



## **Helminths of the Green and Black Poison Frog, *Dendrobates auratus* (Anura, Dendrobatidae) from Hawaii**

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**Thirty-four specimens of *Dendrobates auratus* from Honolulu, Hawaii were examined for helminths. Three species of Nematoda were found: *Cosmocerca* sp., *Physaloptera* sp. and Acuariid larvae; and one species of Acanthocephala as a cystacanth. *Cosmocerca* sp. was present in the largest number (51) and had the highest prevalence (52 %). All are new host records for this invasive species in Hawaii.**

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*Dendrobates auratus* (Girard, 1855) is native to humid lowlands of Central America from southern Nicaragua to Colombia on the Caribbean versant and from southwestern Costa Rica to western Colombia on the Pacific versant. It was purposely introduced into the upper Manoa Valley on O'ahu, Hawaii in 1932 to aid in insect control using animals originating from Tabago or Tabogilla islands in the Gulf of Panama (Oliver & Shaw 1953). It has since spread to windward Oahu (Hunsaker & Breese 1967) and to Maui (Kraus & Duvall 2004). *Dendrobates auratus* is diurnal, insectivorous, and inhabits lowland wet forests in Hawaii, being most often encountered in residential gardens. In this note we report the first information on helminths in *D. auratus* from Hawaii. Goldberg & Bursey (2010) previously reported two species of Nematoda (*Cosmocerca parva* and *Cosmocerca podicipinus*) and an acanthocephalan centrorhynchid cystacanth in 12 *D. auratus* from Costa Rica.

Thirty-four specimens of *D. auratus* were obtained by FK and deposited in the herpetology collections of the Bishop Museum (BPBM), Honolulu, Hawaii, USA and the Museum of Zoology (UMMZ), University of Michigan, Ann Arbor, Michigan, USA. Collection sites were: different localities in the Manoa Valley, Honolulu County, Honolulu, Hawaii (BPBM 35358–35364) 21.316°N, 157.812°W, collected in 2009, (BPBM 35662–35677) 21.320°N, 157.809°W, collected in 2006 (UMMZ 227576–227580) 21.314°N, 157.803°W, collected in 2000 (UMMZ 227581) 21.317°N, 157.827°W, collected in 2000 and Pauoa Valley, Honolulu County, Honolulu, Hawaii (BPBM 34624) 21.324°N, 157.835°W, collected in 2009 and (BPBM 35678, 35679) 21.324°N, 157.835°W, collected in 2008.

Frogs were collected by hand, fixed in 10 % buffered formalin and preserved in 70 % ethanol. The body cavity was opened by a longitudinal incision from throat to vent and the digestive tract was slit longitudinally and examined under a dissecting microscope. The lungs, body and urinary bladder of each frog were also examined. A total of 88 nematodes and 1 acanthocephalan cystacanth were found. Each helminth was placed in a drop of lactophenol for study under a compound microscope. Found were three species of Nematoda: gravid females assigned to *Cosmocerca* sp., larvae assigned to *Physaloptera* sp. and to the family ACUARIIDAE as well as an acanthocephalan cystacanth. Voucher helminths were deposited in the Harold W. Manter Laboratory of Parasitology (HWML), University of Nebraska, Lincoln, Nebraska, U.S.A.: *Cosmocerca* sp. (HWML 99856); Acuariid larva (HWML 99855); *Physaloptera* sp. (HWML 99857); acanthocephalan cystacanth (lost in processing). Frog taxonomy follows Frost (2016) and parasite terminology is in accordance with Bush *et al.* (1997). Number of helminths, prevalence, mean intensity  $\pm$  1 SD and range are in Table 1.

Table 1. Helminth species, infection sites, numbers (*n*), prevalence, (P as %), mean intensity (*X*) and range (*r*) in 34 *Dendrobates auratus* from Honolulu, Oahu, Hawaii.

Helminth	Infection site	<i>n</i>	P	<i>X</i>	Range
<i>Cosmocerca</i> sp.	Large intestine	51	52	3.2	1–11
<i>Physaloptera</i> sp.	Stomach	8	29	1.6	1–2
Acuariid larva	Stomach wall	29	16	3.2	1–11
Acanthocephalan cystacanth	Small intestine	1	3	1.0	-----

Identification of species of *Cosmocerca* is based upon the characteristics of males, specifically the morphology of spicules and number and arrangement of caudal papillae (Gibbons 2010). As only females were found in our sample, species identification was not possible. We were similarly unable to identify the species of *Cosmocerca* in *Eleutherodactylus coqui* from Hawaii due to insufficient male material, even though we used a sample of 520 specimens (Goldberg *et al.* 2007). *Cosmocerca* sp. in *D. auratus* is a new host record.

Amphibians and reptiles commonly harbor third-stage larvae of *Physaloptera* sp. (Goldberg *et al.* 1993). The *Physaloptera* are heteroxenous (Anderson 2000) and use an insect intermediate host. When the infected insect is ingested by an unsuitable amphibian or reptile host, no development beyond the third stage of the larva occurs. However, in this case, because the larvae were distributed through the digestive tract and no encystment of larvae was found, we believe this is an incidental infection. Any insectivore may harbor physalopteran larvae, which simply pass through the digestive system. To our knowledge this is the first report of larvae of *Physaloptera* in *D. auratus*.

Adults of the ACUARIIDAE inhabit the gizzard of birds; insects (especially Orthoptera and Coleoptera) ingest eggs which develop to third-stage infective larvae (Anderson 2000). Further development does not occur in frogs, which may serve as paratenic or transport hosts. ACUARIIDAE in *D. auratus* is a new host record.

Acanthocephalans use an arthropod intermediate host in which the cystacanth larva stage is infective to the final host occurs (Kennedy 2011). Previously, adults of the acanthocephalan *Acanthocephalus bufonis* have been reported in two invasive anurans in Hawaii: *Rhinella marina* (as *Bufo marinus*) by Barton & Pichelin (1999) and *Glandirana rugosa* (as *Rana rugosa*) by Goldberg *et al.* (2005). Whether the cystacanth reported herein might have developed to *A. bufonis* is not known. Acanthocephalan cystacanth in *D. auratus* is a new host record.

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