

EFFECTS OF CALCIUM (Ca^{2+}) ON PEARLSCALE GOLDFISH
(*Carassius auratus*)

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TERENGGANU
2000

**EFFECTS OF CALCIUM ON PEARLSCALE
GOLDFISH, (*Carassius auratus*)**

BY

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This project report is submitted in partial fulfillment of
the requirements for the Degree of
Bachelor of Fisheries Science

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2000

1100024263

ACKNOWLEDGEMENTS

Firstly, I would like to express my gratitude and appreciation to my supervisors, Dr. Abu-Elmeati, Abdel-Elmagid and Associate Prof. Dr. Most Ashour for their invaluable comments, guidance, period and time throughout my project. Truly without their assistance and supervision, this project would not have been possible.

A very special thanks to Mr. Chien Wen Leung (Akisakumar Jomar) for his valuable advice and providing the broodstock for the experiment. I was also grateful to Prof. Dr. Lay Ah Theng and Associate Prof. Dr. Feroz Nadeem for his and her assistance in my project and work. I am truly grateful to Mrs. Khorai for her help in taking care of the broodstock.

*This thesis is specially dedicated to
Father, Mother and sister*

I am also grateful to my family members, Mr. Jeng Kuan and Mrs. Pui Chuan and Mrs. Lee Mei Ling for their endless love, care and moral support during my days in the university.

I would like to thank Mrs. Chan Lay Hwa for providing me to the facilities of laboratory and animal care. Thanks to my work throughout my project. Thanks also to Mr. Jeng Kuan for his help in providing me with quality broodstock.

Last but not least, a special thanks to Mr. Law Chong Leon for helping me to handle a lot of practical problems and to Miss Carolyn Ho Ching Cheng, Mr. Sim Chung Ah and Mr. Fung for helping me in my project.

ACKNOWLEDGEMENTS

Firstly, I would like to extend my gratitude and appreciation to my supervisors, Dr Abol Munafi Ambok Bolong and Associate Prof. Dr. Noor Azhar for their invaluable comments, guidance, patient and time throughout my project. Truly without their assistance and supervision, this project would not have been possible.

A very special thanks to Mr. Cheah Wan Leong (Akuakultur Johor) for the valuable advises and providing the broodstock for the experiment. I am also grateful to Prof. Dr. Law Ah Theem and Associate Prof. Dr. Faezah Shahrom for his and her comments on my project and work. I am truly indebted to Mrs. Kartini for her help in taking photographs.

My deepest gratitude goes to my beloved Father, Mother, Sister, Pui Chuan and Miss Lee Ai Ching for their endless love, care and moral support during my days in the university.

I would like to thank Miss Mindy Wan Lay Hooi for assisting me in the hatchery & laboratory and shared the burden on my work throughout my project. Thanks also to Mr. Jong Khiam Jan for helping me in water quality analysis.

Last but not least, a special thanks to Mr Law Choon Loon for helping me to breed a lot of Pearlscale goldfish larvae and to Miss Carolyn Ho Cheng Cheng, Mr. Sim Teong Aik and Mr. Peter for helping me in my project.

ABSTRACT

The hatching rate, survival rate and growth rate of Pearlscale goldfish (*Carassius auratus*) larvae, scales formation in young Pearlscale goldfish and calcium absorption (Ca^{2+}) in adult Pearlscale goldfish were studied. The eggs and fish were exposed to various Ca concentrations. The concentration of Ca for incubating Pearlscale goldfish eggs was at 0 mg/L, 50 mg/L, 100 mg/L, 150 mg/L, 200 mg/L and 250 mg/L Ca. High mortality of eggs were observed when Ca concentration used was more than 100 mg/L. The highest hatching rate was recorded in normal tap water (3.307 mg/L Ca) which was 91%. Some detrimental effects such as reduced hatching rate, morphological abnormalities, delayed hatching and reduced motility were observed when Pearlscale goldfish eggs were incubated and hatched in more than 50 mg/L Ca. The severity of larvae abnormalities increases with the increase in Ca concentration.

The survival rates of Pearlscale goldfish larvae in various Ca concentrations decrease from low Ca concentration to high Ca-containing water. Highest survival rate were recorded in the control tank which, contains normal tap water and high mortality were detected in the optimum Ca concentration used in the experiment, which is 250 mg/L Ca. The average survival rate recorded in tap water is 87.50 %. However, the safety Ca level recommended might reach up to 50 mg/L, which secure more than 80 % in larva survival. Growth of Pearlscale goldfish larvae exposed to various Ca concentrations showed a decrease in specific growth rate (SGR) when high Ca concentration was used. The best specific growth rate were obtained in the control tank (normal tap water) and the SGR was 0.0272 %/day. The optimum Ca concentration used in this experiment; 200 mg/L, showed the worst SGR value, which only reach up to 0.0167 %/day. However, the

range of Ca concentration for good larvae growth can be obtained from 0 mg/L to 50 mg/L.

