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Affectiveness of Acaricides (Unique-M, Pyridaben, Oberon and Nissorun) against Red Spider Mites (Tetranychidae) collected from leaves of apple trees in orchards of Swat valley, Pakistan

Shabana Bibi[1], Zaib Ullah*[2], Bakhtawar Khan[1], Fazal Maula[3], Saira[4], Sajid Mahmood[1], Muhammad Fiaz Khan[1], Naveed Akhtar[2], Rashid Ali Khan[1], Rizwanullah[1], Nigar Aksar[1], Samina Yasmin[1], and Muzafar Shah[5]

[1]Department of Zoology, Hazara University Mansehra, Khyber Pakhtunkhwa 21120, **Pakistan**
[2]Department of Zoology, Hazara University Sub-Campus Battagram, Khyber Pakhtunkhwa, **Pakistan**
[3]Senior Research Officer Agriculture research Institute, Mingora, Swat, **Pakistan**
[4]Department of Zoology, University of Swabi, Swabi, Khyber Pakhtunkhwa, **Pakistan**
[5]Centre for Animal Sciences & Fisheries, University of Swat, Charbagh, Swat, Khyber Pakhtunkhwa, **Pakistan**

***Correspondence:** zaibullah_zoology@hu.edu.pk **Received 27-04-2021, Revised: 29-06-2021, Accepted: 11-07-2021 e-Published: 26-07-2021**

The phytophagous red spider mite eats the leaves of apples and may cause serious damage to the apple orchid in Swat. Usually, these spider mites are controlled by acaricides as well as by biological methods. The present study was aimed to evaluate the effects of four acaricides (Unique-M, Pyridaben, Oberon, and Nissorun), against the red spider mites (family Tetranychidae) in apple orchids of Swat, Khyber Pakhtunkhwa, Pakistan. In four different experiments, these four acaricides were applied against red spider mites, acaricides were applied three times, with intervals of 6hrs, 12hrs, and 24hrs. In each experiment, 25 Phytophagous mites, which eat apple leaves were used. The results show that the Oberon (Espiromecifen) was found most effective and advantageous against the phytophagous red spider mites, as compared to other used acaricides. A significantly ($p<0.05$) high mortality of phytophagous mites was observed by the Oberon. However, Nissorun (Hexythiazox) was the least effective in controlling the pests (red spider mites) of apple orchids. These results may serve as a framework for the apple fruit formers and future studies as well.

Keywords: Acaricide, red spider mite, unique, pridaben, Oberon *Tetranychus urticae*, Pakistan

INTRODUCTION

Mites comprise heterogeneous chelicerae groups, with enormously varied in their morphology and biology, due to the high diversity in morphology that mites have adopted in various habitats throughout the world (Chung, 2010). Mites are the biologically most diverse and dominant group, distributed throughout the world inhabiting terrestrial and aquatic habitats (Migeon et al. 2009). Mites having 40,000 species representing an extensive range of life history and effect on agricultural loss. Two families phytoseiidea and Tetranychidae cause severe damage to agriculture (Khajehali et al. 2011). Phytophagous mites feed on plants especially on the leaves of apples and may cause serious damage to fruits production. Phytophagous mites are crop pests and get their food by sucking the liquid content of plants cell and as a result, disturbing the physiology of a host plant and

creating serious injuries to plant tissues and organs whereas some species can also act as vectors of plant viruses and cause significant crop damages (Van Leeuwen et al. 2010; Shoop et al. 1995; Sato et al. 2005). Apple (*Malus pumile* Mill) is one of the most significant fruit trees of the world belonging to the family Rosaceae. It ranks third in utilization after citrus and banana due to its high nutritional value. Acaricides are pesticides that are specifically targeted to control populations of mites which are used in crop protection against phytophagous mites which causing economic damages to ornamental plants and crops (Huffaker et al. 1970). The objective of this study was to determine the efficacy of acaricides against phytophagous mites of apple fruit from three orchards in Swat valley.

MATERIALS AND METHODS

Efficacy of four acaricides namely Unique-M, Pyridaben, Oberon, and Nissorun against phytophagous mites on apple leaves (*Malus pumile* Mill) which were collected from the vicinity of Swat valley (Mingora, Khwaza Khela, and Matta sites), Khyber Pakhtunkhwa, Pakistan and evaluated in May at Agriculture Research Institute, Mingora. The selected apple orchards were regularly sprayed with acaricides for the last four years with chemical acaricides for phytophagous mites. The collected samples from an apple tree (leaves) were kept in the polythene bags e and shifted to the laboratory in the ice box for further studies. The experiment was designed with a completely randomized design (CRD) and conducted under laboratory conditions).

