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In vitro evaluation of different synthetic insecticides against oriental fruit fly, *Bactrocera dorsalis* Hendel

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Abstract
The oriental fruit fly, *Bactrocera dorsalis* (Hendel), is a devastating insect pest that causes large losses and acts as an export barrier for many fruits and vegetables globally. This study evaluated the toxicity of Imidacloprid 25% Wp (Advance Agro®), Trichlorfon 80% SP (Avari®) and Emamectin benzoate 1.9% EC (Welcon®) applied as bait against adults of *B. dorsalis* under laboratory conditions (26.0 ± 2.0 °C and 70.0 ± 5.0% R.H.). Experiment was conducted under Completely Randomized Design (CRD) with factorial arrangements through which mass reared adults of *B. dorsalis* were treated with three concentrations (2, 4 and 8 ppm) of each insecticide along with a control treatment having no insecticide. Mortality percentage of these flies was recorded after 24 and 48 h post treatment. Results revealed that Trichlorfon showed highest mortality (100%) followed by Emamectin benzoate (70%) and Imidacloprid (69.44%) respectively.

Keywords: *Bactrocera dorsalis*, emamectin benzoate, imidacloprid, percent mortality, trichlorfon

1. Introduction
Oriental fruit fly, *Bactrocera dorsalis* Hendel belongs to largest genus *Bactrocera* of family Tephritidae. Among all families of Diptera, Tephritidae has about 4000 described species worldwide [1]. It infests vigorously about 100 host plants including many types of commercial fruits and vegetables, such as citrus, mango, guava, melon, cherry, pear, peach and tomato, cucumber and bitter gourd [2]. It was first reported from Taiwan in 1912 and now it is established in the Asia Pacific region [3].
Adults of *B. dorsalis* are strong flyer and can travel 30 miles in search of food and sites to lay eggs. Their females lay eggs into host fruits in groups of 3 to 30; the female can lay more than 1,000 eggs in her whole life. Maggots come out from these eggs and feeding on the pulp of host fruits and pass over three instars and pupate under the soil. Adults live 90 days on the average and feed on honeydew, decaying fruit, plant nectar and bird dung [4, 5].
Infestation of *B. dorsalis* on fruits not only deteriorates its appearance but also make consumer unable to eat these infested fruits. These fruit flies are not only the production restrainer of many potential fruits and vegetables, but certainly act as export barrier for a potential multimillion dollar worldwide trade. Philippines and Malaysia faced a strict quarantine regulations while exporting fruits and vegetables to worldwide market due to the fruit flies [6, 7]. In USA, about 80% of guava fruits in markets were infested by *B. dorsalis* [8].
The damage caused by fruit flies varied according to insect pest species and the host plant species on which these attacked. *B. dorsalis* Hendel, *B. correcta* Bezzii and *B. zonata* Saunders caused 80, 60-70 and 3-100% loss in guava fruit respectively [9, 10].
Fruit fly management is mostly rely upon the use of insecticides either synthetic or botanical such as dipterex, imidacloprid, triazophos, diazinon, deltamethrine, cypermethrin and neem products [11-13] and these insecticides are used as mixed in protein baits because female fruit flies do not develop eggs unless protein is not given to them as feed so this is why protein baits mixed with insecticide are an effective control method [14, 15]. Keeping in view the overall importance of this pest the current study was conducted to evaluate some synthetic insecticides against oriental fruit fly to find the most effective one.

2. Materials and Methods

2.1 Laboratory evaluation of some selected insecticides against adults of *B. dorsalis*

The study was conducted to evaluate the toxicity of selected insecticides against male and female adults of *B. dorsalis* in laboratory of Entomology, University college of Agriculture, University of Sargodha (32° 7' 48" N and 72° 41' 8" E) in spring 2012.

2.2 Rearing of *B. dorsalis* in laboratory

The initial culture of oriental fruit flies has been obtained from infested guava fruits which were collected from fruit market (district Sargodha, Pakistan) in spring 2012. These collected infested fruits were kept under the laboratory conditions (26.0 ± 2.0 °C and 70.0 ± 5.0% R.H.) inside the plastic trays which were filled by sterilized sand, until pupation. Pupae were collected daily and transferred to adult rearing cages (18 x 16 x 16 inches) having muslin cloth on the two opposite sides and the other two sides, top and bottom were made of transparent glass sheet.

