

## ESTIMATED LEVEL OF SUSCEPTIBILITY OF *TETRANYCHUS URTICAE* KOCH ECOTYPES TO CERTAIN PESTICIDES

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### Abstract

Susceptibility of two strains of the two-spotted spider mite to different pesticides was investigated. The results revealed that Kafr El-Sheikh and El-Gharbiya field strains showed different degrees between vigor tolerance to some compounds such as commite and kelthan with RR 6.33, 5.83, 3.39 and 3.21 folds to susceptibility such as micronized sulphur and volck oil. For kelthan, it appears that adding volck oil decreased  $Lc_{50}$  value from 190 to 140ppm, while adding ridomil decreased  $Lc_{50}$  from 190 to 150ppm for Kafr El-Sheikh strain, while no changes were happened for El-Gharbiya strain. Volck oil caused inhibition to comite by increasing its  $Lc_{50}$  from 760 to 800 and from 700 to 720ppm for Kafr El-Sheikh and El-Gharbiya strains. On the other hand, ridomil showed reverse effect for Kafr El-Sheikh and demonstrates nil effect for El-Gharbiya strain. Combination between cymbush and volck oil combined effect became more strong; the  $Lc_{50}$  was decreased from 110 to 90 and from 115 to 90ppm for Kafr El-Sheikh and El-Gharbiya field strains. The combined effect of volck oil and kindo was extremely low and the corresponding  $Lc_{50}$  was decreased from 55.00 to 54.00 and from 50 to 43ppm for Kafr El-Sheikh and El-Gharbiya strains. The  $Lc_{50}$  values were decreased from 230 to 210 and 270 ppm for both volck oil and ridomil when mixed together with marshal, for Kafr El-Sheikh. When adding volck oil or ridomil to micronized sulphur  $Lc_{50}$  was increased from 7000ppm to 16000 and 13000ppm and from 9000 to 17500 and 10000ppm for Kafr El-Sheikh and El-Gharbiya strains, respectively.

### INTRODUCTION

The problem of resistance mechanism in tetranychid mites to recommended acaricides applied on soybean plants is of great importance. The two-spotted spider mite, *Tetranychus urticae* Koch is considered a key pest infesting soybean plants, it was of a great interest to test the mites for the built of resistance. Soybean plants are attracted with many other insect pests in addition to the target phytophagous mite. Many attempts were carried out to keep the population density of this pest below the

damage threshold level. The separate and the combined effects of pesticides were evaluated by several researchers (Ahn *et al.*, 1993; Hall and Thacker, 1993; Cho *et al.*, 1995; Stark *et al.*, 1997; Herron *et al.*, 1998). The experimental fields were among the selected fields for soybean. Samples were taken from Kafr El-Sheikh and El-Gharbiya Governorates and cultured in the laboratory.

## MATERIALS AND METHODS

**Rearing technique :** Samples of soybean leaves severely infested with *Tetranychus urticae* were taken from Basion region, El-Gharbiya and Sakha Agricultural Research Station farm, Kafr El-sheikh and carefully examined at the acarology laboratory. Sweet potato cuttings, 20 cm. long were put in glass jars of 250 cc. filled with tap water. Adult females collected from infested soybean leaves were transferred to the newly growing cutting leaves by means of three zero brushes. Infested sweet potato leaves and tap water were changed as necessary. The rearing colonies were maintained for about one month.

Petri-dishes (9 cm. in diameter) were filled with cotton-wool, saturated with water and then covered with tissue papers. Four discs each of 2.5 cm. in diameter of sweet potato leaves, were carefully washed, dried and placed upside down on the tissue papers in each dish.

A thin film of water was left around the edge of the leaf disc and acting as a barrier to prevent escaping of the mite survivors. The cotton pad was moistened daily and twenty five adult females similar in shape, colour and size were distributed on each disc. These discs were dipped in the pesticide solution for five seconds, then the dishes were put in an incubator at  $25 \pm 2^{\circ}\text{C}$  and  $70 \pm 5\%$  R. H.

