STUDIES ON NEMATODES INFECTING GRAPES

By

SUFIAN ABDEL-RAHMAN SHEIKH SHUKRI SULTAN

B.Sc. (Agriculture, Entomology) Ain Shams University, Egypt, 1973

THESIS

Submitted in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

in

AGRICULTURAL ZOOLOGY

PLANT PROTECTION DEPARTMENT

FACULTY OF AGRICULTURE

AIN SHAMS UNIVERSITY

1976

APPROVAL SHEET

Thesis titled:

'Studies on Nematodes Infecting Grapes'

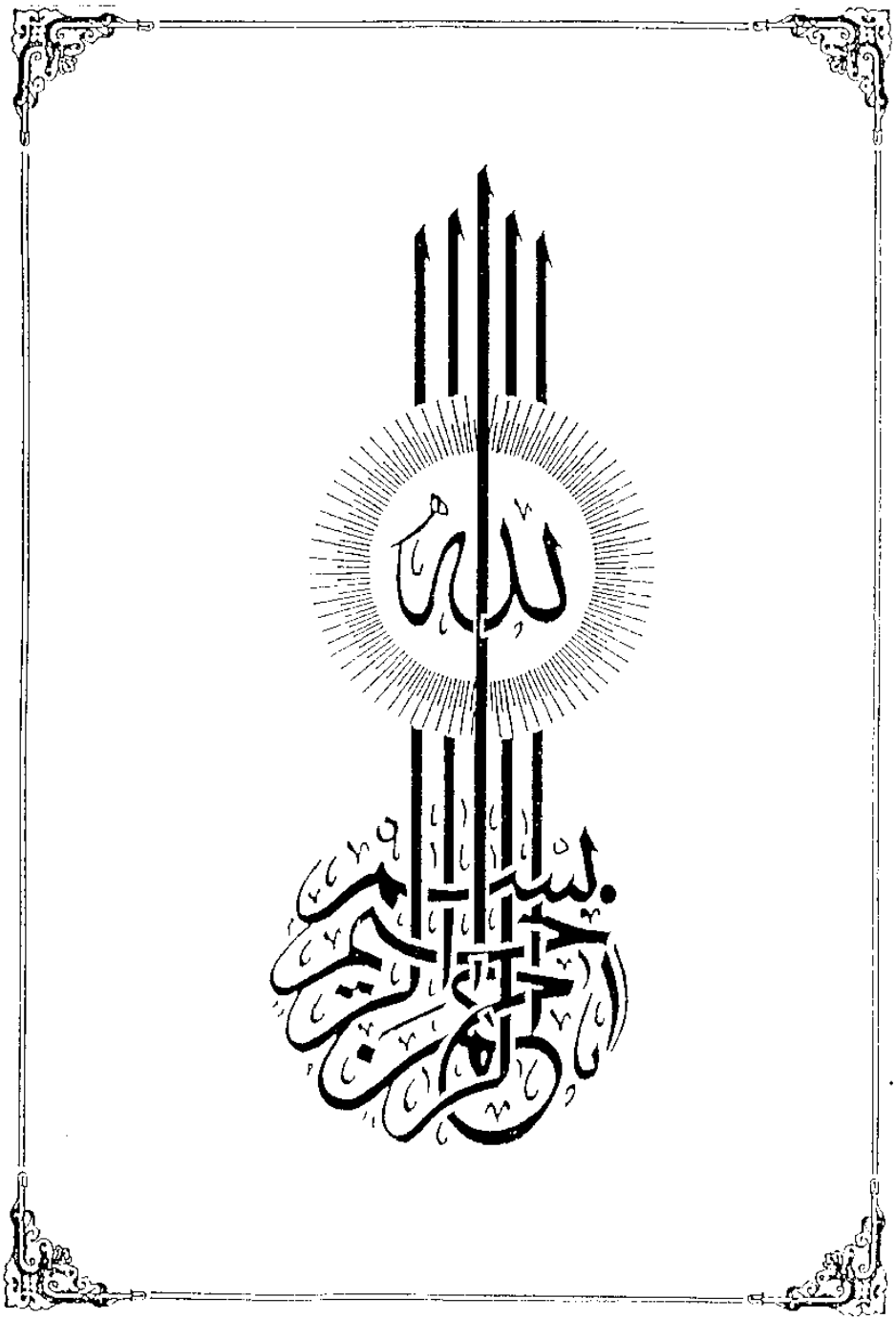
Approved: .....

.....

.....

Committee in Charge

Date : 24 / 1 /1976



BIOGRAPHY

Name : Sufian Abdel-Rahman Sheikh Shukri Sultan

Degree : B.Sc.(Agriculture, Entomology) Ain Shams Univ.,Egypt, 1973.

