TOXICITY EFFECT OF DIFFERENT CONCENTRATIONS OF LAMBDA CYHALOTHRIN AGAINST PINK HIBISCUS MEALY BUGS (*Maconellicoccushirsutus*) UNDER LABORATORY CONDITIONS

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Abstract

The current study was conducted to find out the effect of different doses of lambda cyhalothrin against pink hibiscus mealybugs, (*Maconellicoccushirsutus)* under laboratory conditions. This research work was conducted at the Department of Plant Protection, The University of Agriculture Peshawar during the year 2020. Four different concentrations 0.5%, 0.7%, 0.9% and 1.25% of lambda cyhalothrin were used against using dip and spray method. There were 5 treatments, and each treatment was replicated three times. The experiment was conducted in Complete Randomized Design. In leaf dip method experiment, the results showed that maximum mortality (93.33 %) was recorded at 1.25%, this was followed by 0.9 % with where 70% mortality was recorded after 72 hours. While minimum mortality (23.33%) at 0.5 %, followed by 0.7 % with (56.67%) was recorded. Similarly spray method, maximum mortality of pink hibiscus mealy bugs was recorded (43.33%) at dose rate of 1.25% of lambda cyhalothrin followed by dose rate of 0.9% with (40 %) mortality while minimum mortality (23.33%) was observed at dose rate of 0.5% followed by 0.7 % with (33.33 %) mortality recorded after 72 hours. The study revealed that 1.25 % concentration of lambda cyhalothrin was found effective against adult pink hisbiscus mealybugs in both the dip and spray methods and can be used against in *M. hirsutus* IPM program.

Keywords: Lambda Cyhalothrin, *M. hirsutus*, pink hisbiscus,

Introduction

Maconellicoccushirsutus, commonly known as the pink Hibiscus mealybug, is a recognized pest affecting more than 300 plant species across 74 botanical families, including 203 ornamental species (Abbas et al., 2010). Initially identified in Pakistan in the early 1990s, this pest has become a significant threat to cultivated and wild crops as well as ornamental flora (Abbas et al., 2010). Its remarkable adaptability and diverse biological characteristics have established it as a formidable pest across a wide spectrum of vegetation.The pink Hibiscus mealybug, though polyphagous, exhibits a strong preference for hibiscus plants as its primary food source. Notably, adult females are distinctively pink, hence the common reference to this species as the pink Hibiscus mealybug (Williams, 1996). As with other scale insects, sexual dimorphism is evident, with the wingless neotenic female being notably larger, ranging from 0.4 to 0.8 mm in body length and retaining the ability to feed and grow until mating. The economic impact of controlling the pink Hibiscus mealybug is substantial, with an estimated annual cost of damage control in the US reaching approximately 700 million USD and an overall estimation of 5 billion USD (Ranjan, 2006). Various studies have explored the efficacy of chemical insecticides in reducing mealybug populations. Researchers have observed promising results with different concentrations of chemical insecticides, including carbamates, organophosphates, pyrethroids, insect growth regulators (IGR), and neonicotinoids in both field and laboratory bioassays (Hussain et al., 2012; Jhala et al., 2010; Jacobsen, 2002; Aida et al., 2010; Castle et al., 2011; Fatima et al., 2016).Lambda cyhalothrin, an organic compound used as a pesticide and belonging to the pyrethroid class, was investigated for its efficacy against adult pink Hibiscus mealybugs under laboratory conditions. This compound, a synthetic insecticide resembling the natural insecticide pyrethrin found in chrysanthemum cinerariifolium flowers, targets the nervous system by disrupting sodium channels involved in impulse generation and conduction.The present study aimed to assess the activities of the different concentration of lambda cyhalothrin against adults of pink hibiscus mealybugs' laboratory condition.

Materials and Methods

The study was conducted in the Department of Plant Protection, at The University of Agriculture Peshawar Pakistan 2020, with the trend of higher mealybug infestations during recent years on ornamental plantations.

Specimens' collection

The samples of adult females of hibiscus mealy bug were collected from pink hibiscus at university of Peshawar.

Insecticides Preparation

The necessary quantity of insecticide formulation was measured and added to a beaker. Water was subsequently added to achieve a final volume of 100 ml. This process was replicated for all insecticides, ensuring concentrations of 0.1%, 0.2%, and 0.3% were attained consistently. Different concentrations of insecticide were prepared by using the following method Pal *et al*. (1994).

