ASSESSMENT OF CERTAIN NEW APPROACHES FOR CONTROLLING THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA (WIED.) IN EGYPT

By

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THESIS

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IN

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This Thesis has been Approved by .....

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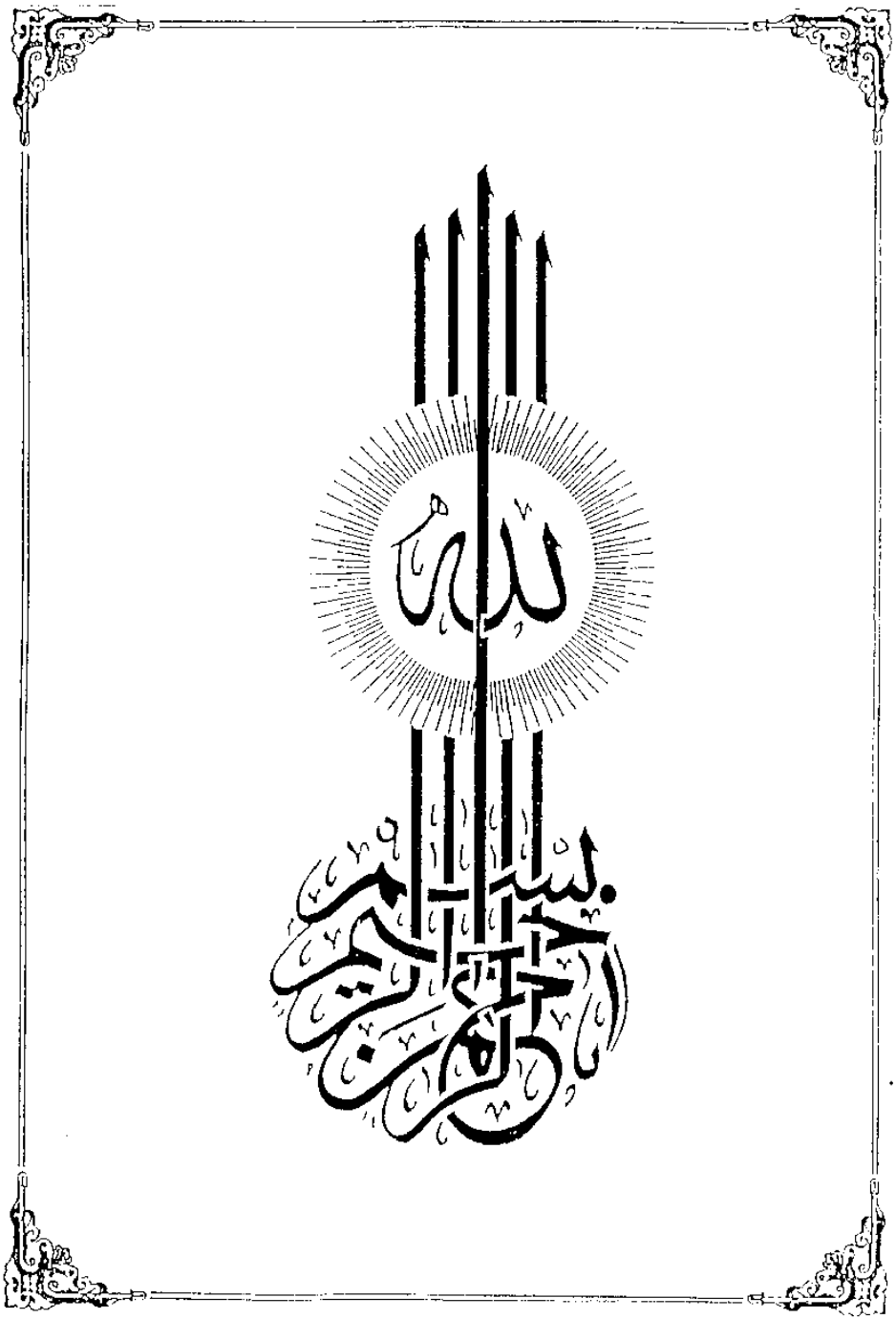

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INTRODUCTION

I. INTRODUCTION

Since the beginning of agriculture man has suffered harm from insects that attacks his vegetable crops and fruits. Many methods have been used to control these pests, but the most common and successful one is chemical insecticides. However, a number of deleterious environmental effects have been attributed to the use of chemical control agents. Moreover, many insect species developed resistance to most of the commonly used insecticides which led to increase of dose, concentration and number of successive applications, and consequently costs. Therefore, the integration of many control methods was required, which led to more sophistication and in turn to future complications. Recently, much attention has been focused on alternate methods of pest control to minimize these problems. Of the more promising alternatives are the entomopathogenic bacteria and radiation in using the sterile insect technique (SIT) programme.

