Research Article

A Behavioral Study of Different Chemicals for the Management of Olive Psyllids

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Abstract | The olive psyllid, also known as *Euphyllura olivina*, is a small insect that feeds on the sap of olive trees. It belongs to the family Psyllidae, which includes other plant-sucking insects. The psyllid can cause significant damage to the olive tree, affecting its growth and yield, and also reducing the quality of the olives produced. A study conducted in 2020 at the agricultural research center in Tarnab, which evaluated the effects of different pesticide treatments on the population of olive psyllids in an olive orchard. The study tested three treatments: CHLORPYRIPHOS 50% EC (T1), THIAMETHOXAM 25 WG (T2), and Detergent (T3), and compared the results to a control group (T4). The study found that after 24 hours, the population of olive psyllids decreased the most in treatment T3, followed by T1 and T2, respectively. After 48 hours, each treatment, except for the control, exhibited a similar pattern of population reduction. Treatment T3 resulted in the most significant decrease in the psyllid population compared to the other treatments. The mean olive psyllid population on a 10 cm branch in plants treated with CHLORPYRIPHOS 50% EC and THIAMETHOXAM 25 WG was significantly different from that of the control and Detergent, but not from either of the other two treatments. The control group had the highest olive psyllid population, which was measured at 22.08 total individuals. These results suggest that treatment with detergent was the most effective at reducing the population of olive psyllids, while CHLORPYRIPHOS 50% EC and THIAMETHOXAM 25 WG were also effective but not as much as T3.

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Introduction

Olea europaea, which translates to European olive, is the scientific name for the olive tree, which belongs to the family Oleaceae and is a native species of the Mediterranean Basin. The olive is a small tree species. Additionally, the plants are cultivated in South America, South Africa, India, China, Australia, New Zealand, Mexico, and the United States of America (Biota of North America, 2014). Pakistan is not a typical

olive-producing nation, although *Olea cuspidata*, a wild subspecies of the olive tree, grows in various sections of the country (Nawaz *et al*., 2022). Since 1986, olive trees have been experimentally planted, beginning with a project supported by the Italian government. With 3.6 million olive plants on 30,000 acres around Pakistan, the olive industry is thriving today (Keyhanian and Abbassi, 2018). The most critical pests on olive plants have been identified as stink bugs, leaf-footed bugs, glassy-winged sharpshooters, olive shoot worms, olive bud mites, and psyllids (Sandra and Jenifer, 2018). In Iran, olive psyllids are the most significant pest during the blooming of olive plants (Burckhardt, 2009). *Euphyllura olivina* (Costa) are members of the six-family superfamily Psylloidea. As suggested by its popular name, olive psyllids belong to the family Psyllidae, which has over 100 genera.

During infestations, the nymphs and adults of the olive psyllid emit a white, waxy fluid that may induce flower dropping at an early stage. The waxy substance covers the larvae, most likely to conceal them from predators or protect them from drying out. Honeydew, also generated by nymphs and adults, may grow. Generally, psyllids are either monophagous or oligophagous (Kabashima *et al*., 2014). Pruning may use to reduce olive psyllid populations. Pruning infected regions, especially suckers and central limbs, will promote air circulation and expose olive psyllids to more heat (Johnson, 2009; Abd-Rabou, 2008). If pesticides are necessary, it is preferable to administer them before olive psyllids start generating their waxy secretions, which protect against chemicals (Peter *et al*., 2014). Insecticides should target the first generation to prevent second-generation severe infestations since the secretions complicate management measures (Ksantini *et al*., 2002). Contact insecticides are non-residual and effective against psyllids (Malumphy, 2011). According to Tunisian researchers, the endoparasitic wasp Psyllaephagus euphyllurae parasitizes the olive psyllid. Some of its predators include a tiny pirate insect, lacewing, and a lady beetle. Of all the natural enemies found, the beetle represented 49% of the population (Meftah *et al*., 2014). The mealybug destroyer lady beetle, green lacewing larvae, and a few other lady beetle species have sometimes been observed with olive psyllids in America (Johnson *et al*., 2010). Researchers in California will examine the ability of the green lacewing and the mealybug killer to control pest populations (Johnson, 2009).

