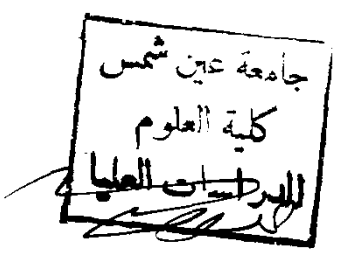
COMPARATIVE HISTOCHEMICAL AND PHYSIOLOGICAL STUDIES ON SOME GASTROPODS

THESIS

Submitted for the Award of the Degree of
DOCTOR OF PHILOSOPHY



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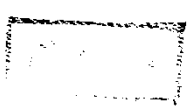

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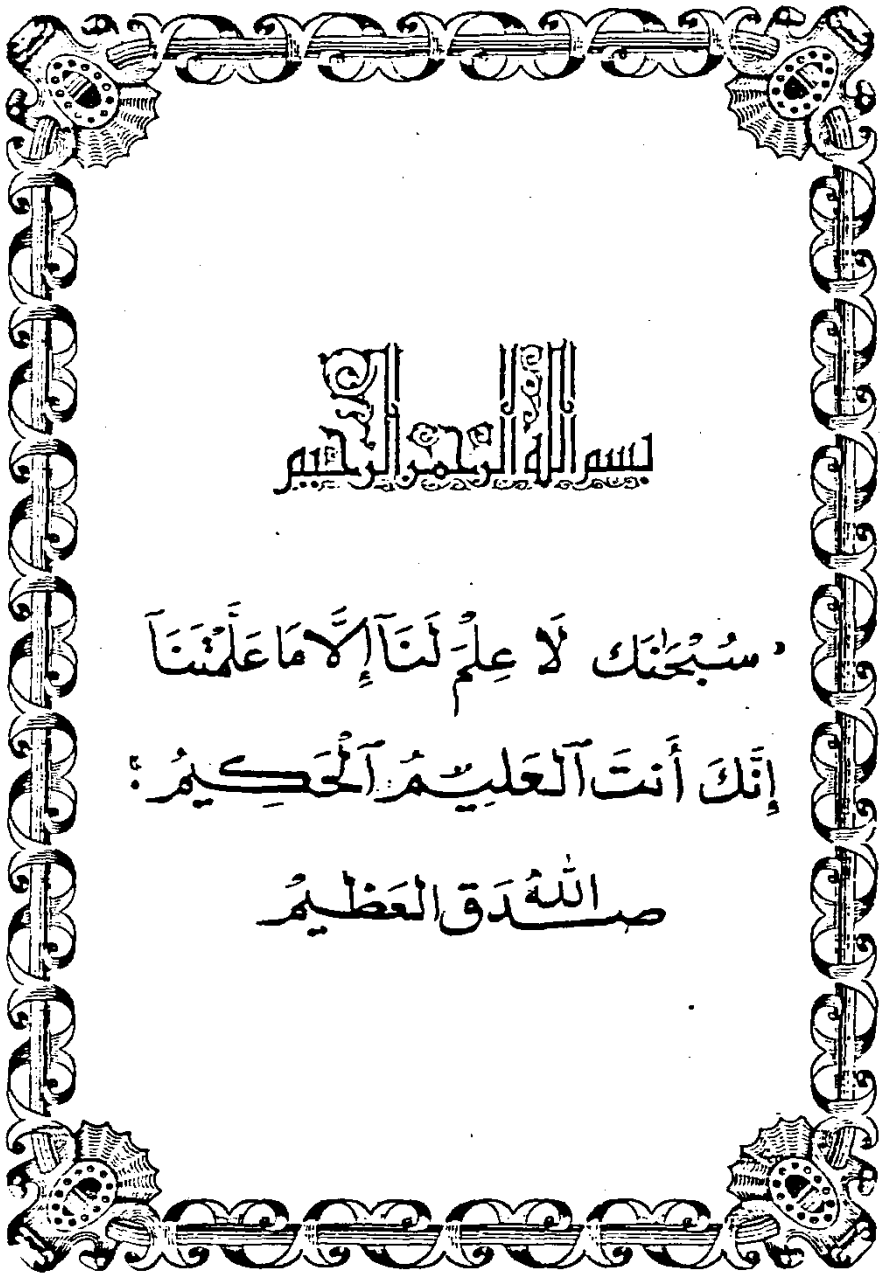
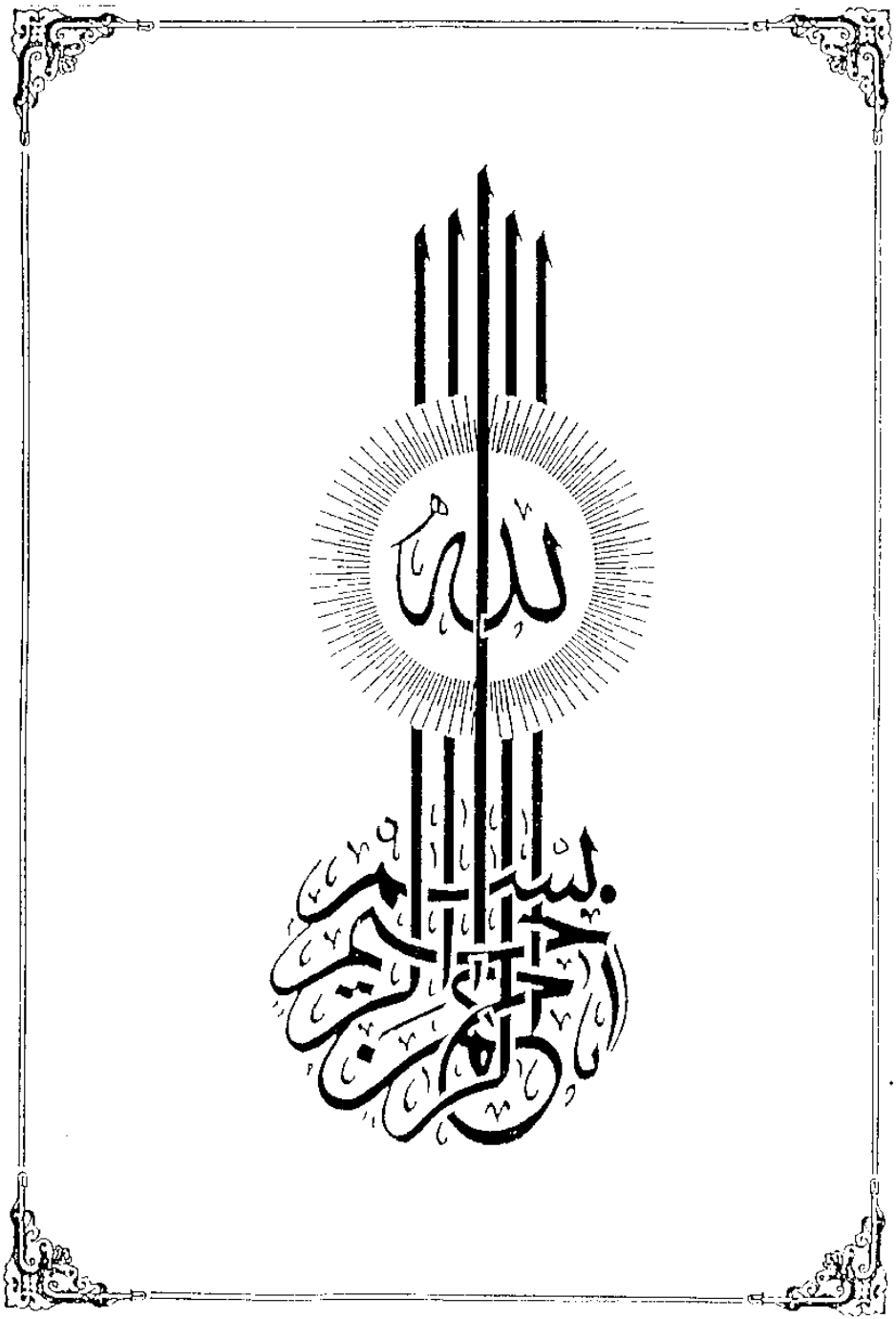


