rana pipiens* (A), Sarapiquí, Heredia (Caballero and Caballero-Rodríguez 1969), Turrialba, Cartago (Sullivan 1971). Specimens: CNHE, HWML, USNPC. Notes: Specimens collected by Caballero and Caballero-Rodríguez (1969) was included in the genus *Brenesia* Caballero and Caballero-Rodríguez, 1969, which was later synonymized with *Pseudosonsinotrema* by Sullivan (1974). Additionally, species described by Sullivan (1971) as *Pseudosonsinotrema echinophallus* Sullivan, 1970 was synonymized with *P. tabai* (Sullivan, 1974).

Lepocreadiidae (Odhner, 1905)
Nicoll, 1935

45. *Bianium plicatum* (Linton, 1928) Stunkard, 1930. Intestine, *Spherooides* sp. (F), Mata de Limón, Puntarenas (Caballero and Brenes-

Madrigal 1957). Specimens: CHCR, CNHE.

46. *B. simonei* (Travassos, Teixeira de Freitas and Bührnheim, 1965) Yamaguti, 1971 Intestine, *Arothron hispidus* (F), Bahía Prieta, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.

47. *Hypocreadium myohelicatum* Bravo-Hollis and Manter, 1957. Intestine, *Epinephelus itajara* (F), Golfo de Santa Clara, Guanacaste (Pérez-Ponce de León *et al.* 1998). Specimens: CNHE.

Leucochloridiidae (Poche, 1907)
Dollfus, 1934

48. *Leucochloridium costaricense* Brenes-Madrigal and Arroyo-Sancho, 1962. Intestine, *Gymnostinops montezuma* (B), Cachí, Cartago (Brenes-Madrigal and Arroyo-Sancho 1962). Specimens: CHCR.

Macroderoididae McMullen, 1937

49. *Glypthelmins facioi* Brenes-Madrigal, Arroyo-Sancho, Jiménez-Quirós and Delgado-Flores, 1959.

Intestine, *Rana pipiens* (A), Corís, Cartago (Brenes-Madrigal *et al.* 1959b), Turrialba, Cartago (Sullivan 1976). Specimens: CHCR, USNPC.

50. *G. hepaticus* (Lutz, 1928). Liver, *Bufo marinus* (A), Piedades de Santa Ana, San José (Caballero *et al.* 1957). Specimens: CHCR, CNHE. Notes: Originally recorded as *Choledocystus intermedius* Caballero, Bravo-Hollis and Zerecero, 1944, but synonymized with *G. hepaticus* by Sullivan (1977).

51. *G. palmipedis* (Lutz, 1928) Travassos, 1930. Intestine, *Bufo marinus* (A), Chapernal, Puntarenas (Brenes-Madrigal and Arroyo-Sancho 1960). Specimens: CHCR.

52. *Paralopharynx gonzalezi* Brenes-Madrigal, Arroyo-Sancho and Montero-Gei, 1960
Intestine, *Ctenosaura similis* and *Basiliscus* sp., (R), Río Grande de Atenas, Alajuela (Brenes-Madrigal *et al.* 1960b). Specimens: CHCR, HWML.
53. *Wallinia chavarriai* Choudhury, Daverdin and Brooks, 2002.
Intestine, *Astyanax aeneus* (F), Río Sapoa, Guanacaste, and *Bryconamericus scleropardius* (F), Río Sapoa and Quebrada Limonal, Guanacaste (Choudhury *et al.* 2002). Specimens: HWML, USNPC.
- Microphallidae Travassos, 1920
54. *Maritreopsis longibursatus* (Caballero and Brenes-Madrigal, 1964) Deblock, 1973.
Intestine, *Chamaeptes unicolor* (A), Caserío de Tiquiares, San José (Caballero and Brenes-Madrigal 1964). Specimens: CHCR, CNHE.
Notes: Originally described as *Ornithotrema longibursatum* Caballero and Brenes-Madrigal, 1964 and transferred to the genus *Maritreopsis* Deblock, 1963 by Deblock (1973).
55. *M. prolixum* (Caballero and Montero-Gei, 1961) Deblock, 1973.
Bile ducts, *Philander opossum* (M), Río Grande de Atenas, Alajuela (Caballero and Montero-Gei 1961). Specimens: CNHE.
Notes: Originally described as *Maritrema prolixum* Caballero and Montero-Gei, 1961, and later transferred to the genus *Pseudomaritrema* Belopolskaya, 1952 by Caballero (1964), and to the genus *Metamaritrema* by Yamaguti (1971).
56. *Ornithotrema momoti* Caballero, Brenes-Madrigal and Arroyo-Sancho, 1963.
Intestine, *Momotus momotus* (B), Sarapiquí, Heredia (Caballero *et al.* 1963a). Specimens: CHCR, CNHE.
57. *Spelotrema skrjabini* (Caballero, 1958) Yamaguti, 1971.
Intestine, *Didelphis marsupialis* (M), Bello Horizonte, Escazú, San José (Caballero 1958). Specimens: CHCR, CNHE.
Notes: Originally described as *Carneophallus skrjabini* Caballero, 1958.
- Monorchidae Odhner, 1911
58. *Lasiotocus costaricae* (Manter, 1940) Yamaguti, 1954.
Intestine and caeca, "Medialuna" (F), Puerto Culebra, Guanacaste (Manter 1940). Specimens: HWML, USNPC.
Notes: Originally described as *Proctotrema costaricae* Manter, 1940.
- Opecoelidae Ozaki, 1925
59. *Helicometra sinuata* (Rudolphi, 1819) Odhner, 1902.
Intestine, "Moray" (F), Puerto Culebra, Guanacaste (Manter 1940). Specimens: HWML.
- Opisthorchiidae (Looss, 1899)
Braun, 1901
60. *Amphimerus costarricensis* Lamothe-Argumedo and Brenes-Madrigal, 1983.
Bile ducts, *Felis catus* (M), Boruca, San José (Lamothe-Argumedo and Brenes-Madrigal 1983). Specimens: CNHE.
61. *A. neotropicalis* Caballero, Montero-Gei and Caballero-Rodríguez, 1963.
Pancreatic ducts, *Philander opossum* (M), Río Grande de Atenas, Alajuela (Caballero *et al.* 1963b). Specimens: CNHE.
Note: Nasir and Díaz (1972) synonymized this species with *A. speciosus* (Stiles and Hassall, 1896) and Correa-Gomes (1979) with *A. pseudofelineus* (Ward, 1911).
- Paragonimidae Dollfus, 1939
62. *Paragonimus caliensis* Little, 1968.

Lungs, *Chironectes minima* and *Procyon lotor* (M), Gamalotillo de Puriscal, San José and *Didelphis marsupialis* (M), Parrita, Puntarenas (Brenes-Madrigal *et al.* 1984).

63. *P. mexicanus* Miyazaki and Ishii, 1968. Lungs, *Canis familiaris* and *Conepatus semistriatus* (M), NA (Brenes-Madrigal *et al.* 1984), *Didelphis marsupialis* (M), Tabarcia de Mora, San José (Brenes-Madrigal *et al.* 1980), *Felis catus* (M), Balsa de Atenas, Alajuela, Rincón de Osa, Puntarenas, Tabarcia de Mora, San Isidro de Balsa and Cangrejal de Acosta, San José (Brenes-Madrigal *et al.* 1980), *Felis pardalis* (M), Bagaces, Guanacaste (Brenes-Madrigal *et al.* 1980), *Philander opossum* (M), Río Grande de Atenas, Alajuela (Caballero and Montero-Gei 1961), Balsa de Atenas and Tornos de Atenas, Alajuela, Rincón de Osa, Puntarenas, and San Isidro de Balsa, San José (Brenes-Madrigal *et al.* 1980), *Procyon lotor* (M), San Isidro de Balsa, San José (Brenes-Madrigal *et al.* 1980), *Urocyon cinereoargenteus* (M), Balsa de Atenas and Turrúcares, Alajuela (Brenes-Madrigal *et al.* 1980), Carrizal de Alajuela, Alajuela (Caballero 1956). Specimens: CNHE. Notes: Brenes-Madrigal *et al.* (1980), synonymized all records of *Paragonimus rudis* (Diesing, 1850), by Caballero (1956) and by Caballero and Montero-Gei (1961) with *P. mexicanus*.

Paramphistomidae Fiscoeder, 1901

64. *Cotylophoron* sp. Stomach, *Bos taurus* (M), San Carlos, Alajuela (NP). Specimens: USNPC.
65. *Megalodiscus temperatus* (Stafford, 1905) Harwood, 1932. Intestine, *Rana pipiens* (A), Corís, Cartago (Brenes-Madrigal *et al.* 1959b). Specimens: CHCR.
66. *Paramphistomum cervi* (Schrank, 1790) Stomach, *Bos taurus* (M), San José, San José (NP). Specimens: CHCR.

67. *P. liorchis* Fiscoeder, 1901. Rumin, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.

Plagiorchiidae (Lühe, 1901) Ward, 1917

68. *Ochetosoma bravoae* Brenes-Madrigal and Arroyo-Sancho, 1960. Esophagus, "Colubridae" (R), Bello Horizonte, Escazú, San José (Brenes-Madrigal and Arroyo-Sancho 1960). Specimens: CHCR.
69. *O. miladelarocai* Caballero y Vogelsang, 1947. Esophagus, *Drymobius margaritiferus* (R), Corís, Cartago (Brenes-Madrigal *et al.* 1959a). Specimens: CHCR.
70. *Plagiorchis* sp. Intestine, amphibians, birds and turtles, NA (Brenes-Madrigal 1961).

Proterodiplostomidae Dubois, 1936

71. *Prolecithodiplostomum constrictum* Dubois, 1936. Intestine, *Caiman crocodylus* (R), La Selva, Heredia and Palma Sur, Puntarenas (Brooks *et al.* 1977). Specimens: HWML.
72. *Proterodiplostomum medusae* (Dubois, 1937) Caballero, Hidalgo-Escalante and Grocott, 1957. Intestine, *Crocodylus acutus* (R), Los Chiles de Grecia, Alajuela (Caballero and Brenes-Madrigal, 1958), *Caiman crocodylus* (R), La Selva, Heredia (Brooks *et al.* 1977). Specimens: CHCR, CNHE, HWML.

Psilostomidae Looss, 1900

73. *Mesaulus grandis* (Rudolphi, 1819) Braun, 1902. Intestine, *Ajaia ajaja* (B), Mata de Limón, Puntarenas (Caballero and Brenes-Madrigal 1958). Specimens: CHCR, CNHE.

Notes: Originally recorded as *Cotylotretus grandis* (Rudolphi, 1819) Odhner, 1910 and transferred to *Mesaulus* Braun, 1902.

Rhopaliidae (Looss, 1899) Viana, 1924

74. *Rhopalias baculifer* Braun, 1900.
Intestine, *Philander opossum* (M), Río Grande de Atenas, Alajuela (Caballero and Montero-Gei 1961). Specimens: CNHE, HWML.
75. *R. coronatus* (Rudolphi, 1819) Stiles and Hassall, 1898.
Intestine, *Didelphis marsupialis* (M), Bello Horizonte, Escazú, San José (Caballero *et al.* 1957), *Philander opossum* (M), Río Grande de Atenas, Alajuela (Caballero and Montero-Gei 1961), Cariari, Limón (Siebert 1970). Specimens: CHCR, CNHE, HWML.
76. *R. horridus* (Diesing, 1850) Stiles and Hassall, 1898.
Intestine, *Didelphis marsupialis* (M), Bello Horizonte, Escazú, San José (Caballero *et al.* 1957), *Philander opossum* (M), Río Grande de Atenas, Alajuela (Caballero and Montero-Gei 1961). Specimens: CHCR, CNHE.
77. *R. macracanthus* Chandler, 1932.
Intestine, *Philander opossum* (M), Cariari, Limón (Siebert 1970).

