STUDIES ON APHIDS INFESTING CITRUS PLANTS IN EGYPT AND ITS CONTROL

By

KAMEL HASSAN EL-LAITHY

B. Sc. Agriculture (Entomology)

رسالة

THESIS

Submitted in Partial Fulfilment of the Requirements for the Degree

Of

MASTER OF SCIENCE

in

ENTOMOLOGY

Plant Protection Department

Faculty of Agriculture

Ain-Shams University

1974

Central Library - Ain Shams University

APPROVAL SHEET

This Thesis for the M.Sc. Degree
has been Approved by :

A. Hafez

M. M. Mostafa

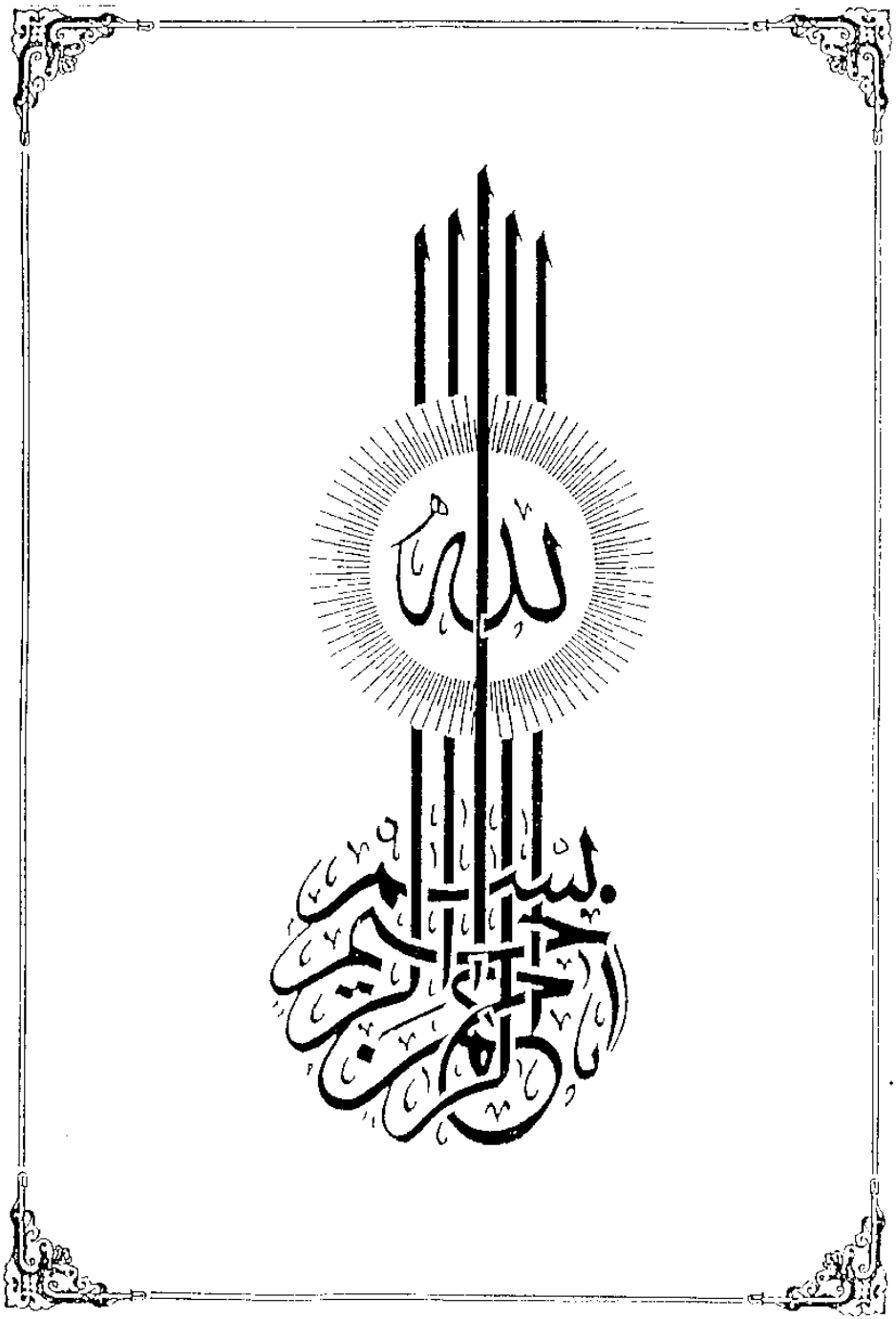
A. Badawi

Committee in Charge

Date : 10 / 11 / 1974

...ooOoo...

Central Library - Ain Shams University



Central Library - Ain Shams University

A C K N O W L E D G M E N T

The author is indebted to Prof. Dr. A.I. Badawi, Head of Plant Protection Department, Faculty of Agriculture, Ain-Shams University, for the facilities and encouragements, he kindly offered throughout the course of this work.

The author wishes also to express his deep gratitude to Prof. Dr. A. Habib, Professor of Entomology, to Dr. E.A. El-Kady, Prof. of Entomology and to Dr. A. Shaaban, Assoc. Prof. of Insecticides in the same department for their supervision constructive criticism and valuable suggestions which they offered during this work.

The author feels most grateful to Dr. R. Rizkalla, for his help in the statistical analysis, and Dr. M.S. Hassan, Head of the Aphids Section, Ministry of Agriculture, for his keen interest and continuous help throughout this work.

...ooOoo...

Central Library - Ain Shams University

C O N T E N T S

Page

INTRODUCTION 1

REVIEW OF LITERATURES 3

PART I :

A Survey of the Different Species of Aphids Attacking Citrus Plants 14

PART II :

Biological Studies of A. gossypii 26

Material and Methods 27

Results and Discussion 30

1) Reproduction 30
2) Number of moults 30
3) Nymphal period 30
4) First instar 34
5) Second instar 34
6) Third instar 34
7) Fourth instar 36
8) Pre-parturition period 36
9) Parturition period 41
10) Post-parturition period 43
11) Longevity of the insect 45
12) Fecundity 46
