
**UNIVERSITI PUTRA MALAYSIA**

# SOME ASPECTS OF THE LIFE CYCLE OF FISH BLOOD FLUKE, *Sanguinicola armata* PLEHN, 1905 (DIGENEA: SANGUINICOLIDAE) IN GRASS CARP (*Ctenopharyngodon idellus* CUVIER AND VALENCIENNES, 1884) FINGERLINGS

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**FPSS 1995 4**

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*By*

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Thesis submitted in fulfilment of the
requirement for the degree of Master of Science
in the Faculty of Fisheries and Marine Science,
Universiti Pertanian Malaysia

September 1995

**ACKNOWLEDGEMENTS**

I would like to express my deepest gratitude to my supervisory committee, Dr. Faizah Shaharom-Harrison, Associate Professor Dr. Jambari Haji Ali and Dr. Hassan Mohd. Daud for their guidance, constant support and advice. I would especially like to thank Dr. Faizah Shaharom-Harrison, the chairman of the supervisory committee for her encouragement, time and endless patience throughout the project.

Special recognition is also due to Professor J.W. Lewis of Royal Holloway, University of London who confirmed the sporocyst generations in this study. Thanks are also due to Professor Bjorn Berland of Institute of Zoology, University of Bergen, Norway and Mr Majeed of Faculty of Fisheries and Marine Science (Terengganu Branch) for translating some of the literature in German and Spanish. My sincere thanks also to B.W. Herbert of Department of Primary Industries, Australia for giving some of the literature needed for review.

I also wish to thank Mr Ng Sween Chu, owner of Ng's Aquatic Farm, Melaka for supplying the seed of locally bred grass carp used in this study.

I thank Mrs Kartini Mohamad (Terangganu Branch) who helps with the scanning electron microscopy. Thanks also to Mrs Jariah Sulaiman and Mr Sabri Omar for helping me with the photography and Mr. Mahmmud Jusoh who kindly let me use the facilities in Microbrian Laboratory.

My sincere gratitude go to IRPA (Intensification of Research for Priority Area) No: 1-07-05-076-50370 for financial assistance in this study. I am also grateful to Professor Mohamed Shariff bin Mohamed Din for his support and help me in various ways during the project. I thank Mrs Chan Soo Mum, Miss Premala Arul and all friends who supported me in every way throughout the project.

Finally, my sincere thanks to my dad, mum, sisters and brothers for their invaluable and endless encouragement, sacrifices, patience and love throughout my study.

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## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| B & b | - | Body |
| bs | - | Body Spines |
| CM | - | Circular Muscles |
| cm | - | Centimetre |
| DF | - | Dorsal Fin |
| E | - | Eyespot |
| eg. | - | For Example |
| FC | - | Flame Cell |
| FT | - | Forked Tail |
| G | - | Granule |
| GC | - | Germ Cell |
| GT | - | Gill Tissues |
| H & E | - | Haematoxylin and Eosin |
| IC | - | Immature Cercaria |
| IF | - | Infected Fish |
| IGT | - | Infected Gill Tissues |
| L | - | Litre |
| M | - | Membrane |
| ml | - | Millilitre |
| mm | - | Millimetre |
| pa | - | Papilla |
| p | - | Pores |
| PG | - | Penetration Gland |
| ppm | - | Part Per-Million |
| R | - | Rodlet |
| SA | - | Sac |
| SC | - | Segmented Cell |
| SD | - | Standard Deviation |
| SEM | - | Scanning Electron Microscopy |
| SH & sh | - | Sensory Hair |
| T & t | - | Tail |
| TB | - | Tubule |
| TEM | - | Transmission Electron Microscopy |
| UG | - | Unknown Gland |
| UGT | - | Uninfected Gill Tissues |
| US | - | Uninfected Snail |
| VC | - | Vitelline Cell |
| Z | - | Zygote |
| µm | - | Micrometre |

Abstract of thesis submitted to the Senate of Universiti Pertanian Malaysia in fulfilment of the requirements for the degree of Master of Science.

