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Comparative analysis of efficacy and longevity of different pheromone baited septa for control of *Gram Pod Borer* in Chickpea in Uttaranchal, India

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ABSTRACT

Pheromones are species specific chemicals which are biodegradable, eco-friendly, chemically safe, and required in ultra low dosages and used as efficient tool for insect pest management. Efficiency of pheromone traps used for pest control depends on air borne pheromone stimulus, in specific ratio and concentration released from septa. Field longevity of synthetic lures for *Helicoverpa armigera* (Lepidoptera: Noctudae) and efficacy of different septa were evaluated by mass trapping experiments in Pantnagar, India.The longevity (shelf life) of septa impregnated with pheromone components (Hexadecenol) and 97:3 blend (Z-11-hexadecenal and Z-9-Hexadecenal) were studied by gas chromatographic estimation of the residual pheromone remaining on the septa at different time interval and temperature conditions. The rubber eraser septum is found to be most effective one. This study is helpful to popularize the pheromone technology among the farmers as they can store the already loaded septa and use them for control of *H.armigera*.

Key words: Chick pea, *Helicoverpa,* Pheromone, *Septa,* Shelf life.

INTRODUCTION

Chickpea has been well recognized as a valuable source of protein particularly in the developing countries where majority of the population depends on the low-period food for dietary requirements. In addition, chickpea also plays an important role in sustaining the soil productivity by fixing up to 141 kg nitrogen/ha (Rupela, 1987).Chickpea is the third most important grain legume in the world after dry beans and dry peas. Among the reported insect pests, the gram pod borer, *Helicoverpa armigera* (Hubner) is the key pest at pod formation stage of chickpea, which may account for about 20-80 per cent yield loss. Of the single strategies adopted to control this pest, no single treatment was successful. Perhaps, repeated application of synthetic pesticides developed resistance in the pests. Loss of control due to the development of multi resistant strains has been reported in many crops (Mehrotra**,** and Phokela, 1992).

The noctuid genera of Helicoverpa contains pest of worldwide importance. More than 75 species and sub species are found on very wide range of wild and cultivated host plants (Kumara, and Shivakumara, 2003). In India *H. armigera* has developed resistance against pyrethroids, organophosphates and organochlorine insecticides and also to Bacillus thuringiensis (B.t), suggesting thereby use of sex pheromone (Kranthi *et al* 2002 and Wu *et al* 2002). In order to help timely management of the pest, pheromone traps are widely recommended (Hall, and Cork, 1998).

Efficiency of pheromone traps used for pest control depends on air borne pheromone stimulus, in specific ratio and concentration released from septa of trap (Kohl 2004). To make the most of the pheromone applied in the field, a good formulation is needed and such formulation aims to trap the pheromone inside the dispenser which protect it from degradation by environmental factors and release it at a controlled rate for the required period in the field (Weatherston, 1990). Therefore both things are necessary, the good septa (dispenser) and the shelf life of formulation for the success of pheromone technology. The shelf life in this case refers to the effectiveness of loaded septa with pheromone blend and storage of this blend in different temperature conditions. This study was done to provide pheromone blend or loaded septa to farmers easily and by knowing this one can store the septa or blend for different time before use. Correct storage conditions are essential to assure the performance of pheromone lures (Rauscher and Heinrich 2001).

MATERIALS AND METHODS

Experimental site: The field experiments were conducted in 3 seasons at Crop Research Centre of G. B. Pant University of Agriculture and Technology, Pantnagar, Uttaranchal. It is situated at the foothills of Shivalik range of Himalayas i.e. 29°N latitude, 79.3°E longitude and at an altitude of 243.8 msl. Pantnagar comes under humid subtropical zone and represents tarai climate.

Preparation of the septa: Total seven different types of septa were taken for the comparative analysis. The rubber eraser, rubber cup, glass slides, cotton single, cotton double, glass bottle and filter paper septa were used as dispenser of pheromone component.

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The rubber eraser and cup septa were first thoroughly washed with warm distilled water followed by acetone and hexane and allowed to get completely dry overnight. Other septa were washed with hexane, dried and used. Standard solutions of (Z)-11 hexadecenal and (Z)-9 hexadecenal were prepared by dissolving 100 mg of the component in 100 ml of hexane. The pheromone blends were prepared by adding Z-11 HDAL and Z-9 HDAL in the ratio of 97: 3 (the major pheromone components of *H.armigera*).The septa were loaded with 1 mg/ml of each pheromone blend i.e. 97: 3 of (Z)-11 Hexade cenal and (Z)-9 Hexadecenal respectively.

Shelf life study: It was studied at room temperature, fridge (5-7°C) and freezer (-5 to -10°C) conditions

Instrument for the study of shelf life: Hewlett Packerd Model 5890 Series II capillary gas chromatograph equipped with Flame Ionisation detecor and HP 3396 Series II integrator.

