J. Helminthol. Soc. Wash.
62(1), 1995, pp. 94–98

Research Note

Nonproliferous Tetrathyridia of *Mesocestoides* sp. (Eucestoda: Mesocestoididea) in *Ptenopus garrulus maculatus* (Sauria: Gekkonidae) from Namibia, South West Africa, with a Summary of the Genus from Old World Lizards

CHRIS T. MCALLISTER,[1] AARON M. BAUER,[2] AND ANTHONY P. RUSSELL[3]

[1] Renal-Metabolic Lab (151-G), Department of Veterans Affairs Medical Center, 4500 South Lancaster Road, Dallas, Texas 75216,
[2] Department of Biology, Villanova University, Villanova, Pennsylvania 19085-1699, and
[3] Department of Biological Sciences, University of Calgary, 2500 University Drive, Northwest, Calgary, Alberta, Canada T2N 1N4

ABSTRACT: A new host and geographic distribution record is reported for tetrathyridia of *Mesocestoides* sp. in 1 of 12 (8%) specimens of barking geckos, *Ptenopus garrulus maculatus,* from Namibia, South West Africa. The infected host had numerous tetrathyridia encapsulated in the liver and mesenteries. Further examination failed to demonstrate morphological features indicative of asexual proliferation in these tetrathyridia. A summary is provided of the Old World lizards thought to be hosts of tetrathyridia of *Mesocestoides* sp.

KEY WORDS: Eucestoda, Mesocestoididea, tetrathyridia, *Mesocestoides* sp., lizards, geckos, Sauria, Gekkonidae, *Ptenopus garrulus maculatus,* survey, prevalence, intensity.

Tapeworms of the genus *Mesocestoides* are parasites that, in the tetrathyridial (metacestode) stage, infect a variety of amphibians and reptiles. In Old World lizards, metacestodes thought to represent *Mesocestoides* sp. have been reported from the families Agamidae, Anguidae, Chamaeleonidae, Gekkonidae, Lacertidae, and Scincidae (e.g., Witenberg, 1934; Hughes et al., 1941a, b). Two recent papers summarize reports of *Mesocestoides* sp. tetrathyridia from North American lizards (McAllister, 1988; Goldberg and Bursey, 1990). However, not since the compendium of Hughes et al. (1941a, b, 1942) have summations been provided on this tapeworm in Old World lizard hosts. Herein, we provide a new host and geographic distribution record for *Mesocestoides* sp., along with a summary of the Old World lizards previously reported to harbor this metacestode.

Twenty-two nocturnal geckos, including 12 barking geckos, *Ptenopus garrulus maculatus* (A. Smith, 1849), 4 sand geckos *Chondrodactylus angulifer* Peters, 1870, 4 Bibron's geckos *Pachydactylus bibronii* (A. Smith, 1845), and 1 each of *Pachydactylus mariquensis* A. Smith, 1849, and spotted thick-toed gecko, *Pachydactylus punctatus* Peters, 1854, were collected alive by hand in early October 1987 in flat (elevation 540 m), sandy habitat in the vicinity of Keetmanshoop, Keetmanshoop District, Namibia, South West Africa (26°36′S, 18°08′E) and examined for tetrathyridia. Specimens were killed by intraperitoneal injection of T-61 euthanasia solution, fixed in 10% neutral-buffered formalin, and stored in 70% ethanol. Stomachs were removed from preserved geckos for dietary analysis (Bauer et al., 1989) and, at the same time, if encapsulated tetrathyridia were noted, tissue was embedded in paraffin blocks, sectioned at 10 μm, stained with hematoxylin and eosin or Mallory's azan trichrome, and mounted in Permount®.

Representative specimens of *Mesocestoides* sp. tetrathyridia have been deposited in the U.S. National Parasite Collection, U.S. Department of Agriculture, Beltsville, Maryland 20705 as USNM Helm. Coll. No. 82906. Voucher specimens of geckos are deposited in the herpetological collection of the California Academy of Sciences, San Francisco (CAS).

Only 1 (5%) of the 22 individual geckos were infected; 1 of 12 (8%) *P. garrulus maculatus* (adult female, snout–vent length = 55 mm, CAS 167747). An undetermined (not all quantified) number of encapsulated tetrathyridia were found in the liver (Fig. 1) and mesenteries of this host. On further examination, these tetrathyridia were found to represent *Mesocestoides* sp. Each thin host-derived capsule contained either a single tetrathyridium or 2–3 tetrathyridia (Fig. 1). Infected tissues had minimal inflammatory re-

Table 1. Old World lizards reported or thought to be hosts of tetrathyridia of *Mesocestoides* sp.

