BIOLOGICAL AND ECOLOGICAL STUDIES ON SNAILS IN EGYPT

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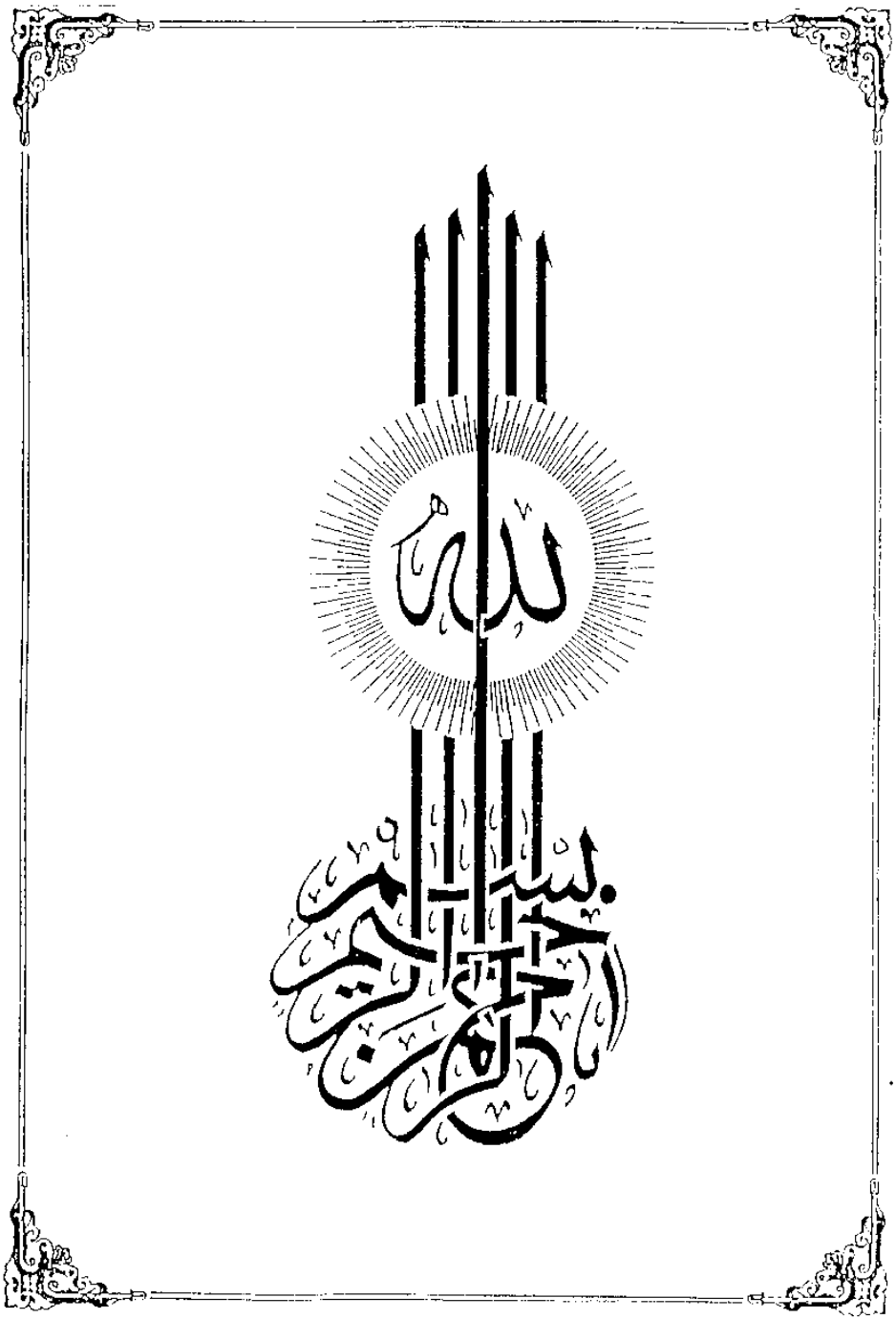

GENERAL INTRODUCTION

A survey of the snails recorded in Egypt "Medical Parasitology by El-Gindy et al., (1958)", showed the presence of the following spp.

(1) Order Prosobranchia

(a) S.O. Aspidobranchia

Fam. Neritidae, *Neritina nilotica*.

