



Comparative Performance Assessment of Two Commonly Used Anesthetics in *Mystus gulio*

Tarisha Maknoon

Roll No.: 0123/03

Registration No.: 1275

Session: 2023-2024

**A thesis submitted in partial fulfillment of the requirements for the degree of
Master of Science in Fish Biology and Biotechnology**

Department of Fish Biology and Biotechnology

Faculty of Fisheries

Chattogram Veterinary and Animal Sciences University

Khulshi, Chattogram-4225, Bangladesh

May 2025

Authorization

I hereby declare that I am the sole author of this thesis. Furthermore, I provide Chattogram Veterinary and Animal Sciences University (CVASU) permission to promulgate this thesis to other educational institutions or individuals for scholarly research. Additionally, I grant CVASU the right to replicate the thesis, whether in total or part, through photocopying or any other means, as requested by different educational institutions or individuals engaged in scholarly research.

By appending my signature to this document, I affirm that the digital version of this thesis, which has been submitted to the CVASU Library, will be an accurate version of what I initially submitted.

Author

May 2025

Comparative Performance Assessment of Two Commonly Used Anaesthetics in *Mystus gulio*

Tarisha Maknoon

Roll No.: 0123/03

Registration No.: 1275

Session: 2023-2024

**This is to certify that I have examined the above Master's thesis and have found that
is complete and satisfactory in all respects, and all revisions required by the thesis
examination committee have been made**

Dr. Md. Mahiuddin Zahangir

Supervisor

Dr. Mohammad Faisal

Co-supervisor

Dr. Md. Mahiuddin Zahangir

Chairman of the Examination Committee

Department of Fish Biology and Biotechnology

Faculty of Fisheries

Chattogram Veterinary and Animal Sciences University

Khulshi, Chattogram-4225, Bangladesh

May 2025

ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to my Allah, the most benevolent, most merciful, most altruistic. It is with his divine assistance that the author has successfully pursued her Master's course and submitted this thesis for the degree of Master of Science in Fish Biology and Biotechnology. I would also express my heartfelt gratitude to my research supervisor, Dr. Md. Mahiuddin Zahangir, Associate Professor and Head of the Department of Fish Biology and Biotechnology at Chattogram Veterinary and Animal Sciences University (CVASU), for his continuous support, guidance, and invaluable feedback throughout this research. His expertise and encouragement were instrumental in shaping this thesis. Without his thoughtful supervision, this thesis would not have been possible to give this thesis a constructive format. Special recognition is extended to the co-supervisor, Dr. Md. Faisal, Professor of the Department of Fishing and Post-Harvest Technology, for his insightful guidance and invaluable suggestions in refining the research content.

The author would like to show her earnest thankfulness to her fellow mate, Md. Nayeem Hossain and Md. Mijanur Rahman also to her senior Joya Chakraborty and juniors Haphsa Khanom, Md. Shamim Rahman for their assistance and kind consideration during the research period. She also thanks all the teachers, employees, and students. The author also expresses her gratitude to her parents for their immense support, sacrifices, companionship, love, and earnest prayers throughout her academic journey.

The Author

May 2025

Table of Contents

Chapter 1	1
Introduction	1
1.1. Research Questions	5
1.2. Objectives.....	5
Chapter 2	6
Review of Literature	6
2.1 Anesthesia	6
2.2 Immersion anesthesia	7
2.3 Parenteral anesthesia	8
2.4 Analgesia.....	8
2.5 Euthanasia	8
2.6 Monitoring of anaesthesia	9
2.6.1 Anaesthetic depth	9
2.6.2 Cardiopulmonary activity.....	9
2.6.3 Water quality	9
2.6.4 Recovery.....	9
2.7 List of some commonly used anesthetics in aquaculture	9
2.8 Plant-based anesthetics and their applications	10
2.9 Experimental evidence of different anesthetics in fish species.....	11
2.10 <i>Mystus gulio</i>	15
2.11 Research gap	16
Chapter 3	17
Materials and Methods	17
3.1 Experimental site.....	17
3.2 Collection and acclimation of experimental fish.....	17
3.3 Anaesthetic agent	18
3.4 Experimental design.....	18
3.5 Anaesthesia induction and recovery.....	19

3.6 Observation and categorization of stages.....	20
3.7 Observation of post-anaesthesia effect	22
3.8 Statistical Analysis	22
Chapter 4	23
RESULTS	23
a. Anesthesia induction time in <i>Mystus gulio</i> at different doses of clove oil and dygenol	23
b. Anesthesia induction time for different sized <i>Mystus gulio</i> using clove oil and dygenol:.....	24
c. Anesthesia recovery time of <i>Mystus gulio</i> at different doses of clove oil and dygenol:	25
d. Anaesthesia recovery time for different-sized <i>Mystus gulio</i> using clove oil and dygenol:.....	26
e. Correlation between induction and recovery in <i>Mystus gulio</i>	27
Chapter 5	31
DISCUSSION	31
Chapter 6	35
CONCLUSION AND RECOMMENDATIONS.....	35
REFERENCES.....	36
Brief Biography of the Author.....	50