Family/species*	Locality	Reference
Agamidae		
Agama bibroni	not given	Frank, 1981
Stellio caucasius	Soviet Union†	Sharpilo, 1976; Annaev, 1978
S. erythrogaster	Soviet Union†	Annaev, 1978
S. stellio	Middle East	Witenberg, 1934
Trapelus sanguinolentus	Soviet Union†	Annaev, 1978
Anguidae		
Anguis fragilis	Poland	Lewin, 1990
Pseudopus apodus	Soviet Union†	Annaev, 1978
Chamaeleonidae		
Bradypodion pumilum‡	South Africa	Burrage, 1973
Chamaeleo brevicornis§	Madagascar	Brygoo, 1963
C. dilepis	Kenya	Baylis, 1937
C. fischeri	Tanzania	Baylis, 1937
C. oustaleti	Madagascar	Brygoo, 1963
Gekkonidae		
Ptenopus garrulus	Namibia	This paper
Tarentola annularis	Egypt	Meggitt, 1927a
T. delalandii	Canary Islands	Roca et al., 1987
T. mauritanica	Algeria	Crety, 1887; Joyeux and Baer, 1932
Tenuidactylus caspius	Soviet Union†	Annaev, 1978
T. fedtschenkoi	Soviet Union†	Annaev, 1978
Lacertidae		
Acanthodactylus boskianus	Syria	Witenberg, 1934
Eremias arguta	Soviet Union†	Sharpilo, 1976
E. velox	Soviet Union†	Annaev, 1978
Lacerta agilis	Germany	von Linstow, 1878
L. laevis	Middle East	Witenberg, 1934
L. saxicola	Soviet Union†	Sharpilo, 1976
L. schreiberi	Spain	Roca and Ferragut, 1989; Roca et al., 1990
L. viridis	France	Valenciennes, 1844; Henry, 1927; Joyeux and Baer, 1933, 1936
L. vivipara	France	Leuckart, 1874; Joyeux and Baer, 1936
Ophisops elegans	Soviet Union†	Sharpilo, 1976
Podarcis bocagei	Spain	Roca et al., 1989
P. hispanica	Spain	Roca et al., 1989
P. muralis	Spain	Garcia-Adell and Roca, 1988
P. pityusensis	Spain	Roca and Hornero, 1991, 1992
Psammodromus hispanicus	Spain	Roca et al., 1986; Roca and Lluch, 1988
Pygopodidae		
Lialis burtonis	Australia	Hill, 1895
Scincidae		
Chalcides ocellatus	Morocco	Dollfus, 1958
Mabuya carinata	Burma	Meggitt, 1927b

* Some of these hosts were originally reported to be infected with *Cisticercoideum, Cysticercoides, Cysticercus, Dithyridium, Piestocystis,* or *Tetrathyridium*; reassignments as tetrathyridia made by Witenberg (1934) and Hughes et al. (1941a).

† Specific localities in states of the former Soviet Union not known.

‡ Burrage (1973) reported unknown cestode capsules and metacestodes that may represent *Mesocestoides* sp.

§ Brygoo (1963) reported unknown tetrathyridia that may represent *Mesocestoides* sp.

Figure 1. Three tetrathyridia of *Mesocestoides* sp. encapsulated in the liver of *Ptenopus garrulus maculatus* from Namibia, South West Africa.

sponse or compression. None of the tetrathyridia exhibited morphological evidence of asexual proliferation such as large numbers of tetrathyridia per capsule, multiple scoleces, supernumery suckers or buds (see Specht and Voge, 1965). Tetrathyridia lacked an apical organ and armed rostellum but possessed prominent suckers, calcareous corpuscles, and a deep invagination canal. They appeared similar histologically to New World *Mesocestoides* sp. tetrathyridia from xantusid (Goldberg, 1985), phrynosomatid (McAllister, 1988; Goldberg and Bursey, 1990; McAllister et al., 1992), and teiid (McAllister et al., 1991b, c) lizards.