There has been little study on olive propagation and biochemical analysis but none on plant protection measures. Psyllids often attack during the blooming season, losing 20-30% of flowers. Therefore, this research aimed to investigate the impact of several chemicals on olive psyllids.

Materials and Methods

The research conducted in 2020 aimed to investigate the impact of different pesticide treatments on the population of olive psyllids in an olive orchard in Tarnab, Peshawar. A total of 1500 plants of different olive cultivars were grown in the orchard, with 50% of the plants being attacked by olive psyllids. The experiment involved selecting three plants as replications, with three plants treated with water serving as controls. Three branches, each measuring 10 centimeters in length, were chosen from each duplicate plant, using the East, North, West, and South dimensions. The treatments were randomized, and a total of four treatments were used. The first treatment involved the use of CHLORPYRIPHOS 50% EC (0.6 g/ 3L), while the second treatment used THIAMETHOXAM 25 WG (0.6 g/ 3L). The third treatment involved the application of Detergent (7.5 g/3L), while the fourth treatment (control) involved the use of only water. Observations were recorded on the number of dead insects on randomly selected plants, with observations taken a day before treatment, 24 hours after treatment, 48 hours after treatment, 72 hours after treatment, and one week after imposing the remedies. The occurrence of olive psyllids was also recorded by dividing each treatment into four quadrants (replications). The experiment was carried out following suggested agronomic practices, and the layout was provided in a supplementary file. The researchers aimed to determine the effectiveness of the different treatments in controlling the population of olive psyllids in the orchard.

Statistical analysis

The results of the two trials testing the effect of insecticides on olive psyllid population growth showed no statistically significant assay concentration interactions, and a mixed linear regression best represented the point estimates with random effects. The statistical analysis was performed using R with the help of ggplot2 and Stan Development Team, and ANOVA was provided with all the in vitro data using Statistica 10 by Statsoft Inc. The treatments were

compared using Fisher's least significant difference test with a significance level of 0.05. However, the passage does not provide information on the specific results of the statistical tests or the comparison of the treatments.

Results and Discussion

The research conducted in 2020 aimed to investigate the impact of different pesticide treatments on the population of olive psyllids in an olive orchard in Tarnab, Peshawar. After observing the typical symptoms of olive psyllid attack like Leaf curling; The leaves of the olive tree may curl and become distorted, Stunted growth; The growth of the olive tree may be stunted, with the leaves and branches appearing small and underdeveloped, Honeydew; Olive psyllids produce a sugary substance called honeydew, which can cover the leaves and branches of the tree. This can lead to the growth of black sooty mold, which can further damage the tree, Yellowing of leaves, which is a sign of stress or damage (Figures 1, 2). After applying treatment data was recorded and findings presented in Table 1 demonstrated that the pre-treatment with pesticide resulted in a mean psyllid population comparable to that of the control group per 10 cm of a branch. However, when treatments were administered on both sides of the chosen field and data from before the treatments were compared, the number of psyllids decreased dramatically in all treatments except for the control treatment. After 24 hours of treatment, the population dropped the most in T3, followed by T1 and T2 accordingly; this was in contrast to T4, where the population rose upwards. After a treatment period of 48 hours, the same pattern of population decline was found in all treatments except for the control. In treatment T4, there was a substantially higher number of psyllids than in any other treatments combined (5.83). The mean olive psyllid population on the 10 cm branch in the T1, T2 and T3 treated plants was substantially different from the T4 (control) populations. However, the differences between T1 and T2 were not statistically significant. According to the records, the most olive psyllids were found in the control group (22.08). Data collected seventy-two hours after treatment likewise showed substantial differences except for the control comparison. Compared to the other treatments, the percentage killed off by the T3 therapy was much higher (3.08) than it was. The number of psyllids decreased in T1 (6.31) and T2 (6.50), and although this was considerably high in comparison to the control (26.36), these two times were not statistically different from one another. After one the first application of the T3, there was a discernible drop of 1.75 percentage points in the insect population. CHLORPYRIPHOS 50% EC (3.33 comparison to control (30.78) was also successful because it provided sufficient and substantial rules of the psyllid's population. This made it more effective than control. THIAMETHOXAM 25 WG was the least successful of the three treatments compared to T1 and T3. Following a week of treatment, the population grows again (7.22) (Figure 2). Some explanation is required for this pattern.

