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## Evaluation of Encapsulated Parapheromonal Traps against *Bactrocera Zonata* (Saunders) under Laboratory Conditions

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### Abstract

The laboratory experiment was conducted to evaluate the efficacy of laboratory prepared encapsulated nanofiber fixed with methyl eugenol to attract peach fruitfly *Bactrocera zonata* (Saunders). Effect of wind velocity, time and distance on fly response towards encapsulated nanofibers was recorded. Various wind velocities (0.30, 0.65, 1.20, 1.70, and 2.45 m/sec) maintained through table fan were tested. Standard was made to release seven flies for each experimental trial. Temperature ( $29\text{ }^{\circ}\text{C} \pm 2$ ) and relative humidity ( $64 \pm 4\%$ ) were maintained in the laboratory, RH Pearson's Correlation was used to relate the independent variables i.e. distance, wind, and velocity against the attractiveness of traps towards fruit flies. This discovered the response of fruitflies with distance was moderately negative and highly significant ( $r -0.4090, p < 0.001$ ); response of fruitflies with time was moderately negative and highly significant ( $r -0.5206, p < 0.001$ ); relationship of flies with wind velocity was moderately negative and highly significant ( $r-0.3686, p < 0.001$ ). Flies tend to take more time when either distance or wind velocity was increased.

**Keywords:** flytrap, encapsulated, methyl eugenol, pheromone

### 1. Introduction

Nanotechnology consists of many disciplines that provide a broad spectrum of opportunities in various fields like agriculture, pharmaceuticals, electronics and insecticides. It also helps in management of insect pests during the formulations of insecticides based on nanomaterials. It is an art which focus on usual strategies used for the management of insect pests and possible of nanomaterials in insect pest control as current approaches of nanotechnology. (Ragai and Sabry, 2014) [1]. The advancement led to the fabrication of nanomaterials that consists of different shapes and sizes. These advancements are base engineering to create exclusive properties application requirement. However, use in agriculture, particularly for plant protection and production, is an under-explored area in the research community (Khot *et al.*, 2012) [2]. The studies show the potential of nanomaterials in enhancing the seed germination and growth, plant protection, the detection of pathogens, and pesticide/herbicide/insecticide residue detection (Khot *et al.*, 2012) [2]. Various species of *Bactrocera* are invasive and major pest many countries are engaged in managing continuous trapping programs for the detection. (McPheron and Steck, 1996) [3]. Many attractive kairomones Methyl eugenol (4-allyl-1,2-dimethoxybenzenecarboxylate) and cue-lure [4-(*p*-acetoxyphenyl)-2- butanone] are extensively used in the world against *B. zonata*, and *B. cucurbitae*, respectively. The males of 176 species of Dacinae are attracted to cuelure- raspberry ketone, and 58 species to methyl eugenol (Metcalf, 1990) [4]. The new rising field of nanotechnology has much significance in integrated pest management. The present study was considered with the hypothesis to discover a plan of effective dose of methyl eugenol, fused in nanofibers, for the attraction of peach fruitfly under laboratory conditions.

### 2. Materials and Methods

#### Place of work

Experiments was conducted at Postgraduate Laboratory, Department of Entomology, and Sindh Agriculture University Tandojam. Fixation of methyl eugenol in encapsulated nanofibers was carried out at Nanomaterials Research Laboratory, Mehran University of Engineering Science and Technology, Jamshoro, Pakistan.