Plates

Plate 1 : Nuna tengra (<i>Mystus gulio</i>).....	15
Plate 2 : Experimental site (Marine Fish Hatchery, Cox's Bazar).....	17
Plate 3 : Sampling site for collecting fish (<i>Mystus gulio</i>)	18
Plate 4 : A) Taking water by using measuring cylinder, B) Taking anesthesia solution using a micropipette, C and D) Mixing the anesthesia with the water properly by using a spoon.	18
Plate 5 : Tengra Fish (<i>Mystus gulio</i>).....	19
Plate 6 : A) Taking the fish for anaesthesia induction, B) Placing the fish in the anesthesia solution, C) Wiping the fish by using tissue paper, D) Measuring length, E) Measuring weight, F) Shifting fish in the recovery tank	20

Figures

Sl. No.	Figure Names	Page numbers
1	Anesthesia induction time of <i>Mystus gulio</i> at different concentrations of clove oil and dygenol. The values are presented here as mean \pm standard deviation of the mean (SD). Different letters of the alphabet are denoted to mean that statistically significant at $p < 0.05$ (n = 10–15 in each experimental group). Asterisks (*, $p < 0.05$; **, $p < 0.01$ and ***, $p < 0.001$) denotes the significant differences in the induction time between clove oil and dygenol.	23
2	Anesthesia induction time for different sized <i>Mystus gulio</i> using clove oil and dygenol. The values are presented here as mean \pm standard deviation of the mean (SD). Different letters of alphabets are statistically significant at $p < 0.05$ (n = 10–15 in each experimental groups). Asterisks (**, $p < 0.01$ and ***, $p < 0.001$) denotes the significant differences in the induction time between clove oil and dygenol.	25
3	Anesthesia recovery time of <i>Mystus gulio</i> at different doses using clove oil and dygenol. Different letters of the alphabet are statistically significant at $p < 0.05$ (n = 10–15 in each experimental group). Asterisks (**, $p < 0.01$ and ***, $p < 0.001$) denote the significant differences in the recovery time between clove oil and dygenol.	26
4	Anesthesia recovery time for <i>Mystus gulio</i> at different doses using clove oil and dygenol. Values presenting here stating as mean \pm standard deviation of the mean (SD).	27

	<p>Different letters of alphabets are statistically significant at $p < 0.05$ ($n = 10-15$ in each experimental groups). Asterisks (**, $p < 0.01$ and ***, $p < 0.001$) denotes the significant differences in the recovery time between clove oil and dygenol.</p>	
5	<p>Plots illustrating the relationship between dose (ppm) (100, 150, and 200ppm) and induction/recovery time (s) in different sized (small, medium and large) <i>Mystus gulio</i> following administration of (A) clove oil and (B) dygenol. Lines connect the mean induction and recovery times for each size group across the tested doses, with individual data points overlaid to show variability.</p>	28
6	<p>Interrelationship among the different induction and recovery time of <i>Mystus gulio</i> using clove oil. The variables are defined as (i) for induction and (r) for recovery for different doses (100, 150, and 200 ppm). Values indicated that each axis represents the range of measured values for each parameter. Correlation coefficients (r) are shown by numerical values; higher correlations are indicated by greater font sizes. Asterisks indicate the significance level (*, $p < 0.05$ and **, $p < 0.01$).</p>	29
7	<p>Interrelationship among the different induction and recovery time of <i>Mystus gulio</i> using dygenol. The variables are defined as (i) for induction and (r) for recovery for different doses (100, 150 and 200ppm). Values indicated each axis represents the range measured</p>	30

	values for each parameter. Correlation coefficients (r) are shown by numerical values; higher correlations are indicated by greater font sizes. Asterisks indicate the significance level (*, $p < 0.05$ and **, $p < 0.01$).	
--	--	--

Abstract

Anesthesia is the state in which an external agent depresses the nervous system, thereby rendering a lack of sensation, which is very important for routine aquaculture operations. The prime objective of this study is to assess the anesthetic effects of clove oil and dygenol on the *Mystus gulio*, through measuring the time of anesthesia recovery. To determine the effect of clove oil and dygenol, three groups of fish were tested with different body sizes, where small fish with a mean body length (3.85 ± 0.3 cm), medium (10.7 ± 2.2 cm), and large (14.1 ± 0.7 cm), $n = (10-15)$. The anesthetics were used at concentrations of 100, 150, and 200 ppm. The results elucidate the significant relationships between the concentration of the anesthetic and the body size of the fish. Each of these variables showed statistical significance ($p < 0.05$). With an increment of the concentrations of anesthesia, induction time decreased linearly for each group of fish for both clove oil and dygenol ($P < 0.05$). In addition, the independent sample t-test expressed a significant difference between clove oil and dygenol at each concentration and size of fish. From our experiment, it was found that dygenol needs less time compared to the clove oil at each dose for different groups of fish. Anesthesia time and the recovery time were shorter for the small fish than the larger ones ($P < 0.05$). There was no record of fish mortality in this study, indicating that all fish used in this study recovered successfully after being anesthetized. I can conclude my study that the smaller-sized *Mystus gulio* was more easily anesthetized and recovered more rapidly from anesthesia than the larger-sized fish. So, this study might be helpful for the further study of laboratory handling, care, and research for this commercially important fish species.

Keywords: Anesthesia, Induction, Recovery, Dygenol, Clove Oil, *Mystus gulio*