Brachylaima cribbi n. sp.

(Digenea: Brachylaimidae):

Taxonomy, life-cycle kinetics and infections in animals and humans.

ANDREW R. BUTCHER, B. APP. SC.

FACULTY OF SCIENCE

SCHOOL OF MOLECULAR AND BIOMEDICAL SCIENCE

THE UNIVERSITY OF ADELAIDE

SOUTH AUSTRALIA

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Abstract

Brachylaima spp. (Digenea: Brachylaimidae) are terrestrial trematodes of mammals and birds and have land snails as their first and second intermediate hosts. This thesis describes a new species of *Brachylaima* and investigates infection in both snail intermediate hosts and definitive host animals. A laboratory life-cycle was established using brachylaimid eggs recovered from the faeces of an infected human. Five species of introduced European helicid and hygromiid snails, *Theba pisana*, *Cernuella virgata*, *Cochlicella acuta*, *Cochlicella barbara* and *Microxeromagna armillata* were susceptible first intermediate hosts. These same snails and introduced *Helix aspersa* as well as the native snails *Succinea australis* and *Strangesta gawleri* were suitable second intermediate hosts. Field and laboratory studies revealed that in addition to humans and mice, various species of birds and reptiles were also definitive hosts. On the basis of its unique morphological and life-cycle features, a new species, *Brachylaima cribbi* was described. The scanning electron microscopical appearances of the various life-cycle stages were detailed. Studies of Swiss albino outbred mice and 8 strains of inbred mice revealed that C57BL/6J mice were most susceptible to *B. cribbi* infection. The peak infection occurred 4 weeks after inoculation with metacercariae following which worms were expelled over the next few weeks. Exposure to a second infection in C57BL/6J mice did not result in accelerated expulsion of adult worms but did significantly inhibit their fecundity. In contrast, when immunodeficient NOD SCID mice were infected with *B. cribbi* metacercariae the adult worms persisted for the life span of the host mice. 6,432 land snails were collected over a distance of 3,000 km across southern Australia. Sporocyst-infected snails were found in all districts of South Australia and Victoria with the percentages of infected *T. pisana, C. virgata, C. acuta* and *C. barbara* ranging from 1.7 to 4.7%. These 4 species together with *M. armillata*, *S. australis* and *S. gawleri* were infected with metacercariae being found in 18-63% of snails and the mean number of metacercariae per infected snail ranged from 2.1 to 6.1. Laboratory studies revealed that eggs may remain viable for almost 12 months in mouse faeces. The prepatent period for a sporocyst infection is 7-10 weeks after egg ingestion. Metacercariae 7 weeks of age are capable of developing into adult worms. Detailed studies of seasonal variations in sporocyst and metacercarial infection rates were studied at 4 ecologically diverse sites on the Yorke Peninsula of South Australia. The clinical features and epidemiological circumstances of *B. cribbi* infections of 12 humans are detailed, as is their satisfactory response to treatment with praziquantel.

Author's statement

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give my consent to this copy of my thesis, when deposited in the University library, being available for loan and photocopying.

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Andrew R. Butcher

Dated this day Wednesday, 16th of July 2003.

Dedication

To my children, Drew, Monique and Richelle;

Collecting helicid and hygromiid snails at Murray Bridge, South Australia.

"Press on: nothing in the world can take the place of perseverance. Talent will not; nothing is more common than unsuccessful men with talent. Genius will not; unrewarded genius is almost a proverb. Education will not; the world is full of educated derelicts. Persistence and determination alone are omnipotent."

Calvin Coolidge, 30th President of the United States of America (1872 - 1933)

I also thank the treating practitioners, patients and parents of infected children for their cooperation and assistance in the collection of clinical data and specimens. The support of local farmers Mr Michael Richards and Mr Richard Way for allowing me to collect snails and animals on their properties and Mr Nick Allen and Mr Sergi Kozirev for their assistance with animal collections is appreciated.

Lastly, but most importantly, I thank my family. To my wife Wendy; words can not express my appreciation for your support, companionship and love over the many years of my academic life and throughout this study. My children Drew, Monique and Richelle for helping me on the numerous field trips with the collection of snails, dissecting specimens and recording data. I also thank my parents for their encouragement and support especially in those early years when I was still finding my way in life.

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Publications

During the course of this study a number of papers have been published in the scientific literature (Appendix B).

Butcher, A.R. & Grove, D.I. (2001). Description of the life-cycle stages of *Brachylaima cribbi* n. sp. (Digenea: Brachylaimidae) derived from eggs recovered from human faeces in Australia. *Systematic Parasitology* **49**: 211-221.

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Butcher, A.R., Palethorpe, H.M. & Grove, D.I. (2002). The susceptibility of inbred mice to infection with *Brachylaima cribbi* (Digenea: Brachylaimidae). *Parasitology International* **51**: 109-115.

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