PHYTOCHEMICAL STUDIES OF CERTAIN COMMON ALGAE OF AQUABA GULF

Thesis

Submitted in Partial Fulfilment for the Degree
of
Master of Science (M.Sc.)
in
Microbiology

By

Muhammed Gad Abd El-Ghany
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To

Ain Shams University
Faculty of Science
Botany Department
Microbiology Unit

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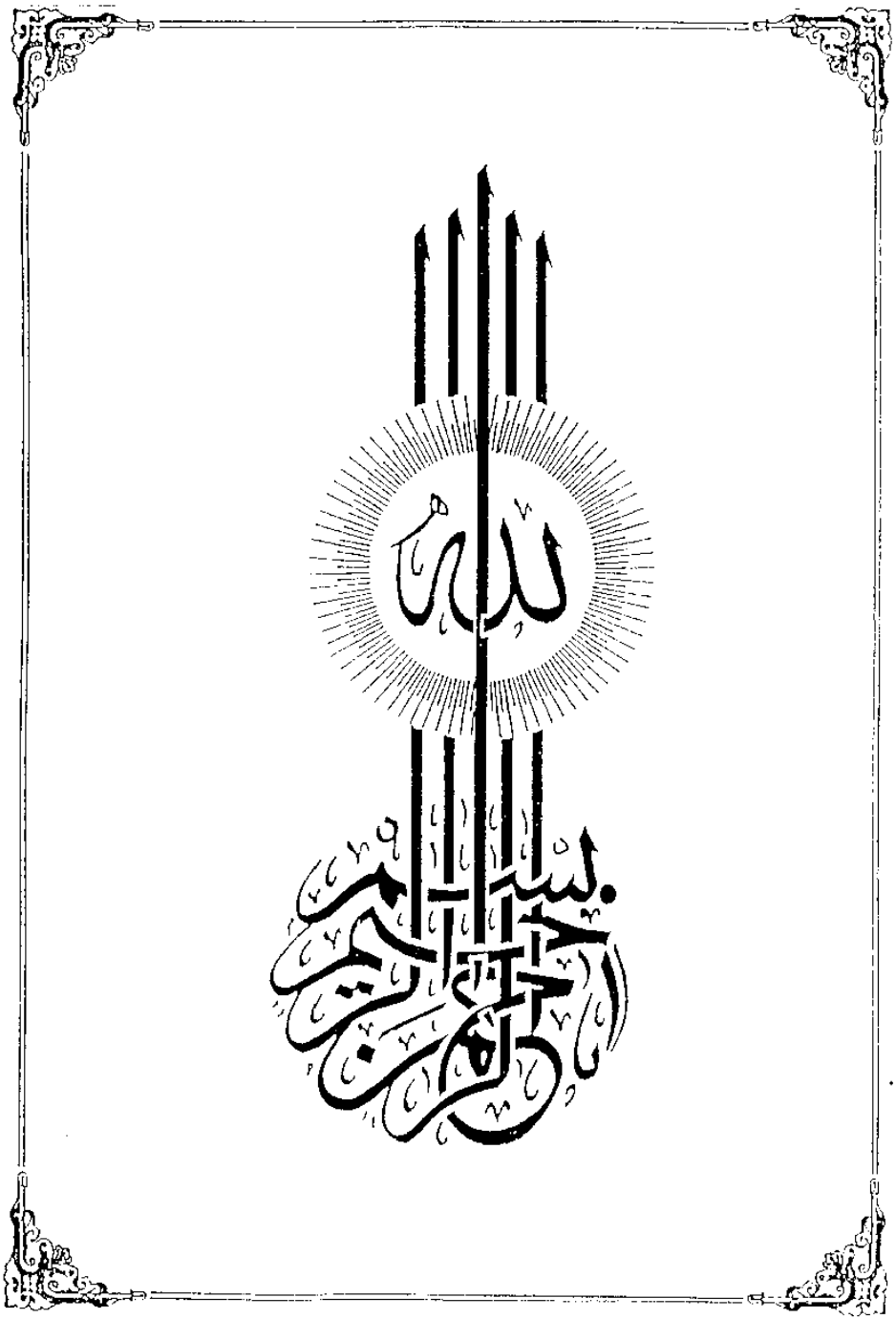
TO

MY PARENTS

&

MY WIFE



This thesis has not been previously submitted for any degree at this or at any other university.

