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Effect of Different Pesticides against Scale Insect (Coccus Hesperidum) Sucking Insect Pests of Pistachio in District Mastung, Balochistan

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Abstract: *Field evaluation of various insecticides was carried out during 2017-18 against different insect pests of pistachio, in district Mastung (Balochistan). The tested pesticides include Superacide, Acetamiprid and Carbosulfan; while winter oil was also kept as a treatment which is commonly applied in the study area and Control was kept to compare the insecticidal efficacies.The efficacy of these pesticides was evaluated against scale insects. The results show that insect pest population was significantly differed on pistachio trees sprayed with different insecticides. On the basis of pre-treatment count, the 1st and 2nd spray efficacy of Acetamiprid against the 1st and 2nd spray efficacy of Carbosulfan was highest (90.50 and 88.71%), followed by Superacide (80.78 and 78.89%), Acetamiprid (62.46 and 60.45%) and winter oil (56.18 and 57.21%). Against scale insects, the 1st and 2nd spray efficacy of winter oil was highest (99.78 and 99.83%), followed by Carbosulfan (52.64 and 49.76%), Acetamiprid (43.54 and 40.01%) and Superacide (36.34 and 38.44%). However,and against scale insects the winter oil showed almost 100 percent efficacies on pistachio. Ranking of insecticides on the basis of efficacy showed that again winter oil and against scale insects winteroil>Carbosulfan>Acetamiprid>Superacide*

Keywords; *Effectiveness, Insecicides , pistachio, scale insects, Mastung Balochistan*

INTRODUCTION

Pistachio, Pistacia vera, is a nut fruit of high economic importance in the Anacartdiaceac plant family. The name pistachio is derived from Persian world "Pista" and nut his has been cultivated in the Iran and surrounding regions extensively. Other species cultivated include P. terelanthus, P. atlantia, P. motica and P. chinesis. It originates in China, mid Asian region, Aljeria and Mediterrranean region. Pitachio is more commonly cultivated in Italy, Spain, France, Palestine, Iran, Pakistan and in various parts of Unites States (PARC, 2018). Pakistan ranks 15th in Pistachio production (682 tons); but ranks 1st in yield per hectare (34145 kg ha-1); while Iran in on top of Pistacho producing countries of the world; followed by USA, China, Turkey, Syria, Greece, Spain, Italy, Tunisia, Madagascar, Afghanistan, Australia, Kyrgyzstan and Uzbekistan (FAOSTAT, 2017). Pakistan has tremendous potential pistachio farming and particularly entire Balochistan province has incredible potential of pistachio farming. However, only 200-300 hectares are under the pistachio cultivation in the province (Khan, 2015). In 2008, the pistachio production of Pakistan was 773 tons but in 2014 production declined to 659 tons. Regardless of tremendous production potential, Pakistan has a tiny share in world production that is only 0.1 percent (FAOSTAT, 2014).

Pistachio tree is generally infested by numerous insect pests at its entire growth stages; and the common pistachio insect pests included Pistachio psylla, Agonoscena Pistaciae; Kermani apistaciella and Acrosternum heegeri, Acrosternum millieri, Apodiphus amygdali, Brachynema germari, Brachynema segetum, Lygaeu spandurus. The phytophagous insects also attack pistachio which mainly include mites fruit moth, Recurvaria pistaciicola; Idiocerus stali, fruit scale, Pistaciaspis pistaciae, the trunk and branch scale, Melanaspis inopinata; the bark beetle, Hylesinus vestitus; leaf borer, Ocneri aterebinthina and common mites, Mehrnejad, 1998; Mehrnejad and Daneshvar, 1991a; Mehrnejad and Daneshvar, 1991b; Michailides and Morgan, 1990). In Pakistan, the pistachio is cultivated mostly in Balochistan and in some parts of KPK. In Balochistan, the pistachio is infested by spiders, mealy bug and many scpecies of scale insects.

Chemical control of insect pests is yet an effective tool to deal with; and with the introduction of new insecticides, their efficacy level needs to be evaluated time to time to ensure their quality and efficacy to control insect pests. There are a number of insecticidal groups used to combat insect pests. Nevertheless, many of the insect and thrips pests of pistachio can be controlled by chemical control using different pesticides.

In Mastung district of Balochistan, the Pistachio is attacked mainly by Reportedly Supracide, Methidathion, Methiathion, Acetamiprid, Carbosulfan are used against scale insects; while Panadublin, Prapergit and Abamectin are used against scale insect. However, Propenophos and Carbosulfan are found effective against sucking insect pests attacking pistachio (Anon, 2018). Yazdani (2001) recommends an integrated pest management that included mechanical control, collection and burning of dried branches in the gardens until late March, cultural control with improved soil, regular irrigation and supply adequate soil moisture, use of animal manner, pruning, follow planting distance, ploughing which increased the pupa mortality in soil. The proposed study was carried out to investigate the effect of different pesticides against insect pests of Pistachio at district Mastung Balochistan.