About 36 species of Old World lizards representing 19 genera within 7 families are thought to be naturally infected hosts of tetrathyridia of *Mesocestoides* sp. (Table 1). Although footnotes explain inclusion of some hosts in the table, many of these lizards were reported originally to be infected with metacestodes allocated to other genera (i.e., *Cisticercoideum, Cysticercoides, Cysticercus, Dithryridium, Piestocystis,* or *Tetrathyridium*). Reassignment to tetrathyridia and therefore *Mesocestoides* was made by Witenberg (1934) and Hughes et al. (1941a). However, inclusion of these records here is based on the published opinions of these authors because voucher specimens of hosts and/or parasites are not available. As in snakes (Conn and McAllister, 1990; McAllister et al., 1991a), metacestodes that resemble tetrathyridia but belong to different taxa occur in lizards and may be confused with *Mesocestoides* sp. tetrathyridia. Therefore, some of these records may not be valid for the genus.

In conclusion, our report represents the first time *Mesocestoides* sp. tetrathyridia have been found in *P. garrulus maculatus* and the country of Namibia, South West Africa. McAllister et al. (1991a) recently reported *Mesocestoides* sp. tetrathyridia from neighboring Cape Province, South Africa, in a Namib tiger snake, *Telescopus beetzi* (Barbour, 1922). Interestingly, as has been reported for other amphibians and reptiles (McAllister, 1988; McAllister and Conn, 1990), overall prevalence of infection in lizards appears to be low for *Mesocestoides* sp., whereas intensity of infection is usually rather high. Further documentation of additional host records are warranted, in order to gain a better understanding of the biology and distribution of this enigmatic cestode.

A.M.B. thanks the directorate of Nature Conservation, Windhoek, Namibia, for permission to collect lizards and the University of Calgary and California Academy of Sciences for financial support. We also thank N. V. Fedorova for translating the Russian literature and S. R. Goldberg, R. L. Bezy, and C. M. Garrett for help with lizard nomenclature.

Literature Cited

Annaev, D. 1978. Helminth fauna of reptiles in the Turkmen-SSR USSR. Izvestiya Akademii Nauk Turkmenskoi SSR Seriya Biologischeskikh Nauk 3:49–53. (In Russian.)

Bauer, A. M., A. P. Russell, and B. D. Edgar. 1989. Utilization of the termite *Hodotermes mossambicus* (Hagen) by gekkonid lizards near Keetmanshoop, South West Africa. South African Journal of Zoology 24:239–243.

Baylis, H. A. 1937. LIX. Some parasitic worms from East African chamaeleons. Annals and Magazine of Natural History Serie 10 19:584–593.

Brygoo, E. R. 1963. Contribution à la connaissance de la parasitologie des caméléons malgaches (2e

partie). Annales de Parasitologie Humaine et Comparee 38:525–738.

Burrage, B. R. 1973. Comparative ecology and behaviour of *Chamaeleo pumilus pumilus* (Gmelin) & *C. namaquensis* A. Smith (Sauria: Chamaeleonidae). Annals of the South African Museum 61:1–158.

Conn, D. B., and C. T. McAllister. 1990. An aberrant acephalic metacestode and other parasites of *Masticophis flagellum* (Reptilia: Serpentes) from Texas. Journal of the Helminthological Society of Washington 57:140–145.

Crety, C. 1887. Richerche sopra alcuni cisticerchi dei rettili. Atti della Regia Accademia dei Medico Roma 13:235–246.

Dollfus, R. Ph. 1958. Miscellanea helminthologica Maroccana XXVI. Archives de l'Institut Pasteur du Maroc 5:540–546.

Frank, W. 1981. Endoparasites. Pages 291–358 *in* J. E. Cooper and O. F. Jackson, eds. Diseases of the Reptilia. Vol. I. Academic Press, New York.

Garcia-Adell, G., and V. Roca. 1988. Helminthofauna de lacertidos de los Pirineos Centrales Ibéricos. Revista Iberica de Parasitologia 48:257–267.

Goldberg, S. R. 1985. Larval cestodes (*Mesocestoides* sp.) in the liver of the island night lizard, *Xantusia riversiana*. Journal of Wildlife Diseases 21:310–312.

———, **and C. R. Bursey.** 1990. Prevalence of larval cestodes (*Mesocestoides* sp.) in the western fence lizard, *Sceloporus occidentalis biseriatus* (Iguanidae), from southern California. Bulletin of the southern California Academy of Sciences 89:42–48.

Henry, A. 1927. Tetrathyridium et *Mesocestoides*. Bulletin de la Societe Centrale Medicale Veterinaire 103:147–152.

Hill, J. P. 1895. A contribution to a further knowledge of the cystic cestodes. Proceedings of the Linnean Society of New South Wales 9:49–84.

Hughes, R. C., J. R. Baker, and C. B. Dawson. 1941a. The tapeworms of reptiles. Part I. American Midland Naturalist 25:454–468.