Culture of peach fruit fly: The culture of peach fruitfly was obtained from laboratory reared population, at Department of Entomology, Sindh Agriculture University Tandojam. Method of observation: Prepared nanofibers material was placed in laboratory. 7 males of *B. zonata* were released in laboratory at various distances, to see their attraction towards nanofibers. Temperature, relative humidity was also record to evaluate their effect on the level of attractiveness of nanofibers towards male fruit flies, weekly observations for 3 months were recorded to check cumulative decrease in stability. Effect of wind velocity on encapsulated nanofibers: As pheromones and other behavioral chemicals are greatly influenced by wind in the field conditions, insects can communicate at large distance in the presence of wind in required direction. In laboratory artificial wind was arranged through controlled fan; the wind velocity was recorded and the nanofiber material was placed in front of fan; males of *B. zonata* were released at various distances. Effect of various wind velocities on the attraction fruit flies were recorded. Data analysis: The data was represented through descriptive statistics, through the statistical software SXW 8.0.

### 3. Results and Discussion

In order to assess the lure of peach fruitfly headed to capsulated nanofiber, 07 flies were released at various distances from 1 to 5 meters and at various wind velocities, time and number of flies reached destination were noted. For discovering relationship of various factors the statistical test Pearson's Correlation was applied and the results are presented here. Standard was made to release seven flies for each conduct. This discovered the response of fruitflies with distance was moderately negative and highly significant ( $r = -0.4090$ ,  $p < 0.001$ ); response of fruitflies with time was moderately negative and highly significant ( $r = -0.5206$ ,  $p < 0.001$ ); relationship of flies with wind velocity showed a moderately negative and highly significant ( $r = -0.3686$ ,  $p < 0.001$ ). Flies tend to take more time when either distance or wind velocity was increased.

**Table 1:** Flies response at various distances and wind velocities

Release at Distance (meters)	Wind M/S	Time taken to reach at fiber	Flies reached
1	0.30	0.54	4
1	0.65	0.47	5
1	1.20	0.74	4
1	1.70	0.37	4
1	2.45	0.49	3
2	0.30	1.40	4
2	0.65	1.17	4
2	1.20	1.61	5
2	1.70	1.98	3
2	2.45	1.48	2
3	0.30	3.04	3
3	0.65	1.87	4
3	1.20	2.72	4
3	1.70	2.84	2
3	2.45	4.82	2
4	0.30	3.63	2
4	0.65	2.81	3
4	1.20	3.46	4
4	1.70	3.58	2
4	2.45	5.93	1
5	0.30	4.10	2
5	0.65	3.04	3
5	1.20	3.58	3
5	1.70	5.19	3
5	2.45	8.52	1

**Table 2:** Correlations (Pearson)

	Independent variables		
	Distance	Time	Wind
Flies response (Dependent variable)	$r = -0.4090$	$r = -0.5206$	$r = -0.3686$
	$p < 0.001$	$p < 0.001$	$p < 0.001$

Peach fruitfly *Bactrocera zonata* is not only the pest of peach, but it also attacks on fruits of guava, fig, brijal, tomato, potato, loquat etc. (Siddiqui *et al.*, 2003, El-Samea and Fetoh, 2006) [5, 6]. Methyl eugenol (4-allyl-1,2-dimethoxybenzenecarboxylate) is highly attractive kairomone to *B. zonata*, *B. dorsalis* and some other species. This pheromone is widely used for the control of this pest especially in fruit orchards. The idea behind present experiment was to develop a product that may utilize small amount chemical with maximum efficiency and that may last for longer period, simply to control the release of pheromone as required. Similar type of nanotechnology was made by Bhagat, *et al.*, (2013) [7], but they prepared a nanogel for the control of fruit pests. Christoph (2011) [8] first time investigated thermos-gravimetrics and revealed that pheromones are unconfined from nanofibers in nearly linear fashion in many weeks. The idea was taken and methyl eugenol was fixed in nano-fibers, to use in the field.

### 4. Conclusion

The present study concluded that the response of fruitflies with distance was moderately negative and highly significant when distance was increased flies were finding hard to reach at the source. Response of fruitflies with time was moderately negative and highly significant it was when distance of flies was decreased the flies were taken less time to reach at their destination. It is hoped the product in future will replace the conventional method of using pheromonal traps for the control of fruitflies.

### 5. Acknowledgment

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