Objective

1. *To evaluate the efficacy of different insecticides against sucking scale insect*

MATERIALS AND METHODS

This study was carried out during 2018 in the pistachio plantation at farmers' field at district Mastung, Balochistan.Various synthetic pesticides and locally used winter oil was applied as chemical control against scale insects in the Coccus hesperidum species. An untreated (control) was also kept to compare the efficacy of synthetic pesticides and winter oil. The test was conducted using a randomized block design with three replications of each treatment. The following pesticides were used to evaluate their efficacy against target pests on pistachio.

Preparation of botanical extracts:

Treats	***Trade Name***	***Chemical Name***	***Group***	***Dosage***
T_1	*Superacide*	*Triefluoromethanesulfonic*	*Sulpher*	*1.00 L/100 L water*
T_2	*Winter oil*	*Methyl Salicylate*	*Hydrogen*	*1.00 L/100 L water*
T_3	*Acetamiprid*	*Mospilan*	*Chloropyridinyl*	*1.00 L/100 L water*
T_4	*Carbosulfan*	*Carbosulfan*	*Methylcarbamate*	*1.00 L/100 L water*
T_5	*Control (untreated)*	*--*	*--*	*--*

The pistachio plantation was sprayed using above treatments with a knapsack hand sprayer. Five branches on each of the sample pistachio trees were selected (two branches from the bottom of the tree, two branches from top of the tree and one from the middle of the mottom) and tagged and on the basis of these five branches, the insect pest infestation was recorded. Each treatment was applied and the efficacy was examined after 3 days, 7 days and 14 days of spray and compared with pre-treatment population. One pistachio plant/tree was considered as treatment replicated three times; so a total of 15 pistachio trees were selected for spray applications. The significance of the efficacy of insecticides was evaluated using analysis of variance and least significant difference using Statistix Ver 8.1 software package.

RESULTS

The field evaluateons were carried out during 2017-18 to investigate the effect of different pesticides against insect pests of pistachio in district Mastung (Balochistan). The tested pesticides included Superacide, Acetamiprid and Carbosulfan; while winter oil was also kept as a treatment which is commonly applied on pistachu Control was kept to compare the insecticidal efficacies. The efficacy of these pesticides was evaluated against scale insects mostly belonging to Coccus hesperidum species. The pre-treatment pest population was monitored one day before spray of each treatment; while post-treatment count of certain insect pests was done after

three, seven and fourteen days of each spray of different insecticides. Five branches in each experimental tree were monitored for insect pest infestation and on the basis of insect mortality the efficacies of the insecticides were developed and the data are given in Tables 1-6.

Scale insects (*Coccus hesperidum*)

First spray

The ANOVA proposed that the population of scale insects on pistachu trees sprayed with various pesticides differed significantly when monitored after three days of first spray ($F=17.44$; $DF=14$; $P<0.05$); after seven days of spray ($F=37.62$; $DF=14$; $P<0.05$) and after fourteen days of spray ($F=39.67$; $DF=14$; $P<0.05$) while pre-treatment population on all the experimental trees was insignificant ($F=0.24$; $DF=14$; $P>0.05$).

The data (Table 5) demonstrated that winter oil remained highly effective to control the scale insects with population of 223.52, 11.18 and 1.79/tree after 3, 7 and 14 days of spray over 802/tree pre-treatment population showing 99.78 percent efficacy. The insect population on trees sprayed with Carbosulfan was 379.58, 360.60 and 346.18/ tree after 3, 7 and 14 days of spray over 731/tree pre-treatment population showing 52.64 percent efficacy. The Acetamiprid spray application decreased scale insects population upto 510.65, 485.12 and 412.35/tree after 3, 7 and 14 days of spray over 730.33/tree pre-treatment insect count showing an efficacy of 43.54 percent. However, Superacide among the insecticides resulted in least efficacy with average scale insects population of 585.90, 533.17 and 469.19/tree after 3, 7 and 14 days of spray over 737.90/tree pre-treatment insect count showing efficacy of 36.34 percent; while scale insects were abundantly on control trees. On the basis of experimental results, the treatments were ranked as winter oil> Carbosulfan> Acetamiprid> Superacide.