Occupation : Graduate student, Plant Protection Department, Faculty of Agriculture, Ain Shams University.

Nationality : Jordanian

Date of Registration : 22/1/1974.

Courses Attended :

		Unit	Grade
Agricultural Zoology	(203)	3	Excellent
Biostatistics	(220)	3	Very Good
Insect Ecology	(214)	4	Very Good
Insect Taxonomy	(208)	4	'Good'
Plant Microtechnique	(201)	4	Excellent
Plant Histology	(203)	4	Very Good
Viticulture	(225)	3	Excellent
Special Studies	(299)	3	Very Good
Research	(300)	5	Excellent
English Language		-	'Good'

ACKNOWLEDGMENT

I wish to express my grateful appreciation to Prof. G.I. Issa, Professor of Agricultural Zoology, Plant Protection Department, Faculty of Agriculture, Ain Shams University, for his valuable suggestions and constructive criticism during the preparation of the manuscript.

Significant contributions were also made by Dr.A.H. Taha, Assistant Professor of Agricultural Zoology, Plant Protection Department, same Faculty. I feel fully indebted to him for suggesting the problem, constant advice and encouragement and for the interest he took throughout the course of this study.

I also wish to acknowledge the help of Mr. A.S. Hassan, Assistant Teacher of Agricultural Zoology, Plant Protection Department, same Faculty, during the practical work.

TABLE OF CONTENTS

I. INTRODUCTION

All grape varieties (*Vitis vinifera* L.) grown on their own roots and most common grape rootstocks used for commercial propagation may be attacked by several kinds of plant-parasitic nematodes. Investigations and experience indicate that nematodes on grape may be a problem in any area where grapes can be grown successfully.

The nematodes which attack grape represent virtually all types of plantparasitic species in term of their life histories. Some nematodes are migratory(*Pratylenchus* spp.) and sedentary (*Meloidogyne* spp.) endoparasites. Another nematodes are ectoparasites(*Xiphinema* spp., *Criconemoides* spp. and *Paratylenchus* spp.). The sedentary semi-endoparasitism in grape roots is also symbolized by the citrus nematode, *Tylenchulus semipenetrans* Cobb. Additionally, the reniform nematode, *Rotylenchulus reniformis* Linford & Oliveira (sedentary semi-endoparasite), is also detected on grape roots established in vineyards at the Faculty of Agriculture, Shubra El-Khaima, during a routine work in nematology.

The life cycles of the latter two nematodes are more interesting and remarkably different. On this account, the

present work was undertaken to delve into their life histories and population developments when both coinhabited grape roots. Besides, histological studies were practiced to dig for their feeding sites in root tissues.

II. REVIEW OF LITERATURE

A. Distribution and Hosts of Rotylenchulus reniformis Linford & Oliveira and Tylenchulus semipenetrans Cobb.

The reniform nematode, R.reniformis, parasitizes a large number of cultivated plants and fruit trees and is distributed throughout tropical and subtropical countries. Ayala and Ramirez (1964) have compiled a bibliography on its host range and distribution, and Dasgupta et al. (1968) and Siddiqi (1972) reported it from several plants in different countries. Oteifa(1970) described it as a major soil pest in loamy and heavy soils of Egypt. Nevertheless, it has not been reported infecting grapes anywhere, though Dasgupta and Seshadri(1971) and Riad (1974)identified it from soil around the roots of grapevienes in India and Egypt, respectively.

Dasgupta and Seshadri(1971) reported the existence of two races (A & B) of R. reniformis in India, which were morphologically similar but different in their capacity to reproduce on different hosts. They collected ten populations of R.reniformis from the soil around different crops(castor,2;citrus,1;cotton,2;coffee,1;grapevine,3;

and pineapple, 1 populations), and tested for reproduction on castor, cowpea and cotton. These populations were morphologically similar and consisted of males and females in equal numbers. They found that nine populations were able to reproduce on cowpea, castor and cotton (designated as Race A) and one population (derived from grapevine) multiplied on cowpea only (designated as Race B), but failed to reproduce on castor and cotton.

The distribution of the citrus nematode, T.semipenetrans, almost coincides with citriculture in the world. The hosts list of it in Egypt seems to fit the data of other countries (Oteifa & Shaarawi, 1962). Thirty one species and varieties of citrus plants (Citrus and Fortunella spp.) were found infected. Rutaceous non-citrus plants; e.g. Calodendrum capensis Thunb., Ruta bracteosa DC. and Ruta graveolens were recorded as hosts of the citrus nematode (Cohn, 1965). Also, it is reported to attack genera outside Rutaceae; including grapevines, V. vinifera, (Raski et al., 1956; Seinhorst & Sauer, 1956; Oteifa & Tarjan,1965); lilac, Syringa vulgaris L., (Raski et al., 1956); persimmon,

Diospyros lotus L., (Nesbitt, 1956; Raski et al., 1956); bindweed or climbing hempweed, Mikania batatifolia Dc., (Chitwood & Birchfield, 1957); Mikania scandens Willd., (Hannon et al., 1963); and olive, Olea europaea L. (Baines & Thorne , 1952).

