

INTRAOCULAR SPARGANOSIS (PLATYHELMINTHES: CESTODA: PSEUDO-PHYLLIDEA: DIPHYLLOBOTHRIIDAE) IN THE GREEN TREE SNAKE *DENDRELAPHIS PUNCTULATUS* (SERPENTES: COLUBRIDAE: COLUBRINAE)

Terence J. Annable^{1*} and Dean C. Metcalfe²

¹Faculty of Science and Mathematics, Avondale College,

PO Box 19, Cooranbong, NSW 2265.

Email: tannable@avondale.edu.au

²PO Box 4056, Werrington, NSW 2747.

Email: dean_metcalfe@yahoo.com.au

*corresponding author

Sparganosis is an endoparasitic condition involving some species of Cestoda (tapeworms) that commonly affects frogs and reptiles almost worldwide but is especially prevalent in South America, eastern Asia, and Australia (Lane & Mader, 1996). The pseudogenus 'Sparganum' consists of a number of species of tapeworms belonging to four genera (commonly *Dibothriocephalus* spp., Thomas, 1985; Johnson-Delaney, 1996). *Spirometra erinacei* is also commonly reported as the agent of sparganosis in Australian snakes (e.g., Purvis, 1989; Watharow, 2001, and references cited therein). The final or definitive hosts (in which cestodes mature) for these endoparasites are usually cats or dogs, although foxes may also serve as final hosts; occasionally humans can become accidental hosts (Acha & Szyfres, 2005). Ova are shed in the faeces of these final host species which can wash into rivers, lakes or puddles where they hatch into embryonic coracidia. The first intermediate host is a freshwater copepod (a small aquatic crustacean), commonly *Cyclops* spp., that ingests these coracidia. The coracidia then develop within the copepod to become proceroids. Reptiles, amphibians, birds, mammals, and some freshwater fish serve as the second intermediate host when they ingest water containing infested copepods; the proceroids migrate through their tissues and develop into plerocercoid cysts or 'spargana'. Encysted spargana can live for many years in host tissues, occasionally causing inflammation and fibrosis (Miller et al., 2005), but mostly there is very little effect on the host because encysted spargana gen-

erate little if any immunological response or metabolic load. A third intermediate host may occur when another vertebrate preys on the second intermediate host, e.g. when a snake eats an infested frog, leading to encysted plerocercoids in the snake. The lifecycle is completed when an infested intermediate host is eaten by a cat, dog, or fox; the plerocercoid then attaches to the intestinal wall, matures into a tapeworm and starts laying eggs within about nine days (Lane & Mader, 1996). Some small reptiles such as geckos can suffer sparganosis (Brown, 2012). These species are unlikely to consume copepods and largely feed on other arthropod groups suggesting that the life cycle may be even more complex than currently thought, and great care should be taken by humans to avoid possible infestation (see below).

Cats, dogs and foxes are ecologically novel in Australia, which suggests that the thylacine, Tasmanian devil, quolls, and other native carnivores could have been the definitive hosts for these tapeworms prior to human settlement and the introduction of exotic mammalian predators. However, this hypothesis would require spargana-causing Cestoda to have been present in Australia prior to introduction of the dingo, which cannot be demonstrated as no vouchers from this time are available for examination, and also the ability of species responsible for sparganosis to reach sexual maturity and reproduce in endemic carnivorous marsupials or rodents which is not yet established; hence, it is also possible sparganosis is a relatively recent

condition in Australian vertebrates.

The Green Tree Snake *Dendrelaphis punctulatus* is moderately common in the lower Hunter Valley region and it was no surprise when we were called by telephone on a warm day in mid-summer by neighbours of the first author to attend a property on the northwestern rural outskirts of Cooranbong, NSW (37°04.82'S 151°26.95'E), on 26 January 2007 around midday to remove a snake from a subspherical ceramic hanging basket with several subcircular openings, situated on their verandah; we did not know which species it was but had been informed that it was 'quite a long snake'. The snake was identified as *D. punctulatus*. On such occasions the authors' practice is to check the health of the snake, record measurements and injuries or scalation anomalies (for possible future recognition), remove easily removable ectoparasites,

