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**First occurrence of Spargana (Cestoda:
Diphyllobothriidae) in the snakes, *Cryptelytrops
insularis* (Viperidae) and *Dendrelaphis inornatus
timorensis* (Colubridae) from Timor-Leste**

(with two text-figures)

A survey of amphibians and reptiles in Timor-Leste (Kaiser et al., 2010), a recently independent country in the Lesser Sunda Archipelago, confirmed the presence of the white-lipped island pitviper, *Cryptelytrops insularis* (Kramer, 1977) and the Timor bronzeback, *Dendrelaphis inornatus timorensis* (Smith, 1927). We here report on the presence of cestode larvae in these species, their first record for Timor-Leste.

One *Cryptelytrops insularis* (hand-collected at ca. 5 km S Mehara, Lautém District, Timor-Leste, 08°30'S, 125°35'E, 28 July 2009) and one *Dendrelaphis inornatus timorensis* (hand-collected at the Timor Village Hotel, Wailakurini, Viqueque District, Timor-Leste, 08°47'S, 126°59'E, 22 July 2009), were examined. The snakes were euthanized by intracardial injection of a 5% procaine solution (Altig, 1980). In the process of preparing the specimens for preservation in 10% buffered formalin, several areas of subcutaneous swelling were noticed along the lateral sides of the body in both snakes. Careful incisions into the interscalar space above each swelling allowed extraction of elongate cream-colored 'worms' from subcutaneous tissue (Fig. 1). Each specimen was preserved in ethanol, regressively stained with haematoxylin, and mounted in balsam. Specimens were studied as whole-mounts under a dissecting microscope and identified as spargana (Fig. 2). Voucher specimens were deposited in the United States National Parasite Collection (USNPC, Beltsville, Maryland) as *C. insularis* (USNPC 102540) and *D. inornatus timorensis* (USNPC 102541).

Diesing (1854) proposed the term "sparganum" for larval cestodes with unknown affinity to adults. This designation is commonly used when referring to plerocercoid (= infective) larvae of tapeworms in the family Diphyllobothriidae, and larvae of this type have been listed as



Figure 1. Removal of a sparganum from *Dendrelaphis inornatus timorensis*. Photo by Paul Freed.

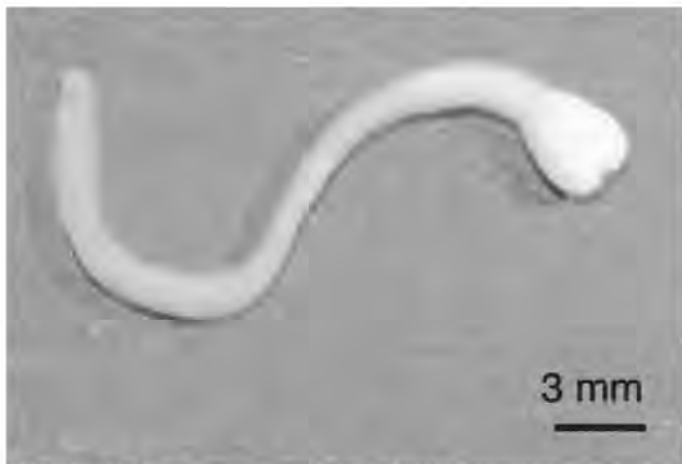


Figure 2. Whole mount of a sparganum from *Dendrelaphis inornatus timorensis*. Photomicrograph by Charles R. Burse.

parasites of reptiles from various regions of Eurasia (Table 1). Spargana are known from all vertebrate groups, except fish (Bray et al., 1994). In their life cycle, the first intermediate host is a freshwater copepod (Li, 1929), which provides opportunity for infection of amphibians. Infection of snakes can then easily occur by ingestion of amphibians carrying plerocercoids. No further larval development occurs in the snake, but it may serve as a paratenic (= transport) host. Ingestion of infected snake meat was described as a leading cause of human sparganosis by Kobayashi (1925).

The localities where we collected the infected snakes are typical frog habitats for Timor-

Leste. The pitviper locality is adjacent to Lake Ira Lalaro, the largest freshwater body in Timor-Leste, whereas the bronzeback locality was in a riverine habitat. We observed rice paddy frogs of the genus *Fejervarya* and treefrogs of the genus *Polypedates* in both habitats and therefore consider it highly likely that the food chain for both *C. insularis* and *D. i. timorensis* includes both types of frogs as prey. Species of *Fejervarya* are known hosts for spargana elsewhere (e.g., Taiwan: Ooi et al., 2000), even to the exclusion of other frogs.