Second spray

The analysis of variance suggests that scale insects population on pistachu trees sprayed with different insecticides varied significantly when observed after three days of second spray ($F=21.72$; $DF=14$; $P<0.05$); after seven days of spray ($F=36.96$; $DF=14$; $P<0.05$) and after fourteen days of spray ($F=38.75$; $DF=14$; $P<0.05$); while pre-treatment population on all the experimental trees was insignificant ($F=0.24$; $DF=14$; $P>0.05$).

It is evident from the data (Table 6) that after second spray too, the winter oil proved to be highly against scale insects with population of 156.40, 7.82 and 1.25/tree after 3, 7 and 14 days of spray over 737.84/tree pre-treatment population showing 99.83 percent efficacy. The insect population on trees sprayed with Carbosulfan was 370.51, 351.98 and 337.90/tree after 3, 7 and 14 days of spray over 672.52/tree pre-treatment population showing 49.76 percent efficacy. The Acetamiprid spray application decreased scale insects population upto 499.16, 474.20 and 403.07/tree after 3, 7 and 14 days of spray over 671.91/tree pre-treatment insect count showing an efficacy of 40.01 percent. However, Superacide was least effective with average scale insects population of 521.26, 474.34 and 417.42/tree after 3, 7 and 14 days of spray over 678.04/tree pre-treatment insect count showing efficacy of 38.44 percent; while scale insects were copiously existed on control trees. On the basis of experimental results, the second spray treatments were ranked as winter oil> Carbosulfan> Acetamiprid> Superacide.

Table 5: Population of scale insect (*Coccus hesperidum*) per tree in different plots sprayed with pesticides before and after 3, 7 and 14 days of 1st spray

Treatment	Pre treat. count	Post treatment count			Total reduction	Efficacy (%)
		3 days	7 days	14 days		
Superacide	737.00	585.90^{b}	533.17^{b}	469.19^{b}	267.81	36.34
Winter Oil	802.00	223.52^{d}	11.18^{d}	1.79^{c}	800.21	99.78
Acetamiprid	730.33	510.65^{bc}	485.12^{bc}	412.35^{b}	317.98	43.54
Carbosulfan	731.00	379.58^{cd}	360.60^{c}	346.18^{b}	384.82	52.64
Control	766.67	766.44^{a}	758.77^{a}	751.19^{a}	15.48	2.02
SE±	*89.877*	*69.638*	*63.358*	*60.426*	--	--
LSD	*NS*	*160.59*	*146.10*	*139.34*	--	--
P-value	*0.9093*	*0.0005*	*0.0000*	*0.0000*	--	--

Table 6: Population of Scale insect (*Coccus hesperidum*) per tree in different plots sprayed with pesticides before and after 3, 7 and 14 days of 2nd spray

Treatment	Pre treat. count	Post treatment count			Total reduction	Efficacy (%)
		3 days	7 days	14 days		
Superacide	678.04	521.26[b]	474.34[b]	417.42[b]	260.62	38.44
Winter Oil	737.84	156.40[d]	7.82[c]	1.25[c]	736.59	99.83
Acetamiprid	671.91	499.16[bc]	474.20[b]	403.07[b]	268.84	40.01
Carbosulfan	672.52	370.51[c]	351.98[b]	337.90[b]	334.62	49.76
Control	705.33	705.12[a]	698.07[a]	694.58[a]	10.75	1.52
SE±	*82.687*	*61.645*	*58.848*	*56.307*	--	--
LSD	*NS*	*142.15*	*135.70*	*129.84*	--	--
P-value	*0.9096*	*0.0002*	*0.0000*	*0.0000*	--	--

Pistachio yield

The effect of insecticides on pistachio for its yield was investigated and statistical analysis identified significant difference in yield ($P<0.05$) due to application of various pesticides as compared to control (untreated). Among pesticides, the pistachio trees sprayed with Acetamiprid produced highest pistachio yield of 35.72 kg/tree, closely followed by winter oil (35.66 kg/tree); while relatively lower yields were obtained from trees sprayed with Carbosulfan (33.45 kg/tree) and Superacide (31.34 kg/tree). However, the least pistachio yield (18.75 kg/tree) was obtained in control (untreated). The data showed that all the treatments were effective to increase pistachio yield over control. However, whitefly and scale insects suppression by Acetamiprid and winter oil more positively influenced the pistachio yield over rest of the treatments.