Stomylotrematidae (Travassos, 1922)
Poche, 1926

78. *Stomylotrema ucremium* Brenes-Madrigal, Arroyo-Sancho and Muñóz-Montoya, 1966.
Intestine, *Icterus galbula* (B), Alajuela, Alajuela (Brenes-Madrigal *et al.* 1966). Specimens: CHCR.

Telorchidae Dollfus, 1925

79. *Telorchis* sp.
Intestine, turtle (R), NA (Brenes-Madrigal 1961), *Geomyda manni* (R), NA (NP). Specimens: USNPC.
80. *T. pseudoaculeatus* Dollfus, 1929

Intestine, *Kinosternon cruentatum* (R), Santa Ana, San José (Caballero and Brenes-Madrigal 1957). Specimens: CHCR, CNHE.

Notes: According to Nasir (1974), this species is a synonym of *T. aculeatus* (Von Linstow, 1879).

Urotrematidae Poche, 1926

81. *Urotrema scabridum* Braun, 1900.
Intestine, *Eptesicus propinquus* (M), Monte Heredia, Heredia (Caballero *et al.* 1957). Specimens: CHCR, CNHE.

Monogenoidea

Bychowsky, 1937

Allodiscocotylidae Tripathi, 1959

1. *Hargicola oligoplites* (Hargis, 1957) Lebedev, 1970.
Gills, *Oligoplites altus* (F), Golfo de Nicoya, Puntarenas (NP). Specimens: CNHE.

Cemocotylidae Yamaguti, 1963

2. *Cemocotylella elongata* (Meserve, 1938) Price, 1962.
Gills, *Caranx caballus* (F), Golfo de Nicoya, Puntarenas (NP). Specimens: CNHE, HWML.

Chauhaneidae Lebedev, 1972

3. *Ahpua piscicola* Caballero and Bravo-Hollis, 1973.
Gills, *Caranx caballus*, *Oligoplites altus* (F), Golfo de Nicoya, Puntarenas (NP). Specimens: CNHE, HWML.

Dactylogyridae Bychowsky, 1933

4. *Ameloblastella chavarriai* (Price, 1938) Kristky, Mendoza and Scholz, 2000.

- Gills, *Rhamdia rogersi* (F), San Pedro Montes de Oca, San José (Price 1938).
Notes: This species was described as *Cleidodiscus chavarriai* Price, 1938, transferred to the genus *Urocleidoides* Mizelle and Price, 1964 by Molnar *et al.* (1974) and established as the type species of *Ameloblastella* Kritsky, Mendoza and Scholz, 2000 by Kritsky *et al.* (2000).
5. *Aphanoblastella travassosi* (Price, 1938) Kritsky, Mendoza and Scholz, 2000.
Gills, *Rhamdia rogersi* (F), San Pedro Montes de Oca, San José (Price 1938).
Notes: This species was described as *Cleidodiscus travassosi* Price, 1938, transferred to the genus *Urocleidoides* by Molnar *et al.* (1974) and established as the type species of *Aphanoblastella* Kritsky, Mendoza and Scholz, 2000 by Kritsky *et al.* (2000). Specimens: HWML.
6. *Jainus hexops* Kritsky and Leiby, 1972.
Gills, *Astyanax fasciatus* (F), 3 km. SW of Rincón, Puntarenas (Kritsky and Leiby 1972). Specimens: USNPC.
7. *Palombitrema heteroancistrum* Price and Bussing, 1968.
Gills, *Astyanax fasciatus* (F), Río Montenegro, 23 Km NW of Cañas, Guanacaste (Price and Bussing, 1968), 3 km. SW of Rincón, Puntarenas (Kritsky and Leiby 1972). Specimens: USNPC.
Notes: Price and Bussing (1968) created the genus *Palombitrema* Price and Bussing, 1968 to include this species; Kritsky and Leiby (1972) synonymized it with *Urocleidoides* and Suriano (1997) re-established its validity.
8. *Urocleidoides costaricensis* (Price and Bussing, 1967) Kritsky and Leiby, 1972.
Gills, *Astyanax fasciatus* (F), Cañas, Guanacaste (Price and Bussing 1967). Specimens: USNPC.
Notes: Species described as *Cleidodiscus costaricensis* Price and Bussing, 1967, transferred to *Urocleidoides* by Kritsky and Leiby (1972) and considered as *incertae sedis* by Kritsky *et al.* (1986).
9. *Urocleidoides strombicus* (Price and Bussing, 1967) Kritsky and Thatcher, 1974.
Gills, *Astyanax fasciatus* (F), Cañas, Guanacaste (Price and Bussing 1967). Specimens: USNPC.
Notes: Described as *Cleidodiscus strombicus* Price and Bussing, 1967 later included in *Urocleidoides* by Kritsky and Thatcher (1974) and considered as *incertae sedis* by Kritsky *et al.* (1986).
- Diclidophoridae Cerfontaine, 1895
10. *Hargicotyle louisianensis* (Hargis, 1955) Mamaev, 1972.
Gills, *Menticirrhus* sp., (F), Puntarenas (Bravo-Hollis and Arroyo-Sancho 1962a). Specimens: CNHE.
Notes: Originally recorded as *Choricotyle louisiana* Hargis, 1955, the type species of *Hargicotyle* Mamaev, 1972.
- Discocotylidae Price, 1936
11. *Heterobothrium ecuadori* (Meserve, 1938).
Gills, *Sphoeroides* sp. (F), Mata de Limón, Puntarenas (Caballero and Brenes-Madrigal 1957). Specimens: CNHE.
Notes: Specimens originally described as *Tagia ecuadori* Sproston, 1946. However, Euzet and Birgi (1975), propose *Tagia* as a synonym of *Heterobothrium* Cerfontaine, 1895.
12. *Pseudomazocraes monsvaisae* Caballero and Bravo-Hollis, 1955.
Gills, *Vomer declivifrons* (F), Puntarenas (NP). Specimens: CNHE, HWML.
- Gyrodactylidae Cobbold, 1864
13. *Anacanthocotyle anacanthocotyle* Kritsky and Fritts, 1970.
External surface, *Astyanax fasciatus* (F), 3 km., SW of Rincón, Puntarenas (Kritsky and Fritts 1970). Specimens: USNPC.

14. *Gyrodactylus bullatarudis* Turnbull, 1956. External surface, *Poecilia sphenops* (F), 3 km., SW of Rincón, Puntarenas (Kritsky and Fritts 1970). Specimens: USNPC.
15. *G. costaricensis* Kritsky and Fritts, 1970. External surface, *Astyanax fasciatus*, *Poecilia sphenops* (F), 3 km., SW of Rincón, Puntarenas (Kritsky and Fritts 1970). Specimens: USNPC.
16. *G. neotropicalis* Kritsky and Fritts, 1970. External surface, *Astyanax fasciatus* (F), 3 km., SW of Rincón, Puntarenas (Kritsky and Fritts 1970). Specimens: USNPC.

Hexabothriidae Price, 1942

17. *Erpocotyle carcharhini* Watson and Thorson, 1976. Gills, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976). Specimens: USNPC.
18. *Heteroncocotyle leucas* Hargis, 1955. Gills, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976). Specimens: USNPC.

Microbothriidae Price, 1936

19. *Dermophthirius maccallumi* Watson and Thorson, 1976. Skin, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976). Specimens: USNPC.

Microcotylidae Taschenberg, 1879

20. *Jaliscia caballeroi* (Bravo-Hollis, 1960) Mamaev and Egorova, 1977. Gills, "tunna" (F), Golfo de Nicoya, Puntarenas, (NP). Specimens: CNHE.
21. *Polymicrocotyle manteri* Lamothe-Argumedo, 1967. Gills, *Lutjanus colorado* (F), Golfo de Nicoya, Puntarenas, (NP). Specimens: CNHE.

Polystomatidae Gamble, 1896

22. *Neopolystoma fentoni* Platt, 2000. Conjunctival sac, *Kinosternon leucostomum* (R), Quebrada Costa Rica, Guanacaste, and *Rhinoclemmys pulcherrima* (R), Quebrada El Duende and Quebrada San Gerardo, Guanacaste (Platt 2000). Specimens: CHIOC, USNPC.

Protomicrocotylidae Poche, 1926

23. *Neomicrocotyle pacifica* (Meserve, 1938) Yamaguti, 1968. Gills, *Xurel marginatus* (F), Puerto Culebra, Guanacaste (Meserve 1938). Specimens: USNPC. Notes: Species originally described as *Protomicrocotyle pacifica* Meserve, 1938.

Cestoidea

Rudolphi, 1808

Anoplocephalidae Cholodkovsky, 1902

1. *Anoplocephala magna* (Abildgaard, 1789) Sprengel, 1905. Intestine, *Equus caballus* (M), NA (Brenes-Madrigal 1961).
2. *A. perfoliata* (Goeze, 1782) Blanchard, 1848. Intestine, *Equus caballus* (M), NA, Limón (Brenes-Madrigal, 1961), San Pedro Montes de Oca, San José (NP). Specimens: USNPC.
3. *Anoplocephaloides floresbarroetae* Rausch, 1976. Bile duct, *Sylvilagus brasiliensis* (M), Aserrí, San José (Flores-Barroeta *et al.* 1961). Notes: The species was misidentified by Flores-Barroeta *et al.* (1961) as *Paranoplocephala infrequens* (Douthitt, 1915). Later, based on this record, Rausch

- (1976) erected *Anoplocephaloides flores-barroetae* Rausch, 1976. In 1990, this species was transferred to the genus *Leporidotaenia* Genov, Murai, Georgiev and Harris, 1990 by Genov *et al.* (1990), however this genus was considered a synonym of *Anoplocephaloides* by Beveridge (1994).
4. *A. mamillana* (Mehlis, 1831) Rausch, 1976.
Intestine, *Equus caballus* (M), NA (Brenes-Madrigal 1961).
Notes: Originally described as *Paranoplocephala mamillana* (Mehlis, 1831).
 5. *Avitellina centripunctata* (Rivolta, 1874) Gough, 1911.
Intestine, *Canis familiaris* (M), NA (Brenes-Madrigal 1961).
Notes: This species is a typical parasite of ruminants.
 6. *Mathevotaenia bivittata* (Janicki, 1904) Yamaguti, 1959.
Intestine, *Marmosa* sp. (M), Río Grande de Atenas, Alajuela (Flores-Barroeta *et al.* 1961).
Notes: Originally recorded as *Oochoristica bivittata* Janicki, 1904.
 7. *M. didelphidis* (Rudolphi, 1819) Spasskii, 1951.
Intestine, *Marmosa* sp. (M), Río Grande de Atenas, Alajuela (Flores-Barroeta *et al.* 1961).
Notes: Originally recorded as *Oochoristica didelphidis* (Rudolphi, 1819).
 8. *M. pennsylvanica* (Chandler and Melvin, 1951) Yamaguti, 1959.
Intestine, *Didelphis marsupialis etensis* (M), Bello Horizonte, Escazú, San José (Flores-Barroeta *et al.* 1958a). Specimens: CNHE.
Notes: Originally recorded as *Oochoristica pennsylvanica* Chandler and Melvin, 1951.
 9. *Moniezia* sp.
Intestine, *Capra hircus* (M), NA (Alvarado *et al.* 1990).
 10. *Moniezia benedeni* (Moniez, 1879) Blanchard, 1891.
Intestine, *Bradypus griseus griseus* (M), Turrialba, Cartago (Flores-Barroeta *et al.* 1958b), *Bos taurus* (M), San José, San José (Brenes-Madrigal, 1961). Specimens: USNPC.
 11. *M. expansa* (Rudolphi, 1805) Blanchard, 1891.
Intestine, *Bos taurus* (M), NA (Brenes-Madrigal 1961).
 12. *Oochoristica guanacastensis* Brooks, Pérez Ponce de León, and García, 1999.
Intestine, *Ctenosaura similis* (R), Parque Nacional Santa Rosa, Guanacaste (Brooks *et al.* 1999). Specimens: CNHE, USNPC.
- Cathetocephalidae Dailey and Overstreet, 1973
13. *Cathetocephalus thatcheri* Dailey and Overstreet, 1973
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
- Dasyrhynchiade Dollfus, 1935
14. *Dasyrhynchus variouncinatus* (Pintner, 1913) Pintner, 1928.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
- Davaineidae Fuhrmann, 1907
15. *Davainea proglottina* (Davaine, 1860) Blanchard, 1891.
Intestine, *Gallus gallus* (B), NA (Brenes-Madrigal 1961).
 16. *Raillietina* sp.
Intestine, *Gallus gallus* (B), NA; *Sigmodon hispidus* (M), Cañas, Guanacaste Rodríguez-Ortíz *et al.* 2000). Specimens: USNPC.
 17. *R. echinobothrida* (Megnin, 1880) Fuhrmann, 1924.
Intestine, *Gallus gallus* (B), NA (Brenes-Madrigal 1961).