This procedure was replicated four times for each concentration of each tested pesticide used. Untreated 4 discs (check treatment) for each experiment were dipped only in tap water. The following pesticides were used:

1. Kelthan 18.5%: 2,2,2- trichloro-1,1-bis (4- chlorophenyl) ethanol.
2. Commite 73%: 2(4-(1,1 dimethylphenoxy) cyclohexyl 2- propynyl sulfite.
3. Cymbush 10%: (Rs)-a-cyano-3- phenoxybenzyl) (1Rs)-(cis)trans-3-(2,2- dichlorove-nyl)-2,2 dimethylcyclopropanecarboxylate.

4. Kindo 5%: R- $\alpha$ -cyno-3-phenoxybenzyl (2)-(1s) bis-3-(2-chlor-3,3,3-Trifinopropenyl) - 2,2-dimethylchloropa necarboxylate.
5. Marshal 25%: 2,3-dihydro-2,2-dimethyl-7-benzofurnyl (dibutylaminothio- methylcarbamate).
6. Ridomil 50%: Methyl-N- (2- methyl acetyl)-N- (2,6xylyl)-DI-alaninate.
7. Micronized sulphur 70% W.P.(Fungicide).
8. Volck oil 82% (Insecticide).

Five different serial concentrations for each pesticide were prepared from the formulated material by diluting it with tap water. Mortality counts were carried out 24 h. after treatment. The data obtained were corrected in relation to the control mortality according to **Abbott's formula (1925)**. The efficacy of different toxicants was determined according to **Sun (1950)**. To evaluate percentages of mortality in the field experiments, **Henderson and Tilton (1955)**, formula was adopted.

## RESULTS AND DISCUSSION

**Pesticides applied alone:** The results presented in Tables 1&2 revealed that all tested pesticides affected strongly adult females of the two-spotted spider mite, *T. urticae* with variable degrees. The strains of Kafr El-Sheikh and El-Gharbiya were considered as vigor's tolerant to the acaricide commite with RR 6.33 and 5.83 folds, respectively, but both strains acquired moderate tolerance to kelthan with RR 3.39 and 3.21 folds, respectively. Kafr El-Sheikh strain had more homogeneity than El-Gharbiya strain with slope levels of 1.64 and 1.52.

The Pyrethriods cymbush and kindo, which are not specific acaricides, showed also moderate effect against this pest with RR 3.06 & 2.89 folds for Kafr E-Sheikh strain and 3.19 & 2.63 folds for El-Gharbiya strain.

In general, it is obvious that Kafr El-Sheikh strain seems to be more tolerant than El-Gharbiya strain.

In respect to the carbamate compound marshal, which appeared to be specific to the two-spotted spider mite, it gave equal mortality against both strains, but El-Gharbiya strain was less homogenous as compared with Kafr El-Sheikh strain with slope

values of 1.59 and 1.70, respectively.

As regards the interval ovicide compound micronized sulphur, data stated that this pesticide demonstrates high specificity rates against eggs and contrasts appeared to be weak against other mobile stages. This compound demonstrates the highest  $Lc_{50}$  (7000 and 9000ppm) and the lowest slope values (0.90 and 0.95) for both Kafr El-Sheikh and El-Gharbiya strains, respectively.

It appears that mechanical effect of volck oil results from establishing a film around unmobile spider mite stages. For the active stages, results obtained were equal with  $Lc_{50}$  800, 880ppm and slope values 1.33 and 1.59 for Kafr El-Sheikh and El-Gharbiya strains, respectively. The results obtained revealed that El-Gharbiya strain was more homogenous than Kafr El-Sheikh strain.

The effect of ridomil was also tested in the present study on the two-spotted spider mite, *T. urticae* females. The data yielded slight effect as the  $Lc_{50}$  values for Kafr El-Sheikh (1250) and El-Gharbiya (2300ppm) were obtained.

Table 1. Effect of certain pesticides against adult females of *T. urticae* Kafr El-Sheikh Eco-types

Treatments	$Lc_{50}$ value ppm	Slope value	Upper limit	Lower limit	RR	Susceptible strain
Kelthan 18.5%	190	1.64	236.55	152.61	3.39	56
Commite 73%	760	1.52	969.76	595.61	6.33	120
Cymbush 10%	110	1.47	142.45	84.94	3.06	36
Kindo 5%	55	1.39	69.85	43.31	2.89	19
Marshal 25%	230	1.59	287.50	184.00	2.09	110
Micronized sulphur 70%	7000	0.90	8800.00	4654.54	1.91	3660
Volck oil 82%	800	1.33	1052.00	608.37	1.63	490
Ridomil 50%	1250	1.00	1862.50	838.93	2.09	598

