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EFFICIENCY OF SOME ALTERNATIVE INSECTICICEDS ON THE WHITE PEACH SCALE, *Pseudaulacaspis pentagona* (HEMIPTERA: DIASPIDIDAE).

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ABSTRACT

The present work was conducted to evaluate the efficiency of some alternative insecticides on the nymph and adult female populations of *P. pentagona* under laboratory and field conditions.

Two groups of alternative insecticides were evaluated, these groups were Mineral oils (Misrona oil 85% mayonnaise & Alboleum oil 80% mayonnaise were used at rate of 2.5 %.) and Neem extracts (Neemix 4.5 % EC & Trilogy 90 % EC were used at rate of 1% and 1.5 %, respectively). One Organophosphorus insecticide (Fenitrothion 50 % EC at rate of 0.15%) was used as control measure for the two alternative groups.

Laboratory bioassays of the tested alternative groups were carried out under laboratory conditions, by dipping the infested branches in the solution of each tested compound where the field evaluations were carried out in peach orchard at Qalubiya Governorate by spraying the tested alternative compounds with motor sprayer (Kobota).

The obtained results showed that, the toxicity of the alternative insecticides on the white peach scale, *P. pentagona* were varied under laboratory conditions. The highest toxicity of the tested compounds on the nymphal stage according to their LC_{50} were fenitrothion (0.183%) followed by Neemix (0.357%). Mineral oils came in the 3rd order [Misrona oil (0.844%) & Alboleum oil (0.924%)] whereas Trilogy came in the last order (1.027%). The toxicity of the tested compounds on the adult female populations had the same trend, the highest toxic compounds were fenitrothion (0.226%) followed by Neemix (0.709%). Mineral oils came in the 3rd order [Misrona oil (1.368%) & Alboleum oil (1.388%)] and Trilogy came in the last order (2.310%).

The efficiency of the tested alternative insecticides under field conditions after five weeks of application showed that, Mineral oils were more effective on *P. pentagona* populations, they reduced the insect populations to 89% (Misrona oil) and 88.3% (Alboleum oil), whereas Neem extracts were less effective on the insect populations 66.4% (Neemix) and 57 % (Trilogy), respectively. Fenitrothion had a moderate effect on the insect populations (79.3%).

The obtained results proved that, the Mineral oils are highly efficient as alternative insecticides for controlling the white peach scale, *P. pentagona* compared with Neem extracts. So, it prefers to use the Mineral oils for controlling the scale insects in IPM program and more studies should be carried on neen extracts to improve their efficiency for control insect pests to minimize the environmental pollution with pesticides.

INTRODUCTION

Peach, *Prunus persica* is economic important deciduous fruit crop in Egypt and considered as one of the popular fruits for the Egyptian peoples.

The cultivated area with peach trees in Egypt about 83703 feddans producing about 425273 tons of fruits as estimated by Ministry of Agriculture and Land Reclamation (2007).

The white peach scale, *Pseudaulacaspis pentagona* (Targ.-Tozz.) is one of the most important armored scale insect infesting peach trees in Egypt. It recorded with heavily infestations on trunk, branches and twigs of peach trees, the severe infestations of *P. pentagona* affected greatly on peach trees resulting poor crop with poor quality and quantity. Wenxian, *et al.* (2003) showed that, the different stages of *P. pentagona* causes wilting of twigs; death of branches; defoliation and considerable yield loss.

The white peach scale, *P. pentagona* has a wide range of host plants include many agricultural crops such as fruit trees; ornamental plants and field crops (Ozawa, 1994; Ghabbour & Mohammed, 1996; Paloukis & Navrozidis, 1997; Kreiter & Dijoux, 1998; Dawei, 1999 and Moharum, 2006).

Application of chemical pesticides causes serious problems such as building up of pest resistances, upsetting of natural balance and hazards to the environment. So, the present work was conducted to evaluate the efficiency of some alternative insecticides for controlling the white peach scale *P. pentagona* under laboratory and field conditions.

MATERIALS AND METHODS

Two groups of alternative insecticides were evaluated under laboratory and field conditions for controlling the white peach scale, *P. pentagona*. The evaluated groups were:

A- Mineral oils:

This group was presented with two Mineral oils compounds as follows:

1- Misrona oil 85% Mayonnaise: Formulated by Misr Company for Petroleum Egypt, used with rate of 2.5 %.