- 18.** *R. tetragona* (Molin, 1858) Fuhrmann, 1924.
Intestine, *Gallus gallus* (B), San José, San José (Flores-Barroeta and Hidalgo-Escalante 1960), NA (Brenes-Madrigal, 1961). Specimens: CNHE.
Notes: Originally recorded as *Inermicapsifer tetragona* (Molin, 1858).
- Dilepididae Railliet and Henry, 1909
- 19.** *Amoebotaenia* sp.
Intestine, *Gallus gallus* (B), NA (Brenes-Madrigal 1961).
- 20.** *A. cuneata* (Linstow, 1872).
Intestine, *Gallus gallus* (B), NA (Brenes-Madrigal 1961).
- 21.** *Anomotaenia* sp.
Intestine, *Turdus grayi* (B), NA (Brenes-Madrigal 1961).
- 22.** *Choanotaenia* sp.
Intestine, *Gallus gallus* (B), NA (Brenes-Madrigal 1961).
- 23.** *C. infundibulum* (Bloch, 1799) Railliet, 1896.
Intestine, *Gallus gallus* (B), NA (Brenes-Madrigal 1961).
- 24.** *Paricterotaenia* sp.
Intestine, *Sturnaella magna* (B), Cantón Cartago, Cartago (NP), *Oriolus oriolus* (B), San José San José (NP). Specimens: USNPC.
- Dipylidiidae Stiles, 1896
- 25.** *Dipylidium caninum* (Linneo, 1758) Leuckart, 1863.
Intestine, *Canis familiaris*, *Felis catus* (M), NA (Brenes-Madrigal 1961); *C. familiaris*, San José, San José (Vargas and Contreras 1998).
- Hymenolepididae Railliet and Henry, 1909
- 26.** *Aploparaksis* sp.
Intestine, *Turdus grayi* (B), NA (Brenes-Madrigal 1961).
Notes: Recorded as *Haploparaxis* sp.
- 27.** *Diorchis acuminatus* (Clerc, 1902) Clerc, 1903.
Intestine, Undetermined host (B), NA (Brenes-Madrigal 1961).
Notes: The original distribution range of this species is in Europe (Schmidt 1986).
- 28.** *Hymenolepis* sp.
Intestine, *Gallus gallus*, *Gymnostinops montezuma*, *Ostinops quatemozinus* (B), San José San José, (NP). Specimens: USNPC.
- 29.** *H. cantaniana* Polonio, 1860.
Notes: This species is listed in Brenes-Madrigal (1961), but no information is provided.
- 30.** *H. diminuta* (Rudolphi, 1819) Weinland, 1858.
Intestine, *Rattus norvegicus* (M), San José, San José (Vives and Zeledón 1957); *Sigmodon hispidus* (M), Cañas, Guanacaste (Rodríguez-Ortíz *et al.* 2000).
- 31.** *Vampirolepis nana* (Von Siebold, 1852) Spasskii, 1954.
Intestine, *Rattus norvegicus* (M), San José, San José (Vives and Zeledón 1957).
- Lacistorhynchidae Guiart, 1927
- 32.** *Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976). Specimens: USNPC.
- Onchobothriidae Braun, 1900
- 33.** *Acanthobothrium campbelli* Marques, Brooks and Monks, 1995.
Spiral valve, *Urotrygon chilensis* (F), Costa de Pájaros, Puntarenas (Marques *et al.* 1995). Specimens: HWML, MNHG.
- 34.** *A. cimari* Marques, Brooks and Monks, 1995.
Spiral valve, *Dasyatis longus* (F), Punta Morales, Golfo de Nicoya, Puntarenas (Marques *et al.* 1995). Specimens: HWML, MNHG.

35. *A. costarricense* Marques, Brooks and Monks, 1995.
Spiral valve, *Dasyatis longus* (F), Punta Morales, Puntarenas (Marques *et al.* 1995). Specimens: HWML, MNHG.
36. *A. franus* Marques, Centritto and Stewart, 1997.
Spiral valve, *Narcine entemedor* (F), Playa Cuajiniquil, Golfo de Santa Elena, Guanacaste (Marques *et al.* 1997). Specimens: CHIOC, CNHE, USNPC.
37. *A. inbiorium* Marques, Centritto and Stewart, 1997.
Spiral valve, *Narcine entemedor* (F), Playa Cuajiniquil, Golfo de Santa Elena, Guanacaste (Marques *et al.* 1997). Specimens: CHIOC, CNHE, USNPC.
38. *A. nicoyaense* Brooks and McCorquodale, 1995.
Spiral valve, *Aetobatis narinari* (F), Punta Morales, Golfo de Nicoya, Puntarenas (Brooks and McCorquodale 1995). Specimens: HWML, MNHG.
39. *A. puntarenasense* Marques, Brooks and Monks, 1995.
Spiral valve, *Dasyatis longus* (F), Punta Morales, Golfo de Nicoya, Puntarenas (Marques *et al.* 1995). Specimens: HWML, MNHG.
40. *A. vargasi* Marques, Brooks and Monks, 1995.
Spiral valve, *Dasyatis longus* (F), Punta Morales, Golfo de Nicoya, Puntarenas (Marques *et al.* 1995). Specimens: HWML, MNHG.
41. *Acanthobothroides pacificus* Marques, Brooks and Molina-Ureña, 1996.
Spiral valve, *Himantura pacifica* (F), Playa Panamá, Guanacaste (Marques *et al.* 1996). Specimens: HWML, MNHG.
42. *Phoreiobothrium trilocolatum* Linton, 1901.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976). Specimens: USNPC.
43. *Platybothrium hypoprioni* Potter, 1927.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
Otobothriidae Dollfus, 1942
44. *Othobothrium penetrans* Linton, 1907.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976). Specimens: USNPC.
Phyllobothriidae Braun, 1900
45. *Anthobothrium laciniatum* Linton, 1890.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
46. *A. pristis* Woodland, 1934.
Spiral valve, *Pristis perotteti* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
47. *Phyllobothrium leuci* Watson and Thorson, 1976.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
48. *P. nicaraguensis* Watson and Thorson, 1976.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
49. *P. pristis* Watson and Thorson, 1976.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).
50. *Rhinebothrium geminum* Marques, Brooks and Molina-Ureña, 1996.
Spiral valve, *Himantura pacifica* (F), Playa Panamá, Guanacaste (Marques *et al.* 1996). Specimens: HWML, MNHG.
Proteocephalidae La Rue, 1911
51. *Ophiotaenia* sp.
Intestine, *Constrictor constrictor* (R), San José, San José (Brenes-Madrigal 1961). Specimens: USNPC.
52. *O. perspicua* La Rue, 1911.

Intestine, *Bothrops* sp., (R), Muelle San Carlos, Alajuela (Flores-Barroeta *et al.* 1961).

Pterobothriidae Pintner, 1931

53. *Pterobothrioides carvajali* Campbell and Beveridge, 1997.
Spiral valve, *Dasyatis longus* (F), Playa Cuajiniquíl, Golfo de Santa Elena, Guanacaste (Campbell and Beveridge 1997). Specimens: USNPC.

Taeniidae Ludwig, 1886

54. *Echinococcus granulosus* (Batsch, 1786) Rudolphi, 1810 (hydatidid cyst).
Lungs, *Bos taurus* (M), Los Cartagos, Alajuela (Velázquez and Morales 1983).
55. *E. oligarthrus* Diesing, 1863.
Intestine, *Felis concolor costaricensis* (M), Talamanca, San José (Brenes-Madrigal *et al.* 1973).
56. *Taenia* sp.
Intestine, *Agouti paca* (M), NA (Matamoros *et al.* 1991).
57. *T. omissa* Lühe, 1910 (cysticerci).
Lungs, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.
58. *T. pisiformis* (Bloch, 1780) Gmelin, 1790.
Intestine, *Urocyon cinereoargenteus* (M), Carrizal, Alajuela (Flores-Barroeta *et al.* 1958b).
Notes: This species was originally recorded as *Taenia laticollis* Rudolphi, 1819.
59. *T. saginata* Goeze, 1782 (cysticerci).
Muscle, *Bos taurus* (M), Cartago and Guanacaste (Brenes-Madrigal 1961).
60. *T. solium* Linneo, 1758 (Cysticerci).
Muscle, *Sus scrofa* (M), NA (Brenes-Madrigal 1961).
61. *T. taeniaeformis* Batsch, 1796 (adult and cysticerci).
Liver, *Rattus norvegicus*, *R. rattus* (M), San José, San José (Vives and Zeledón 1957; Intestine, *Felis wiedii nicaraguense*

(M), Mata de Limón, Puntarenas (Flores-Barroeta *et al.* 1958b), *F. catus* (M), San José, San José (Brenes-Madrigal 1961).

Tentaculariidae Poche, 1926

62. *Nybelinia bisulcata* (Linton, 1889) Poche, 1926.
Spiral valve, *Carcharhinus leucas* (F), Barra del Colorado, Río Colorado, Limón (Watson and Thorson 1976).

Trilocularidae Yamaguti, 1959

63. *Escherbothrium molinae* Berman and Brooks, 1994.
Spiral valve, *Urotrygon chilensis* (F), Costa de Pájaros and Punta Morales, Golfo de Nicoya, Puntarenas (Berman and Brooks 1994).

ACANTHOCEPHALA

(Rudolphi, 1808)

Centrorhynchidae Van Cleave, 1916

1. *Centrorhynchus* sp.
NA, *Mustela noveboracensis* (M), San José, San José (NP). Specimens: USNPC.
2. *C. tumidulus* (Rudolphi, 1819) Travassos, 1923 (cysthacanth).
Intestine, *Rana* sp. (A), NA (Brenes-Madrigal 1961).

Echinorhynchidae Cobbold, 1876

3. *Acanthocephalus lutzi* (Von Linstow, 1896) Meyer, 1931 (cysthacanth).
NA, *Leptodactylus gracilis* (A), San José, San José (NP). Specimens: USNPC.

Illiosentidae Golvan, 1960

4. *Koronacantha pectinaria* (Van Cleave, 1940).
Intestine, "Medialuna" (F), Bahía Culebra, Guanacaste (Van Cleave 1940),

Microlepidotus brevipinnis (F), Playas Panamá and Hermosa, and Golfo de Santa Elena, Playa Cuajiniquil, Guanacaste (Monks *et al.* 1997). Specimens: CNHE, HWML, USNPC.

Notes: Van Cleave (1940) described this species as *Tegorhynchus* Van Cleave, 1921, but was later transferred to *Koronacantha* Monks and Pérez-Ponce de León, 1996 by Monks *et al.* (1997).

Moniliformidae Van Cleave, 1924

5. *Moniliformis moniliformis* (Bremser, 1811) Travassos, 1915.
Intestine, *Rattus norvegicus*, *R. rattus* (M), San José, San José (Vives and Zeledón 1957). Specimens: CNHE, USNPC.