Insecticide Volume (mL) =

$$\frac{\text{Total volume (L)} \times \text{Percentage of insecticide required}}{\text{Formulation of insecticide}} \times 100$$

Laboratory Procedure

The fresh, untreated, and non-infested leaves of the host plant were collected from the pink hibiscus plants and were brought to the plant protection laboratory of the University of agriculture Peshawar. Fresh, uncontaminated leaves from pink hibiscus plants, free from any prior treatment or infestation, were gathered and transported to the Plant Protection Laboratory at the University of Agriculture, Peshawar. These leaves underwent a thorough wash with distilled water and were completely air-dried before the commencement of treatments. The experimental setup consisted of thirty (30) large Petri dishes, each containing leaves and 5 adult female mealybugs. Treatments were administered using both drip and spraying methods, while the experimental units were maintained at a room temperature range of 26–30°C. To sustain leaf turgidity throughout the bioassay periods, a slightly moistened cotton pad was placed in each Petri dish alongside the leaf material.

Insecticide Exposure

Before releasing the mealy bugs into the Petri dishes, they were provided with fresh leaves from non-infested host plants for feeding. To evaluate the impact of insecticides on adult female mealy bugs, the topical exposure procedure outlined by Pal et al. (1994) was adopted.

Dip method

Three host plant leaves were plucked from tested plant species. The leaves were washed through tap water and then fully dried and were dip in the prepared solution of lambda cyhalothrin after dipping it was placed outside the petri dish for 20 mints to get dry. Petri dish with 14 cm die were cleaned and put in white what Man filter paper and proper moisture content applied. These shoots were placed in petri dish at equidistance manner. A circle was in the middle of the petri dish. When these plants fully settled then 30 number of mealybugs were put on the point/circle in middle of the petri dish gently.

Collection of Data and Statistical Analysis

Mortality data were recorded after 24, 48 and 72 hours of post-application. The obtained data were analyzed by using Probit analysis.

Results and Discussion

The results regarding efficacy of lambda cyhalothrin toxicity at various concentration levels against pink hibiscus mealybugs under laboratory condition using dip method has been shown in Table1. Results revealed that maximum mortality of pink hibiscus mealy bugs (93.33%) was recorded at dose rate of 1.25% followed by dose rate of 0.9% with (70%) while minimum mortality (23.33%) was observed at dose rate of 0.5% followed by dose rate of 0.7% with mortality (56.67%).

Table 1: Toxicity of Lambda cyhalothrin against adult Pink HibiscusMealy bug collectedfrom the University of Peshawar KPK Pakistan under laboratory conditions using leaf dip method.

Dose (%) lambda cyhalothrin	**Sample size (n)**	**Mortality**	**Corrected Mortality**	**Probit**
0.5	30	23.33	17.86	4.079
0.7	30	56.67	53.57	5.089
0.9	30	70	67.86	5.463
1.25	30	93.33	92.86	6.466

The results regarding efficacy of lambda cyhalothrin toxicity at various concentration levels against pink hibiscus mealy bug under laboratory condition using spray method has been shown in Table 2. Results revealed that maximum mortality of pink hibiscus (43.33%) was recorded at dose rate of 1.25% followed by dose rate of 0.9% with (40%) while minimum mortality (23.33%) was observed at dose rate of 0.5% followed by dose rate of 0.7% with mortality (33.33%).Similar results were obtained by Ujjan *et al* (2015) who reported that the lambda cyhalothrin was proved to be highly effective against mealybugs. These findings are also related with Barbosa et al (2018) who concluded neuro toxic insecticide lambda cyhalothrin caused maximum mortality of mealybugs. The results also showed that the chemicals which are used have toxic effects on insects and their life cycle.

Table 2: Toxicity of Lambda cyhalothrin against adult Pink Hibiscus mealy *bug* collectedfrom the University of Peshawar KPK Pakistan under laboratory conditions using leaf spray method.

Dose (%) lambda cyhalothrin	Sample size (n)	Mortality	Corrected Mortality	Probit
0.5	30	23.33	17.86	4.079
0.7	30	33.33	28.57	4.434
0.9	30	40	35.71	4.634
1.25	30	43.33	39.29	4.729

Figure 1 shows the mortality of mealy bug on different doses of lambda cyhalothrin on different time intervals. In figure the x-axis showed the level of doses and y-axis represents the mortality rate of mealy bug. The results showed that when the dose rate increases the mortality *M. hirsutus.* also increases. The highest mortality 6.2% was recorded at doses rate (1.25%) while the lowest mortality 3.5% was recorded is at 0.5% dose rate. Our results are in lines with the finding of Ujjan *et al*. (2015). According to their results the mortality rate was recorded (1.2%) at a dose rate of (0.4%).