(b) S.O. Pectinibranchia

Fam. Viviparidae (Paludinidae), *Vivipara unicolor*;

Fam. Ampullariadae (Pilidae), *Ampularia ovata*, *Lanistis bolteni*;

Fam. Thiaridae (Melaniidae), *Melania tuberculata*, *Cleopatra bulimoides*, *Cleopatra cyclostomoides*;

Fam. Valvatidae, *Valvata nilotica*;

Fam. Cerithidae, *Pirenella conica*;

Fam. Bithyniidae, *Bithynia subbadiella*.

(2) Order Pulmonata

(a) S.O. Basomatophora

Fam. Lymnaeidae, Lymnaea truncatula, Lymnaea cailliaudi, Lymnaea stagnalis;

Fam. Physidae, Physa acuta;

Fam. Ancylidae, Ancylus sp.;

Fam. Planorbidae, Bulinus Bulinus truncatus, Biomphalaria alexandrina alexandrina, Gyraulus mareoticus, Planorbis philippi.

(b) S.O. Stylomatophora

Fam. Helicidae, Cochlicella acuta;

Fam. Succinidae, Succinea cleopatra.

It was found nearly impossible to cover the study of the ecology and biology of all these species, and thus the study was only devoted to the species which act as vectors for Bilharziasis, the most serious endemic disease in Egypt, and to one other snail which was found in association with them in all waterways.

The following three species of snails were thus included in the present study :

1. Bulinus truncatus (Audouin) The intermediate host for Schistosoma haematobium. This snail is widely spread in waterways in both Lower and Upper Egypt.

2. Biomphalaria alexandrina (Ehrenberg) The intermediate host of Schistosoma mansoni. This snail was restricted in the waterways of the Delta region and was entirely absent in Upper Egypt as far down as Cairo (Azim, 1948). It suddenly spread in Upper Egypt. This started in 1952 in Beni Suef governorate (El-Gindy 1957). It appears that, this snail is at present extending to the South as it recently became established in the northern area of Menya governorate (personal observations and communications 1971).

3. Physa acuta Draparnaud. This snail is very common in Egypt (Abd El-Malek 1958) and was experimentally infected by Angiostrongylus contenensis in Japan (Yanagisawa, 1968). It was studied for comparison since it may have a role in decreasing infection among target snails (Chernin, 1968).

The operation of the High Aswan Dam has changed many factors affecting the population of the snails.

The present knowledge, as that of many others, may guide to recommendations for the methods to be adopted for the eradication of snails.

The work presented in this thesis comprises a study of three main parts :

Part I. The relation between snails and higher aquatic, and semi-aquatic weeds :

A - Laboratory studies include the effect of different higher aquatic and semi-aquatic weeds on the fecundity of snails.

B - Field studies include the relation between snail populations and different higher aquatic and semi-aquatic weeds in three governorates namely : Menoufia representing middle Delta, Kafr-El-Sheikh representing the north of the Delta, and Menya representing the middle of Upper Egypt. Representative waterways were chosen and visited four times during July and October 1970, January and April 1971.

Part II. Biological studies, including, incubation period and hatching percentage, growth rate, sexual maturity, survival, fecundity and lifespan, were determined under normal variable room temperature. This was

repeated nearly every two months to investigate the effect of diurnal and seasonal fluctuations of temperature on the snails and to give a picture near to that prevailing in the field during the various seasons of the year.

Part III. Factors affecting snail's growth, survival and fecundity e.g. crowding, water volume and water depth were studied in the laboratory.

It would be mentioned here, that the review of literature dealing with this study is so volumenous. It was thus found more convenient to cite the review of each part separately.

II - REVIEW OF LITERATURE

Aquatic plants have an important role in conditioning the aquatic complex. Literature includes some studies dealing with their relation to snails or to other aquatic organisms. The most important informations can be summarized as follows :

Simpson (1932) recorded the following plants in the irregation cabals of Egypt : Aquatic free floating : Eichhornia crassipes and Pistia stariotes. Anchored to the mud : Ceratophyllum demersum, Nymphaea coerulea, Nymphaea lotus, Potamogeton spp. Plants invading canals from the banks : the most important of which belong to the genera : Agrostis, Cyperus, Echinochloa, Phragmites, Polygonum and Typha.

Boycott (1936) made a statistical study of concurrences between snails and plants and arrived at the conclusion that the snails can get along quite well without the plants, and that there is no essential biological connection between them. Nevertheless, he also observed that water snails in England are generally found in abundance with Potamogeton crispus or with Nymphaea spp.,

n part because these plants grow in places which are in ther respects favourable to the snails, and in part ecause their large flat leaves provide a convenient and rofuse growth of algae for the snails to eat.