Biotypes of the citrus nematode that differ in ability to infect and reproduce on some hosts have been described (Baines et al., 1969). They described two biotypes of citrus nematode in California that produced different levels of infection (number of adult females/ cm of feeder root) on ' Homosassa'sweet orange (Citrus sinensis L.) and a hybrid of it ('Troyer' citrange). They concluded that the difference in infectivity and rate of development of two California biotypes were apparently due to differences in the ability of the nematodes to penetrate the root and establish a satisfactory feeding site.

Stokes (1969) described a population of T.semi-penetrans that infected grass, Andropogon rhizomatus Swallen (grass strain) in Florida, but not rough lemon, Citrus limon (L.) Burm.; sour orange, Citrus aurantium L.; or trifoliate orange, P.trifoliata.

In Egypt, Oteifa and Shaarawi(1962) indicated that the orange (C. sinensis) var. Valancia was less frequently infected with T. semipenetrans than the local var. Balady, in spite of the fact that both were normally grafted on the same rootstock, C. aurantium var. Balady. They suggested that the scion variety may have influenced the rate of susceptibility or resistance. Seddik(1974) found that orange, C. sinensis cultivars Balady and Naval were the most favorable hosts for the reproduction of the citrus nematode; whereas mandarin, Citrus reticulata Blanco cultivar Balady was the least favorable host. He emphasized that most of these citrus cultivars were grafted on Balady sour orange rootstocks leading to the suggestion that scion may influence the susceptibility of rootstocks to the magnitude of nematode infection.

Baines et al. (1974) found four biotypes (pathotypes) of the citrus nematode occurring in California, USA, were differentiated on the basis of differences of infectivity on ' Homosassa ' sweet orange, ' Troyer ' citrange,'pomeroy' and ' Rubidoux' trifoliate orange, 'Thompson seedless' grape, and 'Manzanillo' olive.

The wide distribution of T. semipenetrans on vines was found in Murray irrigation area, Australia, by .

Seinhorst and Sauer (1956) and caused a general unthriftiness which was reduced by fumigation (Sauer, 1962). It was found in almost as many cases as root-knot. Moreover, in one instance it was the only parasitic nematode associated with a poor patch of Doradillos (grapevine wvar. Doradillo). Seinhorst and Sauer(1956) found this nematode on the vine roots (females) and in the surrounding soil (males & larvae) in enormous numbers. Raski et al. (1965) stated that root symptoms on grape resemble those seen on citrus although its effect on grape has not been evaluated completely.

B. Biology and Histopathology of R. reniformis on its Hosts

The life cycle of R. reniformis is detailed by Linford and Oliveira (1940) on cowpea, Peacock(1956) on soybean, Birchfield (1962) and Oteifa and Salem (1972) on cotton, and Sivakumar and Seshadri(1971) on castor. The first molt occurs within the egg. The remarkable feature is that the eggs are able to hatch in water and the larvae develop to the preadult stage without feeding and growth, through a series of at least three superimposed molts. Eggs hatched within

6-8 days after deposition; and larval development requires about 8 days (Linford & Oliveira, 1940; Oteifa & Salem, 1972) or 19 days (Kassab, 1974). Females begin to lay eggs about 7-9 days (Linford & Oliveira, 1940) or 6 days (Kassab, 1974) after penetrating cowpea roots. On cotton, eggs were laid after 10-15 days from feeding(Oteifa & Salem, 1972).

Females lay their eggs outside in gelatinous matrices on the root surface. An average of 100 eggs per egg-mass was recorded (Linford & Oliveira, 1940; Kassab, 1974) . Sex ratio of larvae hatched in water was approximately 1 : 1 , but in soil washings males usually outnumbered young females (Linford & Oliveira, 1940).

The complete life cycle of R. reniformis from egg to egg takes about 15 days on soybean (Peacock, 1956) ; 17-23 days (Birchfield, 1962) or 32 days (Oteifa & Salem, 1972) on cotton; about 24-29 days (Linford & Oliveira,1940) or 30 days (on cowpea (Kassab, 1974).

The reniform nematode is bisexual and reproduces by amphimixis (Triantaphyllou & Hirschmann, 1964), although Sivakumar and Seshadri, (1971) reported that it could also