Statistical Analysis

The collected data were statistically analyzed by using (STATISTIX V 8.1) a statistic program with a one-way analysis of variance (ANOVA) with the level of significance set at $P \leq 0.05$. The means were compared by the LSD test (Ullah et al. 2020; Rahat et al. 2020; Ahmad et al. 2021; Khan et al. 2021; Ullah et al. 2021).

RESULTS

Effectiveness of acaricides against red spider mites at the interval of six hours (Mingora site)

Four different acaricides i.e Unique-M, Pyridaben, Oberon, and Nissorun were studied separately by applying on apple leaves against 25 numbers of phytophagous mites (ERM), the effectiveness was recorded at the interval of six hours (17.00%), 12 hours (21.00%) and 24 hours (23.66 %). According to the findings of Oberon showed a statistically significant ($p<0.05$) effect against the phytophagous mites as compared to other acaricides used. the lowest dead population was recorded with Nissoron (9.00 %, 11.66 %, and 13.00 %) (Table 1).

Effectiveness of acaricides against red spider mites at the interval of six hours (Khwaza Khela site)

Similarly, in the same study, we also evaluate the efficacy of four selected acaricides (Unique-M, Pyridaben, Oberon, and Nissorun) were used separately on apple leaves (collected from the Khwaza Khela site) against 25 numbers of phytophagous mites. Results revealed that the effectiveness of Oberon was recorded higher and statistically significant ($p<0.05$) at the interval of 6 hours, 12 hours, and 24 hours (18.66%), 20.66%, and 23.00 %) respectively, than the other three acaricides. Whereas, the lowest dead population was recorded with Nissoron (Hexythiazox) after the three intervals (9.00 %, 12.00 %, and 14.00 %) (Table 2).

Effectiveness of acaricides against red spider mites at the interval of six hours (Matta site)

Furthermore, in the present study, the efficacy of four selected acaricides was studied separately by applying on apple leaves (collected from Matta site) against 25 numbers of phytophagous mites (ERM), the effectiveness was recorded at the interval of six hours (15.00 %), 12 hours (17.00 %) and 24 hours (21.00 %). Oberon was found to be significantly ($p<0.05$) effective against the phytophagous mites as compared to other acaricides. The lowest dead population was recorded with Nissoron (Hexythiazox).

Similarly, in the present selected acaricides i.e Unique-M, Pyridaben, Oberon, and Nissorun were studied separately by applying on apple leaves (collected from Matta site) against 25 numbers of phytophagous mites, the effectiveness was recorded at the interval of six hours, 12 hours and 24 hours and the effectiveness of Oberon were found to be highest (15.00 %, 17.00 %, and 21.00 %). The findings of the study depicted Oberon statistically significant ($p<0.05$) against the phytophagous mites as compared to other acaricides used. However, among the rest of the three acaricides, the Nissoron showed the lowest dead population (6.00 %, 7.33 %, and 10.00 %) (Table 3).

Table 1: Effectiveness of acaricides against red spider mites (Mingora site)

Treatments	No of Mites	Doses ml/lit			Live			Moribund			Dead		
	N	After 6 hrs (n)	After 12 hrs (n)	After 24 hrs (n)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)
Unique-M	25	1	1	1	12.00	9.66	8.00	2.00	1.66	2.00	11.00	13.00	15.00
Pyridaben	25	2	2	2	10.00	6.66	4.33	2.00	1.33	1.66	13.00	17.00	19.00
Oberon	25	0.25	0.25	0.25	6.33	3.33	1.00	1.66	0.66	0.33	17.00	21.00	23.66
Nissorun	25	1g/liter	1g/liter	1g/liter	13.66	12.00	10.66	2.33	1.33	1.66	9.00	11.66	13.00

Statically Significant value: p<0.05; N: total number

Table 2: Effectiveness of acaricides against red spider mites (Khwaza Khela site)