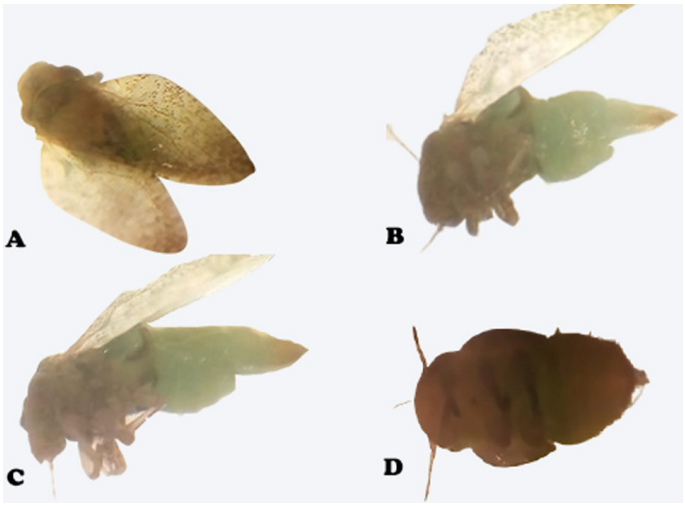

Figure 1: *Olive psyllid photos at a different angle were taken during scouting. A represents the upper view of the adult olive psyllid. B represents the lower view of the adult olive psyllid. C represents the side view of the adult olive psyllid. D represents the lower view of an adult olive psyllid having no wings.*

Table 1: *Olive Psyllid population recorded after applications.*

Treatments	Mean olive psyllids population on 10 cm branch				
	Before	After 24 hrs	After 48 hrs	After 72 hrs	After one week
CHLORPYRIPHOS 50% EC	20.79A	13.97 BC	10.15 B	8.53 B	5.56 C
THIAMETHOXAM 25 WG	18.58A	17.15 B	12.10 B	8.70 B	9.52 B
Detergent	18.88A	13.10 C	7.15 C	5.10 C	3.97 C
Control	22.31A	22.64 A	24.10 A	28.58 A	32.90 A
LSD value	4.2611	4.3203	2.0266	2.9579	2.7455

Olive Psyllid data was recorded before application of different insecticides, after 24 hours of application, after 48h, 72h and after one week of application. Significant difference was observed after one week of application and for different treatments (Insecticides).

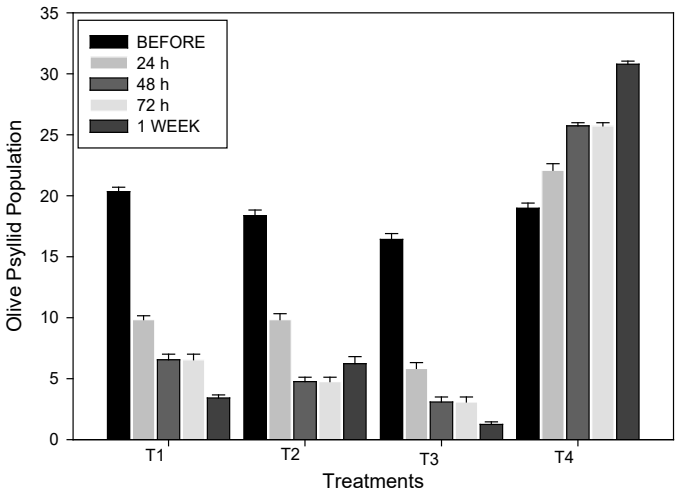

Figure 2: *Efficacy of different insecticides on olive psyllids. Y- axis exhibited the olive psyllid population decrease. X-axes represent different chemical treatments, including the control treatments. Other color bars show the recorded data at different duration. Here, T1 represents CHLORPYRIPHOS 50% EC treatment, T2 exhibited the THIAMETHOXAM 25 WG treatment, T3 represents Detergent treatment, and T4 is the control treatment in which we applied only water.*