and then release it into suitable habitat close to the point of capture. The snake measured 922+352 mm (1.274 m total length) and weighed 68.5 g. When the head was viewed from above, the left eye was protruding (Figure 1); a bulging eye commonly suggests either a retro-ocular tumour, or in this case, an indication of increased intraocular pressure (unilateral glaucoma). Movement of a hand close to the left eye produced no response, which suggested no effective vision. Examination revealed what appeared at first glance to be an opaque white cataract in the left eye (Figure 2); however, cataracts in squamate reptiles in the experience of the first author are usually homogeneously opaque, although scattered or localised opacities are sometimes seen within the lens (not the case in this instance). Further examination showed that the opaque body rolled inside the eye as

the head of the snake was tilted (Figure 3). It was also noted that the iris was missing except for a small area at the upper margin. There were about 12 small soft subcutaneous masses scattered over the dorsum and sides of the snake suggesting sparganosis. Close examination showed the intraocular opacity had substructure and appeared coiled, suggesting an intraocular sparganum. There was no evidence of a lens, presumed either missing, or perhaps the lens capsule itself formed a capsule for the sparganum, although in the latter case this would require penetration of the capsule of the lens and displacement of the crystallin proteins, which has not been previously reported.

The fact that the left iris of the *D. punctulatus* in the above case was largely destroyed suggested that the intraocular sparganum had been there for a long time. Damage by the sparganum probably included the aqueous fluid drainage channels in the eye leading to

probable glaucoma. The pale retina suggests poor retinal circulation, often seen in glaucoma. The snake was otherwise in good condition and not malnourished, which suggested it could feed adequately with effectively monocular vision. Because surgical removal of the intraocular sparganum was not practicable, the snake was released into suitable open woodland habitat near a creek (after removal of six of the largest subcutaneous spargana).

This *D. punctulatus* was a mature adult (maximum total length in NSW 125.5 cm; Shine, 1991) suggesting it was several years old. Frogs are a major component of the diet especially in populations close to water courses; as the total number of frogs ingested increases with age it would be expected that the numbers of spargana would also increase. The first author has observed this relationship between age and sparganum infestation rate in Swamp Snakes *Hemiaspis*

Figure 1. Head of *Dendrelaphis punctulatus* in dorsal aspect showing protruding left eye.

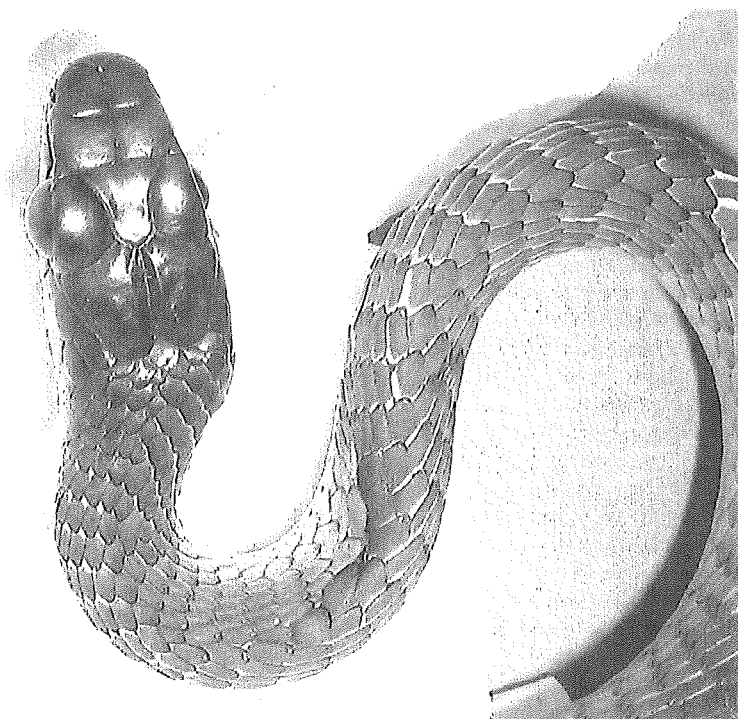


Figure 2. Lateral view of head showing intraocular sparganum, missing lens and iris and poor vascularisation of retina.

