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Invitor efficacy of organic, inorganic pesticides and predators against mealybug (Phenococcus *solenopsis*)

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Authors' Contribution: **Qaisrani, T.K.** collected experimental data; **A. Ali & S. A. Memon** designed the experiment, **D.M. Baloch** analysed the data.

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ABSTRACT

Mealybugs (*Phenacoccus solenopsis*) is a diverstating insect pest of agriculture crops, vegetables, fruits and ornamental plants. In the current study, the impact of synthetic pesticides (malathion, profenophos, and bifenthrin), organic plant extracts (neem, tobacco and eucalyptus) with three concentrations 5, 10 and 20% and natural enemies such as lady bird beetle (*Coccinella septempunctata*), brumus beetle, *(Brumus suturalis)*, spider (*Cheiracanthium melanostomus*) and green lacewing (*Chrysoperla carnea)* was examined on the mortality rate of mealybug. The maximum mortality rate was recorded in profenofos followed by bifenthrin and malathion, respectively. The efficacy of neem extract was recorded higher on all three concentrations 5, 10 and 20% as compared to tobacco and eucalyptus and control group. Lady bird beetle was recorded the efficient natural enemy of the mealybug as compared to green lacewing, brumus beetle and spider. The inorganic pesticides, organic plant extract and natural enemies have great potential to reduce the pest population of mealy bug.

Keywords: Mealy Bug, green lacewing, lady bird beetle, neem seed, tobacco, malathion, profenophos.

INTRODUCTION: Mealybugs are serious insect pests in agriculture and worldwide 158 species of mealybugs are considered pests (Miller *et al.*, 2002). The polyphagous mealybugs make up around 22% of the population and their feeding may result in plant death, defoliation, diminished plant growth and yellowing of the leaves. To protect plants from the ravages of these insect pests, weeds, or diseases, pesticides are substances or mixes of materials that are frequently used in agriculture or public health protection programmes. Pesticides, fungicides, herbicides, rodenticides and plant growth regulators are a few types of pesticides (Alewu and Nosiri, 2011). Insecticides are highly effective at controlling insect pests and they may also lead to the resistance of insect pests (Sparks *et al.*, 2001). Botanical pesticides are alternatives to conventional pesticides and subgroup of bio pesticides in agricultural pest management. The low toxicity to humans, selectivity toward beneficial insects, and lack of persistence and bioaccumulation in the environment are the key factors of botanical pesticide (Dimetry, 2014). Natural predators that are frequently observed include ladybird beetles, green lacewings, spiders, big-eyed bugs, pirate bugs, flower flies, parasitic wasps, parasitic flies, and predatory mites (Sharma and Joshi, 2010). Mealybug hosts are increasing every day causing destruction of field crops, and expensive ornamental plants. The cost effective and environment friendly methods are required to manage the mealybug.

OBJECTIVES: The current study was designed to check the *invitro* efficacy of organic pesticides, inorganic plant esxtracts and natural enemies against mealybug.

MATERIALS AND METHODS: The mealybug was collected from the Indian mallow plants (*Abutilon muticum*) located at Uthal, Balochistan and mainted on the pumpkin and potato in the laboratory. The pesticide company recommended dose of organic pesticide (malathion, profenophos, and bifenthrin) were used and three concentrations of (5%, 10% and 20%) of inorganic plant extract (neem seed, tobacco and eucalyptus extract) was sprayed separately on 2nd and 3rd instar (n=100). Plant extract method was used according to Rajput *et al.*, (2017). Sterile distilled water was used as a negative control and mortality rate was recorded daily (up to 4 days). The Lady bird beetle, brumus beetle, spider and green lacewing were collected from the brinjal field of Uthal and reared in the laboratory at 25 ± 2 °C with 60% relative humidity. The randomly seleced predators (n=10) were allowed to feed on 2nd and 3rd instars (n=300) of mealybugs and mortality rate was recorded after 24 h. The experiment was conducted in randomized complete design (RCD) and repeated thrice. One Way Analysis of Variance (ANOVA) was used with the help of SPSS software and treatment means were compared with Tukey test at $p<0.05$ probability level

RESULTS AND DISCUSSION: Mealybugs are well known as a sucking insects pest that cause severe damage to many field crops, fruits, ornamental plants, and vegetables (Nagrare et al., 2009) and synthetic pesticides are being frequently used to manage the insect pests. The profenofos insecticide exposed key efficacy against *P. solenopsis* (Hussain *et al.*, 2020). Sanghi *et al.*, (2015) reported that profenofos insecticide has ability to reduce the pest population of mealybug.

In present experiment we observed the maximum mortality rate was recorded in profenofos (97%) and bifenthrin (91.9%) as compared with malathion (86.2%) and control group (table 1). In the field, predators (lady bird beetle, green lacewing, brumus beetle and spider) play a vital role to reduce the population of mealybug. In the current study, lady bird beetle was found the effective predator of mealybug as compared to green lacewing brumus beetle and spider. Normally adults of Lady bird beetles showed no differences between crawlers and 2nd instar of mealybug (Hameed *et al.*, 2013).