Scale formation on young Pearlscale goldfish mainly in scales' calcified area and thickness increased significantly with the increase in Ca concentration. Generally, the recommended concentration of Ca used for best results in scale formation and low mortality would be at the range of 50 mg/L to 100 mg/L. Pearlscale goldfish has the highest distribution of Ca in bones followed by scales and soft tissues.

Calcium absorption in adult Pearlscale goldfish was detected in high Ca-containing water for five days experiment. The highest peak of Ca^{2+} uptake recorded by bones and soft tissues were at the fourth day of treatment where else the peak for Ca^{2+} uptake in scales was detected on the second day. However, loss of Ca in bones, scales and soft tissues were recorded when adult Pearlscale goldfish was exposed to deionized water.

ABSTRAK

Kadar penetasan, kemandirian dan pertumbuhan rega ikan emas jenis 'Pearlscale' (*Carassius auratus*), pertumbuhan sisik pada ikan peringkat muda dan peresapan kalsium (Ca^{2+}) dalam ikan matang telah dikaji. Telur ikan serta rega dan induk didedahkan ke dalam kepekatan kalsium yang berbeza. Kepekatan penggunaan kalsium untuk penetasan telur ikan emas jenis 'Pearlscale' adalah pada 0 mg/L, 50 mg/L, 100 mg/L, 150 mg/L, 200 mg/L dan 250 mg/L. Kematian telur yang tinggi berlaku apabila penggunaan kepekatan kalsium untuk penggeraman adalah melebihi 100 mg/L. Kadar penetasan telur yang paling tinggi dicatatkan adalah dalam air paip (3.307 mg/L Ca) iaitu 91%. Beberapa kesan seperti pengurangan dalam kadar penetasan, kecacatan morfologi, penglambatan dalam masa penetasan dan pengurangan dalam pergerakan rega dapat dikesan apabila telur ikan emas dieram dan penetasan dibuat pada kepekatan kalsium melebihi 50 mg/L. Kesan kecacatan yang lebih teruk meningkat apabila kepekatan kalsium yang digunakan bertambah.

Susutan nilai kadar kemandirian rega ikan emas 'Pearlscale' berlaku dari kepekatan kalsium yang rendah ke kepekatan yang tinggi. Kadar kemandirian yang paling tinggi adalah pada tangki kawalan iaitu air paip (3.307 mg/L Ca) dan sebaliknya kadar kematian yang tinggi berlaku pada kepekatan kalsium 250 mg/L yang juga merupakan kepekatan kalsium yang paling tinggi digunakan dalam kajian ini. Purata kadar kemandirian dicatatkan dalam air paip adalah 87.50%. Tetapi, penggunaan kalsium boleh dipertingkatkan sehingga 50 mg/L untuk mencapai kadar kemandirian melebihi 80%. Pertumbuhan rega ikan emas 'Pearlscale' yang dimasukkan ke dalam kepekatan

kalsium yang berlainan menunjukkan pengurangan dalam nilai kadar pertumbuhan spesifik (SGR) apabila penggunaan kepekatan kalsium meningkat. Kadar pertumbuhan spesifik yang paling baik dicatatkan adalah 0.0272 %/hari iaitu dalam tangki kawalan (air paip). Kepekatan kalsium yang digunakan dalam kajian ini menunjukkan nilai SGR yang paling teruk iaitu hanya 0.0167 %/hari. Tetapi, pertumbuhan rega yang baik masih dapat dicapai pada julat kepekatan kalsium 0 mg/L ke 50 mg/L. Pertumbuhan sisik pada ikan emas peringkat muda khususnya pada sisik berkalsit (calcified scales) dan ketebalan sisik meningkat sejajar dengan peningkatan kepekatan kalsium. Secara amnya, penggunaan kepekatan kalsium yang sewajarnya adalah pada julat 50 mg/L ke 100 mg/L untuk menjamin pertumbuhan sisik berkalsit dan pengurangan dalam kematian ikan.

Ikan emas jenis 'Pearlscale' mencatatkan distribusi kalsium yang paling tinggi pada tulang diikuti dengan bahagian sisik dan tisu ikan. Peresapan kalsium dalam ikan emas dapat dikesan apabila ikan dimasukkan ke dalam kepekatan kalsium yang tinggi dimana peresapan kalsium yang paling tinggi pada tulang dan tisu ikan berlaku pada hari kedua hingga ke hari yang keempat kajian. Peresapan kalsium yang paling tinggi dalam sisik dicatat pada hari yang kedua. Sebaliknya, kehilangan kalsium pada bahagian tulang, sisik dan tisu berlaku apabila ikan emas matang dimasukkan ke dalam air nyahion.