Oligacanthorhynchidae

Southwell and MacFie, 1925

6. Oligacanthorhynchidae gen. sp.
Subcutaneous tissue, *Tonatia silvicola* (M), Península de Osa, Puntarenas (Gibson and McCarthy 1987).
7. *Oncicola oncicola* (Ihering, 1892) Travassos, 1916.
Muscle, *Gallus gallus* (B), Parrita, Puntarenas (Zeledón and Arroyo-Sancho 1960).
8. *Prosthenorchis* sp.
Intestine, *Saimiri oerstedii* (M), Parque Nacional Corcovado (Appleton and Boinski 1991).
9. *P. elegans* (Diesing, 1851) Travassos, 1915
Intestine, *Cebus capucinus* (M), NA (NP). Specimens: USNPC.

Plagiorhynchidae Golvan, 1960

10. *Plagiorhynchus angrense* (Travassos, 1926) Schmidt and Kuntz, 1966.
Intestine, *Mustela frenata* (M), NA (Brenes-Madrigal 1961).
Notes: In accordance with Brenes-Madrigal (1961), this record is doubtful because this species has been only recorded in birds.

In Costa Rica it was recorded as *Prosthorhynchus angrensis* Travassos, 1926.

Polymorphidae Meyer, 1931

11. *Polymorphus corynosoma* Travassos, 1915
Intestine, *Mustela frenata* (M), NA (Brenes-Madrigal 1961).
Notes: Recorded as *Hexaglandula corynosoma* (Travassos, 1915). According to Amin (1992), it is a typical parasite of herons.
12. *P. minutus* (Goeze, 1782) Lühe, 1911.
Intestine, "birds", NA (Brenes-Madrigal 1961).

NEMATODA

(Rudolphi, 1808)

Ancylostomatidae (Looss, 1905)

1. *Ancylostoma braziliense* Gómes de Faria, 1910.
Intestine, *Potos flavus arborensis* (M), NA (Brenes-Madrigal 1961).
2. *A. caninum* (Ercolani, 1859).
Intestine, *Canis familiaris* (M), San José, San José (Brenes-Madrigal 1961, Vargas and Contreras 1998), *Canis latrans* (M), and *Felis catus* (M), San José, San José (Brenes-Madrigal 1961). Specimens: USNPC.
3. *Bunostomum phlebotomum* (Railliet in Rizzo, 1900).
Intestine, *Bos taurus* (M), San Isidro de Coronado, San José (Brenes-Madrigal 1961). Specimens: USNPC.
4. *B. trigonocephalum* (Rudolphi, 1808).
Intestine, *Capra hircus* (M), Sabanilla de Montes de Oca, San José (Brenes-Madrigal 1961).
5. *Gaigeria pachyscelis* Railliet and Henry, 1910.
Intestine, *Bos taurus* (M), Turrialba, Cartago and *Capra hircus* (M), Sabanilla de Montes de Oca, San José (Brenes-Madrigal 1961).

6. *Globocephalus urosubulatus* (Alessandri-
ni, 1909).
Intestine, *Sus scrofa* (M), Puriscal and
Santa Ana, San José (Brenes-Madrigal
1961).
7. *Monodontus* sp.
Intestine, *Sigmodon hispidus* (M), Cañas,
Guanacaste (Rodríguez-Ortíz *et al.* 2000).
- Angiostrongylidae
(Boehm and Gebauer, 1934)
8. *Angiostrongylus costaricensis* Morera and
Céspedes, 1971
Mesenteric arteries, *Ateles geoffroyi* (M),
NA (Berrocal *et al.* 1997), *Nasua narica*
(M), NA (Monge *et al.* 1978), *Sigmodon*
hispidus (M), San Rafael, Alajuela
(Rodríguez-Ortíz *et al.* 1999, 2000)
Notes: Chabaud (1972) included this species
in the genus *Parastrongylus* Baylis, 1928,
which is considered a subgenus of *Angios-*
trongylus Kamensky, 1905 by Anderson
(1978).
- Ascarididae Baird, 1853
9. *Ascaris lumbricoides* Linneo, 1758.
Intestine, *Alouatta palliata palliata* (M),
La Pacifica, Guanacaste (Stuart *et al.*
1990), *Canis familiaris* (M), NA (Brenes-
Madrigal 1961).
10. *A. suum* Goeze, 1782.
Intestine, *Sus scrofa* (M), Matadero
Municipal, San José (Brenes-Madrigal
1961).
11. *Lagochilascaris* sp.
Larynx, *Felis pardalis mearnsi* (M), San
Vito de Java, Puntarenas (Brenes-
Madrigal *et al.* 1972).
12. *Neoascaris vitulorum* (Goeze, 1782).
Intestine, *Bos taurus* (M), Turrialba,
Cartago (Brenes-Madrigal 1961).
Notes: According to Hartwich (1974),
Neoascaris Travassos, 1927 is a synonym
of *Toxocara* Stiles, 1905.
13. *Ophidascaris* sp.
NA, *Constrictor constrictor* (R), NA
(Brenes-Madrigal 1961).
14. *Parascaris equorum* (Goeze, 1782).
Intestine, *Equus caballus* (M), NA, Limón
(Brenes-Madrigal 1961).
15. *Porrocaecum* sp. (adult and larvae).
NA, “goose” (B), and “cobra imperator”
(R), San José, San José (NP). Specimens:
USNPC.
16. *P. angusticolle* (Molin, 1860).
Intestine, “Carraco” (B), NA (Brenes-
Madrigal 1961).
17. *Toxocara canis* (Werner, 1782).
Intestine, *Canis familiaris* (M), San José,
San José (Brenes-Madrigal 1961, Vargas
and Contreras 1998).
18. *T. mystax* (Zeder, 1800)
Intestine, *Felis catus* (M), NA (Brenes-
Madrigal 1961).
- Ascaridiidae Travassos, 1919
19. *Ascaridia* sp.
Intestine, Columbidae (B), San José (NP).
Specimens: USNPC.
20. *A. columbae* (Gmelin, 1790).
Intestine, *Columba fasciata* (B), NA
(Brenes-Madrigal 1961).
21. *A. galli* (Schrank, 1788) Freeborn, 1923.
Intestine, “duck”, *Gallus gallus*, *Meleagris*
gallopavo (B), NA (Brenes-Madrigal
1961).
- Atractidae (Railliet, 1917) Travassos, 1919
22. *Atractis caballeroi* Brenes-Madrigal and
Bravo-Hollis, 1960.
Intestine, *Kinosternon cruentatum* (R),
Santa Ana, San José (Brenes-Madrigal
and Bravo-Hollis 1960). Specimens:
CHCR, CNHE.
Notes: Bursey and Flanagan (2002) trans-
ferred this species to the genus
Klossinemella Costa, 1961.
23. *A. impura* Caballero, 1944.
Intestine, *Kinosternon cruentatum* (R),
Santa Ana, San José (Brenes-Madrigal
and Bravo-Hollis 1960). Specimens:
CHCR, CNHE.
Notes: Bursey and Flanagan (2002) recog-
nized this species as valid.

24. *A. longicaudatum* (Brenes-Madrigal and Bravo-Hollis, 1960) Baker, 1987.
Intestine, *Ctenosaura similis* (R), Liberia, Guanacaste and Mata de Limón, Puntarenas (Brenes-Madrigal and Bravo-Hollis 1960). Specimens: CHCR, CNHE.
Notes: Baker (1987) synonymized the genus *Cyrtosomum* Gedoelst, 1919 with *Atractis* Dujardin, 1985, transferring to this the species described by Brenes-Madrigal and Bravo-Hollis (1960). Bursey and Flanagan (2002) re-established the genus *Cyrtosomum* as valid, including in this genus *Cyrtosomum longicaudatum* Brenes-Madrigal and Bravo-Hollis, 1960.
- Chabertiidae (Popova, 1952)
Lichtenfels, 1980
25. *Oesophagostomum radiatum* (Rudolphi, 1803).
Colon and intestine, *Bos taurus* (M), San Pedro Montes de Oca, San José and Turrialba, Cartago (Brenes-Madrigal 1961). Specimens: USNPC.
26. *O. venulosum* (Rudolphi, 1809).
Intestine, *Capra hircus*, “sheep” and “rats” (M), NA (Brenes-Madrigal 1961).
Note: This species is not a common parasite of rodents.
- Cosmocercidae (Railliet, 1916)
Travassos, 1925
27. *Aplectana itzocanensis* Bravo-Hollis, 1943.
Intestine, *Bufo marinus* (A), San José, San José (Brenes-Madrigal and Bravo-Hollis 1959). Specimens: CHCR, CNHE.
Notes: The original record was made as *Oxysomatium itzocanensis* (Bravo-Hollis, 1943). According with Baker (1985) and Goldberg *et al.* (1998), the specimens may belong to *Aplectana incerta* Caballero, 1949.
28. *Oxysomatium* sp.
Intestine, *Constrictor constrictor* and “culebra coral” (R), NA (Brenes-Madrigal 1961).
- Diaphanocephalidae Travassos, 1920
29. *Kalicephalus* sp.
Intestine, “cobra imperator” (R), San José, San José (NP). Specimens: USNPC.
30. *K. inermis macrovulvus* (Caballero, 1954)
Intestine, *Bothrops atrox* (R), Hospital San Juan de Dios, San José (Brenes-Madrigal and Bravo-Hollis 1960). Specimens: CHCR, CNHE.
Notes: Species described as *Kalicephalus macrovulvus* Caballero, 1954 and considered as a subspecies of *Kalicephalus inermis* Molin, 1861 by Schad (1962).
31. *K. subulatus* Molin, 1861
Intestine, *Constrictor constrictor* (R), San Juan, San José (NP). Specimens: USNPC.
- Dictyocaulidae (Skrjabin, 1933)
32. *Dictyocaulus* sp.
Lungs, *Capra hircus* and *Bos taurus* (M), NA (Brenes-Madrigal 1961). Specimens: USNPC.
33. *D. arnfieldi* (Cobbold, 1884)
Lungs, *Equus caballus* (M), NA, Limón (Brenes-Madrigal 1961).
34. *D. eckerti* Skrjabin, 1931.
Lungs, *Bos taurus* (M), Turrialba, Cartago (Brenes-Madrigal 1961).
35. *D. viviparus* (Bloch, 1782).
Lungs, *Bos taurus* (M), Irazú and Paraiso-Orosi, Cartago (Echandi-Quiros 1964).
- Diplotriaeidae Skrjabin, 1916
36. *Diplotriaeina muscisaxicolae* Schuurmans-Stekhoven, 1952.
Aerial sacs, *Nesotriccus ridgwayi* (B), Isla Cocos, Puntarenas (Anderson *et al.* 1980). Specimens: USNPC.
- Gnathostomatidae Lane, 1923
37. *Echinocephalus jenzeni* Hoberg, Brooks, Molina-Ureña and Erbe, 1998.
Spiral valve, *Himantura pacifica* (F), Playa Panamá, Guanacaste (Hoberg *et al.* 1998). Specimens: USNPC.

