

**Suez Canal University  
Faculty of Agriculture  
Department of Plant Protection**



# **Toxicological and Biological Impact of Several Natural Additives on Certain Pesticides**

**By**

**Rehab Ibrahim Mohamed Hafez**

**B.Sc. Agricultural Sciences (Plant Protection), 2008**

**M. Sc. Agricultural Sciences (Pesticides), 2014**

**Faculty of Agriculture - Suez Canal University**

**THESIS**

**SUBMITTED IN PARTIAL FULFILLMENT OF**

**THE REQUIREMENTS FOR THE DEGREE OF**

**DOCTOR OF PHILOSOPHY**

**In Agricultural Sciences – Plant Protection**

**(Pesticides)**

**Department of Plant Protection – Faculty of Agriculture**

**Suez Canal University**

**2021**

## Table of contents

Subject	page
Abstract	<b>I</b>
Table of Contents	<b>III</b>
List of tables	<b>V</b>
List of figures	<b>VII</b>
List of Abbreviations	<b>IX</b>
<b>Chapter 1: Introduction</b>	<b>1</b>
<b>Chapter 2: Review of literature</b>	<b>3</b>
1- Chemical control	<b>3</b>
1-1 Insect growth regulators	<b>3</b>
1-2 Traditional chemical acaricides	<b>9</b>
1-3 Natural compounds	<b>14</b>
2- Inorganic compound	<b>24</b>
3- Chemical defense	<b>26</b>
• Antioxidant as a chemical defense	<b>31</b>
4- Gas Chromatography – Mass Spectrometry to identification of natural compounds which have biological activity	<b>38</b>
5- The two spotted spider mites TSSM	<b>40</b>
<b>Chapter 3: Material and Methods</b>	<b>45</b>
1- Chemical used	<b>45</b>
1-1 Insect growth regulators	<b>45</b>
1-2 Traditional chemical control	<b>46</b>
1-3 Boric acid	<b>47</b>
1-4 Antioxidant compounds	<b>47</b>
2- Laboratory experiment	<b>49</b>
2-1 Extraction of natural compound	<b>49</b>
2-2 The plant extract at different pH level of polar solvent	<b>51</b>

	2-3-Maintenance of the colony of two spotted spider mites.	<b>53</b>
	3- Evaluation of the efficacy of tested acaricides on two spotted spider mites.	<b>54</b>
	4- Determination of total phenolic compound contents in eggplant leaves.	<b>54</b>
	5- Identification of natural compound by using GC-MS	<b>55</b>
	4- Field Study	<b>54</b>
	5- Statical analysis	<b>55</b>
<b>Chapter 4: Results and Discussions</b>		<b>59</b>
<b>Chapter 5: Conclusion</b>		<b>118</b>
<b>Chapter 6: Summary</b>		<b>120</b>
<b>Chapter 6: Reference</b>		<b>127</b>
Arabic summary		<b>١</b>

## List of table

Table No.	Title	Page No.
1	Toxicity of certain acaricides to adult females of the two spotted spider mite <i>T. urticae</i>	61
2	Regression equation of certain tested pesticides against <i>T. urticae</i>	62
3	Toxicity of lufenuron insecticides to adult females of <i>T. urticae</i>	64
4	Regression equation of certain tested pesticide against <i>T. urticae</i>	64
5	Effect of boric acid on adult female of <i>T. urticae</i>	67
6	Regression equation of boric acid against <i>T. urticae</i>	67
7	Effect of methanol extract of moringa seeds on <i>T. urticae</i>	71
8	Regression equation of moringa methanol extract against <i>T. urticae</i>	71
9	Effect of lectin Petroleum ether extract of moringa seeds on <i>T. urticae</i>	73
10	Regression equation of petroleum ether extract against <i>T. urticae</i>	73
11	Effect of extract <i>N. oleander</i> by methanol solvent on <i>T. urticae</i> .	77
12	Regression equation of methanol extract of <i>N. oleander</i> against <i>T. urticae</i>	77
13	Effect of extract <i>N. oleander</i> leaves by petroleum ether solvent on <i>T. urticae</i>	78
14	Regression equation of petroleum ether extract of <i>N. oleander</i> against <i>T. urticae</i>	78
15	Effect of <i>M. oleifera</i> distilled water extract with different value of pH on <i>T. urticae</i> ..	80
16	<i>Effect of different antioxidants on the average of T. urticae</i>	83

