

Addendum to the Checklist of the helminth parasites of vertebrates in Costa Rica

Beatriz Rodríguez-Ortíz¹, Luis García-Prieto², Jonathan Herrera-Vázquez¹ &
Gerardo Pérez-Ponce de León²

- 1 Laboratorio de Helminología, Facultad de Microbiología, Universidad de Costa Rica, San José, Costa Rica, e-mail: brodrigu@cariari.ac.ucr.cr; jonnathan@biologia.ucr.ac.cr
- 2 Laboratorio de Helminología, Instituto de Biología, UNAM. Ap. Postal 70-153. C.P. 04510, México D.F., e-mail: ppdleon@servidor.unam.mx; gprieto@ibiologia.unam.mx

Received 22-II-2004. Corrected 01-III-2004. Accepted 01-III-2004.

Abstract: In this work, we present an addendum to the "Checklist of the helminth parasites of vertebrates in Costa Rica" with a parasite-host list as well as a host-parasite list. This addendum updates the available information on this group of parasites in Costa Rica, since very recently a new input has been made to describe the helminth fauna of vertebrates, particularly at the Área de Conservación de Guanacaste. In this paper, we add 33 records, representing 23 species. This raises the number of helminth species described in vertebrates from Costa Rica to 325, represented by 89 species of digeneans, 23 of monogeneans, 63 of cestodes, 13 of acanthocephalans, and 137 of nematodes. In total, 133 species of vertebrates have been studied for helminths in Costa Rica (31 species of fishes, 7 amphibians, 18 reptiles, 40 birds, and 37 mammals). Currently, 67 species (20.6 %) have been recorded as new species from Costa Rica and most of them are endemic to particular regions. The Colección de Helmintos de Costa Rica, housed at the Universidad de Costa Rica (UCR), San José, is the depository of only 23% of the species recorded so far; however this situation is changing and people recognizes.

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

Palabras Clave: Helmintos, Costa Rica, Biodiversidad, Inventarios biológicos, Parásitos, Vertebrados.

The checklist of helminth parasites of vertebrates in Costa Rica, published recently (Rodríguez-Ortiz *et al.* 2004), updated all the available information about helminth parasites of vertebrates in Costa Rica along the past 50 years. Notwithstanding, the inventory of all eukaryotic parasites of the species of vertebrates living within the Área de Conservación Guanacaste, Costa Rica, started in 1996 by Daniel R. Brooks and co-workers, has produced a great dealt of information in the last two years. For this reason, we present this addendum, in order to compile all this information and some other available records, all of them will be available electronically in 2004 at www.chcr.ucr.ac.cr.

MATERIALS AND METHODS

Refer to Rodríguez-Ortiz *et al.* (2004).

RESULTS

This addendum to the checklist contains records of 23 species included in 17 genera of helminths (9 digeneans, 1 acanthocephalan and 13 nematodes). 14 of them represent new species and 4 new genera. Helminths were reported in 25 species of vertebrates not previously studied in Costa Rica. Likewise, we add some taxonomic remarks made in recent publications on 5 species included in the original

checklist. Next, we present the information for each species of helminth.

Symbology: B= bird; M= mammal; R= reptile; NA= information not available; CHCR refers to the Colección de Helmintos de Costa Rica, San José, Costa Rica; HWML to the Harold W. Manter Laboratory of Parasitology, University of Nebraska State Museum, Lincoln, Nebraska, U.S.A.; USNPC to the U.S. National Parasite Collection, Beltsville, Maryland, U.S.A.

PLATYHELMINTHES

Gegenbaur, 1859

Digenea (Van Beneden, 1858)

Brachylaimoidea

Joyeux and Foley, 1930

1. *Bakkeius moragai* Zamparo, Brooks and Causey, 2003
Gallbladder, intestine, *Gymnopithys leucaspis* (B), Estación San Gerardo, Guanacaste, *Henicorhina leucosticta*, *Phaenostictus mcleannani*, *Thryothorus pleurostictus* (B), Maritza and Sendero la Parcela, Guanacaste (Zamparo *et al.* 2003b). Specimens: CHCR, USNPC.
2. *Pojmanskia riosae* Zamparo, Brooks and Causey, 2003
Intestine, gallbladder, *Thryothorus pleurostictus* (B), Cafetal, Guanacaste, *Caryothraustes poliogaster*, *Euphonia hirudinacea*, *Morococcyx erythropygius*, *Platyrrinchus coronatus*, *Thryothorus nigricapillus*, (B), Estación San Gerardo, Guanacaste (Zamparo *et al.* 2003b). Specimens: CHCR, USNPC.
Notes: Both genus were not assigned to any of the families within the Brachylaimoidea.