The Mediterranean fruit fly, Ceratitis capitata (Wied.) or medfly is considered the most economically important fly of the family Tephritidae allover the world. It originated from West Africa and today is found in Southern Europe and in isolated localities in Central Europe, in most African countries, Australia, Central and South America, Mexico, Hawaiian and Bermudan islands,

Turkey, Syria, Cyprus, Saudi Arabia. Medfly became established in these areas because of ideal climatic conditions, lack of natural enemies and a continual source of favourable and alternative hosts. Now more than 200 hosts of medfly have been reported worldwide (Christenson and Foote, 1960). Medfly has been known to exist in Egypt since the turn of this century. Its presence was first reported in 1904 (El-Ghawabi 1928). Since then gradual spread have been recorded.

The medfly attacks many kinds of fruit in Egypt causing great damage to fruit production. Estimates of crop loss due to this pest have been made by equating infestation, trap catches and other related information. These estimates ranged from a net loss of 10-15 %. However, the estimates are based mainly on data from the early 1960's and usually assume that percent infestation equals percent loss.

The total host fruit area in 1986 was 368,149 feddans. Seventy one percent of the total area was citrus, 10.2 % mangoes, and 5.1 % guavas. The remaining 13.7 % was distributed in a descending order to figs, pears, apricots peachs and plums and other miscellaneous hosts.

The total fruit production of 9 major medfly hosts was 2,002.586 metric tons, 78.3 % from citrus, 8.6 % from guava, 5.59 % from mango and 7.51 % for the remaining fruits. *

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* Agriculture Economic Documentation.

The total retail value of the 9 medfly host fruits produced in 1981 (Report on Survey crop losses by medfly in Egypt in 1983) was L.E. 319.7 million. Citrus represented 45.4 %, while mangos represented 32 % followed by guava 6.1 %. The remaining 16.5 % was distributed among the remaining fruit hosts.

The gross retail value of the infested fruits was L.E. 29.3 million of which 56.3 % from citrus. The estimated loss from medfly infestation is 15.0 million, the estimated cost of chemical control is L.E. 8.4 million, and the total loss is L.E. 23.4 millions.

This pest can be effectively controlled by applying an attractant bait and insecticide in a spray. Eradication can be achieved by the sterile insect technique (SIT). However, the latter technique frequently requires reduction of the wild medfly population with insecticidal bait spray before it can be effectively applied.

When the SIT is used over large land areas, bait spray must be applied to large areas. This causes environmental problems (Ehler and Endicott 1984, Ehler et al. 1984, Gary and Mussen 1984 and Troetschler 1984) and has at times caused serious problems with eradication programs. Because of these objections, the insecticidal bait spray has become less acceptable and unless an environmentally acceptables replacement for the insecticide is found,

an essential component of the SIT system for eradicating medfly populations may be lost. The development of a safe biocontrol agent such as B. thuringiensis to replace the chemical insecticide in the bait sprays would solve these problems.

B. thuringiensis (B.t.) was discovered in the early part of the 20th century (Berliner 1915). The first commercial product was produced before 1938. However, its development for biological control of insect pests was slow, partly due to the inability to distinguish between the different taxonomic varieties and to recognize their mode of action. The introduction of serotypes based on flagellar or H. antigens (de Barjac and Bennefoi 1962) and extra biochemical studies (Heimpel and Angus 1958, Norris 1964, Norris and Burges 1965) enabled the varieties to be more clearly distinguished. Now it is apparent that B. thuringiensis is a complex species presently divisable into more than 30 varieties by serological and biochemical tests. Some serotypes can be subdivided, on the basis of different enzymatic reactions, into biotypes, which may also have different pathogenicity spectra. Several insecticidal agents are now known to be produced by B. thuringiensis, three of which are used in agriculture; spores, δ-endotoxin and β-exotoxin. The different spectrum of activity against insect species arises partly from the

combined effects of the potencies of the varying concentrations of the different insecticidal materials that it produces. However, the primary cause of the spectral differences lies in the characteristics of the active agents themselves.

Early trials for controlling the medfly in Egypt included application of sodium arsenite as a bait, sodium flouride and sodium flusilicate as a spray.

Since the introduction of new organic insecticides; organochlorine such as Lindane and organophosphate such as dimethoate were applied. Radiation trial was also explored by many investigators (Shoukry 1968 and Hafez and Shoukry 1972).

This study aimed at assessment of Y-radiation standardization, and effects, as well as demonstration, characterization and evaluation of B.thuringiensis fermentation products that could be of biological activity against the adults of Mediterranean fruit fly, Ceratitis capitata (Wied.).

Such a study might lead to establishment of a sound, effective and safe control programme of the medfly in Egypt.

REVIEW OF LITERATURE