2- Alboleum oil 80% Mayonnaise: Produced by Kafr El-Zayat Company for Pesticides & Chemical, used with rate of 2.5 %.

B-Neem extracts: This group presented with two Neem extracts as follows:

1- Neemix 4.5 % EC: It produced by Thermo Trilogy Company /Nichimen, USA, used with of rate of 1.5%.

2- Trilogy 90 % EC: It produced by Thermo Trilogy Company /Nichimen, USA and used with rate of 1%

C- Organophosphorus compound: This group was presented with one insecticide compound *i.e.* Fenitrothion 50 % EC formulated by Sumitomo Company, used with rate of 0.15%. This compound was used as control measure for the two alternatives groups.

1- Toxicity of some alternative insecticides on pre-adults and adult females of *P. pentagona* under laboratory conditions:

Laboratory bioassays of the tested groups were carried out under laboratory conditions, using dipping method. Serial concentrations for each tested alternative insecticide were prepared by diluting the tested formulation of the insecticides. Samples of infested peach branches with pre-adults and adult females of *P. pentagona* were collected from the infested orchard and

transferred to the laboratory. The infested branches were examined carefully and 50 branches were selected for each concentration (10 branches/5 rep.). The selected branches were dipped into each insecticide solution for 30 seconds and the control branches dipped in water only. Both treated and untreated branches left for dryness and kept in paper bags for three days. Counts of alive and dead pre-adults and adult females were carried out after three days from application. The percent of mortalities were calculated then corrected % of mortalities was calculated according to Abbot's formula (1925). Mortality curves were drawn up on probit logarithmic graph paper, then $Lc_{50`s}$, $Lc_{90`s}$ and slope were calculated. Toxicity index was calculated according to the method developed by Finney (1971).

$$Toxicity\ \text{index} = \frac{LC50\ of\ the\ most\ active\ treatment \times 100}{LC50\ of\ certain\ treatment}$$

2- Field evaluation of the tested alternative insecticides on pre-adults and adult females of *P. pentagona*

The field evaluation was carried out in January11, 2008 at Kafr Shoker, Qalubiya Governorate at mean temperature of 13±1°C and 65% R.H. The peach orchard kept away from any control measures before and during the investigation. Five treatments were applied in three replications, each replicate contain three peach trees besides other three trees were left as control (untreated check).

Spraying was accomplished by motor sprayer (Kobota) with diluted solution of 13 liters/tree. Samples of 9 branches per each treatment (3 branches X 3 replicates) were taken as index for pre-treatment counts (pre-adults and adult females) whereas the post treatment counts were recorded after 1, 2, 3, 4 and 5 weeks, respectively.

The reduction percentages were estimated according to Henderson and Tilton (1955) equation. Reduction percentages of the insect populations were transferred to arc sine before conducting analysis of variance (F test) and LSD values were used to separate the means. The statistical analysis of the present work was conducted using MSTATC computer Program.

RESULTS AND DISCUSSIONS

1-Toxicity of the tested alternative insecticides on the nymph and adult female stages of *P. pentagona* under laboratory conditions.

a- Pre-adult stage:

Data in Table (1) showed the different potencies of the five tested insecticides against the pre-adults of *P. pentagona*. Fenitrothion found to be the highly potent compound. The LC_{50} and LC_{90} values were 0.183% and 0.937%. The other tested compounds were arranged according to their $LC_{50`s}$ in descending order as follows: Fenitrothion; neemix; misrona; alboleum and trilogy. The $LC_{50`s}$ of these tested compounds were 0.183; 0.357; 0.844; 0.924 and 1.027% respectively and their toxicity indexes were 100; 51.264; 21.682; 19.805 and 17.819%, respectively. The slope value is known to be a very important feature of the regression line. It is helpful in determining the

exact reaction of population. Comparatively, low slope values indicate the heterogenic in response to the tested pesticides and have the possibility of further decrease in sensitivity after continuous uses with pesticides. The slope values in Table (1) showed that, alboleum and fenitrothion had the highest slope values *i.e.* 1.860 and 1.806, respectively while trilogy had the lowest slope value (0.985).

b- Adult females:

Data in Table (1) showed the potency of the same tested alternative insecticides on the adult females of *P. pentagona* using the same technique. Considering the LC_{50} values for the tested insecticides, fenitrothion was the most efficient compound against adult females population followed by neemix, misrona, alboleum and trilogy. The LC_{50}`s of these tested compounds were 0.226 ; 0.709 ; 1.368 ; 1.388 and 2.310% respectively and their toxicity indexes were 100 ; 31.876 ; 16.52 ; 16.282 and 9.784% respectively.