A case of human sparganosis reported by Munckhof et al. (1994) is instructive in illustrating how the spargana life cycle may be continued in a human host after its presence in one or more paratenic hosts. The infected individual was a Timorese refugee who had fled his homeland during the time of the Indonesian occupation (1975–99). As a result of the ceaseless persecution of people opposed to the occupation (Niner, 2009), he had only been able to survive during his escape by consum-

ing both raw snakes and frogs. Thus, the connection between frogs, snakes, and humans was made at least once in Timor-Leste. We believe it is likely that during the food shortages in the decades of Indonesian occupation, sparganosis may have contributed considerably to the morbidity in the country but remained unnoticed in remote areas. There have only been four reported cases of human sparganosis in Indonesia (Margono et al., 2007), with one case occurring in Ambon, an island in the Moluccas archipelago. Timor-Leste is a new locality record for spargana, and *Dendrelaphis inornatus timorensis* represent a new host record.

Table 1. Global distributional records for spargana in reptiles. References: ¹Auffenberg, 1980; ²Cho et al., 1973; ³Cobbold, 1861; ⁴Guyénot and Naville, 1924; ⁵Hasegawa, 1985; ⁶Honda, 1938; ⁷Iwata, 1933; ⁸Joyeux and Baer, 1927; ⁹Kagei, 1973; ¹⁰Kagei and Kifune, 1977; ¹¹Kobayashi, 1925; ¹²Lai et al., 2004; ¹³Liu et al., 2004; ¹⁴Odening et al., 1980; ¹⁵Parona, 1887; ¹⁶Pinnell and Schmidt, 1977; ¹⁷Polonio, 1860; ¹⁸Seo et al., 1964; ¹⁹Shimalov and Shimalov, 2000; ²⁰Weinstein et al., 1954; ²¹Yildirimhan et al., 2007; ²²this paper; ²³Auffenberg, 1981; ²⁴Sanda et al. 2001; ²⁵Yanagisawa et al., 1999; ²⁶Miura et al., 2001; ²⁷Fukumoto et al., 2006; ²⁸Hughes et al., 1941.