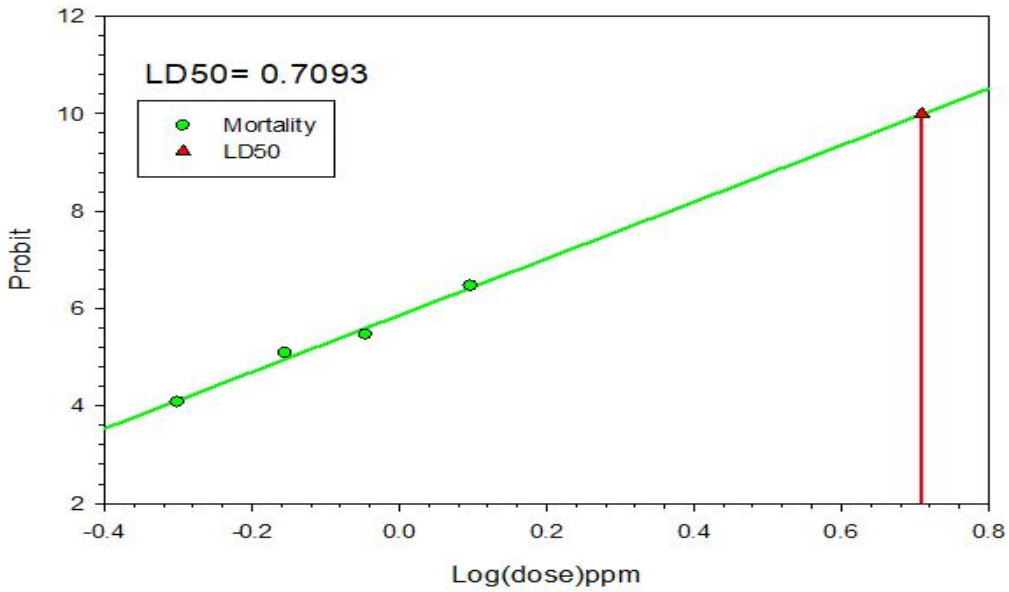

Figure 1: Dose response bioassay of lambda cyhalothrin against *M. hirsutus* under laboratory condition using leaf dip method.

Figure 2 shows the mortality of mealybugs at various doses of lambda cyhalothrin at different time intervals. In figure the x-axis shows the doses level and y-axis represents the mortality rate of mealy bugs. The results showed that when the dose rate of lambda cyhalothrin increases, the mortality of *M. hirsutus* also increases. The highest mortality 6.2% was recorded at dose rate of (1.25%) while the lowest mortality 3.4% was recorded at 0.5% dose rate. Our results are parallel with the study of Raymond and Dickinson (2006), who reported that the insecticides lambda cyhalothrin, dinotefuran, and clothianidin which caused more than 80% adults mortality during 72h duration on *Leptomastixdactylopii* (Hymenoptera Encyrtidae) , a parsaitoid of the *pseudococcid* , *Plaanoccouscitri.*

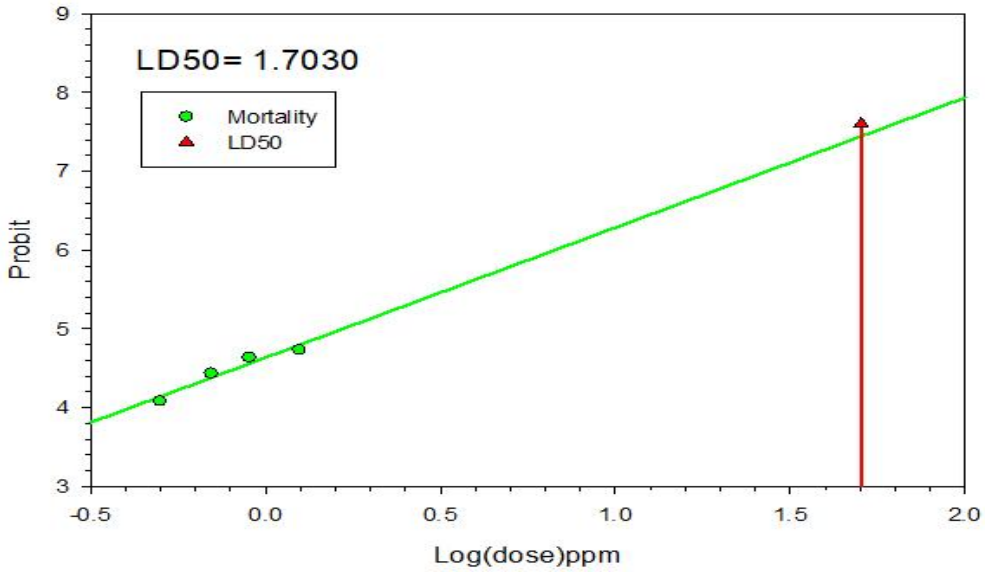

Figure 2: Dose response bioassay of lambda cyhalothrin against *M. hirsutus* under laboratory condition using leaf spray method.

Conclusion and Recommendation

The results of our experiment revealed that maximum mortality of pink hibiscus mealy bugs occurred at dose rate 1.25% in spray and dip methods. When the duration of lambda cyhalothrin increases the rate of mortality of pink hibiscus mealybugs also increases. The study revealed that 1.25% concentration of lambda cyhalothrine was found effective against *M. hirsutus*and recommended to use in further studies against the *M. hirsutus.*

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