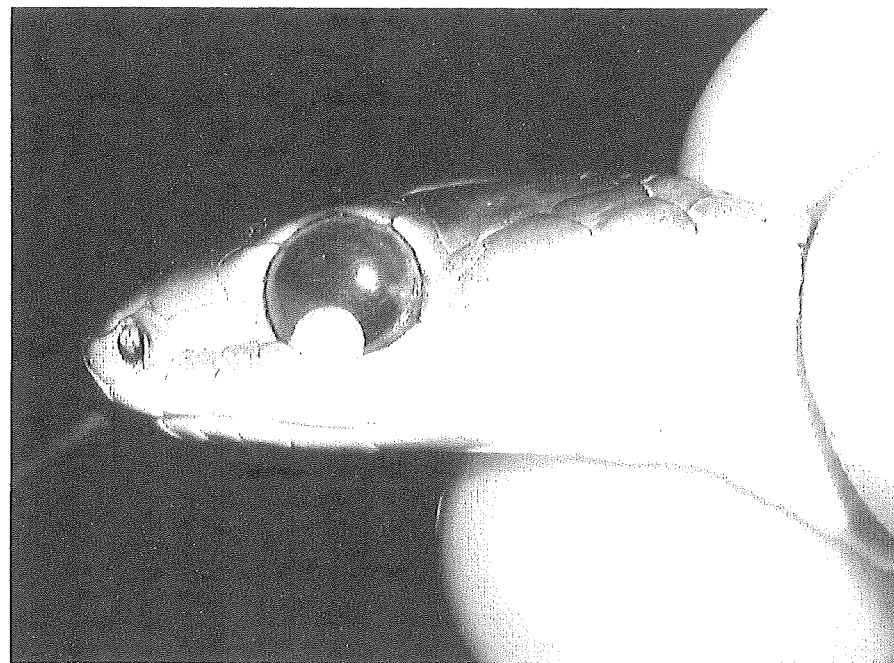
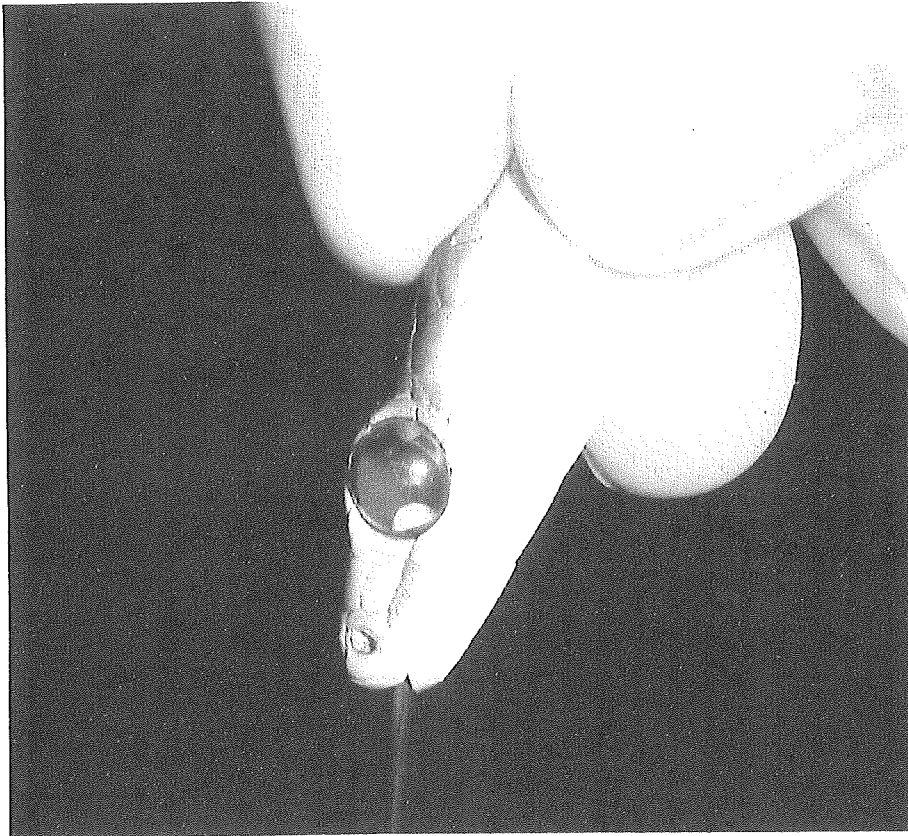


Figure 3. Downward tilted head showing mobility of sparganum.



signata (Elapidae), a locally sympatric species that also feeds on frogs (Shine, 1987). Of 30 *H. signata* examined from the vicinity of Cooranbong, NSW, no small juveniles had spargana, medium sized snakes had very few spargana, but large adults always had a few to many spargana. One large adult (696 mm TL) *H. signata*, found near the same locality as the above *D. punctulatus*, had severe sparganosis with about 40 spargana scattered over the body (but no evidence of intraocular sparganosis). Another large male *H. signata* (625 mm TL) found near Coffs Harbour, NSW, also had numerous spargana.