	<i>(moving stages) /nch<sup>3</sup> on eggplant under field conditions and it's percent reduction.</i>	
17	Value of total phenol in the leaves of eggplant after 3, 7, 14, 21 and 28 days :( mg/100g).	86
18	Relations between reduction percentages of mites and value of total phenol in leaves of eggplant.	86
19	Reduction percentage of mites after treatments with abamectin only and abamectin with three kinds of antioxidants	91
20	Comparison between reduction percentages of mites of used antioxidants only and used it with abamectin.	91
21	Chemical constituents of <i>M. oleifera</i> methanol extract at pH 4 by using GC/MS technique	99
22	Chemical constituents of <i>M. oleifera</i> methanol extract at pH 7 by using GC/MS technique	103
23	Chemical constituents of <i>M. oleifera</i> methanol extract at pH 9 by using GC/MS technique	111
24	The most chemical constitutes of <i>M. oleifera</i> seeds by using GC/MS technique	117

## List of Figures

<b>Figure</b>	<b>page</b>
<b>Figure (1):</b> Dosage mortality line for different pesticides against <i>T. urticae</i>	<b>62</b>
<b>Figure (2):</b> Dosage mortality line for lufenuron against <i>T. urticae</i>	<b>65</b>
<b>Figure (3):</b> Dosage mortality line for boric acid against <i>T. urticae</i>	<b>67</b>
<b>Figure (4):</b> Mortality percentages of mites by methanol extract at different concentration	<b>72</b>
<b>Figure (5):</b> Dosage mortality line for moringa methanol extract against <i>T. urticae</i>	<b>72</b>
<b>Figure (6):</b> Mortality percentage of mites by petroleum ether extract at different concentration	<b>74</b>
<b>Figure (7):</b> Dosage mortality line for petroleum ether extract against <i>T. urticae</i>	<b>74</b>
<b>Figure (8):</b> Dosage mortality line for methanol extract of <i>N. oleander</i> against <i>T. urticae</i>	<b>77</b>
<b>Figure (9):</b> Dosage mortality line for petroleum ether extract of <i>N. oleander</i> against <i>T. urticae</i>	<b>78</b>
<b>Figure (10):</b> Dosage mortality line for different values of pH with distilled water against <i>T. urticae</i> .	<b>80</b>
<b>Figure (11):</b> Reduction percentages of <i>T. urticae</i> after treatment by different antioxidant on eggplant under field condition.	<b>83</b>

<b>Figure (12):</b> Value of total phenol in eggplant leaves after treatment with antioxidants	<b>87</b>
<b>Figure (13):</b> GC/MS chromatogram of <i>M. oleifera</i> methanolic seed extract at pH (4)	<b>102</b>
<b>Figure (14):</b> GC/MS chromatogram of <i>M. oleifera</i> methanolic seed extract at pH (7)	<b>110</b>
<b>Figure (15):</b> GC/MS chromatogram of <i>M. oleifera</i> methanolic seed extract at pH (9)	<b>115</b>

## List of Abbreviations

<b>TSSM</b>	Two spotted spider mites
<b>AchE</b>	Acetyl cholinesterase
<b>EPA</b>	Environmental Protection Agency
<b>IGR</b>	Insect Growth regulator
<b>H.A</b>	Humic acids
<b>A.A</b>	Ascorbic acids
<b>S.A</b>	Salsylic acids
<b>GC- MS</b>	Gas chromatography–mass spectrometry
<b>GABA</b>	$\gamma$ amino butyric acid
<b>pH</b>	Potential of hydrogen



# Abstract

The efficacy of tested acaricides was studied on the two spotted spider mites *Tetranychus urticae*. The results showed that methomyl was the most toxic compound, while abamectin had the lowest effect. Lufenuron compound had a latent effect on *T. urticae* and the most effect was after 5 days of treatment at LC<sub>50</sub> (1.54 ppm). In organic compound, boric acid had its effect after 7 days of treatment so it has a latent effect on mites. Results of effect of natural additives of plant extract showed that extraction of *M. oleifera* seeds showed that it has the most effect on adult female of *T. urticae* after 5 days of treatment, while results of extraction of *N. oleander* leaves had a lowest effect on mites. Because of Moringa has the most efficacy so studying the effect of extraction at different values of pH, results showed that the alkaline had the most effect at LC<sub>50</sub> level. Under field conditions, antioxidants have an effect on eggplant. It was observed that both of humic acids and ascorbic acid have a high reduction percentages after 28 days of treatment (91 %). Antioxidants play an important role in total phenol on leaves of plant, using spectrophotometer to measure the amount of total phenol in leaves, data showed that at treatment of salicylic acid and ascorbic acid values was increase. Determination the major chemicals constitute of moringa seeds at different values of pH by using GC/MS, we found that the most important compound are oleic acid, Hexadeconic acid, 1-amino-2, 6 dimethyl piperidine , Furanol , 1,2-benzenedicarboxylic acid and octadeconic acid.