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Management of San Jose Scale (*Quadraspidiotus perniciosus*) by HMOs and Insecticides in Apple Orchards of Kashmir, India

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Apple is attached by number of insect pests, among them San Jose Scale (*Quadraspidiotus perniciosus*) is key pests. San Jose scale (SJS) attacks temperate fruit crop in the state of J&K. It sucks sap from, twigs, branches, and fruits, weakens the plant and the fruits having scale infestation is rendered unthrifty and unmarketable. The pest causes great loses to apple in quantity and quality and debilities apple tree by vigour and health. The objective of this study was to examine efficacy of HMOs as dormant sprays at different concentrations to manage San Jose scale (*Quadraspidiotus perniciosus* Comstock) and two insecticides viz Chlorpyriphose 25EC and Dimethoate 30Ec at different concentrations were checked for their bio-efficacy in same orchard in late spring during 2021-22. On the basis of pooled data for years for revealed that highest cumulative mean mortality (79.48%) was recorded with the application of Bal spray at concentration of 2.5% followed by 77.56%. mortality of SJS @ 2.5% concentration by HP oil. Chlorpyriphose recorded 71.98% pooled mean mortality at 0.03 5 concentration.

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Keywords: Management; San Jose scale; orchards; Kashmir; insecticides; HMO.

1. INTRODUCTION

San Jose scale is a major pest of apple trees. It can injure fruit directly and can also reduce tree vigor by removing sap, eventually killing the tree. Introduced into the United States from China in 1870 [1,2,3], this scale insect continues to be a major pest in apple-growing regions of North America, Kashmir [4,5,6,7,8,9,10,11]. San Jose scale and several other insect pests usually are managed by dormant petroleum oil sprays. Butler et al. [12] and Butler and Henneberry [13] demonstrated that insect management on vegetables and field crops is plausible with soybean oil. Little work has been done with soybean oil on fruit crops, even though it is 1) a renewable agricultural product, 2) relatively nontoxic to humans, and 3) domestically abundant. Additionally, insect and mite pest species have not been reported to develop resistance to vegetable or petroleum oils [14,15,16,17. Pless et al. [18] reported that 2.5% and 5.0 % soybean-oil dormant sprays resulted in > 95% San Jose scale mortality when evaluated within 2 weeks of treatment. Almost 100% control of San Jose scale was achieved when a second spray was applied. Management of San Jose scale in Kashmir currently is accomplished using dormant and/or delayed-dormant petroleum-oil sprays. The objectives of this study were to: 1) determine the effect of a new Dormant oil (HMO) as dormant spray to manage San Jose scale on apple trees and spray of different insecticides on build up population in coming late spring season in the same orchards, 2) to compare the efficacy of both the pesticides.

2. MATERIALS AND METHODS

Field trials were laid during 2021-22 in zawoora srinagar (Kashmir). During dormant season, Bal spray oil were sprayed at 1.5, 2.0, 2.5% concentrations along with standard check H.P oil at 1.5, 2.0, 2.5%.While as insecticides chloropyriphose 25 EC @ 0.01, 0.015%. 0.02%, 0.025% and 0.03% concentration and Dimethoate 30EC @0.03% conc. as standard check San Jose Scale *Quadraspidiotus perniciosus during summer generation in same selected plants* .The pesticides molecule were sprayed with help of motorized sprayer and live insect pest population were counted from sample (twigs/ branches) and were observed under binocular microscope one day before application of pesticide (spray) and at subsequent intervals, post count observation were also recorded. The experiment was laid in RBD with 7 treatments with 3 replications in each treatment and one tree represented one replicate. Per cent mortality was worked out by computing the difference between pre and post treatment population of the pest. The data was subjected to analysis of variance and critical difference at 5% level of significance was worked out.

