

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. RUSSELL³

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 *Pach-*

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

* Some of these hosts were originally reported to be infected with *Cisticercoideum*, *Cysticercoides*, *Cysticerus*, *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 *Mesocoestoides* 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, supernumerary 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 *Mesocoestoides* 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 *Mesocoestoides* 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 *Mesocoestoides* 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 *Mesocoestoides* sp. tetrathyridia. Therefore, some of these records may not be valid for the genus.

In conclusion, our report represents the first time *Mesocoestoides* sp. tetrathyridia have been found in *P. garrulus maculatus* and the country of Namibia, South West Africa. McAllister et al. (1991a) recently reported *Mesocoestoides* 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 *Mesocoestoides* 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 Biologicheskikh 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 (2^e

- 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. Recherche sopra alcuni cisticerchi dei rettili. *Atti della Regia Accademia dei Medico Roma* 13:235-246.
- Dollfus, R. Ph.** 1958. *Miscellanea helminthologica Marocana 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* Vailant. *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 olivaceus*, 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 Iberica 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 platelmintos de reptiles de las Islas Canarias. *Revista Iberica de Parasitologia* 47:263-270.
- , and **M. J. Hornero.** 1991. Helminthofauna de *Podarcis pityusensis* (Bosca, 1883) (Sauria: Lacertidae). *Revista Española 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'helminthofauna 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 conocimiento 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 laceratae*. *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.