Barlow (1948) "Cited by Watson (1958)" observed hat, in Egypt, Bulinus truncatus prefers clean broad- eafed plants such as Potamogeton crispus, with which it s believed to be particularly associated.

Welch (1952) discussed detailed informations deal- g with the higher aquatic plants and their relation to uatic complex. The aquatic plants, in general, can be ouped into three assemblages :

1. Emergant : rooted in the bottom, submerged at ir basal portions, and elevated into the air at the s. They constitute the shoreward zone, extending from the edge of the water lakeward to depths which vary circumstances. The chlorophyll bearing portion are ated above water, while the submerged portions usually less chlorophyll development.

2. Floating composed of plants which are rooted e bottom but their foliage floats upon the surface

of water, and often do not project above it. However, certain ones are wholly floating and unattached. They are found in zones typically occurring next beyond the emergent zone. The depths occupied vary somewhat but are usually about 10 cm. to 2.5 m.

3. Submerged plants are rooted at the bottom and often form large, dense areas, particularly in late summer when the growth has reached a maximum. They are found in zones which occupy the deeper water beyond the zone of floating plants, extending downward to depths which vary with conditions and in average waters do not exceed 6 m.

Wright (1956) has drawn attention to the presence of microhabitats of high oxygen tension favoured by snails such as those on the underside of water lilies (Nymphaea sp.) and at the roots of rice and other growing plants.

El-Gindy (1957) stated that adult Bulinus truncatus snails has a certain preference to submerged plants as Potamogeton crispus, Nymphaea lotus and pistia stratiotes. Biomphalaria boissyi on the other hand, inhabits water bodies where the aquatic plants extend in heavy growth close to the surface of water. These plants are usually

Eichhornia crassipes, Typha angustata, and Panicum repens. It is noteworthy that these plants flourish in spring and summer, which coincide with the periods of high activity of the snails.

Abd-El-Malek (1958) stated that it is a well-known fact that the presence of aquatic vegetation is advantageous to organisms living in the water, because it increases the amount of dissolved oxygen and consumes carbon dioxide. The broad leafed vegetation provides a particularly suitable surface where the snail can crawl and deposit its egg masses. Food is also provided for the snails in the form of the browmish-green layer, the periphyton which encrusts the submerged parts of the plant. Water plants are an important factor in the habitat of bilharziasis snail vectors. They affect the number of snails, but are not essential for their occurrence. In other words, the presence of vegetation makes the habitat more favourable for subsistence and breeding, but snails also occur in smaller numbers in the absence of these weeds. It seems that a heavy growth of aquatic plants, especially in small swamps or pools that have no inflow, render the habitat unsuitable for the vectors.

This is due to stagnation of the water and to the abundance of humus and decaying vegetable matter.

Hubendick (1958) stated that vegetation which (whether living or dead) is an important part of the habitat both as substratum and as food for its inhabitats. The living plants consume carbon dioxide and produce oxygen, and thus influence the chemical macro- and microclimates of the water. Overcrowding of vegetation particularly rooted vegetation reaching above the surface, shades the water. Plant life can also provide calm niches in moving water.

Pelwagora - Szumlowicz 1958 "Cited by Wright (1960)" found that there was an improvement in the breeding of snails in the presence of vegetation. This might be due to direct oxidation of the chemical substances by the oxygen given out by the plants, or it might be that the plants actually removed the toxic materials from the water.

Pesigan et al. (1958) found that removal of vegetation in and around the infested streams by flooding, damming and clearing, was among the measures used to control the snail host of Schistosoma japonicum in

Philipines. Alternating clean and uncleaned portions were tested. The uncleaned areas showed an overall increase in snail density, whereas the population in the cleaned areas never regained its original density and averaged 25.6% of that in the uncleaned areas.

Van Der Schalie (1958) applied control methods in Qualyub area, Egypt, and observed that in the regions to which Biomplalaria alexandrina snails were restricted, water hyacinth (Eichhornia sp.) was also abundant, whereas it did not occur elsewhere in the area.

Watson (1958) observed that Bulinus truncatus is generally markedly more abundant in streams and pools containing a rich growth of suitable species of water plants which provide the snails with food, shelter and suitable surfaces on which they lay their eggs, and is often scanty or absent in waters free from plant life. It should be noted, however, that this snail is able to establish itself and breed in habitats in which the only vegetation consists of encrusting algae, a favourite food, growing on the smooth surface of mud, stones, cement or brich work.