### Comibnation of Pesticides

**1. Kelthan and its combinations:** The results obtained in Table 3 revealed different degrees of susceptibility of the adult females when exposed to kelthan and its mixtures with volck oil or ridomil. Kafr El-Sheikh strain exhibited more tolerance to kelthan alone followed by El-Gharbiya strain with  $Lc_{50}$  values of 190 and 180 ppm., with resistance ratio of 3.39 and 3.21 folds, respectively. The slope values were 1.64 and

1.54. This means that Kafr El-Sheikh strain was more homogenous to Kelthan than El-Gharbiya strain.

Table 2. Effect of certain pesticides against adult females of *T. urticae* El-Gharbiya Eco-types

Treatments	LC <sub>50</sub> value ppm	Slope value	Upper limit	Lower limit	RR	Susceptible strain
Kelthan 18.5%	180	1.54	217.62	148.88	3.21	56
Commite 73%	700	1.57	850.50	576.13	5.83	120
Cymbush 10%	115	1.57	143.29	92.29	3.19	36
Kindo 5%	50	1.58	61.90	40.38	2.63	19
Marshal 25%	230	1.70	271.40	194.92	2.09	110
Micronized sulphur 70%	9000	0.95	12132.00	6676.55	2.46	3660
Volck oil 82%	880	1.59	1139.96	679.54	1.80	490
Ridomil 50%	2300	0.80	3854.80	1372.32	3.85	598

Table 3. Separate and combined effect of kelthan with ridomil or volck oil against *T. urticae* Kafr El-Sheikh and El-Gharbiya Eco-types

Governorate	Treatments	LC <sub>50</sub> value ppm	Slope value	Confidence limit's FLC <sub>50</sub>		Resistance ratio	Susceptibility strain LC <sub>50</sub> ppm
				Upper	Lower		
				Kafr El-Sheikh	Kelthan 18.50%		
Kafr El-Sheikh	Kelthan+ Ridomil	150	1.14	214.05	105.12	3.49	43
Kafr El-Sheikh	Kelthan+ Volck oil	140	1.64	172.20	113.82	3.33	42
El-Gharbiya	Kelthan 18.50%	180	1.54	217.62	148.88	3.21	56
El-Gharbiya	Kelthan+ Ridomil	200	1.92	239.20	167.22	4.65	43
El-Gharbiya	Kelthan+ Volck oil	180	1.12	233.82	138.57	4.29	42

With respect of the mixture (kelthan + ridomil), it was found that effectiveness of kelthan increased for Kafer El-Sheikh strain, while the reverse effect was obtained

for El-Gharbiya strain with  $Lc_{50}$  values of 150 and 200ppm, respectively. The slope values revealed that El-Gharbiya strain was more homogenous than Kafr El-Sheikh strain with slope values of 1.92 and 1.14, respectively.

As regards kelthan combined with volck oil, it showed that Kafr El-Sheikh strain became more susceptible than El-Gharbiya strain with  $Lc_{50}$  values of 140 and 180ppm, respectively, but Kafr El-Sheikh strain became more homogenous than El-Gharbiya strain with slope values of 1.64 and 1.12, respectively.

It could be concluded that adding ridomil to kelthan in El-Gharbiya Governorate decreased the effectiveness of this compound with RR 4.65 folds as compared with kelthan alone (3.39), while adding volck oil caused increase in susceptibility of Kafr El-Sheikh strain to kelthan than others.

**2. Commite and its combinations:** Data presented in table 4 clearly show that the tolerance level varies among the established strains as compared with the standard one and could be summarized as follows:

- a. Kafr El-Sheikh strain seems to be more tolerant (RR 6.33) to commite alone than El-Gharbiya strain (5.83 folds).
- b. El-Gharbiya strain was more homogenous (1.57) than Kafr El-Sheikh (1.52).
- c. For commite/ridomil mixture, the results indicate that Kafr El-Sheikh ( $Lc_{50}$  660) strain tend to be more susceptible than El-Gharbiya strain ( $Lc_{50}$  700ppm), the two strains appear to be more homogenous with slope value of 1.75 as compared with the effect of commite alone.
- d. As for commite/volck oil mixture, the results revealed increasing  $Lc_{50}$  for Kafr El-Sheikh mite strain (800ppm) and accordingly more RR than others (5.33) and less homogeneity (slope value 1.69) were obtained. For El-Gharbiya strain, the effect of the mixture was more tolerant than others (720ppm), RR (4.80) and slope value (1.69) lie less than commite/ridomil for El-Gharbiya mite strain.