———, ———, **and** ———. 1941b. The tapeworms of reptiles. Part II. Host catalogue. Wasmann Collector 4:97–104.

———, ———, **and** ———. 1942. The tapeworms of reptiles. Part III. Proceedings of the Oklahoma Academy of Science 22:81–89.

Joyeux, C., and J. G. Baer. 1932. Recherches sur les cestodes appartenant au genre *Mesocestoides* Vaillant. Bulletin de la Société de Pathologie Exotique 25:993–1010.

———, **and** ———. 1933. Lé reencapsulement de quelques larves de Cestodes. Comptes Rendus des Seances de l'Academie des Sciences Paris 197:493–495.

———, **and** ———. 1936. Cestodes. Faune de France, Paris 30:1–613.

Leuckart, K. G. F. R. 1874. Bericht ueber die wissenschaftliche Leistungen. Archiv fuer Naturschutz und Landschaftsforschung 2:437.

Lewin, J. 1990. Parasitic worms in a slowworm (*Anguis fragilis* L.) population from the Bieszczady Mountains (Poland). Acta Parasitologia Polonica 35:207–215.

Linstow, O. F. B., von. 1878. Neue Beobachtungen an Helminthen. Archiv fuer Naturschutz und Landschaftsforschung 44:218–245.

McAllister, C. T. 1988. *Mesocestoides* sp. tetrathyridia (Cestoidea: Cyclophyllidea) in the iguanid lizards, *Cophosaurus texanus texanus* and *Sceloporus olivaceous*, from Texas. Journal of Wildlife Diseases 24:160–163.

———, **and D. B. Conn.** 1990. Occurrence of tetrathyridia of *Mesocestoides* sp. (Cestoidea: Cyclophyllidea) in North American anurans (Amphibia). Journal of Wildlife Diseases 26:540–543.

———, ———, **. S. Freed, and D. A. Burdick.** 1991a. A new host and locality record for *Mesocestoides* sp. tetrathyridia (Cestoidea: Cyclophyllidea), with a summary of the genus from snakes of the world. Journal of Parasitology 77:329–331.

———, ———, **and S. E. Trauth.** 1992. Tetrathyridia of *Mesocestoides lineatus* (Cestoidea: Cyclophyllidea) in *Sceloporus undulatus hyacinthinus* (Sauria: Iguanidae) from Arkansas. Journal of the Helminthological Society of Washington 59:241–243.

———, **J. E. Cordes, D. B. Conn, J. Singleton, and J. M. Walker.** 1991b. Helminth parasites of unisexual and bisexual whiptail lizards (Teiidae) in North America. V. *Mesocestoides* sp. tetrathyridia (Cestoidea: Cyclophyllidea) from four species of *Cnemidophorus*. Journal of Wildlife Diseases 27: 494–497.

———, **S. E. Trauth, and D. B. Conn.** 1991c. Helminth parasites of unisexual and bisexual whiptail lizards (Teiidae) in North America. VII. The six-lined racerunner, *Cnemidophorus sexlineatus*. Texas Journal of Science 43:391–397.

Meggitt, F. J. 1927a. Report on a collection of cestodes mainly from Egypt. Part II. Cyclophyllidea, family Hymenolepididae. Parasitology 19:420–448.

———.1927b. On cestodes collected in Burma. Parasitology 19:141–153.

Roca, V., and M. V. Ferragut. 1989. Helminthofauna del lagarto verdinegro, *Lacerta schreiberi* Bedriaga, 1878 (Reptilia: Lacertidae) del sistema central (España). Revista Ibérica de Parasitologia 49:291–300.

———, ———, **and M. J. Hornero.** 1990. Estimaciones ecológicas acerca de la helminthofauna de *Lacerta schreiberi* Bedriaga, 1878 (Sauria: Lacertidae) en el sistema central (España). Revista Española de Herpetologia 4:93–100.

———, **E. Lopez Garcia-Adell, and L. M. Ramos-Zapatero.** 1987. Algunas formas adultas y larvarias de platemintos de reptiles de las Islas Canarias. Revista Ibérica de Parasitologia 47:263–270.

———, **and M. J. Hornero.** 1991. Helminthofauna de *Podarcis pityusensis* (Bosca, 1883) (Sauria: Laceridae). Revista Espanõla de Herpetologia 5: 77–87.

———, **and** ———. 1992. A contribution to the knowledge of helminth communities of insular lizards. Pages 393–398 *in* Z. Korsós and I. Ziss, eds. Proceedings of the 6th Ordinary General Meeting of the Societas Europaea Herpetologica, 19–23 August 1991. Hungarian Natural History Museum, Budapest, Hungary.

