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## Evaluation of Flytrap against *Bactrocera Zonata* (Saunders) Under Laboratory Conditions

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### Abstract

The laboratory experiment was conducted to evaluate the attraction of Fly Trap prepared by methyl eugenol was mixed with nanofiber with the help of electro spinning. In laboratory experiment for testing effect of various wind velocities (0.25, 0.82, 1.23, 1.60 and 2.17) on prepared nano materials controlled pedestal fan was utilized. Total 7 fruitflies were released in each conduct. During experiment laboratory temperature and humidity was maintained at  $28\text{ }^{\circ}\text{C} \pm 2$  and relative humidity  $65 \pm 4$ . The effect of independent variables (time, distance, wind and velocity) was analyzed through Pearson's Correlation test. This revealed the response of fruitflies with wind highly significant ( $r = -0.6838, p < 0.0000$ ), response of fruitflies with distance was moderate, negative and non-significant relationship ( $r = -0.1736, p < 0.0529$ ) is shown. A moderate, negative, but highly significant relationship of flies response was noted with time ( $r = -0.3791, p < 0.001$ ). It was noticed when wind velocity was increased then flies were taking more time to reach at the destination.

**Keywords:** Flytrap, pheromone, fruitfly, methyl eugenol, Pakistan

### 1. Introduction

Nanotechnology is a new technology playing a vital role in different fields of science like medicine, engineering, electronic, pharmaceuticals, food industry including agriculture. Nanoparticles are used in this technology, which are of the size  $10^{-9}$  in diameter having several unique physical, biological and chemical characteristics. Nanoparticles are present naturally in insects especially on the wings. Insect pests, weeds and fungi affecting agricultural production can be managed by the use of nano-pesticides, herbicides and fungicides. The adoption of nanotechnology in the developing countries can revolutionize the agriculture and hence, converting it into green revolution for any nation <sup>[1]</sup>. The genus *Bactrocera* (Diptera: Tephritidae) comprised of five hundred well defined endemic species belonging to Southeast Asia and South Pacific Islands <sup>[2]</sup>. Most of these species found in tropical and subtropical areas and are not harmful to agriculture. Consequently seventy polyphagous *Bactrocera* spp causes damage to vegetables and fruits, crops and severe economic loss to a country <sup>[3]</sup>. Semiochemicals broadly used for control of these harmful insect pests <sup>[4]</sup>. *Bactrocera* males are resistant to chemicals 'parapheromones male lures' <sup>[5]</sup>. In this respect, methyl eugenol and cue lure "kairomones" are used to control the male *Bactrocera* and prevent the field crops from their infestation <sup>[6]</sup>. Methyl eugenol (4-allyl-1,2-dimethoxybenzenecarboxylate) and cue-lure [4-(*p*-acetoxyphenyl)-2-butanone] are highly attractive kairomone lures to *B. zonata*, and *B. cucurbitae*, respectively, estimated that at least 90% of the Dacinae species are strongly attracted to either methyl eugenol or to cue lure raspberry ketone <sup>[7]</sup>. Cue-lure has not been isolated as a natural product but is rapidly hydrolyzed to form raspberry ketone <sup>[8]</sup>. Males of at least 176 species of Dacinae are attracted to cue lure-raspberry ketone, and 58 species to methyl eugenol <sup>[9]</sup>.

Keeping in view the importance of this new emerging field of nanotechnology, in the field of integrated pest management sciences, the present study is designed, with the hypothesis to find out a level of effective dose of methyl eugenol, merged in nanofibers, for the attraction of peach fruitfly *Bactrocera zonata* (Saunders, 1842), in laboratory conditions.

### 2. Materials and Methods

#### Place of work:

Experiments were conducted at Postgraduate Laboratory, Department of Entomology, Sindh

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Agriculture University Tandojam. Fixation of methyl eugenol in 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 and field, and the males of *B. zonata* were released in laboratory at various distances, to see their attraction towards nanofibers. Temperature, humidity, was maintained, weekly observations were recorded to check cumulative decrease in stability. Effect of wind velocity on 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 noted and the nanofiber material was placed in front of fan; males of *B. zonata* were released at various distances. Effects 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

The laboratory and field experiment was conducted to evaluate the effect of laboratory prepared nanofiber fixed with methyl eugenol against *Bactrocera zonata* (Saunders). Laboratory experiment was carried out at department of Entomology, Sindh Agriculture University Tandojam and the field experiment was carried out at Horticultural garden, Sindh Agriculture University Tandojam. Methyl eugenol was mixed with nanofiber with the help of electro spinning at nanomaterials laboratory, department of textile engineering, Mehran University of Engineering and Technology, Jamshoro.