بسم الله الرحمن الرحيم

سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم



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ACKNOWLEDGEMENTS

I wish to express my deep gratitude to late Professor Dr. Tohamy A. Moussa, Professor of cell biology, Zoology Department, Faculty of Science, Ain Shams University, for suggesting and planning this research project.

The author is greatly indebted to Professer Dr. Mahmoud A.El-Banhawy, Professor of cytology and histochemistry and Head of Zoology Department, Faculty of Science, Ain Shams university and to Professor Dr.Gamal Abu-Sinna, Professor of Animal Physiology, Zoology Department, Faculty of Science, Ain Shams University, for supervising the work, continuous help, encouragement and for the critical reading of the manuscripit.

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INTRODUCTION

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The fresh-water gastropod snails constitute a major unique group of molluscs having certain specific morphological, physiological and embryological characteristics. These snails have attracted the attention of many investigators, particularly in Egypt, owing to their high economic and medical importance .

It is well known that many of these gastropods act as intermediate hosts for some digenetic trematodes which are known to induce dangerous parasitic diseases in human being. Among these diseases, schistosomiasis and fascioliasis are the most common in Egypt. The first one is widely distributed, particularly among the farmers, whereas the second one affects cattle and sheep. Therefore, it is generally agreed amongst parasitologists that controlling of the intermediate hosts (snails) is one of the most effective agents for the irradication of such diseases. The failure to solve this problem through the use of molluscicides, besides the hazardous effects of these chemicals, have shifted the attention to the biological control of these snails involving the application of other snail competetors. This has aroused the needs for detailed studies on the biological characteristics and activities of the different groups of such snails.