3. RESULTS AND DISCUSSION

The results of bio-efficacy of dormant spray Balspray oil (HMO) during 2021-22, besides as standard check (HP Oil) and water as control were evaluated against SJS for two years . Balspray oil @ 2.5% resulted in highest mean mortality (79.48%) of SJS followed by H.P (77.56%) at same concentration. At 2.0% concentration the Balspray oil exhibited mortalityof San Jose scale as 76.49% whereas, standard check H.P exhibited 76.49% mean mortality same concentration. All the treatments were statistically different from control, (Fig. 1) on the otherside, bio-efficacy of chloropyriphose 25EC besides Dimethoate 30 EC as standard check and water as control were evaluated against San Jose Scale (SJS) at Zawoora srinagar during summer. Chloropyriphose 25EC @ 0.03% concentration resulted in highest mean mortality (73.95%) of SJS followed by per cent mortality of (72.28%) @ 0.025% concentration. While as chloropyriphose 25EC @ 0.02% concentration exhibited 70.38% mean mortality of SJS, which is statistically at par with mean mortality per cent (68.38%) exhibited by chloropyriphose 25EC @ 0.015% concentration and least mean percent mortality(67.67%) where exhibited by Chloropyriphose 25EC @ 0.01% conc. Whereas Dimethoate 30 EC @ 0.03 recorded (70.71%) mean mortality of SJS during 2021. (Table 1) Bio-efficacy of chloropyriphose 25EC besides Dimethoate 30 EC as standard check and water as control were evaluated against San Jose Scale (SJS) at Zawoora Srinagar. chloropyriphose 25EC @ 0.03% concentration resulted in highest mean mortality (70.02%) of SJS followed by per cent mortality of (68.87%) @ 0.025% concentration. While as chloropyriphose 25EC @ 0.02% concentration exhibited 67.87% mean mortality of SJS, which is statistically at par with mean mortality per cent (62.73%) exhibited by chloropyriphose 25EC @ 0.015% concentration and least mean percent

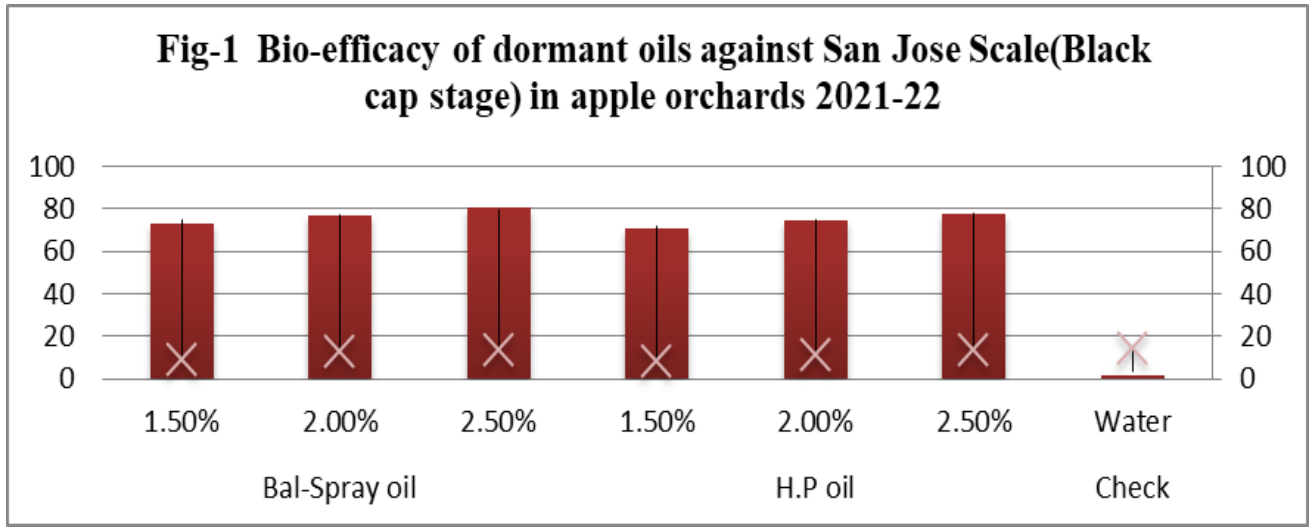

Table 1. Bio-efficiency of different insecticides against San Jose scale (*Quadraspidiotus perniciousus*) on Red Delicious of apple at Zawoora Srinagar during 2021