The culture of peach fruitfly was received from Diptera Research Laboratory, department of Entomology, Sindh Agriculture University Tandojam. Laboratory experiment was conducted to evaluate the attraction of peach fruitfly towards nanomaterials, pedestal fan was used to check effect of various wind velocities, and each range of wind velocity was also checked for release of peach fruitflies at various distances. Pearson's Correlation test was applied to check the effect of distance, time and wind velocity on population.

For testing effect of various wind velocities (0.25, 0.82, 1.23, 1.60 and 2.17) on prepared nanomaterials pedestal fan was utilized. Total 7 fruitflies were released in each conduct. During experiment laboratory temperature and humidity was maintained at  $28\text{ }^{\circ}\text{C} \pm 2$  and relative humidity  $65 \pm 4$ . The effect of independent variables (time, distance, wind and velocity) was analyzed through Pearson's Correlation test. This revealed the response of fruitflies with wind highly significant ( $r -0.6838$ ,  $p < 1.0000$ ), response of fruitflies with distance was moderate, negative and non-significant relationship ( $r -0.1736$ ,  $p < 0.0529$ ) is shown. A moderate, negative, but highly significant relationship of flies response was noted with time ( $r-0.3791$ ,  $p < 0.001$ ). It was noticed when wind velocity was increased then flies were taking more time to reach at the destination.

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

Distance	Wind M/S	Time taken to reach at fiber	Flies reached
1	0.25	0.57	5
1	0.82	0.50	5
1	1.23	0.74	5
1	1.60	0.90	5
1	2.17	0.83	3
2	0.25	1.10	6
2	0.82	0.92	6
2	1.23	1.50	5
2	1.60	1.40	4
2	2.17	1.60	2
3	0.25	2.10	6
3	0.82	1.10	6
3	1.23	1.90	4
3	1.60	1.63	4
3	2.17	2.80	1
4	0.25	2.80	6
4	0.82	1.80	5
4	1.23	2.70	4
4	1.60	3.60	3
4	2.17	3.90	1
5	0.25	3.30	5
5	0.82	2.30	5
5	1.23	3.60	4
5	1.60	3.30	4
5	2.17	4.12	1

**Table 2:** Correlations (Pearson)

Flies response (Dependent variable)	Independent variables		
	Wind	Distance	Time
	r -0.6838	r -0.1736	r -0.3791
p <1.0000	p <0.0529	p <0.0000	

Cases Included 125 Missing Cases 0

The effect of independent variables (time, distance, wind and velocity) was analyzed through Pearson's Correlation test. This revealed the response of fruitflies with wind highly significant ( $r -0.6838$ ,  $p < 1.00$ ), response of fruitflies with distance was moderate, negative and non-significant relationship ( $r -0.1736$ ,  $p < 0.0529$ ) is shown. A moderate, negative, but highly significant relationship of flies response was noted with time ( $r-0.3791$ ,  $p < 0.001$ ). It was noticed when wind velocity was increased then flies were taking more time to reach at the destination. Peach fruitfly *Bactrocera zonata* (Saunders) belong the one of the five hundred well defined endemic species of Southeast Asia<sup>[10]</sup>, about seventy species of this group are stated to be polyphagus and harmful to the important vegetables<sup>[11]</sup>. The results revealed that there was negative correlation of wind velocity with fruitflies population, as mostly at the speed of 2.17 it was noticed that flies could hardly locate nanomaterials, further when wind velocity was combined with increased distance as 1-5 meters, distance was also negatively correlated with flies population, mostly at the distance of 5 meters flies rarely could locate fiber, besides taking too long to reach at their destination. It may be imagined the release from any source is expanded with the increasing distance, as at the circle of 1 meter close to the fiber there may more methyl eugenol particles available as compared to the radius of 5 meters that may contain sparsely available pheromonal particles, results support this assumption, as at the distance of 5 meters flies were having

difficulty in finding source of pheromone. Increasing wind also cause methyl eugenol particles to spread farther away, hence at high speed 2.17 some flies were missing even at very short distance of 1 meter.

In nanotechnology nanogel is prepared by some Nano Scientists as <sup>[12]</sup> used nanogel against fruit pests, the present effort is the first attempt, and is intellectual property of Nanomaterial laboratory, Mehran University of Engineering and Technology. The idea was captured from <sup>[13]</sup> who stated that pheromones are unconfined from nanofibers in nearly linear fashion in many weeks, after several trials, finally nanomaterials was developed and used in present study.

Present study has commercial aspect, that it may be developed on large scale for the benefit of farmers, the nanofiber is efficient, requires very small amount of pheromone and lasts for more than two months.

#### 4. Conclusion

The present study concluded that the response of fruitflies with wind highly significant ( $r = -0.6838$ ,  $p < 1.0000$ ), response of fruitflies with distance was moderate, negative and non-significant relationship ( $r = -0.1736$ ,  $p < 0.0529$ ) is shown. A moderate, negative, but highly significant relationship of flies response was noted with time ( $r = -0.3791$ ,  $p < 0.001$ ).

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