13) Duration and number of generations . 51

PART III :

Review of Literatures 58

Material and Methods 61

A) Laboratory Experiments 62

B) Field Experiments 65

Central Library - Ain Shams University

Page

Results and Discussion 65
A) Laboratory Experiments 65
B) Field Experiments 69

SUMMARY 74

REFERENCES 77

ARABIC SUMMARY.

...ooOoo...

Central Library - Ain Shams University

I N T R O D U C T I O N

Citrus aphids, are the most serious pests in Egypt , cause considerable damage to citrus.

They attack the sweet lemon, mandarins spp., Grape fruit and Orange spp.

Aphids generally cause great damage to several crops. The symptoms of this damage on citrus is the weakening of the plant vigour, curling of its leaves and the production of stunt plants.

In addition, aphids are responsible for transmitting virus diseases which may cause the destruction of the crop.

The present work is, planned to cover the following points :

I) A study of the biology of Aphis gossypii as the main one infesting citrus and causing great damage all over the year, together with the effect of temperature and relative humidity on its longevity, nymphal period, reproductive period, average number of progeny per individual and number of generations.

II) A survey of the species of aphids attacking citrus trees,

Central Library - Ain Shams University

to study their degree of infestation and time of their appearance in the field during one year from 1971-1972.

III) Toxicological studies including comparison between the relative efficiency of four insecticides against Aphis gossypii by determing their LC_{50} under laboratory condition using the laboratory reared culture on cotton.

IV) Chemical control in the field against A. gossypii by using four insecticides.

Central Library - Ain Shams University

REVIEW OF LITERATURES

Tulashvili (1931), in Russia stated that Toxoptera aurantii (Boy), infested only the new shoots of citrus, he added that eleven parthenogenetic generations occurred between mid-July and October.

