CONTROL OF TOMATO LEAFMINER, *Tuta absoluta* (MEYRICK) USING CHEMICAL AND ECO-FRIENDLY INSECTICIDES

By

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ABSTRACT

Tomato crops (Solanaceae), usually attacked by many insectspecies, including the tomato leafminer, *Tutaabsoluta* (Meyrick), where its larvae cause damage up to 80-100% by making tunnels in all tomato parts.The physico-chemical properties of 12 commercial insecticides (five EC, four SC, two SG, and one WG) as well as nine naturally formulated compounds (seven EC and two W/O/W) were measured.All the tested formulations passed the tests except Action Phos and Pestbanscince they failed in the foam formation test. The efficiency of these formulations was examined against *T.absoluta* under laboratory and field conditions. The laboratory evaluation of the testedcommercial insecticides demonstrated thatthe non-conventional insecticides Emperor and Coragen, achieved the superior efficiency with the least LC_{90} values of 1.66 and 1.82 ppm, respectively, followed by Proclaim, Radiant, Vapcomic, and Challenger that gave high efficacy with LC_{90} values of 3.72, 4.84, 8.09, and 164.56 ppm, respectively. Alsothe naturally formulated compoundswere arranged in a descending order according to LC_{90} values as follows:Thymo "w/o/w" >Corian>Origo>Sagix> Rosa >Nimbecidine>Thymo "EC" >Cura>Mentho>Basi.The most promising commercial insecticides (Emperor, Coragen, Radiant, Vapcomic, and Challenger) as well as six naturally formulated compoundsThymo "w/o/w",Corian,Origo,Sagix, Rosa, andNimbecidine were applied in the field.

Data showed that, concerning commercial insecticides, generally average reduction of infestation 7 DAT clarified that Emperor insecticide showed the superior reduction in infestation (98.74%) followed by Coragen (95.51%), then Vapcomic, Radiant and Challenger which recorded about 87.75, 88.48 and 84.89%, respectively. Regarding naturally formulated compounds, In general, the mean reduction in infestation during the last three periods (3, 5 and 7 DAT) showed that Nimbecidin, Rosa, Thymo and Origo resulting in a high reduction in infestation with means of (82.70, 79.67, 79.55 and 77.58%, respectively). The influence of insecticides sequence and insect traps application as a strategy for *T. absoluta* management was carried out. Sex pheromone and sticky traps were used for mass trapping this pest; sex pheromone traps were more effective than the sticky one. When the first infestation appeared, the non-conventional insecticides were consecutively sprayed as follows; Radiant, followed by Coragen and then Emperor (during the vegetative stage). After that during the fruiting stage the formulated essential oils Nimbecidine (commercial) and Rosa (Prepared) were respectively sprayed(during the fruiting stage).The general average of reduction in infestation reached 95.81% when non-conventional insecticides were used. Whereas, it reached 92.15% when the formulated essential oils were used.

Key words: insecticides, *Tutaabsoluta*, Emperor,Coragen, formulations, physico-chemical properties.

DEDICATION

I dedicate this work to whom my heartfelt thanks to parents, brothers and sister who have always been a constant source of support and encouragement during the challenges of my whole college life, as well as to my wife and my kids Mahmoud, Mmohamed, Mariam and Malak for all the support they lovely offered, for their patience and help along the period of my post graduation.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviations	Meaning
a.i.	Active ingredient
AS	Emulsifier
AZ	Azadirachtin
Basi	*Ocimum basilicum* formulation
CBR	Cost benefit ratio
CIPAC	Collaborative International Pesticides Analytical Council Limited
Corian	*Coriandrum sativum* formulation
Cura	*Curcuma longa* formulation
DAT	Day after treatment
EC	Emulsifiable concentrates
EC_{50}	Effective concentrate
EOs	Essential oils
EPA	Environmental Protection Agency
EWs	Oil in water emulsion
FAO	Food and Agriculture Organization
ha	Hectare
IPM	Integrated pest management
LC	Lethal Concentration
LD	Lethal Dose
Mentho	*Mentha longifolia* formulation
O/W	Oil in water emulsion
OD	Emulsifier
Origo	*Origanum majorana* formulation
ppm	Parts per million
Rosa	*Rosmarinus officinalis* formulation
Sagix	*Salvia officinalis* formulation abbreviations
SC	Soluble concentrate
SG	Soluble granules
SI	Emulsifier
Thymo	*Thymus vulgaries* formulation abbreviations
W/O/W	Water in oil in water multiple emulsion
WG	Wettable granules
WHO	World Health Organization
WP	Wettable powder

INTRODUCTION

Tomato plant (*Lycopersicon esculentum* L.), which belongs to family Solanaceae, is an important and profitable vegetable crop for fresh market and processing (Abdelrazig *et al.*, 2015; Kushwaha *et al.*, 2018).

In Egypt, tomato crop is the first horticultural crop, where it occupies 440200 feddan which representing 40% of the total cultivated area devoted to vegetable production, yielding 7.73 M tons. (According to the Ministry of Egyptian Agriculture, 2015). Also, FAO classified Egypt during 2017 as the 5th country around the world in tomato production; ~ 6.3% of the tomato production of the world which represent 8.3 M ton (FAOSTAT, 2017).

Tomato crops (Solanaceae), are usually attacked by a great variety of insect pests, including the tomato leafminer, *Tuta absoluta* (Meyrick). It belongs to Lepidoptera: Gelechiidae, and represents the most important pest on tomato and other Solanaceous plants (e.g. eggplant, potato, sweet pepper and tobacco) as well as on some non-cultivated Solanaceae (*Solanum nigrum* L., *S. eleagnifolium* L., *S. bonariense* L., etc.) and other host-plants (e.g. *Datura ferox* L., *D. stramonium* L. and *Nicotiana glauca* Graham). Moreover, other additional plant species have been reported as alternative hosts (e.g. Cape gooseberry (*Physalis peruviana*, *Phaseolus vulgaris, Lycium sp*. and *Malva sp*) (Caponero, 2009; Garzia, 2009). Hence, it is clear that *T. absoluta* can use various plant species as secondary hosts, notably