Muhammed Gad Abd Elghany

THE THEORETICAL CURRICULA FOR THE DEGREE

The student in addition to this thesis had attended lectures dealing with the branches stated here-after. He passed successfully the examination as well.

These courses are:

- **Bacteriology**
- **Mycology**
- **Virology**
- **Hydrobiology**
- **Physiology**

Head of Botany Deparment

Prof. Dr. W. El-Saadawy

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ABBREVIATIONS

Agr. = Isolate of the Faculty of Agriculture, Ain Shams University

ATCC = American Type Culture Collection

Chla = Chlorophyll a

Chlb = Chlorophyll b

d.wt. = Dry weight

f.wt. = Fresh weight

g. = Gram

hr. = Hour

Med. = Isolate of the Faculty of Medicine, Ain Shams University

min. = Minute

Sci. = Isolate of the Faculty of Science, Ain Shams University

S.D. = Standard deviation

Sp. = Species

CONTENTS

INTRODUCTION

INTRODUCTION

Algae form a large group of the plant kingdom and are of common distribution among all the aquatic habitats. They play a great ecological role as primary producers in the food chain for being photosynthetic. They also constitute a huge biomass, especially in the marine environment, weighed in millions of tons of available organic livestock collectively rich in carbohydrates, proteins and minerals could be of economic potentialities. Such availbility attracted the scientists in biochemistry, biology, chemistry, microbiology, nutrition, pharamcognosy and pharmacology to disclose the secret of these marine plants in particular and the marine organisms in general. The possible participation of algae in solving the food shortage is not only confined to man but also extends to animals. The fact that algae have definite nutritional values due to their protein, vitamins and micronutrients justifies their use as fodder for grazing livestock, principally for sheep and to a lesser extent for horses and cattles.

The oceans and seas of the world are rightly considered to be an untapped source of many things including potential drugs, since they cover approximately 71% of the earth's surface and include an abundance of organisms. Over 500,000 species from 30 phyla live in water (Bhakuni and Silva, 1974).

Although algae are now of minor importance in the economy of some countries, in many others they are used as a direct food source for man. About twenty different species of algae belonging to Chlorophyceae, Phaeophyceae, Rhodophyceae and Cyanophyceae are eaten by Japanese

mannitol. Starch is another polysaccharide which occurs in some green algae and resembles that of higher plants in consisting of amylose and amylopectin.

Recently Sautier (1987) discussed the chemical composition and nutritive value of different species of algae. He concluded that algae contain carbohydrates with slow absorption rates which can improve intestinal function. He stated also that they should be eaten in moderate amounts to prevent excess mineral intake.

Much works have been carried out also on the proteins and amino acid contents of both unicellular and macroscopic algae which gave promising results that algae have a considerable nutritional value (Munda and Gubensek, 1976 and Durrani and Khalil, 1989).

Mageswaran and Sivasubramaniam (1984) found that ***Centroceros clavulatum*** and ***Gracilaria edulis*** had protein contents which were comparable to those of cereals, eggs and fish. The biochemical studies, including proteins of ***Caulerpa taxifolia*** and ***Hypnea musciformis*** indicated that ***H. musciformis*** could be eaten by man, chickens and other animals (Hansi *et al.*, 1986).

Algae might be also considered as a source of certain important micro and macroelements. They are rich in potach, ionic sulphate, trace elements and growth substances.

From seaweeds and in sufficient quantities, the principle cations (potassium, sodium, calcium, magnesium and phosphorus and the major elements; strontium, iron, boron, aluminium, barium, and zinc and the trace elements (chromium, manganese, copper, cadmium, lead, cobalt and

mercurry) were detected [Vinogradov, (1953); Yamamoto and Ishibashi, (1971); Imbamba, (1972); Sivalingam, (1978); Munda, (1978) and Agadi, (1978)].