**SOME ASPECTS OF THE LIFE CYCLE OF FISH BLOOD FLUKE, *Sanguinicola armata* PLEHN, 1905 (DIGENEA: SANGUINICOLIDAE) IN GRASS CARP (*Ctenopharyngodon idellus* CUVIER AND VALENCIENNES 1884) FINGERLINGS**

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September 1995

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The life-cycle of the fish blood fluke, *Sanguinicola armata* Plehn, 1905 was studied in the laboratory. The snail *Gyraulus convexiusculus* Hutton, 1849 was identified as the intermediate host of *S. armata* from grass carp (*Ctenopharyngodon idellus*) fingerlings.

Two types of experiment (pre-trial and laboratory experimental infections) were carried out in order to infect the laboratory bred snails. The pre-trial study was divided into three experiments. In the first experiment, twenty infected fish were exposed to the thirty uninfected snails and was left for the duration of the experiment. For the second experiment, similar number of fish and

snails were left together for 24 hours. In the third experiment, snails were exposed to gill tissues containing miracidia for 12 and 24 hours. Only snails which were exposed to live infected fish with *S. armata* for 24 hours exposure and left together throughout the experiment became infected. The range of the percentage of snail infection rate in the first and second experiment were 0 - 25% and 10 - 46% respectively. For laboratory experimental infections, similar procedures were performed as in the pre-trial study except that ten infected fish were used. The range of the percentage of snail infection rate in laboratory experimental infections were 32 - 48%.

Cercariae of *S. armata* produced from the laboratory experimental infections were used to infect the uninfected grass carp fingerlings. Three hundred cercariae were exposed to 102 uninfected grass carp fingerlings for 24 hours. Two fish were examined daily for over a period of 105 days. A high rate of infection (74%) with a low rate of mortality (4%) was obtained from the study.

A minimum time of 40 to 43 days was needed to complete the life-cycle of *S. armata*. Newly laid eggs contained several vitelline cells and embryos. Within 6 to

8 days, the eggs became mature and possessed a moving ciliated miracidia. The eggs which were found in the kidney, heart, liver and spleen were encapsulated but the eggs found in the gill tissues were not. Miracidia only hatched in the gill tissues and swam freely before penetrating the snail, *G. convexiusculus*.

Upon entering the snail, the miracidium formed a mother sporocyst, which then produced a daughter sporocyst by asexual reproduction. The shape of the sporocyst was variable, thin-walled, nonmotile and unbranched. A maximum of two to three immature cercariae were found inside the thin membrane. Forked-tail cercariae developed from two sporocyst generations within 14 to 15 days in the snail. They were released from the snails and swam in the water towards the abdominal region of grass carp fingerlings. The tail of the cercariae were shed when penetration of the cercarial body was completed. Cercaria took 18 days to undergo the process from penetration to migration into the blood vessel, matured into an adult and released triangular-shaped eggs. Adult fluke which inhabited the bulbus arteriosus was identified from its lanceolate shape with marginal spines on both sides of its body, butterfly-shaped ovary and 10 pairs of testes.

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia, sebagai keperluan untuk mendapat Ijazah Master Sains.

# BEBERAPA ASPEK KITARAN HIDUP FLUK DARAH IKAN, *Sanguinicola armata* PLEHN, 1905 (DIGENEA: SANGUINICOLIDAE) DARI FRI IKAN KAP RUMPUT (*Ctenopharyngodon idellus* CUVIER AND VALENCIENNES 1884)

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Kitaran hidup fluk darah ikan, *Sanguinicola armata* Plehn, 1905 telah dikaji di dalam makmal. Siput *Gyraulus convexiusculus* Hutton, 1849 telah dikenalpasti sebagai perumah perantaraan untuk *S. armata* dari fri ikan kap rumput (*Ctenopharyngodon idellus*).