The obtained results revealed that the tested compounds gave the same efficacy against the adult females. Results in Table (1) revealed that, the pre-adults were more susceptible to the tested compounds than the adult females of *P. pentagona*. The slope values in the same Table indicated that, neemix gave the highest slope value (3.042) followed by fenitrothion (2.781). Misrona and alboleum were almost parallel (2.299 & 2.103) whereas trilogy gave the lowest slope value (1.629).

In Japan, Ozawa (1994) investigated the effectiveness of some insecticides against *P. pentagona* on the tea crop at the laboratory and field conditions, he found that buprofezin 25%W was more effective than methidathion 40%E, chloropyrifos 40E and dichlorvos. Zhao-Shixi *et al.* (1997) tested seven insecticides in laboratory against *P. pentagona* they found that the insecticidal efficacy against nymphs ranged from 79.6 to 90.2% and adult females efficacy ranged from 15.4 to 41.8%. Kwaiz (1999) found that profenofos insecticide had the superior effect against the pre-adult and adult females of *Kilifia acuminata* (Signoret) with LC_{25}, LC_{50} and LC_{90} values followed by diazinon, chlorpyrifos-methyl, Malathion, KZ oil and shokrona oil.

Table (1): Toxicity of different alternative insecticides on pre-adult and adult female populations of white peach scale, *P. pentagona* under laboratory conditions.

Treatment	LC_{50} (%)	LC_{90} (%)	Slope ± se	Confidence limit at LC_{50}		Toxicity index	
				Lower	Upper	LC_{50}	LC_{90}
	Pre-adult stage						
Fenitrothion	0.183	0.937	1.806 ± 0.074	0.085	0.295	100	100
Neemix	0.357	2.051	1.687 ± 0.08	0.323	0.390	51.264	45.69
Misrona	0.844	5.13	1.636 ± 0.069	0.509	1.102	21.682	18.27
Alboleum	0.924	5.022	1.860 ± 0.085	0.627	1.187	19.805	18.66
Trilogy	1.027	18.489	0.985 ± 0.058	0.792	1.242	17.819	4.95
Adult stage							
Fenitrothion	0.226	0.653	2.781 ± 0.089	0.171	0.302	100	100
Neemix	0.709	1.871	3.042 ± 0.103	0.543	0.903	31.876	34.90
Misrona	1.368	5.051	2.299 ± 0.089	0.990	1.754	16.52	12.93
Alboleum	1.388	5.648	2.103 ± 0.074	0.782	2.280	16.282	11.56
Trilogy	2.310	14.143	1.629 ± 0.078	1.788	3.055	9.784	4.62

2- Field evaluation of the tested alternative insecticides on population of *P. pentagona*

The initial effects of the tested insecticides on the pre-adult and adult female populations after one week of application as well as the residual effect after 2, 3, 4 and 5 weeks of application were shown Table (2). The obtained results showed that, the initial effect of tested insecticides after one week of application was varied on the pre-adult populations. The highest effective compound was fenitrothion (88.1%) and the moderate effective compounds were mineral oils *i.e.* misrona and alboleum, they reduced the pre-adult populations to 71.6 and 72.8%, respectively. The less effective compounds on the pre-adult populations were neemix and trilogy, they reduced the populations to 54.8% and 35.9%, respectively. The initial effect of the tested insecticides on the adult female populations showed that, fenitrothion was the highest effective compound on the adult populations (80.2%) followed by misrona (75.9%) and alboleum (71.8%) whereas the neem extracts were lower effective on the adult female populations, they reduced the populations to 62.4% (neemix) and 44.1% (trilogy), respectively.