2.3 Mass rearing of *B. dorsalis*

Pupae of *B. dorsalis* were kept under laboratory conditions (26.0 ± 2.0 °C and 70.0 ± 5.0% R.H.) and newly emerged flies were provided with adult food consists of sugar mixed with hydrolysate protein (3:1w/w) and wet cotton as a source water. The adults of both sexes were mated in the cages. Guava fruits were also placed in the cages as an oviposition site. Then these infested guavas which containing the grown larvae were put inside large plastic jars furnished with sand. The matured larvae were jumped out and pupated in the sand. After complete pupation the sand was sieved and the pupae collected, then placed in a petri dishes and transferred to the rearing cages to start a new generation. The newly emerged flies were used for evaluating the toxicity of various insecticides against male and female adults of *B. dorsalis*.

2.4 Insecticide treatments

The experiment was laid out in Completely Randomized Design (CRD). There were three treatments viz; Imidacloprid 25% Wp (Advance Agro®), Trichlorfon 80% SP (Avari®) and Emamectin benzoate 1.9% EC (Welcon®) along with control. These insecticides were obtained from registered pesticide dealers located in the local grain market of district Sargodha (Punjab, Pakistan) and were used in baits for knowing their efficacy against fruit flies.

Ten (male + female) *B. dorsalis* (5 days old) were confined separately in plastic jar with muslin cloth on its mouth, without food, for 12 hrs and provided with water. 10 ml bait plus specific concentration of insecticide solution were kept in petri dishes and offered to fruit flies in plastic jars. 2, 4 and 8ppm concentrations are made of each insecticide and each concentration replicated thrice. Mortality was recorded after 24 and 48 hrs.

2.5 Statistical analysis

Data regarding percent mortality of *B. dorsalis* analyzed statistically by using Statistix® (version 8.1).

3. Results and Discussion

Mortality percentages of adults of *B. dorsalis* exposed to a series of concentrations of some selected insecticides (Figure 1). Numbers of dead flies were counted and recorded and mortality percentages of adults calculated at 24 and 48 hrs post treatment. Among all treatments, Trichlorfon showed highest mortality rate i.e. 100% with all of it concentrations (2, 4 and 8ppm). Imidacloprid and Emamectin benzoate showed mean mortality of 69.44 and 70% respectively. Control (bait without any insecticide treated) showed lowest mortality (20%).

Ahmad *et al*. [16] stated that Bait (molasses @ 5% + dipterex 100 gm / acre) used for control of fruit fly on ber fruit showed highest yield with least damage whereas, Khan and Musakhel [17] revealed that dipterex plus molasses instead of dipterex alone, showed best result in musk-melon yield against infestation of *B. cucurbitae* Coq. Suhail *et al*. [18] revealed that application of Diptrex 80% SP (Trichlorfon) and installment of 4 pheromone (methyl eugenol) traps/ha in mango orchard gave best control against fruit fly. Three sprays of Dipterex 80 SP on cucumber reducing the fruit fly infestation [19].