38. *Spiroxys* sp.
Intestine, *Geomyda manni* (R), San Juan, San José (Brenes-Madrigal 1961). Specimens: USNPC.
- Gongylonematidae (Hall, 1916)
39. *Gongylonema neoplasticum* (Fibiger and Ditlevsen, 1914)
Stomach, *Rattus novergicus* (M), San José, San José (Vives and Zeledón 1957).
40. *G. pulchrum* Molin, 1857
Esophagus, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.
- Habronematidae (Chitwood and Wehr, 1932)
41. *Habronema megastoma* (Rudolphi, 1819) Seurat, 1914.
Stomach, *Equus caballus* (M), NA (Brenes-Madrigal 1961).
42. *H. microstoma* ((Schneider, 1866).
Stomach, *Equus caballus* (M), San Pedro Montes de Oca, San José (Brenes-Madrigal 1961). Specimens: USNPC.
43. *Parabronema* sp.
Intestine, *Alouatta palliata* (M), Reserva Biológica La Selva (Stoner 1996).
- Heligmonellidae
(Skrjabin and Schikhobalova, 1952)
44. *Hassalstrongylus aduncus* (Chandler, 1933) Durette-Desset, 1972.
Intestine, *Sigmodon hispidus* (M), San Rafael Ojo de Agua, Alajuela (Rodríguez-Ortíz *et al.* 1999, 2000), Cañas, Guanacaste (Rodríguez-Ortíz *et al.* 2000).
45. *Nippostrongylus brasiliensis* (Travassos, 1914).
Intestine, *Rattus novergicus* (M), San José, San José (Vives and Zeledón 1957).
- Heteroxynematidae
(Skrjabin and Schikhobalova, 1948)
46. *Aspicularis tetraptera* (Nitzsch, 1821).
Intestine, *Rattus rattus* (M), Escazú, San José (Vives and Zeledón 1957).
- Kathlaniidae Lane, 1914
Travassos, 1918
47. *Cruzia* sp.
NA, “cobra imperator” (R), San José, San José (NP). Specimens: USNPC.
- Metastrongylidae Leiper, 1908
48. *Metastrongylus elongatus* (Dujardin, 1845).
Trachea, Bronchial tube, *Sus scrofa* (M), NA (Brenes-Madrigal 1961).
- Molineidae (Skrjabin and Schulz, 1937)
49. *Nematodirus* sp.
NA, *Equus caballus* (M), NA (Marín 1955).
Notes: According to Brenes-Madrigal (1961) the record is doubtful because the genus is not parasite of equines.
50. *Oswaldocruzia subauricularis* (Rudolphi, 1819) Travassos, 1917.
Intestine, *Bufo marinus* (M), Tilarán, Guanacaste and Paso Ancho, San José (Brenes-Madrigal and Bravo-Hollis 1959). Specimens: CHCR, CNHE.
- Onchocercidae (Leiper, 1911)
51. *Dipetalonema gracile* (Rudolphi, 1809) Diesing, 1861.
Mesentery, *Cebus capucinus* (M), NA (NP). Specimens: USNPC.
52. *Dirofilaria immitis* (Leidy, 1856) Railliet and Henry, 1911 (adults and larvae).

- Intestine and heart, *Canis familiaris* (M), NA, Heredia (Sancho *et al.* 1989); San José, San José (Leuterer and Gothe 1993, Vargas and Contreras 1998).
53. *Foleyella* sp.
Blood, *Rana forreri* (A), Área de conservación de Guanacaste, Guanacaste (Desser 2001). Specimens: CMNPA.
54. *Litomosoides carinii* (Travassos, 1911).
Body cavity, *Sigmodon hispidus* (M), Cañas, Guanacaste (Rodríguez-Ortiz *et al.* 2000).
55. *L. peñai* Jiménez-Quirós and Arroyo-Sancho, 1960.
Body cavity, *Hemiderma perspicillata* (M), Santa Ana, San José (Jiménez-Quirós and Arroyo-Sancho 1960a). Specimens: CHCR.
56. *Ochoterenella* sp.
Blood, *Bufo marinus* (A), Área de conservación de Guanacaste, Guanacaste (Desser 2001). Specimens: CMNPA.
57. *O. caballeroi* Esslinger, 1987.
Mesentery, *Bufo marinus* (A), San José, San José (Esslinger 1987). Specimens: CNHE.
Notes: Original identification: *Ochoterenella digiticauda* Caballero, 1944.
58. *O. digiticauda* Caballero, 1944 (adults and larvae).
Mesentery, *Bufo marinus* (A), Santa Ana, San José (Brenes-Madrigal and Bravo-Hollis 1959). Specimens: CHCR, CNHE.
Notes: Some of these specimens, identified as *Ochoterenella digiticauda*, were used by Esslinger (1987) to describe *O. caballeroi*.
59. *Onchocerca cervicalis* Railliet and Henry, 1910.
Cervical ligament, *Equus caballus* (M), Esparza, Puntarenas (Velázquez *et al.* 1983).
60. *O. cervipedis* Wehr and Dikmans, 1935.
Dermis, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.
61. *Oswaldofilaria brevicaudata* (Rodhain and Vuylsteke, 1937).
Dermis and blood, *Ctenosaura similis* (R), Reserva Natural de Guanacaste, Guanacaste (Desser 1997).
62. *Setaria cervi* (Rudolphi, 1819).
Body cavity, *Bos taurus* (M), NA (Brenes-Madrigal 1961).
63. *S. equina* (Abildgaard, 1789).
Body cavity, eyes, scrotum, mesentery and pleura, *Equus caballus* (M), NA (Brenes-Madrigal 1961).
64. *S. labiatopapillosa* (Aless., 1838).
Body cavity, *Bos taurus* (M), San José, San José (NP). Specimens: USNPC.
65. *S. yehi* (Durette-Desset, 1966).
Rectum, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.
- Oxyuridae Cobbold, 1864
66. *Oxyuris* sp.
Intestine, *Ateles geoffroyi* (M), NA (Berrocal *et al.* 1997).
67. *Oxyuris equi* (Schränk, 1788).
Intestine, *Equus caballus* (M), San Pedro Montes de Oca, San José (NP), NA, Limón (Brenes-Madrigal 1961). Specimens: USNPC.
Notes: Specimens deposited at the USNPC were determined as *Oxyuris curvula* Rudolphi, 1803.
68. *Skrjabinema* sp.
Intestine, *Capra hircus* (M), NA (Alvarado *et al.* 1990).
69. *S. ovis* (Skrjabin, 1915) Wereschtchagin, 1926.
Intestine, *Capra hircus* (M), NA (Velázquez and Solís 1983).
Notes: This species was found in a goat, which had been imported into Costa Rica from the U.S.A.
70. *Trypanoxyuris* sp.
Intestine, *Ateles geoffroyi* (M), Parque Nacional Santa Rosa, Guanacaste (Stuart *et al.* 1990).
71. *T. minutus* (Schneider, 1866)
Intestine, *Alouatta palliata palliata* (M), La Pacífica, Guanacaste (Stuart *et al.* 1990).

Pharyngodonidae Travassos, 1919

72. *Ozolaimus cirratus* (von Linstow, 1906) Railliet and Henry, 1912.
Intestine, *Ctenosaura similis* (R), Liberia, Guanacaste and Mata de Limón, Puntarenas (Bravo-Hollis and Brenes-Madrigal 1959). Specimens: CHCR, CNHE.
73. *O. ctenosauri* Caballero, 1938.
Intestine, *Ctenosaura similis* (R), Liberia, Guanacaste and Mata de Limón, Puntarenas (Bravo-Hollis and Brenes-Madrigal 1959). Specimens: CHCR, CNHE.
Notes: Originally described as *Ozolaimus monhystera* (Von Linstow, 1902) and re-determined as *O. ctenosauri* by Moravec *et al.* (1996).
74. *O. megatyphlon* (Rudolphi, 1819) Dujardin, 1845.
Intestine, *Ctenosaura similis* (R), Liberia, Guanacaste and Mata de Limón, Puntarenas (Bravo-Hollis and Brenes-Madrigal 1959). Specimens: CHCR, CNHE.
75. *Spauligodon oxkutcabiensis* (Chitwood, 1938).
Intestine, *Sceloporus malachiticus* (R), San José, San José (Goldberg and Bursey 1992). Specimens: USNPC.

Physalopteridae (Railliet, 1893)
Leiper, 1908

76. Physalopteridae gen. sp.
Intestine, *Alouatta palliata* (M), Reserva Biológica La Selva (Stoner 1996).
77. *Physaloptera* sp. (larvae).
Stomach, *Bothrops atrox* (R), NA (Brenes-Madrigal 1961), *Sceloporus malachiticus* (R), Volcán Irazú, Cartago (Goldberg and Bursey 1992). Specimens: USNPC.

Protostrongylidae Leiper, 1926

78. *Parelaphostrongylus tenuis* (Dougherty, 1945).

Brain and craneal sinus, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.

Rhabdiasidae Railliet, 1915

79. *Rhabdias bufonis* (Schrank, 1788) Stiles and Hassal, 1905.
Lungs, *Bufo marinus* (A), San José, San José (NP). Specimens: USNPC.
Notes: According to Baker (1987), this species is only found in Europe.
80. *R. sphaerocephala* Goodey, 1924.
Lungs, *Bufo marinus* (A), Río Tiribi, San José and La Peña, Alajuela (Brenes-Madrigal and Bravo-Hollis 1959), NA (Colam, 1971). Specimens: CHCR, CNHE.
Notes: According to Baker (1987) records from the America's needs confirmation.

Spirocercidae (Chitwood and Wehr, 1932)

81. *Ascarops* sp. (larvae).
Stomach, *Sceloporus malachiticus* (R), San José, San José, San Ramón de Tres Ríos and Volcán Irazú, Cartago (Goldberg and Bursey 1992). Specimens: USNPC.
82. *Leiurus leptcephalus* (Rudolphi, 1819) Leuckart, 1850.
Intestine, *Bradypus griseus* (M), Turrialba, Cartago (Jiménez-Quirós and Brenes-Madrigal 1956). Specimens: CHCR, CNHE.
83. *Mastophorus muris* (Gmelin, 1790) Chitwood, 1938.
Intestine, *Rattus norvegicus* (M), San José, San José (Campos and Vargas 1978).
84. *Physocephalus sexalatus* (Molin, 1860) Diesing, 1861.
Intestine, *Sus scrofa* (M), NA (Brenes-Madrigal 1961).
85. *Spirocerca lupi* (Rudolphi, 1809)
Esophagus, *Canis familiaris* (M), NA, Heredia (Sancho *et al.* 1989).

Spiruridae Oerley, 1885

86. *Protospirura* sp.

- Intestine, *Sigmodon hispidus* (M), Cañas, Guanacaste (Rodríguez-Ortíz *et al.* 2000).
87. *P. muris* (Gmelin, 1790).
Intestine, *Rattus novergicus* (M), San José, San José (Vives and Zeledón 1957, Campos and Vargas 1978).
- Strongyliidae Baird, 1853
88. *Cylicocyclus* sp.
Intestine, *Bos taurus* (M), San Pedro Montes de Oca, San José (NP).
Specimens: USNPC.
89. *C. insigne* Boulenger, 1917.
Colon and intestinal caeca, *Equus caballus* (M), San Pedro Montes de Oca, San José (NP). Specimens: USNPC.
90. *Eucyathostomum webbi* Pursglove, 1976
Intestine, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.
91. *Strongylus edentatus* (Looss, 1900)
Colon and intestinal caeca, *Equus caballus* (M), NA (Brenes-Madrigal 1961).
Specimens: USNPC.
Notes: Originally recorded as *Alfortia edentatus* (Looss, 1900) Skrjabin, 1933.
92. *S. equinus* Mueller, 1780
Colon and intestinal caeca, *Equus caballus* (M), NA, Limón (Brenes-Madrigal 1961).
93. *S. vulgaris* (Looss, 1900).
Colon and intestinal caeca, *Equus caballus* (M), NA (Brenes-Madrigal 1961).
Notes: Recorded as *Delafondia vulgaris* (Looss, 1900) Skrjabin, 1933.
94. *Triodontophorus tenuicollis* Boulenger, 1916.
Intestinal caeca, *Equus caballus* (M), San Pedro Montes de Oca, San José (NP).
Specimens: USNPC.
- Strongyloidea Chitwood and McIntosh, 1934
95. *Strongyloides* sp.
Intestine, *Agouti paca* (M), Cantones Atenas, Central, Poas, San Carlos and Vega, Alajuela, Cantones Cartago and El Guarco, Cartago, Cantón Central, Heredia, Cantón Matina, Limón, Cantón Osa, Puntarenas, Cantones Central, Santa Ana and Terrazú, San José (Matamoros *et al.* 1991); *Capra hircus* (M), NA (Alvarado *et al.* 1990).
96. *S. cebus* Darling, 1911
Intestine, *Alouatta palliata*, *Ateles geoffroyi* and *Cebus capucinus* (M), Curu, Puntarenas, Los Inocentes, La Pacifica and Parque Nacional Santa Rosa, Guanacaste (Stuart *et al.* 1998).
97. *S. ratti* Sandground, 1925
Intestine, *Rattus novergicus* (M), San José, San José (Vives and Zeledón 1957).
98. *S. sigmodontis* Melvin and Chandler, 1950
Intestine, *Sigmodon hispidus* (M), Cañas, Guanacaste (Rodríguez-Ortíz *et al.* 2000).
- Syngamidae Leiper, 1912
99. *Mammomonogamus laryngeus* (Railliet, 1899) Ryzhikov, 1948
Larynx, *Bos taurus* (M), NA (Cordero *et al.* 1981).
100. *Stephanurus dentatus* Diesing, 1839
Liver and kidney, *Bos taurus*, *Sus scrofa* (M), (Brenes-Madrigal 1961).
101. *Syngamus* sp.
Larynx, *Felis pardalis mearnsi* (M), San Vito de Java, Puntarenas (Brenes-Madrigal *et al.* 1972).
102. *S. trachea* (Montagu, 1811)
Trachea, *Gallus gallus* and *Meleagris gallopavo* (B), NA (Brenes-Madrigal 1961).
- Tetrameridae Travassos, 1914
103. *Tetrameres fissipina* (Diesing, 1861)
Intestine, *Gallus gallus* (B), Tres Ríos, Cartago (Brenes-Madrigal *et al.* 1962).
Specimens: CHCR.
- Thelaziidae Skrjabin, 1915
104. *Oxyuris mansoni* (Cobbold, 1879)
Intestine, *Gallus gallus* (B), Turrialba, Cartago (Brenes-Madrigal *et al.* 1962).
Specimens: USNPC.