Borg (1931), in Malta found that the damage to citrus by Toxoptera aurantii was very marked in some cases.

Calderon (1932), in Washington recorded Toxoptera aurantii on limes.

Corbett (1936), in Malaya said that the aphid Toxoptera aurantii caused young leaves to wilt.

Rivnay (1937), in Palastine studied the moisture as the factor affecting wing development in the citrus aphids, Toxoptera aurantii was bred on citrus twigs under controlled condition of temperature, humidity, crowding and food supply. He found that no effect on wing-development was observed during continuous breeding for more than two years at a range of temperature from 14 to 32°C. although the retardation in the development of the insect at low temperature and the acceleration at high ones modified the influence of other factors on wing-production. In experiments, crowding in

Central Library - Ain Shams University

itself was not found to cause wing-development. On stale food, the percentage of alates was high and the number of such forms decreased when fresh food was supplied to the young leaves. When aphids were reared on stale but vigorously growing and succulent twigs few alate individuals were produced, but on twigs allowed to dry for a day, then placed in water, there again allowed to dry and so alternately until the aphid matured, 48 alates and 63 apterae developed, whereas on the control (when the twigs were not removed from water) 10 alates and 111 apterae developed. It was therefore concluded that loss of water rather than the amount of food ingredients ingested by the aphids affected the wing development, and that the decisive factor is not the water content of the food itself but the balance of water in the body of the aphid.

Worsley (1938), in Tanganyika recorded Toxoptera aurantii on citrus.

Rivnay (1938), in Palestine studied the factors affecting the fluctuation in the population of Toxoptera aurantii on citrus. This aphid was numerous in the spring and attacked young growths, but generally caused little damage. Occasionally, however, it attacked the blossom to fall. Apterous and alate females were present and reproduced parthenogenetically throughout the year. There was no

Central Library - Ain Shams University

sexual reproduction, and in the investigations no sexual oviparous females were observed. Examples of an additional alate form, apparently the male, were however found in the course of breeding.

In the laboratory on twigs of citrus, the life cycle of the apterous females lasted only 6-7 days at 22-25°C. and high relative humidity, and this temperature was also the most favourable for reproduction. It was longer at higher or lower temperatures, averaging 9 days at 18-22°C. and 3 weeks at 15°C. At 22°C., the maximum number of youngs produced per female in a day was 8, and the average total production was about 70. Below 13°C., and above 33°C., only 1 per day was produced. Of 121 aphids reared at 30-32°C., only 4 became adults, they were undersized and did not reproduce. Changes in humidity had little effect when the temperature was optimum and the food supply good. At higher temperatures a low relative humidity lowered the thermal death-point.

The population of T. aurantii on the young growth of citrus increased towards the end of February and in March, when the day-temperatures were optimum, and decreased suddenly in April, when the temperature sometimes reached 40°C. This decrease generally occurred before blossoming. Slight re-infestation might occurs during mild weather in summer, otherwise, the aphids were partically absent until the autumn.

Central Library - Ain Shams University

It was concluded that if the daily maximum temperature during December and January exceeded 18°C., infestation would be serious in March, and trees should be sprayed in February with Nicotine sulphate (1 : 800 or 1 : 1,000).

Fennah (1943), recorded Toxoptera aurantii, on the young foliage of orange and lime in all the island of Windward and Leeward.

Quayle (1943), in California found that Aphis spiraecola (Patch), Aphis gossypii (Glov), Toxoptera aurantii (Boy), and Myzus persicae (Sulz), were injurous to citrus in costal and sometimes in intermediate districts in spring and early summer.

Zeck (1949)in Sydney studied the bionomics of Toxoptera aurantii, and Aphis spp which attacked citrus, and found that they injured from mid-September to mid-October in costal areas.

Swirski (1954), in Israel gave a brief notes on aphids that attacked citrus. These included Myzus persicae.

