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Population dynamics and efficacy of some Selected pesticides for the control of potato mite (*Polyphagotarsonemus latus*, Tarsonemidae: Trombidiformes) at Gilgit Baltistan, Pakistan

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Abstract

Field Studies were carried out on the management of potato mite *Polyphagotarsonemus latus*, through chemical pesticides; Confidence (Imadachlorpid), Diafenthuran (Diafenthuran) and Actara (Thiamethoxam) on seasonal plots of Potato crop at Gilgit Baltistan region during 2014. The pesticides were applied at their recommended doses, when the nymph of mite starts appearing and seen easily feeding on potato leaves. Data were collected after interval of 24-hours, 48-hours, 72-hours and 7 days after application of treatments, by counting the number of effected leaves having symptoms of leathery appearance, webbing and downward curling of leaves of potato plants. Overall percent damage per plant by *P. latus*, showed that statistically pesticide were non-significant to each other but significantly different from control plot. Seasonal mean infestation was the highest (14.18%) in the check plot while lowest infestation (1.125%) was noted in plot treated with Difenthuron followed by Confidence and Actara 1.88 and 1.60% respectively. Population trend in spatial relation with temperature revealed that there was a positive significant correlation ($p < 0.005$) was found between population and temperature as every increase or decrease in temperature, showed fluctuation in the population of mite in Skardu region.

Keywords: *Polyphagotarsonemus latus*, Confidence, Actara, Difenthuron, Correlation.

1. Introduction

Potato (*Solanum tuberosum* L.) is the fourth major food crop of the world. Potato is one of the cash crop of Pakistan, total production 3.55 million tons (Food and Agriculture Division, 2012) [3]. In Gilgit Baltistan, agriculture is the key source of income about 90 percent of population involved in agriculture sector (Khan and Akhtar, 2006) [5]. Climate is ideally suited for the cultivation of vegetables and fruits including potato, its productivity are very low. Potato production in Gilgit Baltistan region is (17.17 ton) per hectare. Potato is now gaining status of cash crop in Gilgit Baltistan after Apricot (Food and Agriculture Division, 2012) [3]. Potato crop is attacked by a number of insect pests which cause decrease in yield of the crop. Among all these pests, *Polyphagotarsonemus latus* is one of the emerging and serious pests of potato crop in Gilgit Baltistan (Khan and Akhtar, 2006) [5]. Mites have needle-like piercing-sucking mouthparts They penetrate their mouthparts into plant tissue usually on underside of leaves *P. latus* cause economic loss by causing stunted growth, leathery appearance, webbing and downward curling of leaves and finally dead of potato plants occurs usually mites is difficult to seen by naked eye symptoms of severe infestation cause webbing on leaves complete color loss, curling, ultimately caused death of plant (Painter, 1951) Potato crop is seriously attacked and damaged by a number of insect pests i.e. wireworms, aphids, cutworm and others which cause reduction of yield of the crop. *Polyphagotarsonemus latus* is included one of the devastating insect pest of potato crop (Sing 2002). Potato mites are tiny creatures, clearly seen under hand lens. Mites initially appear undersides of the leaves when their population increases mite's starts moving to the upper sides of the potato plants, Infestation increase in dry and dusty conditions. There population greatly increased when we applied broad spectrum pesticides for control of pests that's also cause mortality of natural enemies. Usually applications of carbaryl (Sevin) are suggested as their population increase and reaching economic injury level. Conservation of natural enemies,

proper and sufficient irrigation, and reduction of dust may be useful for control of mites in field condition. Flooding in field and water spraying is very helpful for their control, releases of predator mites also useful in some situations. Spider mites can also be controlled by use of insecticidal soap or Neem oil as spray on the undersides of the leaves. (Karlik, 1995) [4].

Most miticides (Comite, abamectin, Acramite, Onager, and Oberon) should be applied after early detection of mites. Movento is usually applied for control of mite populations. The potato mite is less than 0.05 inch long. *P. latus* is now becoming serious pest of potato because of limited research, due to excessive use of different pesticides and miticides against mites. They gain resistance against ordinary insecticides and pesticides (Schreiber, 2014) [9].

Work on potato mite is limited in the Gilgit Baltistan region as potato mite is most emerging pests according to the survey of PARC Pakistan. Potato is one of the most growing and cash crop of Gilgit Baltistan but in recent years potato mites cause great reduction in the yield of potato. For minimizing the economic loss the research work was programmed.