- 105.** *Thelazia* sp.
Stomach, *Constrictor constrictor* (R), NA (Brenes-Madrigal 1961).
Notes: Members of *Thelazia* are common parasites in eyes of mammals or birds so the record is doubtful in accordance with Brenes-Madrigal (1961).
- Trichostrongylidae (Leiper, 1908)
Leiper, 1912
- 106.** *Ashworthius patriciapillitae* Hoberg, Abrams, Carreño and Lichtenfels, 2002
Abomasum, *Odocoileus virginianus* (M), Parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001, Hoberg *et al.* 2002).
Specimens: USNPC.
Notes: Describes as *Ashworthius* sp. by Carreño *et al.* (2001).
- 107.** *Cooperia* sp.
Intestine, *Bos taurus* (M), Turrialba, Cartago (Brenes-Madrigal 1961), *Capra hircus* (M), NA (Alvarado *et al.* 1990).
- 108.** *Haemonchus* sp.
Abomasum, *Capra hircus* (M), NA (Alvarado *et al.* 1990).
- 109.** *H. contortus* (Rudolphi, 1803)
Abomasum, *Bos taurus* (M), Sabanilla de Montes de Oca, San José and *Capra hircus* (M), Turrialba, Cartago (Brenes-Madrigal 1961).
- 110.** *Mecistocirrus* sp.
Bos taurus (M), San Pedro Montes de Oca, San José (NP). Specimens: USNPC.
- 111.** *M. digitatus* (Von Linstow, 1906)
Abomasum, *Bos taurus* (M), Turrialba, Cartago (Brenes-Madrigal 1961), Heredia (Porrás 1987), San José and San Pedro Montes de Oca, San José (NP).
Specimens: USNPC.
- 112.** *Ostertagia* sp.
Abomasum and intestine, *Bos taurus* (M), Turrialba, Cartago and *Capra hircus* (M), Sabanilla de Montes de Oca, San José (Brenes-Madrigal 1961).
- 113.** *Mazamastrongylus* sp.
Abomasum, *Odocoileus virginianus* (M), parque Nacional Santa Rosa, Guanacaste (Carreño *et al.* 2001). Specimens: USNPC.
Notes: According to Durette-Desset (1983), the genus *Mazamastrongylus* Cameron, 1935 is synonym of *Spiculoptera* (Orloff, 1933).
- 114.** *Trichostrongylus* sp.
Intestine, *Bos taurus* (M), Turrialba, Cartago (Brenes-Madrigal 1961), *Sigmodon hispidus* (M), San Rafael Ojo de Agua, Alajuela (Rodríguez-Ortíz *et al.* 1999).
- 115.** *T. sigmodontis* Baylis, 1945
Intestine, *Sigmodon hispidus* (M), Cañas, Guanacaste (Rodríguez-Ortíz *et al.* 2000).
- Trichuridae (Ransom, 1911)
Railliet, 1915
- 116.** *Anatrichosoma buccalis* Pence and Little, 1972.
Mouth, *Didelphis marsupialis* (M), Tres Ríos, Cartago (Pence and Little 1972).
Specimens: USNPC.
- 117.** *Capillaria* sp.
Intestine, *Agouti paca* (M), Cantón Central, Heredia (Matamoros *et al.* 1991), *Bos taurus* (M), Santa Ana, San José (Brenes-Madrigal 1961), *Kinosternon cruentatum* (R), Santa Ana, San José (Brenes-Madrigal and Bravo-Hollis 1960). Specimens: CHCR, CNHE.
- 118.** *C. annulosa* (Dujardin, 1845).
Crop and oesophagus, NA (B), NA (Brenes-Madrigal 1961).
Notes: Validity of this records needs confirmation since the species is parasite of rodents in Europe.
- 119.** *C. obsignata* Madsen, 1945.
Intestine, *Columba livia* (B), NA (Brenes-Madrigal 1961), *Gallus gallus* (B), Guácimo, Limón (Brenes-Madrigal *et al.* 1962). Specimens: CHCR.
Notes: The species was transferred to the genus *Baruscapillaria* Moravec, 1982 by Moravec (1982).
- 120.** *Trichosomoides crassicauda* (Bellingham, 1840).

- Urinary bladder, *Rattus novergicus* (M), San José, San José (Vives and Zeledón 1957).
- 121.** *Trichuris* sp.
Intestine, *Agouti paca* (M), Canton Matina, Limón, Carntón Cartago, Cartago and Cantón San Carlos, Alajuela (Matamoros *et al.* 1991).
- 122.** *T. ovis* (Abildgaard, 1795)
Intestine, *Bos taurus* (M), Sabanilla de Montes de Oca, San José and Turrialba, Cartago (Brenes-Madriral 1961).
- Notes: Originally recorded as *Trichocephalus ovis* Abildgaard, 1795.
- 123.** *T. suis* (Schrank, 1788)
Colon and intestinal ceca, *Sus scrofa* (M), NA (Brenes-Madriral 1961).
Notes: Originally recorded as *Trichocephalus suis* Schrank, 1788.
- 124.** *T. vulpis* (Froelich, 1789)
Intestine, *Canis familiaris* (M), San José, San José (Brenes-Madriral 1961, Vargas and Contreras 1998).
Notes: Recorded as *Trichocephalus vulpis* Froelich, 1789 and *Trichuris canis*.

Parasite-Host List

Symbology: * new species. A= acanthocephalan; C= cestode; D= digenean; M= monogenean; N= nematode.

Pisces

Host

Aetobatis narinari
Arothron hispidus
Astyanax aeneus
Astyanax fasciatus

Bryconamericus scleloparius
Caranx caballus

Caranx hippos
Carcharhinus leucas

Helminth Species

*Acanthobothrium nicoyaense** (C)
Bianium simonei (D)
Wallinia chavariae (D)
*Anacanthocotyle anacanthocotyle** (M)
Gyrodactylus costaricensis (M)
*Gyrodactylus neotropicalis** (M)
*Jainus hexops** (M)
*Palombitrema heteroancistrum** (M)
*Urocleidoides costaricensis** (M)
*Urocleidoides strombicirrus** (M)
*Wallinia chavariae** (D)
Ahpua piscicola (M)
Bucephalopsis sp. (D)
Cemocotylella elongata (M)
Manteria brachydera (D)
Stephanostomum casum (D)
Tergestia laticollis (D)
Bucephalus introversus (D)
Anthobothrium laciniatum (C)
Callitetrarhynchus gracilis (C)
Cathetocephalus thatcheri (C)
Dasyrhynchus variouncinatus (C)
Dermophthirius maccallumi (M)
Erpocotyle carcharhini (M)
Heteroncotyle leucas (M)
Nybelinia bisulcata (C)
Otobothrium penetrans (C)
Phoreiobothrium trilocolatum (C)
Phyllobothrium leuci (C)

	<i>Phyllobothrium nicaraguensis</i> (C)
	<i>Phyllobothrium pristis</i> (C)
	<i>Platybothrium hypoprioni</i> (C)
<i>Cichlasoma</i> sp.	<i>Crassicutis cichlasomae</i> (D)
	<i>Crassicutis opisthoseminis</i> * (D)
<i>Dasyatis longus</i>	<i>Acanthobothrium cimari</i> * (D)
	<i>Acanthobothrium costarricense</i> * (C)
	<i>Acanthobothrium puntarenasense</i> * (C)
	<i>Acanthobothrium vargasi</i> * (C)
	<i>Pterobothrioides carvajali</i> (C)
<i>Echidna nocturna</i>	<i>Pseudolecithaster</i> sp. (D)
	<i>Theletrum lamotheri</i> * (D)
<i>Epinephelus itajara</i>	<i>Hypocreadium myohelicatum</i> (D)
<i>Fistularia commersonii</i>	<i>Ectenurus virgulus</i> (D)
	<i>Lecithochirium microstomum</i> (D)
<i>Haemulon maculicauda</i>	Didymozoidae gen. sp. (D)
<i>Himantura pacifica</i>	<i>Acanthobothroides pacificus</i> * (C)
	<i>Echinocephalus jenzeni</i> * (N)
	<i>Rhinebothrium geminum</i> * (C)
<i>Lutjanus colorado</i>	<i>Polymicrocotyle manteri</i> (M)
<i>Menticirrhus</i> sp.	<i>Hargicotyle louisianensis</i> (M)
<i>Microlepidotus brevipinnis</i>	<i>Koronacantha pectinaria</i> (A)
<i>Narcine entemedor</i>	<i>Acanthobothrium franus</i> * (C)
	<i>Acanthobothrium inbitorium</i> * (C)
<i>Oligoplites altus</i>	<i>Ahpua piscicola</i> (M)
	<i>Hargicola oligoplites</i> (M)
	<i>Manteria brachydera</i> (D)
	<i>Mecoderus oligoplites</i> (D)
<i>Oligoplites refulgens</i>	<i>Manteria brachydera</i> (D)
	<i>Mecoderus oligoplitis</i> (D)
<i>Oligoplites</i> sp.	<i>Mecoderus oligoplitis</i> (D)
<i>Poecilia sphenops</i>	<i>Gyrodactylus bullatarudis</i> (M)
	<i>Gyrodactylus costaricensis</i> * (M)
<i>Pristis perotteti</i>	<i>Anthobothrium pristis</i> (C)
<i>Rhamdia rogersi</i>	<i>Ameloblastella chavarriai</i> * (M)
	<i>Aphanoblastella travassosi</i> * (M)
	<i>Stunkardiella minima</i> (D)
<i>Seriola</i> sp.	<i>Bucephalus introversus</i> * (D)
<i>Spherooides</i> sp.	<i>Bianium plicatum</i> (D)
	<i>Heterobothrium ecuadori</i> (M)
<i>Synodus</i> sp.	<i>Lecithochirium monticellii</i> (D)
<i>Urotrygon chilensis</i>	<i>Acanthobothrium campbelli</i> * (C)
	<i>Escherbothrium molinae</i> * (C)
<i>Vomer declivifrons</i>	<i>Pseudomazocraes monsivaisae</i> (M)
<i>Xurel marginatus</i>	<i>Neomicrocotyle pacifica</i> * (M)

Amphibians

Host

Bufo marinus

Helminth Species

Aplectana itzacanensis (N)
Glypthelmins hepaticus (D)
Glypthelmins palmipedis (D)
Gorgoderina megalorchis (D)
Langeronia provitellaria (D)
Mesocoelium travassosi (D)

	<i>Ochoterenella caballeroi</i> (D)
	<i>Ochoterenella digiticauda</i> (N)
	<i>Ochoterenella</i> sp. (N)
	<i>Oswaldocruzia subauricularis</i> (N)
	<i>Rhabdias bufonis</i> (N)
	<i>Rhabdias sphaerocephala</i> (N)
	<i>Acanthocephalus lutzii</i> (A)
	<i>Foleyella</i> sp. (N)
	<i>Neohaematoloechus helibravae</i> * (D)
	<i>Cephalogonimus americanus</i> (D)
	<i>Glythelminis facioi</i> * (D)
	<i>Megalodiscus temperatus</i> (D)
	<i>Pseudosonsinotrema chabaudi</i> * (D)
	<i>Haematoloechus meridionalis</i> * (D)
	<i>Halipegus eschi</i> * (D)
	<i>Langeronia provitellaria</i> (D)
	<i>Centrorhynchus tumidulus</i> (A)
<i>Leptodactylus gracilis</i>	
<i>Rana forreri</i>	
<i>Rana palmipes</i>	
<i>Rana pipiens</i>	
<i>Rana vaillanti</i>	
<i>Rana warchewitschii</i>	
<i>Rana</i> sp.	