Wolcott (1955), studied the despersion of Aphis spiraecola, this species was found on citrus in Florida in 1924 and Cuba, and Port Rico in 1926. He added that A. spiraecola was not of importance on citrus in California, and spread slowly north, reaching Oregon and Washington by 1949-50. It was collected on citrus in Honduras in 1928 and Costa

Central Library - Ain Shams University

Rica in 1933, so that it was presumably widely dispressed in central America and might invade South America.

Nour-Eldin and Bishay (1958), in Egypt found that the Tristiza disease was observed in citrus for the first time in October 1957, when it was found in trees in a varietal plot at the Barrage Experiment Station. He added that the vector of the virus, Toxoptera citricidus (Kirk), did not occur in the country, but Aphis gossypii (Glov), was present.

Stroyan (1961), in Rome gave an account on aphids infesting citrus including the identification of species, he gave also information on the collection, preservation, and preparation of aphid material from citrus, a field key to the alate and apterous viviparous of seven widely distributed species that were common on the crop in various parts of the world. The species concerned were Macrosiphum euphorbiae (Thos), Myzus persicae (Sulz), Aphis gossypii (Glov), Aphis spiraecola (Patch), Aphis craccivora (Koch), Toxoptera aurantii (Boy), and Toxoptera citricidus (Kirk), The last one was a fairly efficient, and Aphis gossypii an efficient, vector of the tristeza virus.

Tao and Tan (1963), in Formosa found that seven species of aphids infested citrus, among them, Toxoptera aurantii, and Toxoptera citricidus which heavily infested

Central Library - Ain Shams University

citrus all over the island, Aphis spiraecola and Aphis gossypii, which only occasionally occurred on citrus, were known vectors of the virus. The remaining three species were Sinomegoura citricola, which was observed in Formosa for the first time in 1935, and Myzus persicae and T. odinae, both of which rarely infected citrus. Data on the seasonal fluctuations in the populations of T. citricidus and T. aurantii were obtained by trapping in a yellow trap filled with water. The results showed that T. citricidus was more numerous than T. aurantii, though the seasonal fluctuations were the same for both species, with a major peak in April and a smaller one in October.

Norman and Grant (1963), stated that Toxoptera citricidus was absent from the United States. Tests there have shown that Aphis gossypii, Aphis spiraecola and Toxoptera aurantii were recorded to transmit the tristiza virus disease. They added that A. gossypii was more efficient in transmitting the disease. T. aurantii and Aphis spiraecola proved to be poor vectors. A survey was carried out on Temple and Valencia orange in 1953 and 1960. In spring of 1953, 31% of the Temple trees were lightly and 9% moderately infested by A. spiraecola 20% of the Valencia trees were lightly infested. Population decreased in summer and autumn. In April 1960, all the Temple trees were infested by A. spiraecola and some by

Central Library - Ain Shams University

A. gossypii and Toxoptera aurantii. In August 1935, 30% of the Temple trees and 20% of the Valencia were infested with the disease. In December 1958, the percentages were 73 and 35.

Ting Wen Poh (1963), in Malaya recorded that Toxoptera citricidus, was an efficient vector of the virus disease, it was common of the trees of citrus.

Johnson and Russell (1964), stated that Toxoptera aurantii was found in Maryland for the first time in August 1960, infesting English holly, Ilex equifolium, it had previously not been known north of Wilmington, North Carolina. It was found again in 1961.

Knorr and Vaughn (1964), said that T. citricidus was not found in Syria. Aphis gossypii and T. aurantii were present but only in small numbers. Other aphids found on citrus were Myzus persicae and Aphis craccivora. All except A. craccivora also occurred on citrus in Lebanon.

Foguet (1964), recorded that T. citricidus was observed on citrus in Tucuman in 1952, but it may have been present earlier since it was found in 1937 in Misiones and Correntes.

McLean (1965), in South Africa found that the virus tristeza was widespread in citrus. The vector was Toxoptera citricidus.

Knorr et al. (1965), recorded five species of aphids

Central Library - Ain Shams University