From these results, it could be concluded however, that mixed volck oil with commite caused decreasing in its effectiveness as compared with the separate effect of commite alone and also, in the mean time less than mixing the compound with ridomil, which positively increases its effectiveness.

Table 4. Separate and combined effect of commite with ridomil or volck oil against Kafr El-Sheikh and El-Gharbiya *T. urticae* Eco-types

Governorate	Treatments	Lc <sub>50</sub> value ppm	Slope value	Confidence limit's FLc <sub>50</sub>		Resistance ratio	Susceptibility strain Lc <sub>50</sub> ppm
				Upper	Lower		
				Kafr El-Sheikh	Commite 73%		
Kafr El-Sheikh	Commite+ Ridomil	660	1.75	817.74	532.68	6.00	110
Kafr El-Sheikh	Commite+ Volck oil	800	1.69	1014.40	630.91	5.33	150
El-Gharbiya	Commite 73%	700	1.57	850.50	576.13	5.83	120
El-Gharbiya	Commite+ Ridomil	700	1.75	875.00	560.00	6.36	110
El-Gharbiya	Commite+ Volck oil	720	1.69	874.80	592.59	4.80	150

**3. Cymbush and its combinations:** Data in table 5 reveal that Kafr El-Sheikh mite strain to cymbush was more sensitive than El-Gharbiya strain, hence the Lc<sub>50</sub> was 110 and 115ppm and the resistant rates were 3.06 and 3.19 folds, respectively.

Also, the results showed that Kafr El-Sheikh strain was more heterogenous than El-Gharbiya strain with slope values of 1.47 and 1.56, respectively. When ridomil added to cymbush in Kafr El-Sheikh Governorate it caused inhibition to the compound, meanwhile it caused increasing in its efficacy for El-Gharbiya strain with Lc<sub>50</sub> of 150 and 100ppm, respectively as compared with cymbush alone. Adding volck oil to cymbush in both Governorates concurred both strains to become more sensitive as compared with the separate effect of cymbush alone.

In general, it could be concluded that the combined effect of volck oil and cymbush caused increasing trend in its effectiveness as general, while the effect of adding ridomil depend on the region which is used in.

Table 5. Separate and combined effect of cymbush with ridomil or volck oil against Kafr El-Sheikh and El-Gharbiya Eco-strain *T. urticae*

Governorate	Treatments	LC <sub>50</sub> value ppm	Slope value	Confidence limit's		Resistance ratio	Susceptibility strain LC <sub>50</sub> ppm
				FLC <sub>50</sub>			
				Upper	Lower		
Kafr El-Sheikh	Cymbush 10%	110	1.47	142.45	84.94	3.06	36
Kafr El-Sheikh	Cymbush+ Ridomil	150	1.54	190.35	118.35	3.33	45
Kafr El-Sheikh	Cymbush+ Volck oil	90	1.62	112.95	71.71	3.33	27
El-Gharbiya	Cymbush 10%	115	1.56	143.29	92.29	3.19	36
El-Gharbiya	Cymbush+ Ridomil	100	1.55	128.00	78.13	2.22	45
El-Gharbiya	Cymbush+ Volck oil	90	1.59	108.90	74.38	3.33	27

**4. Kindo and its mixtures:** Examination of mortality regression lines in Table 6 for Kafr El-Sheikh and Gharbia mite strains exposed to kindo alone and in combination with volck oil or ridomil, revealed that LC<sub>50</sub> value of kindo demonstrates the same value with no change after adding either volck oil or ridomil, but with slight exception for kindo/volck oil at El-Gharbia which increased its effectiveness by decreasing the LC<sub>50</sub> value (43ppm) as compared with kindo alone (50ppm).