Dua eksperimen (Pra-percubaan dan eksperimen jangkitan makmal) telah dijalankan untuk menjangkiti siput yang dibiak dalam makmal. Kajian pra-percubaan dibahagikan kepada tiga eksperimen. Dalam eksperimen pertama, dua puluh ikan jangkitan didedahkan kepada tiga puluh siput yang tidak dijangkiti dan dibiarkan sepanjang masa eksperimen. Untuk eksperimen kedua, jumlah ikan dan siput

yang sama telah digunakan dan dibiarkan selama 24 jam. Bagi eksperimen ketiga, siput didedahkan kepada tisu insang yang mengandungi mirasidia untuk tempoh 12 dan 24 jam. Hanya siput yang didedahkan dengan ikan hidup bagi 24 jam dan dibiarkan sepanjang masa eksperimen didapati berjangkit. Julat peratus siput yang dijangkiti untuk eksperimen pertama dan kedua adalah 0 - 25% dan 10 - 46% masing-masing. Untuk jangkitan eksperimen makmal, kaedah sama seperti dalam kajian pra-percubaan kecuali hanya 10 ikan jangkitan digunakan. Julat peratus siput yang dijangkiti dalam jangkitan eksperimen makmal adalah 32 - 48%.

Serkaria *S. armata* yang dihasilkan dari jangkitan eksperimen makmal digunakan untuk menjangkiti fri ikan kap rumput yang belum dijangkiti. Tiga ratus serkaria telah didedahkan kepada seratus dua ekor ikan kap rumput untuk 24 jam dedahan. Dua ekor ikan diperiksa setiap hari untuk jangkamasa 105 hari. Kadar jangkitan yang tinggi (74%) dan kadar yang kematian rendah (4%) telah diperolehi dari kajian.

Tempoh masa minimum selama 40 hingga 43 hari diperlukan untuk melengkapkan kitaran hidup *S. armata*.

Telur yang baru dikeluarkan mengandungi beberapa sel viteline dan embrio. Dalam jangkamasa 6 hingga 8 hari, telur menjadi matang dan mempunyai mirasidia bersilia yang bergerak aktif. Telur yang dijumpai pada organ ginjal, jantung, hati dan limpa adalah berkapsul manakala telur pada organ insang tidak sedemikian. Mirasidia menetas hanya pada tisu insang dan berenang bebas di dalam air sebelum menjangkiti siput, *G. convexiusculus*.

Apabila memasuki perumah perantaraan, mirasidia membentuk ibu sporosista di mana kemudian ia menghasilkan peringkat anak sporosista melalui pembiakan aseksual. Sporosista mempunyai pelbagai bentuk seperti membran yang nipis, tidak bergerak dan tidak bercabang. Maksimum dua hingga tiga serkaria tidak matang boleh dijumpai dalam membran nipis sporosista. Serkaria berekor dwicabang berkembang daripada dua generasi sporosista dalam jangkamasa 14 hingga 15 hari di dalam siput. Mereka akan keluar dari siput dan berenang ke arah bahagian abdomen fri ikan kap rumput. Ekor serkaria tanggal apabila badan serkaria telah menembusi abdomen ikan sepenuhnya. Serkaria mengambil 18 hari untuk melalui proses jangkitan ke dalam saluran darah dan menjadi dewasa serta mengeluarkan telur berbentuk segitiga. Fluk dewasa yang mendiami bulbus

arteriosus dikenalpasti dari bentuknya seperti daun dengan marginal spina di kedua bahagian sisi badan, ovari berbentuk seperti kupu-kupu dan mempunyai 10 pasang testes.

# CHAPTER 1

# INTRODUCTION

## Background

The grass carp, *Ctenopharyngodon idellus* (Family: Cyprinidae) or locally known as 'chow hu' among Malaysians is a very popular food fish which fetches a high price in the market (Shireman and Smith, 1983). Grass carp is one of the main Chinese Carp species which was introduced extensively into Malaysia in the 1800's from China (Welcommie, 1981). Initially grass carp was introduced primarily for controlling submerged vegetation. Due to its fast growth rate, it soon became an integral part of composite fish culture. It is the most cultivated species in the Southeast Asian region (Pillay, 1976).

The production of grass carp is Malaysia is however, limited because of the inadequate supply of seed mainly due to various problems encountered in its breeding techniques in the last decade. The increase in demand has thus forced some local farmers to import grass carp seed from other countries such as Taiwan and Hong Kong since early 1974 (Low, 1974). Inevitably, the importation of