It is observed that most of the studies which have been carried out on the taxonomy and systematics of fresh-water snails were mainly based on their morphological and anatomical characteristics, but unfortunately this system has been shown to be rather inadequate, as it has also led to considerable confusion regarding the systematics of these species. For example, several taxonomic problems are still persisting concerning genus Bulinus as a result of the high variability in its morphological features. Therefore, a need has sprung to make use of the biochemical characteristics of the snails; a method which has shown some promising success in modern taxonomy.

In this respect, Brown et al.(1982) were of the opinion that Bulinus coulboisi, living in the small water localities at Kigomo on the eastern shore of lake Tanganyika showed clear resemblance to Bulinus truncatus found in the same localities as regards their biochemical specifications besides their tetraploid chromosomal constitution.

However, recent electrophoretic techniques appear to be of great value in the taxonomic studies to improve the specific identification of snails even of similar population species. This has also led to the possibility of applying the histochemical surveys in such taxonomic studies.

Consequently, the present work was planned in an attempt to provide possible means for the systematic and taxonomic identification of snails based on histochemical findings as correlated with the biochemical and electrophoretical ones.

Thus, the first part of the study is concerned with the application of some popularly used histochemical techniques to differntiate between two closely related pulmonate snails: Limnaea caillaudi (Bourguignat , 1883) and Bulinus truncatus (Audouin, 1826). Limnaea caillaudi (Family: Limnaeidae) and Bulinus truncatus (Family: Planorbidae) belong to Order: Basommatophora, Sub-class: Pulmonata, Class: Gastrophoda, Phylum: Mollusca. These two snails were selected in view of their great similarity; both are non-operculate and hermaphrodite snails. They are usually distributed throughout the irrigation canals and along the banks of the River Nile. Besides, there is a great similarity between these two snails regarding the anatomical and histological characteristics of their body organs (Demian, 1960; Demian and Ibrahim, 1965 & 1967; Lutfy et al., 1973 a & b and Moussa et al., 1982 & 1983).

The comparative histochemical studies designed were mainly concerned with carbohydrate, protein and lipid inclusions of the digestive, albumen and hermaphrodite glands

in the two snails. The carbohydrate contents included glycogen, galactogen, acid and neutral mucopolysaccharides, and both carboxylated and sulphated acid mucopolysaccharides. The proteins investigated comprised the total proteins, basic proteins and the amino acids: cystine,cysteine, tyrosine and histidine-containing proteins. Examination of lipids was concerned with both the general lipids as well as the phospholipids.

The histochemical results obtained from the study of the two selected snails were parallelised by the data resulting from the biochemical analysis carried out on the same tissue components as achieved through the separation of haemolymph proteins using the polyacrylamide gel disc electrophoresis. However, disc electrophoresis has distinct advantages over other techniques such as starch gel and paper electrophoresis. The standard 7.5% polyacrylamide gel allows greater fractionation and resolution of components. The gel can be charged with a sample as small as 300-800 micrograms and stained gels are easily stored for future reference (Davis and Lindsay, 1967).

Furthermore, for much verification , these studies were extended to other species namely, Lanistes carinatus (Olivier, 1804a)and Bellamya unicolor (Olivier, 1804 b). Lanistes carinatus (Family: Pilidae) and Bellamya unicolor (Family: Viviparidae) belong to Order: Mesogastropoda,

Sub-class: Prosobranchiata, Class: Gastropoda, Phylum: Mollusca. They are operculate snails and their sexes are separate. Lanistes carinatus acts as an intermediate host for the rat lung nematode; Angiostrongylus cantonensis (Yousif and Ibrahim, 1978) and Bellamya unicolor harbours various larval trematodes (Yousif and Ibrahim , 1979) as well as different protozoan ciliates (Kosa, 1981).

In the present investigation, only male snails were used. These of Lanistes carinatus are distinguished by their specific organ yellow testes (Demian, 1954 and Beddiny 1968) and males of Bellamya unicolor are generally characterized by having a short , curved right tentacle as compared with the left one. This is one of the most characteristic features of the family viviparidae (Malek, 1962).

As has been previously mentioned, it is hoped from this study to be able to offer some keys for differentiation and taxonomic identification of snail species based on their histochemical as well as physiological or biochemical characteristics. Nevertheless, beside this goal, the present investigation will also hopefully fill some of the gaps which are obviously prevailing in the histochemistry and biochemistry of snails in general and the selected species in particular.