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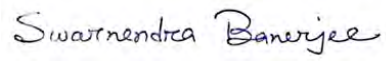
MY PARENTS

“If we knew what it was we were doing, it would not be called research, would it?”

— **Albert Einstein**

Declaration

I declare that the thesis entitled "**Selected Underutilized Fruits of Northeast India for Overall Health Improvement of Humankind**." has been prepared by me under the supervision of Prof. Arnab Sen, Department of Botany, University of North Bengal. No part of the thesis has previously formed the basis for the award of any degree or fellowship.



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I certify that Mr. Swarnendra Banerjee has prepared the thesis entitled "SELECTED UNDERUTILIZED FRUITS OF NORTH EAST IINDIA FOR OVERALL HEALTH IMPROVEMENT OF HUMANKIND", for the award of Ph.D. degree of the University of North Bengal, under my supervision. He has carried out the work at the Department of Botany, University of North Bengal. I may further declare that the results incorporated in this thesis have not been submitted for any other degree elsewhere.

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Paper/Submission ID	1354967
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It is certified that the work contained in the thesis titled **"SELECTED UNDERUTILIZED FRUITS OF NORTHEAST INDIA FOR OVERALL HEALTH IMPROVEMENT OF HUMANKIND"** by **"Mr. Swarnendra Banerjee"** has been carried out following University guideline and it has been approved by the members present in the meeting of the Departmental Research Committee in Botany for processing by the Board of Research Studies.

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Acknowledgement

I would like to express my heartfelt gratitude to my supervisor, Prof. Arnab Sen, for his constant guidance, encouragement, and support at every step of my work. Apart from all the guidance and freedom he has given me in accomplishing this study, I also thank him for being very kind and supportive throughout my PhD journey. His immense knowledge and plentiful experience have encouraged me throughout the course of my research.

I am indebted to Prof. A. Saha, Head of the Department of Botany, University of North Bengal. I am also indebted to Prof. S.C. Roy, Prof. M. Chowdhury, Dr. S. Roy, and Dr. P. Mathur for their guidance.

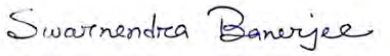
I am grateful to CSIR, Government of India, for providing the fellowship to conduct my research. I am also thankful to the Department of Botany's coordinator UGC (SAP) DRS-III and DST FIST (SANC. No. SR/FST/LS-1/2021/900) for providing the necessary instrumental facilities.

I am thankful to my lab mates for creating an amicable working atmosphere and always being happy to help nature. I am very thankful to all the teaching staff of our department for the administrative help and technical assistance during this work. I would like to thank IIT Bombay, Jawaharlal Nehru University, and IISER Kolkata for the instrument facilities that aid my research work. I also thank USIC, University of North Bengal, for the liquid nitrogen supply.

I am grateful to Dr. Pallab Kar and Dr. Bedabrata Saha for their encouragement, unlimited enthusiasm, and inspiring discussions. His constructive feedback and advice provided the right direction for completing this thesis's work. I thank my collaborators, Sourik Mandal, Jarzis Islam, Anipa Saha,

Usashi Shome, and Rajarshi Sarkar, for their analysis and thoughtful discussions.

I am forever grateful to my parents and family members, especially my elder sister for her constant support and love. I take this opportunity to thank my close friends for their persistent support and strong faith in my abilities, which has helped me to reach this stage.



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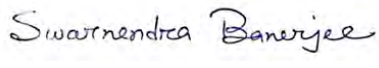
Preface

A study examining 14 underutilized fruits from northeast India found that four fruit samples exhibited higher free radical scavenging activity. These fruits, *Elaeagnus pyriformis*, *Baccurea ramiflora*, *Phyllanthus acidus*, and *Prunus bracteopadus*, were selected for further examination. *In vitro,* antioxidant assays showed that fruit extracts protect cells and cellular organelles from reactive oxygen species (ROS) during stressful conditions. The fruit samples also showed higher antimicrobial activity against gram-positive and gram-negative bacteria than standard, suggesting they can be used as an herbal remedy for microorganism-related disorders. The fruit extracts also showed cytotoxic effects on the adenocarcinoma cell line in a dose-dependent manner. GC-MS analysis revealed that the fruits were rich in long-chain fatty acids and sterols, which benefit human health. The study suggests that these fruit extracts could be used in the food and pharmaceutical industries. The study also found that Elaeagnus pyriformis fruit demonstrated protection against testicular oxidative stress and improved lipid metabolism in rats. Fruit extracts rich in polyphenols, including anthocyanins, phenolic acids, flavonoids, and flavanols, have been found to have beneficial effects on human health. These bioactive compounds, including antioxidant, anticancer, anti-inflammatory, and antimicrobial activity, have the potential for further use in the food and pharmaceutical industries. In vitro and in silico molecular docking analysis showed that these bio compounds could inhibit disease-related proteins, potentially leading to new drug discovery. The study also found that *Elaeagnus pyriformis* fruit

protected against testicular oxidative injury and improved lipid metabolism. Oleaster wine, a traditional wine made from underutilized fruits like silverberry, has been found to have anticancer effects and antioxidant properties. The wine's microbial community showed anti-cancerous solid activity. Oleaster has gained prominence both culturally and commercially. A promising drug discovery area is synthesizing biocompatible plant-mediated fusion of metal nanoparticles, which could be used as green reducing and capping agents for nanoparticle creation using *Elaeagnus* fruit extract. The study explores the potential of nanoparticles in treating oxidative stress-related illnesses and microbial infections. It also investigates the cytotoxic and anticancer properties of AgNPs, which were synthesized using BR fruit juice. The green synthesis approach suggests that nanoparticle-based cancer treatment could be beneficial. The study also investigates the benefits of *P. acidus* nanoparticles (PANPs) for treating renal dysfunction and damage. The results show that PANPs enhance glomerular structure, reduce serum creatinine and urea levels, and promote growth in body weight. The study also highlights the effectiveness of nano-priming with ZnONPs in minimizing the impacts of As-stress in black grams. The study also highlights the potential of using biogenic ZnONPs in nano-remediation to lessen As-induced genotoxicity in Pisum sativum. The study suggests that nanoparticles can be directly employed in irrigation systems, particularly drip irrigation systems, for targeted distribution into the rhizosphere. However, the environmental dangers posed by NPs must be thoroughly investigated.



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