2. Material and Methods

Field location

The experiment was carried out in Randomized Complete Block (RCB) design having four treatments and each treatment was replicated three times against mites on potato crop at Gilgit Baltistan Skardu region during 2014. The field investigation took about three month from sowing to data collection.

Chemical control

Chemical treatments used are Difenthiuron 500 G/L, Imadachlorpid 25 w/p, Actara 25 W/G and control plot. Recommended dose of pesticide were shown in (Table-I). The experimental plot was of 20m² consist of 100 plants per plot which was grown on ridges. All the pesticides were applied as foliar application by Knapsack sprayer formulation was made as the pesticide manufacture recommended. Pesticide was applied in month of June when webbing and leaves curling were seen on potato plants i.e. after chemical application data were taken as by counting number of damaged leaves per plant. Data were noted as damaged leaves per plant after 24hrs, 48hrs, and 72hrs and 7 days. If the infestation is started

again then second application of the treatments will be applied after 14 days and vice versa (Shakur, 2007) [10].

Table I: Treatment formulation and their recommended dose as per acre

Treatments	Active ingredient	Recommended dose Rate/100 lit water
1 Confidence W/P	Imadachlorpid	250 mg/acre
2 Difenthiuron G/L	Difenthiuron	250 ml/acre
3 Actara W/G	Thiamethoxam	24 g/acre
4 Control

Population of Mite In spatial relation to Temperature

Temperature was recorded from the nearest metrological station and was correlated with the population of Mite in Skardu region. We continuously checking the potato plots in study area, every increase or decrease in temperature observation was taken to check the effect of temperature on population of mite. Population of mite was noted as number of mite per leaf from already selected five leaves per potato plant.

Statistical analysis

The experiment was laid out in randomized complete block design with three replications. The collected data was subjected to ANOVA and means was separated, using LSD test at 5% level of significance (Steel and Torrie, 1980).

3. Results

Data of effectiveness of pesticides were taken after 24h, 48h, 72h and 7 days. Effect of Confidence, Difenthiuron and Actara were evaluated for the management of Mite (*Polyphagotarsonemus latus*) in the potato plots. Treatment effect was statistically significant ($P < 0.05$). Data of percent infestation and the effect of pesticides recorded were found statistically significant ($P < 0.05$) as compared to control plot but statistically non-significant to each other (Table-II). Percent infestation was reduces as the effect of pesticide the highest infestation been recorded from the control plots was 13.45, 16.0, 15.30 and 12.0% while lowest infestation was recorded in the plot treated with Difenthiuron was 1.85, 1.30, 0.90 and 0.45% followed by Actara was 2.15, 1.98, 1.30 and 1.0% and by Confidence recorded was 2.45, 2.10, 1.70 and 1.30% respectively.

Table 2: Percent damage per plants by *P. latus* larvae in response to various treatments

Treatments	24 hours of Application	48 hours of Application	72 hours of Application	7 days after Application	Overall mean
Actara	2.15a	1.98a	1.30a	1.00a	1.60a
Confidence	2.45a	2.10a	1.70a	1.30a	1.88a
Difenthiuron	1.85a	1.30a	0.90a	0.45a	1.12a
Control	13.45b	16.00b	15.30b	12.00b	14.18b

Mean in column followed by dissimilar letters are statistically different at 5% level of probability

The lowest mean Percent plants damaged for the whole season was observed in the Plots treated with Difenthiuron was 1.12% followed by Actara and Confidence 1.60 and 1.88% while

highest mean infestation was recorded from control plot was 14.18%. (Fig-I) the results was similar to the finding of (Shakur, 2007) [10].