The surgical removal of subcutaneous spargana is easily accomplished by making a

small nick in the skin under a scale at the apex of the bulge and squeezing out the worm, which may be many centimetres in length. An alternative method is the careful intracystic injection of ethyl alcohol to kill the parasite, which then gradually gets resorbed (Glanze *et al.*, 2005); no dosage is given but we would suggest about 3 μ L. Occasionally some animals react to the sudden release of subcutaneous spargana and may die for no obvious reason (as happened to the large local *H. signata* mentioned above), possibly due to anaphylactic immune reaction. It is thus recommended that a treated snake be retained for a day or so to ensure that it has recovered and that no reaction occurs,

however given such reactions and the relatively benign effects of infestation on snake hosts, the best option may be to leave spargana undisturbed. Sparganosis may also be treated with systemic anthelmintics by qualified veterinarians, however, we have found no confirmation in the literature of the efficacy of such treatments in reptilian intraocular sparganosis.

On a note of caution, it should be noted that any untreated animal from the wild is a potential carrier of possibly serious zoonoses and herpetologists should always practise good hygiene. Salmonellosis particularly poses risks to unwary human handlers, however sparganosis is unlikely to be contracted unless an infested reptile or part thereof is consumed raw. Keep pet reptiles well away from dining areas, always wash after handling, particularly after handling faeces, keep cages spotless, never allow reptiles near the mouth and keep reptiles isolated from dogs and cats. And remember if you ever get the urge to eat your pet snake just make sure it is thoroughly cooked (exposure of all flesh to $>76^{\circ}\text{C}$ for more than 7 minutes)

In conclusion, intraocular sparganosis is recognised in both reptiles and humans (Lane & Mader, 1996; Wiwanitkit, 2005; Johnson-Delaney, 1996; Glanze *et al.*, 2005). It is however uncommon, and this is the first time we have observed this condition.

ACKNOWLEDGMENTS

We thank the two anonymous reviewers for comments on a draft of the manuscript.

REFERENCES

Acha, R.N. & Szyfres, B. 2005. Zoonoses and Communicable Diseases Common to Man and Animals (Third Edition). Vol. 3. Parasitoses. Pan American Health Organization, World Health Organization, Washington.

Brown, D. 2012. A Guide to Australian Geckos & Pygopods in Captivity. Reptile Publications, Burleigh.

Glanze, W.D., Anderson, K.N. & Anderson, L.E. 2005. Mosby's Medical Nursing and Allied Health Dictionary. Fifth Edition Mosby, St. Louis.

Johnson-Delaney, C.A. 1996. Reptile zoonoses and threats to public health. Pp. 20-33 in Mader, D.R. (ed.). Reptile Medicine and Surgery. Saunders, Philadelphia.

Lane, T.J. & Mader, D.R. 1996. Parasitology. Pp. 185-203 in Mader, D.R. (ed.). Reptile Medicine and Surgery. Saunders, Philadelphia.

Miller, B.F., Keane, C.B. & O'Toole, M.T. 2005. Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing and Allied Health Seventh Edition. Elsevier, Philadelphia.

Purvis, M.D. 1989. An infestation of plerocercoids of the cestode *Spirometra erinacei* in the Red Bellied Black Snake, *Pseudechis porphyriacus* (Shaw 1794). Australian Herpetologist 533: 1-3.

Shine, R. 1987. Food habits and reproductive biology of Australian snakes of the genus *Hemiaspis* (Elapidae). Journal of Herpetology 21: 71-74.

Shine, R. 1991. Strangers in a strange land ecology of the Australian colubrid snakes Copeia 1991: 120-131.

Thomas, C.L. (ed.). 1985. Taber's Cyclopedic Medical Dictionary. Fifteenth Edition Davis, Philadelphia.

Watharow, S. 2001. Prevalence of the plerocercoid of *Spirometra erinacei* (Cestoda) in three species of elapid snakes in the Melbourne region. Herpetofauna 31: 28-33.

Wiwanitkit, V. 2005. A review of human sparganosis in Thailand. International Journal of Infectious Diseases 9: 312-316.