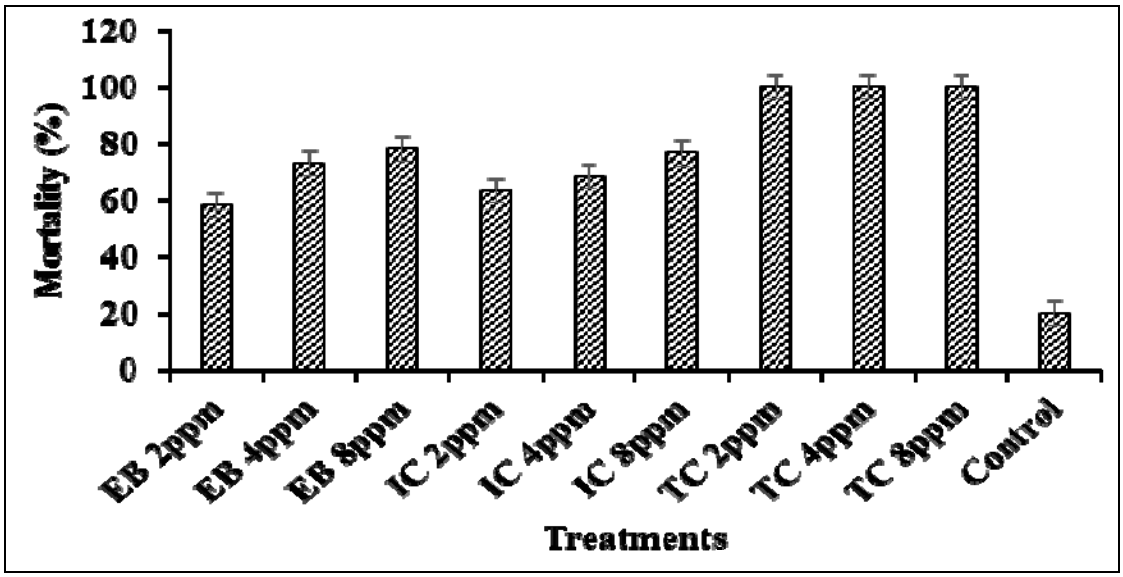

Fig 1: Mean percent mortality of *B. dorsalis* after feeding on different concentrations of insecticides bait under laboratory conditions

Figure 2 represented mortality percentages of all tested insecticides post treatment. 2, 4 and 8ppm concentrations of Emamectin benzoate caused mortality in *B. dorsalis* after 24 hrs about 40, 60 and 70% which significantly increased after

48 hrs to 76.67, 86.67 and 86.67% respectively. In Imidacloprid, 2, 4 and 8ppm concentrations caused 50, 63.33 and 60% mortality after 24 hrs which increased to 76.67, 73.33 and 93.33% after 48 hrs which also showed significantly different results at two sampling stages. Whereas, Trichlorfon showed 100% mortality after 24 hrs of bait application due to all of it tested concentrations (2, 4 and 8ppm). Bait having no chemical inside (control) when fed to *B. dorsalis*, showed natural mortality of 13.33 and 26.67% at 24 and 48 hrs respectively.

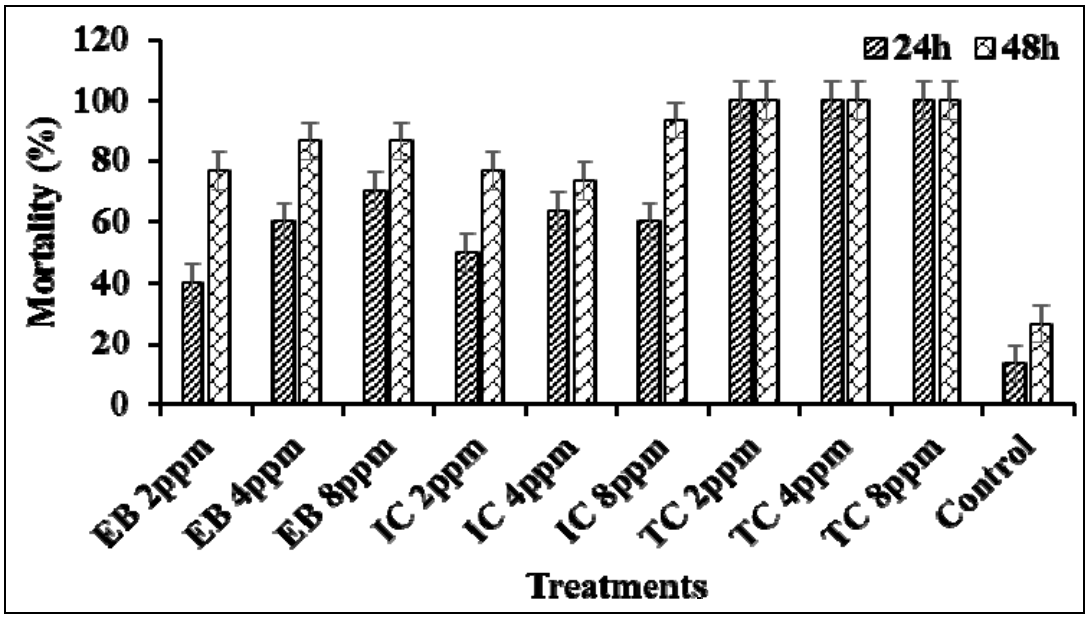

Fig 2: Percent mortality of *B. dorsalis* after 24 and 48 hrs of feeding on different concentrations of insecticides bait under laboratory conditions

4. Conclusion

Findings from above study concluded that all the treatments showed significant mortality of oriental fruit fly population in comparison with control under laboratory conditions. But among all treatments, Trichlorfon is the best remedy against *B. dorsalis*. Now, there is a need to implement all these findings for field assessment.

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