The residual effect of the tested compounds on the nymphal populations was appeared after 2 weeks of application, the highest effective insecticides were obtained by mineral oils *i.e.* misrona (90.6%) and alboleum (88.7%) followed by fenitrothion (80.8%). Neemix came in the 3rd order (71.7%) whereas trilogy gave 55.6% reduction for the pre-adult populations. The residual effect on the adult female populations were relatively higher after 2 weeks of application, the populations reduced to 86.2% (alboleum), 85.3% (misrona) and 80.5% (Fenitrothion) while neem extracts raised to 70.8% (neemix) and 67.8% (trilogy), respectively.

After 3 weeks of application, the residual effects of the tested insecticides were varied on both nymph and adult populations. The highly effective compounds on the nymphal populations were recorded by mineral oils, the percent of reduction increased to 93.6% (alboleum) and 94.1% (misrona), respectively. Fenitrothion decreased to 85.6% after 3 weeks of application compared with its initial effect (one week after application). Reduction percentages raised in neem extracts after 3 weeks of application, the populations reduced to 79.5% (neemix) and 64.8% (trilogy), respectively.

The residual effects were varied also on the adult female populations after 3 weeks of application, the highest effective compounds were mineral oils *i.e.*, (90%) alboleum and misrona (89.6%) whereas the Organophosphorus insecticide (Fenitrothion) came in the 2nd order (79.8%). The lowest reduction percentages were recorded by neem extracts *i.e.* neemix (77.5%) and trilogy (72.3%), respectively.

The residual effects of the tested alternative insecticides on the insect populations after one month of application showed that, the mineral oils were highly effective on the pre-adult populations, they reduced the populations to 90.5% (misrona) and 89.1% (alboleum), respectively whereas fenitrothion decreased the populations to 66.9%. Neemix and trilogy were 53.2% and 59.3%, respectively.

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On the other hand, the residual effects of the tested compounds on the adult populations after one month of application revealed that, the mineral oils were highly effective in decreasing the populations to 90.3 % (misrona) and 91.2% (alboleum) compared with fenitrothion (77.5%); neemix (79.5%) and trilogy (71.5%), respectively.

The residual effects of the alternative insecticides on the insect populations after five weeks indicated the efficiency of the tested compounds against *P. pentagona* as mentioned in Table (2). The results showed that, mineral oils were more effective compounds on both pre-adult and adult female populations, they reduced the pre-adult populations to 97.8% (misrona) & 98.2% (alboleum) and adult populations to 91.5% (misrona) and 89.2% (alboleum), respectively.

Fenitrothion reduced both pre-adult and adult populations to 84.7% and 71.3%, respectively. Neem insecticides were less effective on the insect populations, neemix reduced the pre-adult and adult populations to 61.1% and 63.2%, respectively, whereas trilogy had a poor effect on the pre-adults (57.4%) and adult populations (36.9%).

The average percent of reduction (%) for the insect populations (Table, 2) showed that, mineral oils reduce the population of *P. pentagona* highly, they reduced the pre-adult to 90.7% (misrona) and 90.2% (alboleum) and adults to 86.8% (misrona) and 85.9% (alboleum), respectively. The Organophosphorus insecticides (Fenitrothion) had a moderate effect on the insect populations, it reduced the pre-adult populations to 80.6% and adult populations to 77.7%, respectively. Neem extracts had poor effect on the insect populations, neemix reduced pre-adult populations to 64.1% and adult populations to 70.7% whereas trilogy was less effective on both pre-adults (56.3%) and adult females (55.3%).

The afore-mentioned results indicated that, mineral oils were more effective on *P. pentagona* populations, they reduced the insect populations to 89% (misrona oil) followed by alboleum oil (88.3%). Fenitrothion had a moderate effect on the insect populations (79.3%) whereas neem extracts were less effective on the insect populations, 66.4% (neemix) and 57% (trilogy), respectively.

Paloukis, *et al*., (1997) showed that using paraffin oil, mineral oils and potassium salt of fatty acids give good control for *P. pentagona*. Asfoor (1997) found that the reduction in the *Parlatoria oleae* populations on deciduous fruit trees by application Sumi oil reached to 81.5% followed by cidial K (80.6%), phenthoate (78.8%), diazinon (77.7%), fenitrothion (77.2%) and fenvalerate (70.8%), respectively. Helmy *et al.* (2006) reported that, mineral oils were effective against *Russellaspis pustulaus* infesting apple trees, alboleum reduced the populations to 89.7 - 91.9% and folck oil 90.8 - 91.3%.