Table 7: Pistachio yield (kg/tree) as affected by different insecticides

Treatments	RI	RII	RIII	Mean
Superacide	32.12	31.45	30.45	31.34 b
Winter Oil	36.25	37.10	33.65	35.66 a
Acetamiprid	36.14	38.95	32.08	35.72 a
Carbosulfan	33.70	31.65	35.00	33.45 ab
Control	19.06	20.32	16.88	18.75 c

S.E.±	1.5502
LSD 0.05	3.5749
P-Value	0.0000
CV%	6.13

DISCUSSION

Pistachio is a fruit crop of high economic significance; and Balochistan is renowned worldover for pistachio production. However, less attention has been given towards quality production of pistachio; and insect pest infestation is the major cause to affect the fruit quality of pistachio. Hence, the present study was carried out to investigate different pesticides against different insect pests of pistachio in district Mastung (Balochistan). The tested pesticides included Superacide, Acetamiprid and Carbosulfan; while winter oil was also kept as a treatment which is commonly applied on pistachu and Control was kept to compare the insecticidal efficacies. The efficacy of these pesticides was evaluated against scale insects. The major results achieved in this study are discussed in this chapter.

The 2016) found that scale insects sometimes damage the foliage and fruits entirely and apart from the chemical means including systematic pesticides use of winter oil is a proven solution of all scale insects. The scale insect mostly rest in holes in barks of the tree; and winter oil spray coats the barks; keep the scale insects in holes and in most cases these insect die after spray of winter oil. Mohammadrezaei and Hayati (2015), Amirzade et al. (2014), Beck et al. (2014) and Mehrnejad (2001) reported that there are many different techniques to control scale insects on pistachio but winter oil application has been most effective to control

these serious pistachio pests. The study clearly suggested that winter oil is highly effective against scale insect to control them timely; and with the application of winter oil, the quality produce is achieved. against scale insects the winter oil showed almost 100 percent efficacies on pistachio.

Conclusions

1. *Acetamiprid proved to be most appropriate insecticide to combat scale insects on pistachio on the basis of population record after two spray applications.*
2. *The Carbosulfan has proved to be most effective insecticide for controlling on pistachio.*
3. *The winter oil is highly effective against scale insect to control them timely; and with the application of winter oil, the fruit quality could be maintained.*
4. *The treatments were effective to increase pistachio yield over control. However, scale insects suppression by Acetamiprid and winter oil more positively influenced the pistachio yield over rest of the treatments.*

Suggestions

On the basis of research findings from the present stuydy, it is suggested that Acetamiprid may be applied to control scale insect on pistachio. However, for combating scale insects on pistachio, winter oil could be a single economical and effective solution to combat these insect pests on pistachio.

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APPENDIX

Scale insects first spray

Appendix-XVII Analysis of variance for pre-treatment count of scale insects

Soruce	DF	SS	MS	F	P
Replication	2	1369	684.6		
Treatment	4	11522	2880.6	0.24	0.9093
Error	8	96934	12116.8		
Total	14	109826			

Appendix-XVIII Analysis of variance for post-treatment count of scale insects three days after first spray

Soruce	DF	SS	MS	F	P
Replication	2	717	359		
Treatment	4	507584	126896	17.44	0.0005
Error	8	58194	7274		
Total	14	566495			

Appendix-XIX Analysis of variance for post-treatment count of scale insects seven days after first spray

Soruce	DF	SS	MS	F	P
Replication	2	104	52		
Treatment	4	906016	226504	37.62	0.0000
Error	8	48172	6021		
Total	14	954291			

Appendix-XX Analysis of variance for post-treatment count of scale insects fourteen days after first spray

Soruce	DF	SS	MS	F	P
Replication	2	305	153		
Treatment	4	868994	217248	39.67	0.0000
Error	8	43815	5477		
Total	14	913114			

Scale insects second spray

Appendix-XXI Analysis of variance for pre-treatment count of scale insects (second spray)

Soruce	DF	SS	MS	F	P
Replication	2	1158.9	579.4		
Treatment	4	9752.4	2438.1	0.24	0.9093
Error	8	82045.1	10255.6		
Total	14	92956.4			

Appendix-XXII Analysis of variance for post-treatment count of scale insects three days after second spray

Soruce	DF	SS	MS	F	P
Replication	2	4	2		
Treatment	4	495297	123824	21.72	0.0002
Error	8	45601	5700		
Total	14	540902			

Appendix-XXIII Analysis of variance for post-treatment count of scale insects seven days after second spray

Soruce	DF	SS	MS	F	P
Replication	2	132	66		
Treatment	4	767945	191986	36.96	0.0000
Error	8	41557	5195		
Total	14	809634			

Appendix-XXIV Analysis of variance for pitachio yield

Soruce	DF	SS	MS	F	P
Replication	2	14.657	7.328		
Treatment	4	600.557	150.139	41.65	0.0000
Error	8	28.839	3.605		
Total	14	644.053			