Brachycoeliidae (Looss, 1899)

Johnston, 1912

3. *Mesocoelium monas* (Rudolphi, 1819) Teixeira de Freitas, 1958

Intestine, *Norops limifrons* (R), Hacienda La Suerte, Limón (Burseley and Goldberg 2003). Specimens: HWML.

Notes: Bursey and Goldberg (2003) refers the record of *Mesocoelium travassosi* realized by Caballero and Brenes-Madrigal (1958) in toads from Costa Rica to the species *M. monas*. Both species were synonymized by Teixeira de Freitas (1963).

Brachylaimidae (Joyeux and Foley, 1930)

4. *Tinamutrema canoae* Zamparo, Brooks and Causey, 2003
Cloaca, *Crypturellus cinnamomeus* (B), Finca Jenny, Guanacaste (Zamparo *et al.* 2003a). Specimens: CHCR, USNPC.

Cyclocoeliidae

Kossack, 1911

5. *Neohaematotrephus arayae* Zamparo, Brooks, Causey and Rodríguez, 2003
Body cavity, *Jacana spinosa* (B), Laguna Los Jícaros, Guanacaste (Zamparo *et al.* 2003d). Specimens: CHCR, USNPC.

Macroderoididae

McMullen, 1937

6. *Parallopharynx gonzalezi* Brenes-Madrigal, Arroyo-Sancho and Montero-Gei, 1960
Intestine, *Ctenosaura quinquecarinata* (R), Cuajiniquíl, Guanacaste (Zamparo *et al.* 2004b). Specimens: CHCR, USNPC.
7. *P. matternae* Zamparo, Brooks, Tkach and Rodríguez, 2004
Intestine, *Basiliscus basiliscus* (R), Río Tempisque, Guanacaste (Zamparo *et al.* 2004b). Specimens: CHCR, USNPC.

Prosthogonimidae (Lühe, 1909)

Lahille, 1922

8. *Whallwachsia illuminata* Zamparo, Brooks and Causey, 2003

Bile duct, intestine, *Amazilia saucerrottei* (B), Cafetal, Guanacaste, *Tolomomyias sulphurescens* (B), main entrance to Santa Rosa, Parcela Principe, Estación San Gerardo, Guanacaste (Zamparo *et al.* 2003c). Specimens: CHCR, USNPC.

Urotrematidae
Poche, 1926

9. *Urotrema shirleyae* Zamparo, Brooks, and Tkach, 2004
Intestine, *Norops oxylophus* (R), Santa Rosa, Guanacaste (Zamaparo *et al.*, 2004a). Specimens: CHCR, USNPC.

ACANTHOCEPHALA

(Rudolphi, 1808)
Echinorhynchidae Cobbold, 1876

1. *Acanthocephalus saurius* Bursey and Goldberg, 2003
Intestino, *Norops limifrons* (R), Hacienda La Suerte, Limón (Bursey and Goldberg 2003). Specimens: HWML.

NEMATODA

(Rudolphi, 1808)
Acuariidae Seurat, 1913

1. Acuariidae gen. sp. (larvae)
Stomach wall, *Norops limifrons* (R), Hacienda La Suerte, Limón (Bursey and Goldberg 2003). Specimens: HWML.
2. *Acuaria mayori* Lent, Teixeira de Freitas and Proenca, 1945
Gizzard, *Myiarchus nuttingi* (B), Cafetal and Quebrada Costa Rica, Guanacaste (Zhang *et al.* 2003a). Specimens: USNPC.
3. *A. wangi* Zhang, Brooks and Causey, 2003
Gizzard, *Gymniphys leucaspis* and *Hylophylax naevioides* (B), Estación San Gerardo, Guanacaste (Zhang *et al.* 2003a). Specimens: USNPC.
4. *Syncuaria mycteriae* Zhang, Brooks and Causey, 2003

Gizzard, *Mycteria americana* (A), Santa Rosa, Guanacaste (Zhang *et al.* 2003b). Specimens: USNPC.

5. *Synhimantus (Dispharynx) nasuta* Zhang, Brooks and Causey, 2004.
Craw, *Thraupis episcopus* (B), Estación San Gerardo, Guanacaste (Zhang *et al.* 2004a). Specimens: CHCR, USNPC.