Treatments (hours)	Mortality %			
	Malathion	Bifenthrin	Profenofos	Water (control)
24h	42.0± 0.16a	47.4±0.99a	52.2±0.92a	1.00±0.63a
48h	25.6±0.67b	26.2±0.64b	29.0±0.76b	1.2±0.82a
72h	13.00±0.87c	14.00±1.04c	11.8±0.09c	1.00±0.62a
96h	5.60±0.38d	4.26±1.26d	4.00±0.04d	1.5±0.84a
Mortality	**86.2**	**91.9**	**97**	**4.7**

Table 1: Effect of Inorganic insecticides on the mortality % of mealybug.
Values (Mean ± SE) in given column letters are significantly different by Tukey test (P<0.05).

The maximum feeding potential on mealybug in 24 hours was found with lady bird beetle (91.5%) and green lacewing (86.3%) when it was compared with brumus beetle (74.1%) and spider (71.8%) (figure 1).

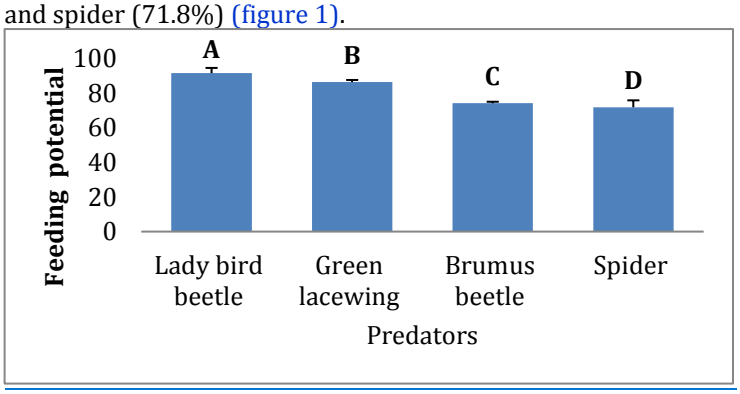

Figure 1: Feeding potential of different predators on mealy bug.
Values (Mean ± SE) in given column letters are significantly different by Tukey test (P<0.05).

The first nymphal instar were the most preferred food of lady bird beetle adults 3rd instar of green lacewing larvae feed significantly higher number on 2nd and 3rd instar as compared with Brumus beetle and spider (Rashid *et al.*, 2012). The application of pesticide was recorded extremely lethal to predators (Tillman, 1995) and need to find safest methods to control mealybugs and less lethal effects on their natural enemies. A variety of plant species carry chemical substances including alkaloids, phenolics and terpenoids and used to control the insect pests (Banu *et al.*, 2010). Azadirachta indica extracts carrying a variety of biological activities including anti-feedant, insect repellent, growth regulating and anti-ovipositional properties against insect pests and mites (Adel and Zaki, 2010). The efficacy of organic insecticides (neem seed, tobacco and eucalyptus) on the mortality rate of mealybug was recorded higher at three concentrations as compared with control (table 2).

Treatments (hours)	Neem seed (5%)	Neem seed (10%) Mortality %	Neem seed (20%) Mortality %	Water control mortality %
24h	12.6±0.09c	18.8±0.08b	14.3±0.67d	1.00±0.63a
48h	18.6±1.07b	17.2±0.99b	21.2±1.07c	1.2±0.82a
72h	19.6±1.26b	23.2±1.24a	25.5±0.89b	1.00±0.62a
96h	22.00±1.82a	24.4±1.56a	27.00±1.36a	1.5±0.84a
Overall mortality %	**72.8%c**	**83.6%b**	**88.00%a**	**4.7%d**
Treatments (hours)	**Tobacco (5%) Mortality %**	**Tobacco (10%) Mortality %**	**Tobacco (20%) Mortality %**	**Water control mortality %**
24h	11.6±0.64c	13.3±0.54c	13.8±0.65c	1.00±0.63a
48h	16.4±1.76b	20.5±1.32ab	21.7±0.87b	1.2±0.82a
72h	22.4±1.43a	23.3±0.98a	23.4±0.99b	1.00±0.62a
96h	20.6±1.09a	25.4±1.41a	27.2±1.32a	1.5±0.84a
Overall mortality %	**71.00%c**	**82.5%b**	**86.1%a**	**4.7%d**
Treatments (hours)	**Eucalyptus (5%) Mortality %**	**Eucalyptus (10%) Mortality %**	**Eucalyptus (20%) Mortality %**	**Water control mortality %**
24h	5.0±0.06c	9.0±0.32c	12.0±0.54b	1.00±0.63a
48h	11.2±0.32b	12.0±0.67b	14.6±1.43b	1.2±0.82a
72h	12.4±1.05b	17.4±0.97a	22.3±0.98a	1.00±0.62a
96h	15.00±0.95a	18.6±1.34a	23.8±1.23a	1.5±0.84a
Overall mortality %	**43.8%c**	**57.00%b**	**72.70%a**	**4.7%d**

Table 2: Effect of Organic insecticides on the mortality % of mealybug.
Values (Mean ± SE) in given column letters are significantly different by Tukey test (P<0.05).

The application of neem extract was recorded higher on all three concentrations as compared to tobacco and eucalyptus. The neem extract is a promising control agent of important pests including mealybug (Mostafa et al., 2018).

CONCLUSIONS: The application of organic plant extract, inorganic pesticides and predictors are capable to reduce the population of mealybug in the field. However, the further studies are required to examine the impact of the plant extract on the predators.

CONFLICT OF INTEREST: There is no declaration of interest by the authors concerning the publication of this paper

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