El-Emery *et al.* (1999) demonstrated that, Malathion with rate of 0.15% and alboleum oil with rate of 2.5% reduced the populations of *Parlatoria oleae* (Clovee) on plum trees by 74.8% and 73.1%, respectively.

The obtained results proved that, the Mineral oils are highly efficient as alternative insecticides for controlling the white peach scale, *P. pentagona* compared with Neem extracts. So, it prefers to use the Mineral oils for

controlling the scale insects in IPM program and more studies should be carried on neen extracts to improve their efficiency for control insect pests to minimize the environmental pollution of pesticides.

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كفاءة بعض بدائل المبيدات فى مكافحة حشرة الخوخ القشرية البيضاء تحت الظروف المعملية والحقلية

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تم تقييم كفاءة مجموعتين من بدائل المبيدات المختلفة فى مكافحة حشرة الخوخ القشرية البيضاء ، شملت المجموعة الاولى الزيوت المعدنية (زيت مصرونا ٨٥% مايونيز وزيت البوليوم٨٠% مايونيز حيث استخدم كل منهما بمعدل ٢,٥%) والمجموعة الثانية كانت مستخلصات نباتية من النيم (مركب نيمكس ٤,٥% مستحلب بمعدل ١% ، ومركب ترالوجى ٩٠% مستحلب بمعدل ١,٥%). بالاضافة الى استخدام احد المبيدات الفسفورية العضوية للمقارنة (سوميثيون ٥٠% مستحلب بمعدل ٠,١٥ %).

تم تقييم المركبات المستخدمة معمليا كما تم ايضا تقييمها حقليا فى بستان خوخ بمحافظة القليوبية (يناير ٢٠٠٨) وذلك برش المركبات المختبرة بموتور رش كوبوتا .

اتضح من نتائج التقييم المعملى وجود تباين واضح فى سمية المركبات المختبرة على طورى الحورية والحشرة الكاملة ، كان اكثر المركبات المختبرة سمية على طور الحورية (LC_{50}) مركب سوميثيون (٠,١٨٣%) ثم مركب نيمكس (٠,٣٥٧%) وكانت الزيوت المعدنية فى المرتبة الثالثة [زيت مصرونا (٠,٨٤٤%) وزيت البوليوم (٠,٩٢٤%)] وفى المرتبة الاخيرة مركب ترالوجى (١,٠٢٧%). كما تبين من التقييم المعملى ان سمية المركبات المختبرة على طور الحشرة الكاملة كانت فى نفس الاتجاه ، حيث وجد ان اكثر المركبات سمية على طور الحشرة كان مبيد سوميثيون (٠,٢٢٦%) ثم مبيد نميكس (٠,٧٠٩%) وكانت الزيوت المعدنية فى المرتبة الثالثة [زيت مصرونا (١,٣٦٨%) وزيت البوليوم (١,٣٨٨%)] وفى المرتبة الاخيرة مركب ترالوجى (٢,٣١٠%).

اتضح من نتائج تقييم المركبات حقليا ان نسب الخفض فى تعداد الحشرة بعد ٥ اسابيع من المعاملة كان عاليا عند المعاملة بالزيوت المعدنية حيث انخفض تعداد الحشرة بـ ٨٩% فى حالة استخدام زيت مصرونا و ٨٨,٣% عند استخدام زيت البوليوم ، كما وجد من الدراسة ان كفاءة مركبات النيم فى خفض تعداد حشرة الخوخ القشرية البيضاء كان بدرجة متوسطة حيث انخفض تعداد الحشرة بـ ٦٦,٤ % عند استخدام مركب نيمكس و ٥٧% عند استخدام مركب ترالوجى.، كما خفض مبيد المقارنة (سوميثيون) تعداد الحشرة بـ ٧٩,٣ %.

وقد تبين من الدراسة كفاءة الزيوت المعدنية كأحد بدائل المبيدات فى مكافحة حشرة الخوخ القشرية البيضاء مقارنة بمستخلصات النيم ولذلك توصى الدراسة باستخدام الزيوت المعدنية فى مكافحة الحشرات القشرية فى برامج المكافحة المتكاملة واجراء مزيدا من الدراسات على مستخلصات النيم لزيادة فعاليتها فى مكافحة الافات الحشرية والحد من استخدام المبيدات الكيماوية للمحافظة على البيئة.