Recently, Mageswaran and Sivasubramaniam (1984) investigated the amount of nitrogen, phosphorus and potassium of ***Gracilaria edulis, G. crassa, Laurencia obtusa, Sargassum polycystum*** and ***Ulva lactuca*** and they concluded that these algae could be used as fertilizers. Limited studies have been carried out to investigate the inorganic constituents of Egyptian marine algal flora. Abd El-Fattah and Hussein (1970) indicated variations in Ca and Mg contents of ***Cystoseira linifolium*** growing in Alexandria region. Further investigation for Cu, Mg, Zn an P contents of ***Enteromorpha intestinalis*** collected from the previous region had been carried out (Hussein *et al.* 1981). El-Naggar (1986 a and b) observed that trace elements content of numerous species of green, brown and red algae from the Mediterranean coast of Egypt, exhibit remarkable differences according to the species, division of algae and season.

The first observation concerning antibiotic active substances secreted by algae was given by Harder (1917). Since the works of Pratt and Forg (1940) and Pratt (1949) on ***Chlorella vulgaris,*** many algal substances have been shown to have bactericidal or bacteriostatic properties towords various pathogenic species (Zaehner, 1962; Watters, 1964).

Sensitivity of diphteria, typhoid, paratyphoid and dysenteric microorganisms to substances mainly consisting of lipid called cyanophycin

(Mamaichuk and Matus, 1959), as well as marinamycin (Soeda and Mitomi 1962) have been reported.

The antibacterial activity is widespread among marine seaweeds. Antibiotics were found in green, brown and red seaweeds, but it is not known whether they are excreted in the sea water or released after death (Provasoli, 1963). Hornsey and Hide (1974) and Pesando and Caram (1984) observed that although antibacterial activity of certain British marine algae, was more evident in some taxonomic groups, it also varied throughout the year. The antimicrobial activity of marine algae of Eastern Sicily was mainly concentrated in the members belonging to order Dictyotales and Fucales from brown algae and Ceramiales from red algae (Caccamese and Azzolina, 1979). Caccamese *et al.* (1980) found that several lipid extracts from marine algae were active against the Tabacco Mosaic Virus. Most of these extracts seemed to inhibit the growth of plant pathogenic fungi, while some of them were active against ***Bacillus subtilis*** (Caccamese *et al.* 1981). El-Naggar (1987a) indicated that extracts of 14 algal taxa of Egyptian marine algae representing green, red and brown algae could inhibit the growth of ***Staphylococcus aureus, Escherichia coli, Bacillus subtilis*** and ***Pseudomonas aeruginosa.*** He also stated that the production of the antibacterial substances varied seasonaly.

Concerning the antifungal activities of algae Codomier *et al.* (1977) and Pesando *et al.* (1979 a,b) detected antifungal substances in ***Asparagopsis ormata*** and ***Falkenbergia rufolanosa*** from Banyuls-Surmer, and in marine phytoplankton of Mediterranean coast of Alpes Maritimes. Seasonal

variations in the production of antifungal compounds by some dictyotales collected from the French Mediterranean coast were also detected (Moreau *et al.* 1988). Stewart *et al.*, (1988) studied the cytotoxic fungicidal nucleosides from blue green algae belonging to Scytonemataceae. They stated that certain nucleosides are frequently responsible for much of the cytotoxicity and antimycotic activities of the members of this family.

Chemical studies of antibiotics from marine organisms have evolved from both ecological and pharamceutical research. The greater advantage and yet the great challenge in working with marine organisms is the probability of discovering new types of molecules which human wisdom and computer capacity have not yet shown the ability to construct (Baker, 1984).

AIM OF WORK

The present work was mainly initiated to study the possibility of getting biodynamic substances from certain common algae growing at Sharm Al-Shaikh region of Aquaba gulf of the Red Sea.

My attention was focused not only on the antibiotic properties of the extracts of these algae but also on the phytochemical evaluation of the members which prove to be antibiotic producers with a view to determine their possible therapeutic and nutritional values.