The results emphasizes that Kafr El-Sheikh mite strain was more tolerant to the compound and its mixtures than El-Gharbiya strain. The homogeneity of the two mite strains increased after adding volck oil or ridomil with exception of the mortality effect of kindo/ridomil for El-Gharbiya Eco-strain of *T. urticae*.

**5. Marshal and its mixtures:** Data tabulated in Table 7 reveal that LC<sub>50</sub> values were the same for both strains of Kafr El-Sheikh and El-Gharbiya (230ppm), while the effect differed greatly upon adding ridomil compound which caused inhibition in the efficacy of marshal by increasing the LC<sub>50</sub> values from 230 to 270ppm, thus increased the slope value from 1.59 to 2.22 for Kafr El-Sheikh strain. For El-Gharbiya mite strain,



it appears that adding ridomil increased the mortality by decreasing the  $Lc_{50}$  from 230 to 220ppm and also decreased the homogeneity of individuals from 1.70 to 1.59 (slope values).

Table 6. Separate and combined effect of kindo with ridomil or volck oil against Kafr El-Sheikh and El-Gharbiya Eco-strain of *T. urticae*.

Governorate	Treatments	$Lc_{50}$ value ppm	Slope value	Confidence limit's		Resistance ratio	Susceptibility strain $Lc_{50}$ ppm
				$FLc_{50}$			
				Upper	Lower		
Kafr El-Sheikh	Kindo 5%	55	1.39	69.85	43.31	2.89	19
Kafr El-Sheikh	Kindo+Ridomil	55	1.65	69.08	43.79	2.62	21
Kafr El-Sheikh	Kindo +Volck oil	54	1.73	67.50	43.20	3.38	16
El-Gharbiya	Kindo 5%	50	1.58	61.90	40.38	2.63	19
El-Gharbiya	Kindo+Ridomil	50	1.49	63.75	39.22	2.38	21
El-Gharbiya	Kindo +Volck oil	43	1.76	51.07	34.54	2.69	16

On the other hand, upon adding volck oil to marshal, it gave more activity than marshal alone with  $Lc_{50}$  values of 210 and 230ppm, respectively, (Kafr El-Sheikh strain); meanwhile, significant changes in tolerance were obtained for El-Gharbiya strain upon adding volck oil to marshal ( $Lc_{50}$  230ppm & slope value 1.70), Table 7.

From these results, it could be concluded collectively that the effect of ridomil, marshal and volck oil differ greatly from an ecosystem to another.

**6. Micronized sulphur:** The results of the laboratory experiments expressed as  $Lc_{50}$  levels are shown in Table 8. For all micronized sulphur alone and its mixtures, the combined micronized sulphur/volck oil effect was more tolerated than others followed by micronized sulphur/ridomil and finally micronized sulphur alone, with  $Lc_{50}$  levels of 17500, 16000, 13000, 10000, 9000 and 7000ppm, respectively.

Table 7. Separate and combined effect of marshal with ridomil or volck oil against Kafr El-Sheikh and El-Gharbiya Eco-strain of *T. urticae*.

Governorate	Treatments	LC <sub>50</sub> value ppm	Slope value	Confidence limit's		Resistance ratio	Susceptibility strain LC <sub>50</sub> ppm
				FLC <sub>50</sub>			
				Upper	Lower		
Kafr El-Sheikh	Marshal 25%	230	1.59	287.50	184.00	2.09	110
Kafr El-Sheikh	Marshal+ Ridomil	270	2.22	316.98	229.98	2.45	110
Kafr El-Sheikh	Marshal+ Volck oil	210	1.76	262.08	160.27	1.68	125
El-Gharbiya	Marshal 25%	230	1.70	217.40	194.92	2.09	110
El-Gharbiya	Marshal+ Ridomil	220	1.59	274.78	176.14	2.00	110
El-Gharbiya	Marshal+ Volck oil	230	1.70	277.15	190.87	1.84	125

The obtained results clearly revealed that Kafr El-Sheikh mite strain exhibited more susceptible level than El-Gharbiya mite strain.

It was noticed that the effect of volck oil dominated ridomil upon adding to micronized sulphur and demonstrated higher slope values (1.75 and 1.13) than ridomil (1.14 and 0.87) for Kafr El-Sheikh and El-Gharbiya strains, respectively.