Table (2): Efficiency of some alternative insecticides on the white peach scale, *P. pentagona* infesting peach trees in Qalubiya Governorate.

Evaluated insecticide	Rate/ Liter	Pre-spraying count			Post spraying counts															Average percent of reduction		
					Initial effect			Residual effect														
					One week			Two weeks			Three weeks			Four weeks			Five weeks					
		11/1/2008			18/1/2008			25/1/2008			1/2/2008			8/2/2008			15/1/2008			Total population		
		Pre-adult	Adult female	Total	Pre-adult	Adult female	Total	Pre-adult	Adult female	Total	Pre-adult	Adult female	Total	Pre-adult	Adult female	Total	Pre-adult	Adult female	Total	Pre-adult	Adult female	Total
Misrona Oil 85% (Mayonnaise)	2.5%	98	104	202	33.0	28.4	61.4	14.0	18.0	32.0	11.0	13.0	24.0	19.0	12.8	31.8	5.0	11.8	16.8	16.4	16.8	33.2
					71.6 %	75.9 %	73.8%	90.6 %	85.3 %	88.2 %	94.1 %	89.6 %	92.2 %	90.5 %	90.3%	90.4 %	97.8%	91.5 %	95.3 %	90.7 **a** %	86.8 **a** %	89.0 **a** %
Alboleum Oil 80% (Mayonnaise)	2.5%	99	98	197	32.0	31.4	63.4	17.0	16.0	33.0	12.0	11.8	23.8	22.0	11.0	33.0	4.0	14.2	18.2	17.4	16.9	34.3
					72.8 %	71.8 %	72.2%	88.7 %	86.2 %	87.5 %	93.6 %	90.0 %	92.1 %	89.1 %	91.2%	89.7 %	98.2%	89.2 %	94.8 %	90.2 **a** %	85.9 **a** %	88.3 **a** %
Fenitrothion 50% EC.	0.15%	99	107	206	14.0	24.0	38.0	29.0	24.6	53.6	27.0	26.0	53.0	67.0	30.6	97.6	34.8	41.0	75.8	34.4	29.2	63.6
					88.1 %	80.2 %	84.1%	80.8 %	80.5 %	80.6 %	85.6 %	79.8 %	83.2 %	66.9 %	77.5%	71.0 %	84.7%	71.3 %	79.4 %	80.6 **b** %	77.7 **b** %	79.3 **b** %
Neemix 4.5% E.C.	1%	95	96	191.0	51.0	41.0	92.0	41.0	33.0	74.0	37.0	26.0	63.0	91.0	25.0	116.0	85.0	47.2	132.2	61.0	34.4	95.4
					54.8 %	62.4 %	58.4%	71.7 %	70.8 %	71.1 %	79.5 %	77.5 %	78.4 %	53.2 %	79.5%	62.8 %	61.1%	63.2 %	61.3 %	64.1 **c** %	70.7 **c** %	66.4 **c** %
Trilogy 90% EC.	1.5%	96	105	201	73.0	66.6	139.6	65.0	39.8	104.8	64.0	35.0	99.0	80.0	38.0	118.0	94.0	88.5	182.6	75.2	53.6	128.6
					35.9 %	44.1 %	40.7%	55.6 %	67.8 %	61.1 %	64.8 %	72.3 %	67.8 %	59.3 %	71.5%	64.0 %	57.4%	36.9 %	49.1 %	56.3 **d** %	58.3 **d** %	57 **d** %
Control		**107**	**122.2**	**229.2**	127.0	138.6	265.6	163.0	144.0	307.0	202.8	147.2	350.0	219.0	155.2	374.2	246.0	163.4	409.4	191.6	149.7	341.2
F value:																				**2534**	**32.75**	**20.81**
LSD at $_{0.05\ \%}$																				**0.57**	**3.41**	**1.56**

Note: Percent of reductions were transferred to arc sine values before conducting analysis of variance.
Means in the same column not followed by the same letter is significantly different (P <0.05) using LSD test in MSTATC computer Program.