Treatments	No of Mites	Doses ml/lit			Live			Moribund			Dead		
	N	After 6 hrs (n)	After 12 hrs (n)	After 24 hrs (n)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)
Unique-M	25	1	1	1	11.33	8.33	6.33	2.00	2.66	1.66	11.67[b]	14.00[b]	17.00
Pyridaben	25	2	2	2	7.66	5.66	3.33	1.33	1.66	1.33	16.00[a]	17.33[a]	20.33
Oberon	25	0.25	0.25	0.25	4.33	3.00	1.00	2.00	1.33	1.00	18.66[a]	20.66[a]	23.00
Nissorun	25	1g/liter	1g/liter	1g/liter	14.00	11.33	8.66	1.66	1.66	2.33	9.00[b]	12.00[b]	14.00

Statistically Significant value (p<0.05); N. total number

Table 3: Effectiveness of acaricides against red spider mites (Matta site)

Statistically Significant value (p<0.05); N: total number

Treatments	No of Mites	Doses ml/lit			Live			Moribund			Dead		
	N	After 6 hrs (n)	After 12 hrs (n)	After 24 hrs (n)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)	After 6 hrs (%)	After 12 hrs (%)	After 24 hrs (%)
Unique-M	25	1	1	1	14.66	12.33	9.66	2.33	3.66	3.66	8.00	9.33	12.00[b]
Pyridaben	25	2	2	2	12.00	9.66	7.66	2.66	3.33	3.33	10.33	12.00	14.00
Oberon	25	0.25	0.25	0.25	8.33	5.33	2.33	1.66	2.66	3.00	15.00	17.00	21.00
Nissorun	25	1g/liter	1g/liter	1g/liter	17.33	15.33	11.66	1.67	2.33	1.66	6.00	7.33	10.00

DISCUSSION

Pest mites are serious threats to fruits, vegetables, cereal crops, and ornamentals throughout the world. These pests become resistant to repeated use of pesticides.

The present study evaluated the efficacy of the targeted acaricides against phytophagous mites of apple leaves from three different locations of Swat valley. Our findings proved that the Oberon and Pyridaben both the acaricides were most effective against the phytophagous mites on leaves in lab conditions. So for the better quality of apple production in the Swat valley, these acaricides could be useful against phytophagous mites which remained a serious threat to the leaves of apple plants. Results of the present study also supported by Ashraf et al. (2015), they conducted a study with a slight difference that the target organism used by them were spotted spider mites (Tetranychus urtica Koch) and significantly highest ($p<0.05$) mortality was obtained by Oberon (Espiromecifen) followed by Pyridaben and Unique-M. Our finding was also in agreement with the results obtained, further tested several acaricides separately and in combinations found that the average population of spider mites was reduced by Pyridaben, which is parallel to our results, Furthermore, (Dunlop, 2010) also reported that combination of Nissorun (hexythiazox) and Pyridaben gave comparatively better control against two-spotted spider mites (TSSM) and European red mites (ERM) in the apple orchard. Similar results were also reported by Hossain et al. (2006) in their study which showed drastic reductions of plant-feeding mites in the field by application of acaricides.

Furthermore, findings of an evaluation of efficacy against selected acaricides showed that Nissorun was least effective against red spider mites than the rest of the applied acaricides. Similar findings were recorded by several studies which depicted comparatively less efficacy of Nissorun against nymphicidal and red spider mites. Another study on orchards of Australia by Nauen et al. (2001) also reported that since 1987 Nissorun was found less effective against a strain of Tetranyncus urticae.

In the light of our findings and results of previous studies, it is recommended that in the future Nissorun should not be used by the formers for control of spider mites because it has the least effective against the spider mites (Nauen et al. 2001). This argument is also supported by the investigation of Bower (1990) in the field of apples.

CONCLUSION

The results acquired from the present study concluded that Oberon (Espiromecfen) was an effective acaricide for controlling the population of pest mites in the field of apple trees. While Nissorun (Hexythiazox) showed the least effective against the population of phytophagous mites.

CONFLICT OF INTEREST

The authors declared that the present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

SB designed and performed the experiments, ZU, SM and S wrote the manuscript. BK helped SB during the conduction of the research. SM and FM supervised the student during the entire study period. MFK and NA, helped during manuscript writing and initial review. RAK, R, NA, SY, MS were responsible for grammatical and other technical mistakes during the review process. All authors read and approved the final version.

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