Reptiles

Host	Helminth Species
<i>Basiliscus</i> sp.	<i>Paralopharynx gonzalezi</i> * (D)
<i>Bothrops atrox</i>	<i>Kalichephalus inermis</i> (N)
	<i>Physaloptera</i> sp. (N)
<i>Bothrops</i> sp.	<i>Ophiotaenia perspicua</i> (C)
<i>Caiman crocodilus</i>	<i>Prolecithodiplostomum constrictum</i> (D)
	<i>Proterodiplostomum medusae</i> (D)
<i>Constrictor constrictor</i>	<i>Kalichephalus subulatus</i> (N)
	<i>Ophidascaris</i> sp. (N)
	<i>Ophiotaenia</i> sp. (C)
	<i>Oxysomatium</i> sp. (N)
	<i>Thelazia</i> sp. (N)
<i>Crocodylus acutus</i>	<i>Proctocaeum acuti</i> * (D)
	<i>Proterodiplostomum medusae</i> (D)
<i>Ctenosaura similis</i>	<i>Atractis longicaudatum</i> * (N)
	<i>Oochoristica guanacastense</i> * (C)
	<i>Oswaldofilaria brevicaudata</i> (N)
	<i>Ozolaimus cirratus</i> (N)
	<i>Ozolaimus ctenosauri</i> (N)
	<i>Ozolaimus megatyphlon</i> (N)
<i>Drymobius margaritiferus</i>	<i>Paralopharynx gonzalezi</i> (D)
<i>Geomyda manni</i>	<i>Ochetosoma miladelarocai</i> (D)
	<i>Telorchis</i> sp. (D)
<i>Kinosternon cruentatum</i>	<i>Spiroxys</i> sp. (N)
	<i>Atractis caballeroi</i> * (N)
	<i>Atractis impura</i> (N)
	<i>Capillaria</i> sp. (N)
	<i>Heronimus mollis</i> (D)
	<i>Telorchis pseudoaculeatus</i> (D)
<i>Kinosternon leucostomum</i>	<i>Neopolystoma fentoni</i> * (M)
<i>Rhinoclemmys pulcherrima</i>	<i>Neopolystoma fentoni</i> (M)
<i>Sceloporus malachiticus</i>	<i>Ascarops</i> sp. (N)
	<i>Physaloptera</i> sp. (N)
	<i>Spauligodon oxkutzcabensis</i> (N)

Aves**Host**

Ajaia ajaja
Buteo nitidus
Calocitta formosa
Chamaeptes unicolor
Columba fasciata
Columba livia
Crotophaga sulcirostris
Gallus gallus

Gymnostinops montezuma

Icterus galbula
Jacana spinosa

Leucopternis semiplumbea
Melaegris gallopavo

Momotus momotus

Nesotriccus ridgwayi
Oriolus oriolus
Ostinops quatemozinus
Pteroglossus torquatus
Sternaella magna
Turdus grayi

Helminth Species

Mesaulus grandis (D)
*Platynosomum costarricense** (D)
Lubens lubens (D)
*Maritrempsis longibursatus** (D)
Ascaridia columbae (N)
Capillaria obsignata (N)
*Eumegacetes macroorchis** (D)
Amoebotaenia cuneata (C)
Amoebotaenia sp. (C)
Ascaridia galli (N)
Capillaria obsignata (N)
Choanotaenia infundibulum (C)
Choanotaenia sp. (C)
Davainea proglottina (C)
Hymenolepis sp. (C)
Oncicola oncicola (A)
Oxyspirura mansonii (N)
Raillietina echinobothrida (C)
Raillietina sp. (C)
Raillietina tetragona (C)
Syngamus trachea (N)
Tetrameres fissispina (N)
Hymenolepis sp. (C)
*Leucochloridium costarricense** (D)
Lutztrema obliquum (D)
*Tanaisia freitasi** (D)
*Zonorchis costarricensis** (D)
*Stomylotrema ucremium** (D)
*Haematotrephus facioi** (D)
*Tanaisia winteri** (D)
Platynosomum illiciens (D)
Syngamus trachea (N)
Ascaridia galli (N)
*Hyptiasmus costarricense** (D)
*Ornithotrema momoti** (D)
Diplotriaena muscisaxicolae (N)
Paricterotaenia sp. (C)
Hymenolepis sp. (C)
Zonorchis macroovarius (D)
Paricterotaenia sp. (C)
Anomotaenia sp. (C)
Aploparaksis sp. (C)

Mammalia**Host**

Agouti paca

Helminth Species

Capillaria sp. (N)
Strongyloides sp. (N)
Taenia sp. (C)
Trichuris sp. (N)

<i>Alouatta palliata</i>	<i>Ascaris lumbricoides</i> (N) <i>Controrchis biliophilus</i> (D) <i>Parabronema</i> sp. (N) Physalopteridae gen. sp. (N) <i>Strongyloides cebus</i> (N) <i>Trypanoxyuris minutus</i> (N)
<i>Ateles geoffroyi</i>	<i>Angiostrongylus costaricensis</i> (N) <i>Oxyuris</i> sp. (N) <i>Strongyloides cebus</i> (N) <i>Trypanoxyuris</i> sp. (N)
<i>Bos taurus</i>	<i>Bunostomum phlebotomum</i> (N) <i>Capillaria</i> sp. (N) <i>Cooperia</i> sp. (N) <i>Cotylophoron</i> sp. (N) <i>Cylicocycclus</i> sp. (N) <i>Dictyocaulus eckerti</i> (N) <i>Dictyocaulus</i> sp. (N) <i>Dictyocaulus viviparus</i> (N) <i>Echinococcus granulosus</i> (C) <i>Fasciola hepática</i> (D) <i>Gaigeria pachyscelis</i> (N) <i>Haemonchus contortus</i> (N) <i>Mammomonogamus laryngeus</i> (N) <i>Mecistocirrus digitatus</i> (N) <i>Mecistocirrus</i> sp. <i>Moniezia benedeni</i> (C) <i>Moniezia expansa</i> (C) <i>Neoascaris vitulorum</i> (N) <i>Oesophagostomum radiatum</i> (N) <i>Ostertagia</i> sp. (N) <i>Paramphistomum cervi</i> (D) <i>Setaria cervi</i> (N) <i>Setaria labiatopapillosa</i> (N) <i>Stephanurus dentatus</i> (N) <i>Taenia saginata</i> (C) <i>Trichostrongylus</i> sp. (N) <i>Trichuris ovis</i> (N)
<i>Bradypus griseus</i>	<i>Leiurus leptcephalus</i> (N)
<i>Canis familiaris</i>	<i>Moniezia benedeni</i> (C) <i>Ancylostoma caninum</i> (N) <i>Ascaris lumbricoides</i> (N) <i>Avitellina centripunctata</i> (C) <i>Dipilydium caninum</i> (C) <i>Dirofilaria immitis</i> (N) <i>Paragonimus mexicanus</i> (D) <i>Spirocerca lupi</i> (N) <i>Toxocara canis</i> (N) <i>Trichuris vulpis</i> (N)
<i>Canis latrans</i>	<i>Alaria nasuae</i> (D)
<i>Capra hircus</i>	<i>Ancylostoma caninum</i> (N) <i>Bunostomum trigonocephalum</i> (N) <i>Cooperia</i> sp. (N) <i>Dictyocaulus</i> sp. (N) <i>Gaigeria pachyscelis</i> (N) <i>Haemonchus contortus</i> (N) <i>Haemonchus</i> sp. (N) <i>Moniezia</i> sp. (C) <i>Oesophagostomum venulosum</i> (N)

	<i>Ostertagia</i> sp. (N)
	<i>Skrjabinema ovis</i> (N)
	<i>Skrjabinema</i> sp. (N)
	<i>Strongyloides</i> sp. (N)
<i>Cebus capucinus</i>	<i>Dipetalonema gracile</i> (N)
	<i>Prostenorchis elegans</i> (A)
	<i>Strongyloides cebus</i> (N)
<i>Chironectes minima</i>	<i>Paragonimus caliensis</i> (D)
<i>Conepatus semistriatus</i>	<i>Paragonimus mexicanus</i> (D)
<i>Didelphis marsupialis</i>	<i>Anatrichosoma buccalis</i> (N)
	<i>Mathevotaenia pennsylvanica</i> (C)
	<i>Paragonimus caliensis</i> (D)
	<i>Paragonimus mexicanus</i> (D)
	<i>Rhopalias coronatus</i> (D)
	<i>Rhopalias horridus</i> (D)
	<i>Spelotrema skrjabini</i> * (D)
<i>Eptesicus propinquus</i>	<i>Limatulum costarricensis</i> * (D)
	<i>Prosthodendrium cordiforme</i> (D)
	<i>Urotrema scabridum</i> (D)
<i>Equus caballus</i>	<i>Anoplocephala magna</i> (C)
	<i>Anoplocephala perfoliata</i> (C)
	<i>Anoplocephaloides mamillana</i> (C)
	<i>Cylicocyclus insigne</i> (N)
	<i>Dictyocaulus arnfieldi</i> (N)
	<i>Habronema megastoma</i> (N)
	<i>Habronema microstoma</i> (N)
	<i>Nematodirus</i> sp. (N)
	<i>Onchocerca cervicalis</i> (N)
	<i>Oxyuris equi</i> (N)
	<i>Parascaris equorum</i> (N)
	<i>Setaria equina</i> (N)
	<i>Strongylus edentatus</i> (N)
	<i>Strongylus equinus</i> (N)
	<i>Strongylus vulgaris</i> (N)
	<i>Triodontophorus tenuicollis</i> (N)
<i>Felis catus</i>	<i>Amphimerus costarricensis</i> * (D)
	<i>Ancylostoma caninum</i> (N)
	<i>Dipylidium caninum</i> (N)
	<i>Paragonimus mexicanus</i> (D)
	<i>Taenia taeniaeformis</i> (C)
	<i>Toxocara mystax</i> (N)
<i>Felis concolor</i>	<i>Echinococcus oligarthrus</i> (C)
<i>Felis pardalis</i>	<i>Lagochilascaris</i> sp. (N)
	<i>Paragonimus mexicanus</i> (D)
	<i>Syngamus</i> sp. (N)
<i>Felis wiedii</i>	<i>Taenia taeniaeformis</i> (C)
<i>Hemiderma perspicillatum</i>	<i>Litomosoides peñai</i> * (N)
<i>Marmosa</i> sp.	<i>Mathevotaenia bivittata</i> (C)
	<i>Mathevotaenia didelphidis</i> (C)
<i>Micronycteris hirsutus</i>	<i>Castroia silvai</i> (D)
<i>Mustela frenata</i>	<i>Euryhalmis costaricensis</i> * (D)
	<i>Plagiorhynchus angrense</i> (A)
	<i>Polymorphus corynosoma</i> (A)
<i>Mustela noveboracensis</i>	<i>Centrorhynchus</i> sp. (A)
<i>Nasua narica</i>	<i>Angiostrongylus costaricensis</i> (N)
<i>Odocoileus virginianus</i>	<i>Ashworthius patriciapillitae</i> * (N)
	<i>Eucyathostomum webbi</i> (N)
	<i>Gongylonema pulchrum</i> (N)