Code	Concen. 100 lit. of water	Percent mean mortality of SJS/cm^2 Post count observation (DAT)						Mean
		Pre count	1st	3rd	7th	10th	15th	
Chorpyriphose 25EC	0.01	24.33	43.61 (41.36)	58.89 (50.12)	67.13 (55.01)	83.94 (66.37)	84.80 (67.05)	67.67
	0.015	23.00	43.44 (41.23)	62.76 (52.39)	68.07 (55.59)	80.98 (64.14)	85.55 (67.65)	68.16
	0.02	27.00	49.24 (44.56)	64.84 (54.68)	69.08 (56.21)	81.66 (64.64)	87.11 (68.95)	70.38
	0.025	27.66	55.60 (48.21)	63.86 (53.04)	70.43 (57.05)	82.74 (65.45)	88.18 (70.43)	72.28
	0.03	24.00	60.00 (50.76)	64.22 (53.26)	71.00 (57.41)	84.26 (66.62)	90.28 (71.83)	73.95
Dimethoate 30 EC	0.03	24.33	48.54 (44.16)	66.59 (54.68)	67.01 (54.74)	83.63 (66.13)	87.78 (69.53)	70.71
Check	Water	24.66	2.68 (9.42)	1.23 (6.36)	2.68 (9.42)	1.23 (6.36)	1.23 (6.36)	1.82
C.D			3.45	1.56	2.09	1.02	1.04	

Table 2. Bio-efficiency of different insecticides against San Jose scale (*Quadraspidiotus perniciousus*) on Red Delicious of apple at Zawoora srinagar during 2022

Insecticide	Conc. 100 lit. of water	Percent mean mortality of SJS/cm^2 Post count observation (DAT)						Mean
		Pre count	1st	3rd	7th	10th	15th	
Chorpyriphose 25EC	0.01	23.33	24.30 (29.53)	44.27 (41.70)	69.99 (56.77)	85.72 (67.77)	88.59 (70.25)	62.57
	0.015	22.00	18.18 (25.23)	50.00 (44.99)	71.22 (57.55)	84.86 (67.09)	89.40 (63.71)	62.73
	0.02	26.66	39.23 (37.00)	58.73 (50.02)	73.91 (59.27)	87.50 (69.28)	93.77 (75.53)	67.87
	0.025	23.00	39.99 (36.26)	53.65 (47.08)	73.91 (59.27)	85.52 (67.62)	91.30 (72.96)	68.87
	0.03	26.00	38.46 (38.32)	61.53 (51.34)	73.07 (58.73)	85.92 (67.95)	92.3 (73.88)	70.02
Dimethoate 30 EC	0.03	23.33	25.71 (30.46)	47.14 (43.78)	69.99 (56.77)	87.14 (68.97)	91.42 (72.96)	65.62
Check	Water	23.66	2.00	1.00	1.00	0.0	0.00	1.33
C.D			2.45	1.58	1.09	1.09	1.46	

Table 3. Bio-efficiency of different insecticides against San Jose scale (*Quadraspidiotus perniciousus*) on Red Delicious of apple at Zawoora srinagar during 2021-22

Insecticide	Conc. 100 lit. of water	%Mortality of SJS 2021	%Mortality of SJS 2022	Pooled Mean
Chorpyriphose 25EC	0.01	67.67	62.57	65.12
	0.015	68.16	62.73	65.44
	0.02	70.38	67.87	69.12
	0.025	72.28	68.87	70.57
	0.03	73.95	70.02	71.98
Dimethoate 30 EC	0.03	70.71	65.62	68.16
Check	Water	1.82	1.33	1.57
C.D		1.03	0.56	

Fig. 2. Some photographs from control plants of apples infested heavily with San Jose Scale (*Quadraspidiotus perniciosus)*

mortality (62.57%) where exhibited by chloropyriphose 25EC @ 0.01% conc. Whereas Dimethoate 30 EC @ 0.03 recorded (65.62%) mean mortality of SJS (Table 2). On the basis of pooled data for years for revealed that highest cumulative mean mortality (79.48%) was recorded with the application of Bal spray at concentration of 2.5% followed by 77.56%. mortality of SJS @ 2.5% concentration by HP oil (Table 3). The results showed that HMOs gave higher percentage of mortality of SJS than insecticides and the reason is only black cap stage of pest is present during dormant season which gets suffocated by the oil layer while as during summer all stages including white cap and motile stages called as crawlers which are only vulnerable to the insecticide spray hence less percentage of mortality were recorded [19-25].

4. CONCLUSION

From this study it was observed that oil (HMOs) gave higher mortality of San Jose Scle on apple than insecticides as the reason is during dormant season pest is present in black cap stage while as during summer pest has all stages including motile stage which only is vulnerable for insecticides.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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