Habronematidae (Chitwood y Wehr, 1932)
Ivaschkin, 1961

6. *Procyrnea mawsonae* Zhang, Brooks and Causey, 2004
Craw, *Buteo magnirostris* (B), Cafetal, Guanacaste (Zhang *et al.* 2004b). Specimens: CHCR, USNPC.
7. *P. maclennanae* Zhang, Brooks and Causey, 2004
Craw, *Heliomaster constantinii* (B), Cafetal, Guanacaste (Zhang *et al.* 2004b). Specimens: CHCR, USNPC.

Hetarkidae

Railliet and Henry, 1912

8. *Strongyluris panamensis* Bursey, Goldberg and Telford, 2003
Intestine, *Norops limifrons* (R), Hacienda La Suerte, Limón (Bursey and Goldberg 2003). Specimens: HWML.

Onchocercidae (Leiper, 1911)

9. *Litomosoides* sp.
ND, *Artibeus jamaicensis* (M), NA (Bain *et al.* 2002).
10. *L. brasiliensis* Almeida, 1936
Body cavity, *Carollia perspicillata azteca* (M), Santa Ana, San José (Bain *et al.* 2003). Specimens: CHCR.
Notes: Bain *et al.* (2003) identified this species based on fragments of females includes among type specimens of *L. peñai*.
11. *Piratuba digiticauda* Lent and Teixeira de Freitas, 1941
Body cavity, *Norops limifrons* (R),

Hacienda La Suerte, Limón (Burse and Goldberg 2003). Specimens: HWML.

Seuratidae (Hall, 1916)
Railliet, 1906

12. *Skrjabinura mesamericana* Zhang and Brooks, 2004.
Intestine, *Calocitta formosa* (B), Estación San Gerardo, Guanacaste (Zhang and Brooks, 2004). Specimens: CHCR, USNPC.
13. *S. vali* (Guerrero, 1971)
Caecum, *Myiarchus tyrannulus*, *Piaya cayana* (B), Cafetal, Guanacaste (Zhang and Brooks, 2004). Specimens: CHCR, USNPC.

Taxonomic remarks on the status of some of the species of helminths from Costa Rica vertebrates

Digenea (Van Beneden, 1858)

Cyclocoeliidae
Kossack, 1911

1. *Uvitellina facioi* (Brenes-Madrugal and Arroyo-Sancho, 1962)
Aerial sacs, *Jacana spinosa* (B), Aranjuez, Puntarenas (Brenes-Madrugal and Arroyo-Sancho 1962). Specimens: CHCR.
Notes: this species was originally described as *Cyclocoelum facioi* Brenes-Madrugal and Arroyo-Sancho, 1962, included in the genus *Haematotrephus* Stossich, 1902 by Yamaguti (1971) and finally transferred to *Uvitellina* Witenberg, 1923 by Zamparo *et al.* (2003d).

Lecithodendriidae (Lühe, 1931)
Odhner, 1910

2. *Langeronia macrocirra* Caballero and Bravo-Hollis, 1949
Intestine, *Bufo marinus* and *Rana warchewitschii* (N), Corís, Cartago (Brenes-

Madrugal *et al.* 1959). Specimens: CHCR. Notes: specimens originally determined as *L. macrocirra*, were transferred to *L. provitellaria* by Christian (1970) and later re-established as *L. macrocirra* by Martínez-Salazar (2004) who re-examined voucher specimens deposited in CHCR.

Cestoidea

Rudolphi, 1808

3. *Mathevotaenia didelphidis* (Rudolphi, 1819) Spasskii, 1951
Intestine, *Marmosa* sp. (M), Río Grande de Atenas, Alajuela (Flores-Barroeta *et al.* 1961).
Notes: this species was originally recorded as *Oochoristica didelphidis* (Rudolphi, 1819). Campbell *et al.* (2003) pointed out that these specimens differ from the original description of *M. didelphidis* and probably represent a distinct species.
4. *M. pennsylvanica* (Chandler and Melvin, 1951) Yamaguti, 1959
Intestine, *Didelphis marsupialis etensis* (M), Bello Horizonte, Escazú, San José (Flores-Barroeta *et al.* 1958). Specimens: CNHE.
Notes: originally recorded as *Oochoristica pennsylvanica* Chandler and Melvin, 1951. Campbell *et al.* (2003) pointed out that description of specimens from Costa Rica differ from the original description of *M. pennsylvanica* in several traits.