**7. Volck oil and Ridomil:** The obtained data in Table 9 showed that El-Gharbiya mite Eco-strain underwent high tolerance levels against ridomil alone with LC<sub>50</sub> of 2300ppm. The least value was obtained when ridomil/volck oil was used for El-Gharbiya mite strain, other mixtures ranked between these two levels; LC<sub>50</sub> levels were arranged in descending order as follows: 950, 880, 800 and 750ppm for ridomil/volck oil for Kafr El-Sheikh strain, volck oil for El-Gharbiya strain, volck oil for Kafr El-Sheikh strain and ridomil/volck oil for El-Gharbiya strain, respectively.

It is obvious that both strains were more susceptible to volck oil than ridomil with LC<sub>50</sub> values 800 and 880ppm for Kafr El-Sheikh and El-Gharbiya strains as compared with LC<sub>50</sub> 2300 and 1250ppm for ridomil for Kafr El-Sheikh strain and El-Gharbiya

mite strain. For Kafr El-Sheikh strain, volck oil/ridomil demonstrates increasing trend in susceptibility mechanism. For ridomil inhibition in effectiveness values for volck oil, in El-Gharbiya strain, the mixture had more sensitivity than volck oil and ridomil expressed  $LC_{50}$  levels of 750, 880 and 2300ppm, respectively.

Table 8. Separate and combined effect of micronized sulphur with ridomil or volck oil against Kafr El-Sheikh and El-Gharbiya Eco-strain of *T. urticae*.

Governorate	Treatments	$LC_{50}$ value ppm	Slope value	Confidence limit's $FLC_{50}$		Resistance ratio	Susceptibility strain $LC_{50}$ ppm
				Upper	Lower		
Kafr El-Sheikh	Micronized sulphur70%	7000	0.90	8800.00	4654.54	1.91	3660
Kafr El-Sheikh	Micronized sulphur + Ridomil	13000	1.14	21580.00	7831.33	2.10	6200
Kafr El-Sheikh	Micronized sulphur +Volck oil	16000	1.75	20160.00	12698.41	2.71	5900
El-Gharbiya	Micronized sulphur70%	9000	0.95	1232.00	6676.55	2.46	3660
El-Gharbiya	Micronized sulphur +Ridomil	10000	0.87	14100.00	7092.20	1.61	6200
El-Gharbiya	Micronized sulphur +Volck oil	17500	1.13	22225.00	13779.53	2.97	5900

It could be obviously noticed that when both strains were treated with volck oil, the effect was quite homogenous for volck oil which is considered better than ridomil. The slope values was arranged in the following pattern: 1.59,1.33,1.00 and 0.80. Meanwhile, mixing volck oil with ridomil increased slope values over all (1.54) for Kafr El-Sheikh. In the mean time, the slope values in El-Gharbiya strain was 1.26 exceeding that of ridomil (0.80), but still less than that of volck oil (1.59). From the results, it could be concluded that volck oil was more active and specific than ridomil as it expressed  $LC_{50}$  of 800 and 880ppm lie less than ridomil which demonstrates  $LC_{50}$  of 2300 and 1250ppm.

Table 9. Separate and combined effect of ridomil and volck oil against Kafr El-Sheikh and El-Gharbiya Eco-strain of *T. urticae*.

Governorate	Treatments	LC <sub>50</sub> value ppm	Slope value	Confidence limit's		Resistance ratio	Susceptibility strain LC <sub>50</sub> ppm
				FLC <sub>50</sub>			
				Upper	Lower		
Kafr El-Sheikh	Ridomil 50%	1250	1.00	1826.50	838.93	2.09	598
Kafr El-Sheikh	Volck oil 82%	800	1.33	1052.00	608.37	1.63	490
Kafr El-Sheikh	Ridomil+ Volck oil	950	1.54	1180.85	764.28	1.86	510
El-Gharbiya	Ridomil 50%	2300	0.80	3854.80	1372.32	3.85	598
El-Gharbiya	Volck oil 82%	880	1.59	1139.96	679.54	1.80	490
El-Gharbiya	Ridomil+ Volck oil	750	1.26	1004.25	560.12	1.47	510

Finally, the over going results could be summarized in the following:

- Both strains appeared more tolerant to commite and kelthan as specific compounds with different degrees as compared with susceptible strain.
- Mixed compounds, volck oil or ridomil converted the strain in most cases to more susceptible. For synthetic pyrethroids cymbush and kindo, both strains showed moderate tolerance trend, but in the mean time less than specific compounds. Marshal (carbamate compound) when added to ridomil demonstrated inhibition effect. Micronized sulphur is considered as an ovicide, hence its effect against mobile stages was still insignificant. It is a well known fact that volck oil is one of the compounds which its mechanical effect is quite minimal on mobile stages of the target pest.