Various reasons limit olive yield below a certain level, the bulk of which are climate-related. However, in certain regions, biotic factors are also to blame. Insects like the olive psyllid constitute a significant cause of olive decline because they feed on the tree's sap and then secrete a cotton-like mass and honeydew, which provides ideal conditions for the ectoparasitic fungus *Capnodium oleaginum* to take hold, altering the tree's photosynthesis and reducing its yield. Pests like the olive psyllid feed on the tree's sap and then secrete a cottony mass and honeydew that let other problems take hold (Arambourg, 1985; Chermiti, 1983; Jarraya, 2003).

In Pakistan, incidents of this nature are uncommon; however, managing and organizing this kind of insect infestation is essential to prevent further harm. This study aims to determine what preventative measures can be taken against this danger through the use of chemicals and other methods.

The usage of this detergent resulted in a dramatic decline in the psyllid population every 24 hours, and the lowest population was identified after a week, when there were only 1.75 Nos. of Psyllid infestations reported. Detergent with the hardness of sodium and magnesium was the most effective control method. To kill insects through touch, detergent was utilized. They are either employed or chosen to control insects, and they are also selected to decrease the possibility of plant harm.

On the other hand, it is essential to point out that environmental conditions might also affect how soaps are used. Minerals in hard water directly affect soaps, causing them to undergo chemical changes and become insoluble (also known as soap scum). Minerals do not have any impact on synthetic detergents. It has been hypothesized that diluted fatty acids sprayed in the field may be an effective pesticide. This has been tried before using detergents to control Citrus Psyllids. This was done since it is believed that detergents contain fatty acids. THIAMETHOXAM 25 WG is a pesticide that belongs to a new chemical class called neonicotinoids and is effective against aphids, whiteflies, and jassids.

THIAMETHOXAM 25 WG is a powerful insecticide that works quickly and is rapidly taken up by plants because it contains the active ingredient thiamethoxam. This ingredient causes death in insects by paralyzing them and then directly making contact with them. It immediately absorbs through the leaf's surface, gets rid of the pests in less than 24 hours, and provides the control that lasts for a long time after application (residual). It takes up to 72 hours for the population of psyllids to decrease significantly after using this product; however, after a week, the population has increased by a marginal group. As a result, it has been hypothesized that using Detergent to get rid of psyllids might be an effective strategy.

Conclusion And Recommendations

In 2020, the research project on the influence of various pesticide treatments on the population of Olive Psyllids was carried out at the Olive Orchard at the Agricultural Research Institute in Tarnab, which is located in Peshawar. The following treatments were included in the study: CHLORPYRIPHOS 50% EC, THIAMETHOXAM 25 WG, and Detergent. Follolwinf study conclude that olive psyllids can be controlled using Detergent; however, it is essential to remember that the salt and fatty acids in the Detergent might cause damage to the plant. THIAMETHOXAM 25 WG is effective for short-term usage, defined as between 24 and 72 hours control. Olive psyllid control is another possible use for the pesticide chlorpyriphos. In conclusion, detergent is a best and cheap option to control olive psyllid.

Acknowledgement

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Novelty Statement

Our results highlighted the possibility of using olf different chemical insecticdes to control olive psyllid in Paklistan, These results suggest that treatment with detergent was the most effective at reducing the population of olive psyllids, while CHLORPYRIPHOS 50% EC and THIAMETHOXAM 25 WG were also effective, however the most effective results were obtained by using the detergent. It is, therefore, desirable to continue to expand the understanding of this actual topic to estimate their efficacy for future applications for the olive psyllid control purposes.

Author's Contribution

Muhammad Arabi Awan: Conceived the ideas of research and conducted experiment.
Hafiz Husnain Nawaz: Helped in management of article.
Naeem Akhtar: Worked for language improvement of manuscript.
Azmat Ali Awan: Prepared first draft.

Conflict of interest
The authors have declared no conflict of interest.

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