NEMATODA (Rudolphi, 1808)

Onchocercidae (Leiper, 1911)

5. *Litomosoides hamletti peñai* (Jiménez-Quirós and Arroyo-Sancho, 1960)
Body cavity, *Carollia perspicillata azteca* (= *Hemiderma perspicillata*) (M), Santa Ana, San José (Jiménez-Quirós and Arroyo-Sancho 1960). Specimens: CHCR. Notes: Bain *et al.* (2003) analyzed the type material of *Litomosoides peñai* and proposed the subspecific status for this species.

Parasite-Host List

Symbology: * new species; ‡ new genus; A= acanthocephalan; D= digenean; N= nematode.

Reptiles

Host	Helminth Species
<i>Basiliscus basiliscus</i>	<i>Paralopharynx matternae</i> * (D)
<i>Ctenosaura quinquecarinata</i>	<i>Paralopharynx gonzalezi</i> (D)
<i>Norops limifrons</i>	<i>Acanthocephalus saurius</i> * (A)
	<i>Acuariidae</i> (N)
	<i>Mesocoelium monas</i> (D)
	<i>Piratuba digiticauda</i> (N)
	<i>Strongyluris panamensis</i> (N)
<i>Norops oxylophus</i>	<i>Urotrema shirleyae</i> * (D)

Aves

Host	Helminth Species
<i>Amazilia saucerrotei</i>	<i>Whallwachsia illuminata</i> *‡ (D)
<i>Buteo magnirostris</i>	<i>Procyrnea mawsonae</i> * (N)
<i>Calocitta formosa</i>	<i>Skrjabinura mesamericana</i> * (N)
<i>Caryothraustes poliogaster</i>	<i>Pojmanskia riosae</i> (D)
<i>Crypturellus cinnamomeus</i>	<i>Tinamutrema canoae</i> *‡ (D)
<i>Euphonia hirudinacea</i>	<i>Pojmanskia riosae</i> (D)
<i>Gymnopithys leucaspis</i>	<i>Bakkeius moragai</i> *‡ (D)
	<i>Acuaria wangi</i> (N)
<i>Helimaster constantinii</i>	<i>Procyrnea macleannanae</i> * (N)
<i>Henicorhina leucosticta</i>	<i>Bakkeius moragai</i> (D)
<i>Hylophylax naevioides</i>	<i>Acuaria wangi</i> * (N)
<i>Jacana spinosa</i>	<i>Neohaematotrephus araya</i> * (D)
<i>Morococcyx erythropygius</i>	<i>Pojmanskia riosae</i> (D)
<i>Myiarchus nuttingi</i>	<i>Acuaria mayori</i> (N)
<i>Myiarchus tyrannulus</i>	<i>Skrjabinura vali</i> (N)
<i>Mycteria americana</i>	<i>Syncuaria mycteriae</i> * (N)
<i>Phaenostictus mcleannani</i>	<i>Bakkeius moragai</i> (D)
<i>Piaya cayana</i>	<i>Skrjabinura vali</i> (N)
<i>Platyrrhinus coronatus</i>	<i>Pojmanskia riosae</i> (D)
<i>Thraupis episcopus</i>	<i>Synhimantus (Dispharynx) nasuta</i> * (N)
<i>Thryothorus pleurostictus</i>	<i>Bakkeius moragai</i> (D)
	<i>Pojmanskia riosae</i> *‡ (D)
<i>Thryothorus nigricapillus</i>	<i>Pojmanskia riosae</i> (D)
<i>Tolmomyias sulphurescens</i>	<i>Whallwachsia illuminata</i> (D)

Mammalia

Host	Helminth Species
<i>Artibeus jamaicensis</i>	<i>Litomosoides sp.</i> (N)
<i>Carollia perspicillata azteca</i> **	<i>Litomosoides brasiliensis</i> (N)

** recorded as *Hemiderma perspicillatum* in the original study

DISCUSSION

After June, 2002, when we finished the compilation of the original "Checklist of the helminth parasites of vertebrates in Costa Rica" (Rodríguez-Ortíz *et al.* 2004), 14 papers have been published with new records on the helminth fauna of Costa Rican vertebrates (particularly in the Área de Conservación de Guanacaste). In these studies, 23 additional species of helminths parasitizing 25 species of vertebrates have been described. About 76% of these new material was deposited in the CHCR. This fact establish a new era for the Colección de Helmintos de Costa Rica, since this collection will become a primary repository for parasite biodiversity in the country. To summarize, up to date 325 helminth species have been described in vertebrates from Costa Rica, represented by 89 species of digeneans, 23 of monogeneans, 63 of cestodes, 13 of acanthocephalans, and 137 of nematodes. We encourage people describing helminth parasites of this country to send specimens to be deposited and saved in this re-emerged collection.