———, **and J. Lluch.** 1988. L'helminthofaune des

Lacertidae (Reptilia) de la zone thermomediterraneenne de l'est de l'Espagne. Aspects ecologiques. Vie Milieu 38:201–205.

———, ———, **and P. Navarro.** 1986. Contribucion al conocimento de la helminthofauna de los herpetos Ibericas. V. Párasitos de *Psammodromus algirus* (L., 1758) Boulenger, 1887, *Psammodromus hispanicus* Fitzinger, 1826 y *Acanthodactylus erythrurus* (Schinz, 1833) Mertens, 1925 (Reptilia: Lacertidae). Boletin de la Real Sociedad Española de Historia Natural Seccion Biologia 81:69–78.

———, **E. Lopez-Balaguer, and M. J. Hornero.** 1989. Helminthofauna de *Podarcis hispanica* (Steindachner, 1870) y *Podarcis bocagei* (Scoane, 1884) (Reptilia: Lacertidae) en el cuadrante noroccidental de la peninsula Ibérica. Revista Ibérica de Parasitologia 49:127–135.

Sharpilo, V. 1976. Parasitic Worms of Reptiles in the Fauna of SSSR. Izd. Naukova Dumka Kiev, Moscow. 287 pp. (In Russian.)

Specht, D., and M. Voge. 1965. Asexual multiplication of *Mesocestoides* tetrathyridia in laboratory animals. Journal of Parasitology 51:268–272.

Valenciennes, A. 1844. Observation d'une espèce de ver de la cavité abdominale d'une lézard vert piquete' des environs de Paris, le *Dithyridium lacertae.* Comptes Rendus des Séances de l'Academie del Sciences Paris 19:544–547.

Witenberg, G. 1934. Studies on the cestode genus *Mesocestoides.* Archivio Zoologico Italiano 20: 467–509.

J. Helminthol. Soc. Wash.
62(1), 1995, pp. 98–102

Research Note

Ectopic *Moniliformis moniliformis* from a Laboratory-Infected Rat, *Rattus norvegicus*

DAVID F. OETINGER
Department of Biology, Kentucky Wesleyan College, Owensboro, Kentucky 42302-1039

ABSTRACT: An 11.3-cm gravid female *Moniliformis moniliformis* was removed from the greater omentum of a female outbred Sprague-Dawley rat 5 mo postinfection. Within the omentum, the worm was isolated in a host connective tissue tunnel in which there were inflammatory reactions and abscess formation. Eggs released by the worm elicited granulomatous reactions. Because lymphocytes were abundant throughout the omental tissue, with large areas of perivascular infiltration, it is suspected that the eggs of *M. moniliformis* in this extraintestinal site have antigenic components capable of stimulating a cell-mediated delayed hypersensitivity reaction.

KEY WORDS: Acanthocephala, ectopic, granuloma, *Moniliformis moniliformis,* omentum.

Necropsy of a laboratory-reared 9-mo-old outbred female Sprague-Dawley rat, fed 20 cystacanths of *Moniliformis moniliformis* (Bremser, 1811) Travassos, 1915, at age 4 mo, revealed a tumorous mass posterior to the stomach (Fig. 1). The approximately 2.5-×-1-×-1-cm mass appeared to be contained completely within a diverticulum of the greater omentum (Fig. 1). Examination revealed the presence of a worm looped throughout the mass (Fig. 1). The worm was removed intact and transferred to tapwater, in which it exhibited slight, very sluggish motility. It was maintained in several changes of tapwater over a period of 2 days before fixation in alcohol–formalin–acetic acid and later processing as a whole mount stained with Mayer's carmalum. The remainder of the mass was fixed in neutral-buffered 10% formalin, postfixed in 70% ethanol, washed in running tapwater overnight, and processed for paraffin sectioning at 10 μm. Sections were stained with Harris's hematoxylin and eosin (Luna, 1968) as well as May-Grünwald stain, the periodic acid–Schiff reaction (PAS), Verhoeff's elastica stain, and Weigert's differential stain for fibrin (Thompson, 1966).

The parasite, an adult female *M. moniliformis,* was approximately 11.3 cm long. It did not become fully distended, nor did the proboscis evaginate, as expected after 2 days in tapwater. This may have been due to injury of the worm during its removal, or it might have been a reflection of reduced viability as a result of the host's response. In the whole-mount specimen, the tegument appeared friable and in some areas seemed to be sloughing. However, the ligament sacs of