	<i>Mazamastrongylus</i> sp. (N)
	<i>Onchocerca cervipedis</i> (N)
	<i>Paramphistomum liorchis</i> (D)
	<i>Parelaphostrongylus tenuis</i> (N)
	<i>Setaria yehi</i> (N)
	<i>Taenia omisa</i> (C)
<i>Philander opossum</i>	<i>Amphimerus neotropicalis</i> * (D)
	<i>Maritrempsis prolixum</i> * (D)
	<i>Paragonimus mexicanus</i> (D)
	<i>Rhopalias baculifer</i> (D)
	<i>Rhopalias coronatus</i> (D)
	<i>Rhopalias horridus</i> (D)
	<i>Rhopalias macracanthus</i> (D)
<i>Potos flavus</i>	<i>Ancylostoma braziliense</i> (N)
<i>Procyon lotor</i>	<i>Paragonimus caliensis</i> (D)
	<i>Paragonimus mexicanus</i> (D)
	<i>Robertdigenea dollfusi</i> * (D)
<i>Rattus novergicus</i>	<i>Gongylonema neoplasticum</i> (N)
	<i>Hymenolepis diminuta</i> (C)
	<i>Mastophorus muris</i> (N)
	<i>Moniliformis moniliformis</i> (A)
	<i>Nippostrongylus brasiliensis</i> (N)
	<i>Protospirura muris</i> (N)
	<i>Strongyloides ratti</i> (N)
	<i>Taenia taeniaeformis</i> (C)
	<i>Trichosomoides crassicauda</i> (N)
	<i>Vampirolepis nana</i> (C)
<i>Rattus rattus</i>	<i>Aspiculuris tetraptera</i> (N)
	<i>Moniliformis moniliformis</i> (A)
	<i>Taenia taeniaeformis</i> (C)
<i>Saimiri oerstedii</i>	<i>Prosthenorchis</i> sp. (A)
<i>Sigmodon hispidus</i>	<i>Angiostrongylus costaricensis</i> (N)
	<i>Hassalstrongylus aduncus</i> (N)
	<i>Hymenolepis diminuta</i> (C)
	<i>Litomosoides carinii</i> (N)
	<i>Monodontus</i> sp. (N)
	<i>Protospirura</i> sp. (N)
	<i>Raillietina</i> sp. (C)
	<i>Strongyloides sigmodontis</i> (N)
	<i>Trichostrongylus sigmodontis</i> (N)
	<i>Trichostrongylus</i> sp. (N)
<i>Sus scrofa</i>	<i>Ascaris suum</i> (N)
	<i>Globocephalus urosubulatus</i> (N)
	<i>Metastrongylus elongatus</i> (N)
	<i>Physocephalus sexalatus</i> (N)
	<i>Stephanurus dentatus</i> (N)
	<i>Taenia solium</i> (C)
	<i>Trichuris suis</i> (N)
<i>Sylvilagus brasiliensis</i>	<i>Anoplocephaloides floresbarroetae</i> * (C)
<i>Tonatia silvicola</i>	<i>Oligacanthorhynchidae</i> gen. sp. (A)
<i>Urocyon cinereoargenteus</i>	<i>Paragonimus mexicanus</i> (D)
	<i>Taenia pisiformis</i> (C)

Unidentified hosts

Host	Helminth Species
"Amphibian"	<i>Plagiorchis</i> sp. (D)
"Atún"	<i>Jaliscia caballeroi</i> (M)
"Aves"	<i>Diorchis acuminatus</i> (C)
"Aves"	<i>Polymorphus minutus</i> (A)
"Aves"	<i>Capillaria annulosa</i> (N)
"Aves" (?)	<i>Plagiorchis</i> sp. (D)
"Carraco"	<i>Porrocaecum angusticolle</i> (N)
"Cobra imperator"	<i>Porrocaecum</i> (N), <i>Kalicephalus</i> sp. (N) y <i>Cruzia</i> sp. (N)
"Colubridae"	<i>Ochetosoma bravoiaie*</i> (D)
"Columbidae"	<i>Ascaridia</i> sp. (N)
"Culebra coral"	<i>Oxysomatium</i> sp. (N)
"Ganzo"	<i>Porrocaecum</i> sp. (N)
"Medialuna" sp.	<i>Lasiotocus costaricae*</i> (D)
"Medialuna" sp.	<i>Koronacantha pectinaria</i> (A)
"Moray"	<i>Helicometra sinuata</i> (D)
"Ovejas"	<i>Oesophagostomum venulosum</i> (N)
"Patos"	<i>Ascaridia galli</i> (N)
"Rats"	<i>Oesophagostomum venosolum</i> (N)
"Tortuga"	<i>Telorchis</i> sp. (D)
"Tortuga"	<i>Plagiorchis</i> sp. (D)

DISCUSSION

In this checklist we present information of 303 species of helminths parasitizing 108 species of vertebrates in Costa Rica. Helminth species are represented by 81 species of digeneans, 23 of monogeneans, 63 of cestodes, 12 of acanthocephalans, and 124 of nematodes. Strikingly, almost all the records we present herein correspond to adult forms infecting mostly the intestine of their hosts, or habitats such as the liver or lungs. Vertebrates infected with helminths are included in all major groups, such as fishes (including elasmobranchs and teleosts, with 31 species), amphibians (7 species), reptiles (14 species), birds (20 species), and mammals (36 species), including both wildlife and domestic. The largest number of helminth species has been described from Mammals, however this might be an artifact of the sampling since this is the group on which more species have been analyzed for helminths in Costa Rica. Characteristically, most records of helminths are presented as isolated reports describing one species in a particular host, and only a few surveys of the helminth fauna of a

particular host have been conducted (see for example Carreño *et al.* 2001). However, in this checklist we present a comprehensive list of the helminth fauna of each host species when it is available, considering all the published accounts, e.g. the toad *Bufo marinus* possess a helminthological record of 12 species of helminths, recorded in 12 reports (papers) from 10 localities along its distributional range in Costa Rica. In contrast, the shark *Carcharhinus leucas* is parasitized with 14 species of helminths in one single locality (Watson and Thorson 1976).

Clearly, the inventory of the helminth parasites of vertebrates in Costa Rica is in its first steps and a large number of species will be described in the next years. So far, only 108 species of vertebrates have been studied for helminths (most of them representing isolated reports and not complete surveys of each host species along its distributional range), and from them, 303 helminth species were recorded. However, only 3.8% of the vertebrate fauna of the country has been studied, considering that there are about 2,855 species of vertebrates in Costa Rica (Janzen 1983, Stiles and Skutch

1989, Bussing 1998). Interestingly, 58 species were recorded as new species from Costa Rica and most of them are endemic to particular regions. This represents approximately 19.1% of endemic species of helminths in vertebrates of Costa Rica. In comparison, after more than 70 years of survey work of helminth parasites of vertebrates in Mexico, approximately 1,632 species of helminths hosted in 947 species of vertebrates have been recorded. Approximately, 20% of the helminth fauna of vertebrates from Mexico has been described so far, according with estimates presented by Pérez-Ponce de León and García-Prieto (2001b).

Considering that every species of vertebrate supports a diverse biota of symbiotic organisms, and that parasites are integral components of biodiversity, we have learned that documenting the diversity of helminth parasites inhabiting vertebrate hosts in Costa Rica (and in any other part of the world) is very important by several reasons. They can act as agents to control and regulate host populations and they can also act as agents of disease representing a threat for domestic and wildlife vertebrates and also a threat for the conservation programs, especially those directed to preserve endangered species and ecosystems. The ecology and evolutionary history of these parasites is tied to that of their hosts, so they can be used as key indicators of ecosystem health, and also as indicators to monitor global change. At the same time, they provide valuable information to the understanding of the biogeographical and coevolutionary history of the association (Gardner and Campbell 1992, Hoberg 1997a, 1997b, Marcogliese and Cone 1997, Overstreet 1997, Brooks and Hoberg 2000, Brooks *et al.* 2001, Pérez-Ponce de León and García-Prieto 2001a).

There is no doubt about the importance of the helminth parasites as part of the inventory of natural resources in Costa Rica and we would like also to emphasize the important role that these parasites may play as agent of diseases in human beings. Several of the helminths mentioned in the checklist are the cause of some disease that directly causes health problems, or at least the potential exists for some of them to

become emerging pathogens (see Morera and Céspedes 1971, Brenes-Madrugal *et al.* 1974, and Brenes-Madrugal *et al.* 1983) for cases of human infections with *Angiostrongylus costaricensis*, *Wuchereria bancrofti*, and *Raillietina* sp., respectively).

To summarize, helminth parasites of vertebrates in Costa Rica need to be considered within any initiatives to accomplish the national inventory of biological resources. The information provided by them is synergistic with all the information about the natural history of the hosts that is being assembled from field data and, in addition to that, the risk of emerging diseases will be assessed and probably all the information will be used when decisions to handle and protect biodiversity are taken. In this sense, to build up and preserve a national depository of the specimens (and the information associated to each of them) is a necessary step. Universities and government agencies have to be convinced to support now, and in the future, the establishment of biological collections where all specimens will be saved, so infrastructure and personnel have to be provided to guarantee the quality of the specimens within collections, as well as to provide a service to the society and the scientific community to make sure that the knowledge and the information contained in collections is available for all of them. At this point, the Colección de Helminthos de Costa Rica (CNCR) has re-emerged and we will try to hold the promise that it will have the standards of quality to assure that it will become the national depository of helminths in the country.

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RESUMEN

Los helmintos de vertebrados silvestres y domésticos han sido estudiados por más de 50 años en Costa Rica; sin embargo, la información sobre los mismos se encuentra dispersa en diversas fuentes. Con el fin de recopilar dicha información, construimos una base de datos que contiene gran parte de los registros sobre helmintos de vertebrados silvestres y domésticos descritos para Costa Rica; éstos fueron obtenidos a partir de búsquedas bibliográficas electrónicas y de consultas a colecciones parasitológicas, conformando un listado que contiene 303 especies, incluyendo 81 especies de digéneos, 23 de monogéneos, 63 de céstodos, 12 de acantocéfalos y 124 de nematodos. Tales registros proceden del estudio de 108 especies de vertebrados (31 especies de peces, 7 anfibios, 14 reptiles, 20 aves y 36 mamíferos), lo cual representa únicamente el 3.8% de la fauna de vertebrados pues en el país se han descrito aproximadamente 2,855 especies. De manera interesante, 58 de las 303 especies (19.1%) que han sido registradas representan especies nuevas y, en su mayoría endémicas. Dado que los parásitos aportan información relevante sobretodo cuando se conjunta de manera sinérgica con aquella obtenida de la historia natural de los hospederos a los que parasitan, consideramos que los helmintos parásitos deben ser incorporados en las iniciativas para completar el inventario biológico nacional. Este trabajo de compilación representa el primer paso para la re-constitución de la Colección de Helmintos de Costa Rica (CHCR), albergada por la escuela de Microbiología de la Universidad de Costa Rica, que de alcanzar y mantener los estándares internacionales de calidad necesarios, deberá convertirse en el depositario nacional de los helmintos de este país.

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