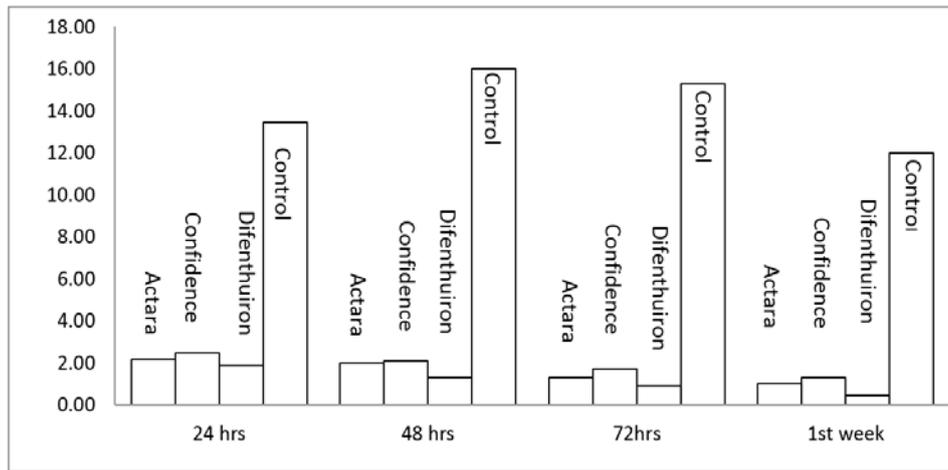


Fig 1: Percent damage per plant caused by Potato Mite in response to various treatments

Population trend of potato mite in spatial relation to temperature: Data showed that temperature was optimum in July which ranged from 22-27c Pregner and Ling (2001) [8]. The population of mite reached to its highest during July Fig. 1 After 5th of August temperature starts fall in Skardu region as

every increase or decrease in temperature in study area a decline in population of mite was observed lowest population of mite were noted during month of August. A significant positive correlation ($P < 0.005$) was found between the population of potato mite and temperature Taylor (1981).

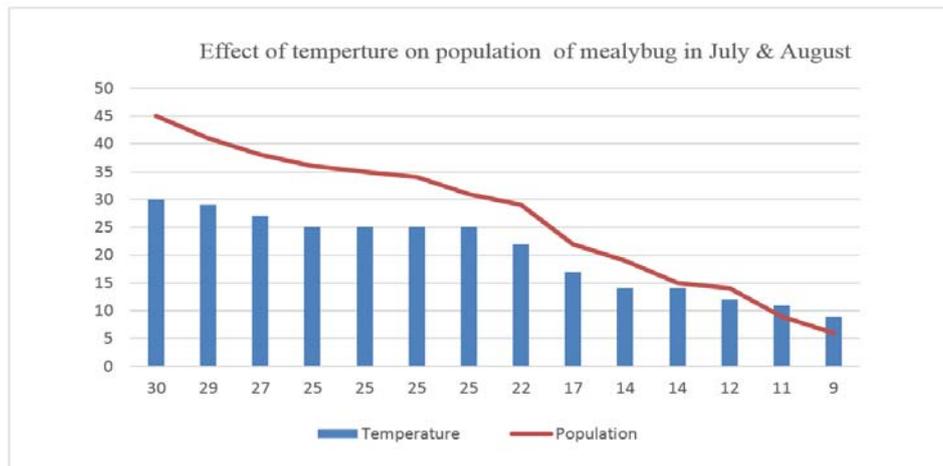


Fig 2: Number of mites per plant recorded from selected five leaves per potato plant in July and August

4. Discussion

Potato is one of the most growing and cash crop of Gilgit Baltistan. Gilgit Baltistan is located in north of Pakistan at elevation 2,500 meters (8,202 feet) (Adle, 2003). In recent year’s potato grower’s increase as compare to past because of increasing demand, potato is attacked by many pest including aphid, cutworm and mite (Sing 2010) [11]. But in Gilgit Baltistan Mite is one of the serious and devastating pest of potato crop causing economic loses. Present investigation revealed that for control of mite in Gilgit Baltistan region Difenthuiron proved best as the lowest mean Percent plants damaged for the whole season was observed in the Plots treated with Difenthuiron was 1.12% followed by Confidence and Actara 1.88 and 1.60% respectively while the highest infestation recorded in control plot was 14.18%. Lowest infestation was recorded after the application of Difenthuiron after 7 days was 0.45%. While other hand we found that there is no significant difference was observed between the effectiveness of the Confidence and Actara. Present results of study were quite similar to the findings of Karar (2010) [6] Malik (1978) [7], Suss (1978) [14] and Chang (1984) [2]. While population in correlation with temperature has a positive

significant relation as increase or decrease in temperature will effect mite population.

5. Recommendation

It is concluded from the present study that Difenthuiron is more effective against potato mite as compared to confidence and Actara. Lowest infestation was noted from the plot which was treated with Difenthuiron for control of potato mite in Skardu region Gilgit Baltistan. It is suggested that application time is too much important when notice symptoms of mite in field Difenthuiron should be applied.

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