The above mentioned results were in agreement with **Labanowska and Tkaczuk (1991)** and **Botha et al. (1994)**, whom found that applied several compounds from several groups alone or in combinations gave different results against *Tetranychus spp.* Under laboratory condition in some cases, the mixed compounds produced results better than used alone and in another case, the reverse results were obtained.

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## تقدير مستوى حساسية الحلم العنكبوتي ذو البقعتين *TETRANYCHUS URTICAE KOCH* للمركبات الكيماوية المختلفة

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أوضحت النتائج أن سلالتي محافظتي كفر الشيخ والغربية قد أظهرتا درجات مختلفة بين درجة التحمل العالية لكل من الكوميت والكالئين بمستوى مقاومة ٦,٢٢ و ٥,٨٣ و ٣,٣٩ و ٣,٢١ مره إلى مستوى حساسية لكل من الكبريت الميكروني وزيت الفولك.

عند إضافة زيت الفولك للكالئين انخفض التركيز المميت لـ ٥٠٪ من ١٩٠ إلى ١٤٠ جزء في المليون بينما إضافة الريدوميل خفض التركيز المميت لـ ٥٠٪ من ١٩٠ إلى ١٥٠ جزء في المليون بالنسبة لسلالة كفر الشيخ، وفي نفس الوقت لم يحدث أي تغيير في سلالة الغربية. خلط زيت الفولك مع الكوميت أحدث تثبيط للمركب وازداد التركيز المميت لـ ٥٠٪ من ٧٦٠ إلى ٨٠٠ ومن ٧٠٠ إلى ٧٢٠ جزء في المليون لكل من سلالتي كفر الشيخ والغربية بينما أعطى خلط الريدوميل تأثيراً عكسياً على سلالة كفر الشيخ ولم يعطي أي تأثير بالزيادة أو النقصان بسلالة الغربية.

وجد أن تأثير المبيد الحشري سيمبوش أصبح أقوى عندما أضيف إليه زيت الفولك حيث انخفض التركيز المميت لـ ٥٠٪ من ١١٠ إلى ٩٠، من ١١٥ إلى ٩٠ جزء في المليون بالنسبة لسلالتي كفر الشيخ والغربية. بينما عند خلط الريدوميل مع السيمبوش حدث تثبيط للمخلوط بالنسبة لسلالة كفر الشيخ.

على العكس فان تأثير مخلوط زيت الفولك مع الكيندو كان ضعيفاً حيث أدى إلى نقص التركيز المميت لـ ٥٠٪ من ٥٥ إلى ٥٤، ومن ٥٠ إلى ٤٣ جزء في المليون بالنسبة لسلالتي كفر الشيخ والغربية، وأيضاً وجد أن الريدوميل لم يعطي أي تأثير عند خلطه مع الكيندو. قل التركيز المميت لـ ٥٠٪ من ٢٣٠ إلى ٢١٠، جزء في المليون لكل من زيت الفولك والريدوميل عند خلطهما بمركب المارشال وذلك لسلالة كفر الشيخ وفي نفس الوقت لم يحدث أي تغيير بالنسبة لسلالة الغربية ماعدا في حالة الريدوميل.

عند إضافة زيت الفولك والريدوميل إلى الكبريت الميكروني سبب تثبيطاً في فعالية الكبريت الميكروني حيث ارتفع التركيز المميت لـ ٥٠٪ من ٧٠٠٠ إلى ١٦٠٠٠ و ١٣٠٠٠ جزء في المليون ومن ٩٠٠٠ إلى ١٧٥٠٠ و ١٠٠٠٠ جزء في المليون لسلالتي كفر الشيخ والغربية. وجد أن إضافة زيت الفولك إلى الريدوميل أنتجا مخلوطاً ذو فعالية أعلى من أي منهما عند استخدامهما منفردين.