Species	Plerocercoid designation	Locality	Reference	Comment
Australian realm				
<i>Chlamydosaurus kingii</i>	<i>Sparganum</i> sp.	Australia		
<i>Dendrelaphis punctulatus</i>	<i>Sparganum</i> sp.	Australia	28	as <i>Dendrophis punctulatus</i>
<i>Morelia spilota</i>	<i>Sparganum</i> sp.	Australia	28	as <i>Morelia argus</i>
<i>Pseudechis porphyriacus</i>	<i>Sparganum</i> sp.	Australia	28	
<i>Pseudonaja textilis</i>	<i>Sparganum</i> sp.	Australia	28	as <i>Demansia textilis</i>
<i>Varanus gouldii</i>	<i>Sparganum</i> sp.	Australia	28	
<i>Varanus varius</i>	<i>Sparganum</i> sp.	Australia	28	
Ethiopian realm				
<i>Echis</i> sp.	<i>Plerocercus echicola</i>	East Africa	28	
Neotropical realm				
<i>Corallus hortulanus</i>	<i>Sparganum</i> sp.	American tropics	28	as <i>Boa enydris</i>
<i>Lachesis muta</i>	<i>Plerocercus lachesis</i>	American tropics	28	as <i>Lachesis muta</i>
Oriental realm				
<i>Bungarus multicinctus</i>	<i>Spirometra erinaceieuropaei</i>	Taiwan	12	
<i>Cryptelytrops insularis</i>	<i>Spargana</i>	Timor-Leste	22	
	<i>Spargana</i>	Komodo Island	23	as <i>Trimeresurus albolabris</i>
<i>Dendrelaphis inornatus timorensis</i>	<i>Spargana</i>	Timor-Leste	22	
<i>Dendrelaphis pictus</i>	<i>Spargana</i>	Komodo Island	23	
<i>Ptyas mucosa</i>	<i>Ligula colubri blumenbachii</i>	India	3	as <i>Coluber blumenbachii</i>
<i>Python molurus</i>	<i>Dibothrium milliapharyngeus</i>	India	28	
<i>Varanus komodoensis</i>	<i>Spargana</i>	Komodo Island	1	
	<i>Spirometra</i> sp.	Flores Island	16	
<i>Varanus salvator</i>	<i>Spargana</i>	Komodo Island	1	
Palaeartic realm				
<i>Amphiesma pryeri</i>	<i>Sparganum mansoni</i>	Okinawa	5	as <i>Natrix pryeri pryeri</i>
<i>Dinodon rufozonatum</i>	<i>Sparganum mansoni</i>	Korea	20	
	<i>Sparganum mansoni</i>	Korea	18	
	<i>Sparganum mansoni</i>	Korea	2	
<i>Elaphe climacophora</i>	<i>Diphyllobothrium erinacei</i>	Japan	7	
	<i>Diphyllobothrium erinacei</i>	Japan	9	
<i>Elaphe dione</i>	<i>Diphyllobothrium mansoni</i>	Korea	6	
	<i>Sparganum mansoni</i>	Korea	2	
<i>Elaphe quadrivirgata</i>	<i>Spirometra erinaceieuropaei</i>	China	13	
	<i>Spirometra erinaceieuropaei</i>	Japan	24, 25, 27	
	<i>Diphyllobothrium erinacei</i>	Japan	7	
	<i>Diphyllobothrium erinacei</i>	Japan	9	
	<i>Diphyllobothrium erinacei</i>	Japan	10	
<i>Elaphe rufodorsata</i>	<i>Sparganum mansoni</i>	Korea	2	
<i>Elaphe schrenckii</i>	<i>Sparganum mansoni</i>	Korea	11	
	<i>Diphyllobothrium mansoni</i>	Korea	6	
<i>Euprepiophis conspicillata</i>	<i>Diphyllobothrium erinacei</i>	Japan	7	as <i>Elaphe conspicillata</i>
<i>Gloydus halys</i>	<i>Sparganum mansoni</i>	Japan	9	as <i>Agkistrodon halys</i>
	<i>Sparganum mansoni</i>	Korea	11	as <i>Agkistrodon halys</i>
	<i>Diphyllobothrium mansoni</i>	Korea	6	as <i>Agkistrodon halys</i>
	<i>Sparganum mansoni</i>	Korea	2	as <i>Agkistrodon halys</i>

<i>Hierophis spinalis</i>	<i>Sparganum mansoni</i>	Korea	2	as <i>Zamensis spinalis</i>
<i>Natrix maura</i>	<i>Ligula pancerii</i>	Italy	15	as <i>Tropidonotus viperinus</i>
<i>Natrix natrix</i>	<i>Spirometra</i>	Germany	14	
	<i>Spirometra erinacei</i>	Belarus	19	
	<i>Diphyllobothrium erinacei</i>	Turkey	21	
	<i>Ligula pancerii</i>	Italy	17	as <i>Tropidonotus natrix</i>
	<i>Plerocercoides pancerii</i>	Italy	4	as <i>Tropidonotus natrix</i>
	<i>Sparganum</i>	Italy	8	as <i>Tropidonotus natrix</i>
<i>Nerodia sipedon</i>	<i>Sparganum browni</i>	New York, USA	28	as <i>Natrix sipedon</i>
<i>Ovophis okinavensis</i>	<i>Sparganum mansoni</i>	Okinawa	5	as <i>Trimeresurus okinavensis</i>
<i>Protobothrops flavoviridis</i>		<i>Diphyllobothrium erinacei</i>	Japan	9
<i>Protobothrops mucrosquamatus</i>	<i>Spirometra erinacei</i>	Taiwan	12	as <i>Trimeresurus mucrosquamatus</i>
<i>Rhabdophis tigrinus</i>	<i>Diphyllobothrium erinacei</i>	Japan	7	as <i>Natrix tigrina lateralis</i>
	<i>Diphyllobothrium erinacei</i>	Japan	9	
	<i>Sparganum mansoni</i>	Korea	11	as <i>Natrix tigrina</i>
	<i>Sparganum mansoni</i>	Korea	2	as <i>Natrix tigrina lateralis</i>
	<i>Spirometra erinacei</i>	Japan	26, 27	
<i>Trimeresurus elegans</i>	<i>Sparganum mansoni</i>	Okinawa	5	as <i>Trimeresurus gramineus</i>
<i>Vipera berus</i>	<i>Spirometra erinacei</i>	Belarus	19	

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