ACKNOWLEDGMENTS

To Daniel R. Brooks for providing information from their databases. Funds to complete this paper were provided by the agreement between the Universidad de Costa Rica and the Instituto Mexicano de Cooperación Internacional through the project: "Support to catalog and maintain the Helminthological collection of the University of Costa Rica".

RESUMEN

En este trabajo presentamos una addenda al "Listado de helmintos parásitos de vertebrados de Costa Rica". Esta addenda actualiza la información disponible acerca de este grupo de parásitos en dicho país, cuyo estudio recientemente ha tomado un nuevo impulso. En este trabajo, se adicionan 33 registros, representando 23 especies. Lo anterior eleva el número de especies de helmintos parásitos de

vertebrados de Costa Rica registrado hasta ahora a 325: 89 especies de digéneos, 23 de monogéneos, 63 de céstodos, 13 de acantocéfalos, y 137 de nemátodos. En total, 133 especies de vertebrados han sido estudiadas en busca de helmintos en Costa Rica (31 especies de peces, 7 de anfibios, 18 de reptiles, 40 de aves, y 37 de mamíferos). Hasta la fecha, 67 especies (20.6 %) fueron descritas como nuevas en Costa Rica y muchas de ellas son endémicas a una región particular. La Colección de Helmintos de Costa Rica, localizada en la Universidad de Costa Rica (UCR) en San José, resguarda material de únicamente el 23% de las especies registradas para el país, pero afortunadamente esto está cambiando actualmente.

REFERENCES

- Bain, O., S. Babayan, J. Gomes, G. Rojas & R. Guerrero. 2002. First account on the larval biology of a *Litomosoides* filaria, from a bat. *Parassitol.* 44: 89-92.
- Bain, O., R. Guerrero, B. Rodríguez, S. Babayan & N. Jouvenet. 2003. Examination of type material of two species of *Litomosoides* (Filaroidea: Onchocercidae), parasites from bats; taxonomic consequences. *Parasite.* 10: 211-218.
- Brenes-Madrigal, R. & G. Arroyo-Sancho. 1962. Helmintos de la República de Costa Rica XX. Algunos tremátodos de aves silvestres. *Rev. Biol. Trop.* 10: 205-227.
- Brenes-Madrigal, R., G. Arroyo-Sancho & E. Delgado-Flores. 1959. Helmintos de la República de Costa Rica XI. Sobre la validez del género *Langeronia* Caballero y Bravo, 1949 (Trematoda: Lecithodendriidae) y hallazgo de *Ochetosoma miladelarocai* Caballero y Vogelsang, 1947. *Rev. Biol. Trop.* 7: 81-87.
- Bursey, C.R. & S.R. Goldberg. 2003. *Acanthocephalus saurius* n. sp., (Acanthocephala: Echinorhynchidae) and other helminths from the lizard *Norops limifrons* (Sauria: Polychrotidae) from Costa Rica. *J. Parasitol.* 89: 573-576.
- Caballero, C.E. & R. Brenes-Madrigal. 1958. Helmintos de la República de Costa Rica VII. Tremátodos de algunos vertebrados salvajes, con descripción de una nueva especie de *Acanthostomum* Looss, 1899. *An. Inst. Biol. Univ. Nac. Autón. Méx.* 29: 165-179.
- Campbell, M.L., S.L. Gardner & G.T. Navone. 2003. A new species of *Mathevotaenia* (Cestoda: Anoplocephalidae) and other tapeworms from marsupials in Argentina. *J. Parasitol.* 89: 1181-1185.
- Christian, A.F. 1970. *Langeronia parva* sp. n. (Trematoda: Lecithodendriidae) with revision of the genus *Langeronia* Caballero and Bravo-Hollis, 1949. *J. Parasitol.* 56: 321-324.

- Flores-Barroeta, L., E. Hidalgo-Escalante & R. Brenes-Madrigal. 1958. Céstodos de Vertebrados IV. Rev. Biol. Trop. 6: 55-78.
- Flores-Barroeta, L., E. Hidalgo-Escalante & F. Montero-Gei. 1961. Céstodos de vertebrados. VIII. Rev. Biol. Trop. 9: 187-207.
- Jiménez-Quirós, O. & G. Arroyo-Sancho. 1960. Helminths of the República de Costa Rica. XV. Nematoda 3. Presencia de *Litomosoides peñai* n. sp. en *Hemiderma perspicillata aztecum* (Saussure, 1860). Rev. Biol. Trop. 8: 63-67.
- Martínez-Salazar, E.A. 2004. Estudio taxonómico de algunas poblaciones del género *Langeronia* Caballero y Bravo-Hollis, 1949 (Trematoda: Lecithodendriidae) en México. Tesis de Maestría, Universidad Nacional Autónoma de México, México D.F., México.
- Rodríguez-Ortiz, B., L. García-Prieto & G. Pérez-Ponce de León. 2004. Checklist of the helminth parasites of vertebrates in Costa Rica. Rev. Biol. Trop. 52 (Supl.1): 1-41.
- Teixeira de Freitas, J. F. 1963. Revisao de Familia Meso-coelidae Dollfus, 1933. Mem. Inst. Oswaldo Cruz. 61: 177-311.
- Zamparo, D., D.R. Brooks & D. Causey. 2003a. *Tinamutrema canoae* n. gen. n. sp. (Trematoda: Digenea: Strigeiformes: Brachylaimidae) in *Crypturellus cinnamomeus* (Aves, Passeriformes, Tinamidae) from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 89: 819-822.
- Zamparo, D., D.R. Brooks & D. Causey. 2003b. *Bakkeius moragai* n. gen. n. sp. and *Pojmanskia riosae* n. gen. n. sp. (Trematoda: Digenea: Brachylaimoidea) in birds from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 89: 823-828.
- Zamparo, D., D.R. Brooks & D. Causey. 2003c. *Wallwachisia illuminata* n. gen., n. sp. (Trematoda: Digenea: Plagiorchiiformes: Prosthogonimidae) in the steely-vented hummingbird *Amazilia saucerrottei* (Aves: Apodiformes: Trochilidae) and the yellow-olive flycatcher *Tolmomyias sulphurescens* (Aves: Passeriformes: Tyrannidae) from the Area de Conservación Guanacaste, Guanacaste, Costa Rica. J. Parasitol. 89: 814-818.
- Zamparo, D., D.R. Brooks, D. Causey & B. Rodríguez. 2003d. *Neohaematotrephus arayae* n. sp. (Digenea: Echinostomiformes: Cyclocoelidae) in *Jacana spinosa* (Aves: Charadriiformes: Jacanidae) from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 89: 829-831.
- Zamparo, D., D.R. Brooks & V. Tkach. 2004a. A new species of *Urotrema* (Digenea: Plagiorchiiformes: Urotrematidae) in *Norops oxylophus* (Squamata) from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 90: in press.
- Zamparo, D., D.R. Brooks, V. Tkach & B. Rodriguez. 2004b. *Paralopharynx matternae* n. sp. (Trematoda: Digenea: Plagiorchiidae) in *Basiliscus basiliscus* (Squamata: Iguania: Corytophanidae) from the Area de Conservación Guanacaste, Guanacaste, Costa Rica. J. Parasitol. 90: in press.
- Zhang, L. & D.R. Brooks. 2004. *Skrjabinura mesoamericana* n. sp. (Nematoda: Seuratoidea: Seuratidae) in birds from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 90: in press.
- Zhang, L., D.R. Brooks & D. Causey. 2003a. Two species of *Acuaria* Bremser, 1811 (Nematoda: Acuarioidea: Acuariae) in Passerine birds from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 89: 1039-1043.
- Zhang, L., D.R. Brooks & D. Causey. 2003b. A new species of *Syncuaria* Gilbert, 1927 (Nematoda: Acuarioidea: Acuariae) in the wood stork, *Mycteria americana* L. (Aves: Ciconiiformes: Ciconiidae) from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 89: 1034-1038.
- Zhang, L., D.R. Brooks & D. Causey. 2004a. Two species of *Synhimantus* (*Dispharynx*) Railliet, Henry and Sissoff, 1912 (Nematoda: Acuarioidea: Acuariae) in passerine birds from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 90: in press.
- Zhang, L., D.R. Brooks & D. Causey. 2004b. *Procyrmea* Chabaud, 1958 (Nematoda: Habronematoidea: Habronematidae) in birds from the Area de Conservación Guanacaste, Costa Rica. J. Parasitol. 90: in press.
- Yamaguti, S. 1971. Synopsis of Digenetic Trematodes of Vertebrates. Keigaku Publishers, Tokyo. 1074 p.

|

—

—

|