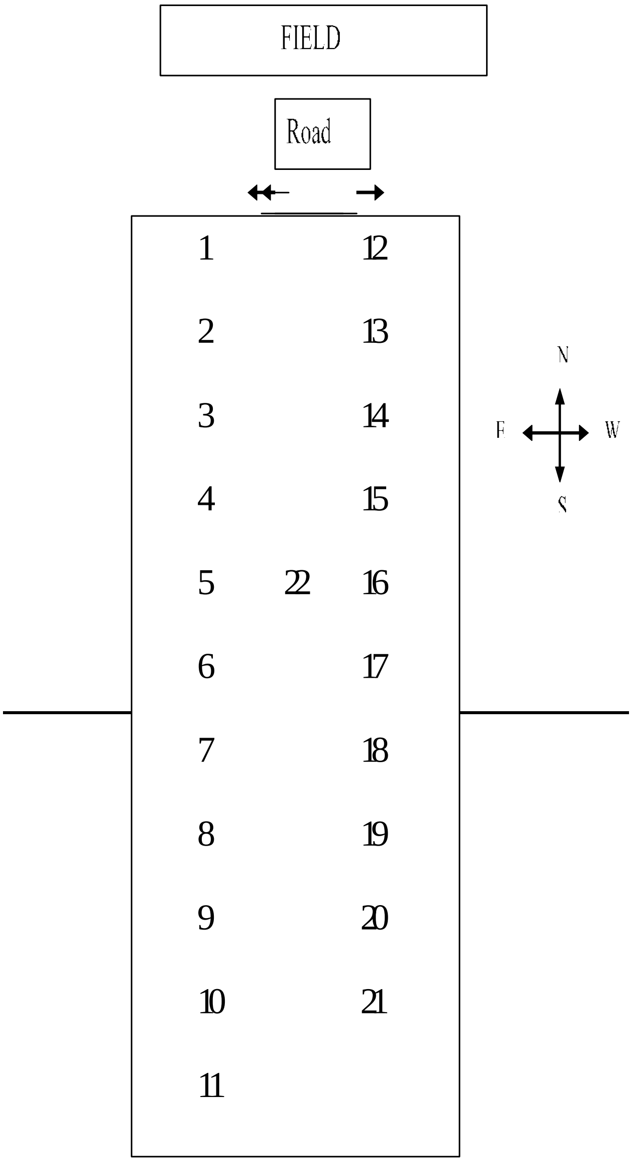
GC Conditions

Gas chromatograph (GC)	Capillary PLOT
Column	Length 5m Id 53 µm, Film thickness 2.65 µm
Detector	FID (Flame ionization detector)
Integrator	HD 3396 series II
Flow rate	ml/min
Carrier gas	Nitrogen (20)
Flame gas	Hydrogen (40)
Air	(400)
Mode	isocratic
Split ratio	Split less
Column temperature	170 °C
Injection port temperature	170 °C
Detector temperature	200° C
Area rejection	0
Chart speed/Attenuation	1 cm/min/0

Installation of pheromone traps in field for monitoring and mass trapping experiments: The pheromone traps with septa, impregnated with pheromone components and blends were placed in the field of chickpea at CRC, G. B. Pant University of Agriculture and Technology, Pantnagar at a height of 1.5 m on a wooden stick above the ground level. Trapped moths were collected, counted daily and destroyed. Total traps were installed at a distance of 30 m from each other from February to May for comparison of different septa and monitoring and mass trapping (Fig.1).

RESULTS AND DISCUSSION

Pheromone traps deployed in the field revealed that the moths first appeared during seventh standard week, which gradually increased and highest population was observed during 12th standard week. After this peak, population began to decline and lowest population was observed during 19th week. Rubber eraser septum with total moth catches of 1966 ranked first with respect to its efficacy in moth population



(All traps baited with same blend and different septa to check the efficacy of different septa).

1- Rubber eraser	12-bottle
2-rubber cup	13-cotton single
3-filter paper	14-glass slide
4-rubber cup	15-cotton double
5-rubber eraser	16-glass slide
6-cotton single	17-filter paper
7-rubber cup	18-cotton double
8-cotton double	19-bottle
9-cotton single	20-glass slide
10-bottle	21- Filter paper
11-rubber eraser	22-Control

Distance between two traps is 30 meter

Fig 1: Layout showing the traps position.

Table 1: Comparison of different septa.

Type of septa	Total catches	Mean of Total catches in three traps
Cotton single	35	11.67
Glass slide	37	12.33
Cotton double	48	16.00
Filter paper	66	22.00
Glass bottle	147	49.00
Rubber cup	1064	354.67
Rubber eraser	1966	655.33

CD At5% 190.13
SEM± 67.71

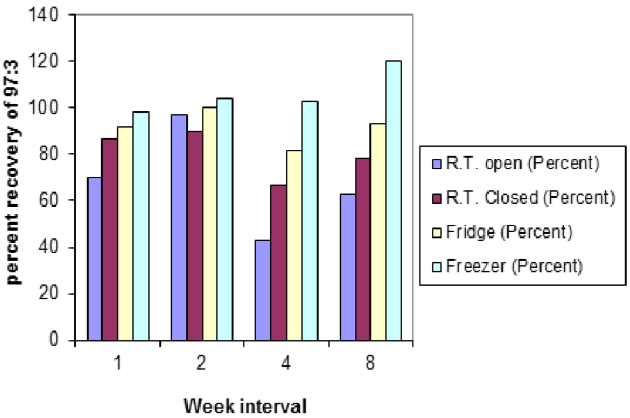


Fig 2: Recovery percentage of 97:3 blends (Z-11 and Z-9 Hexadecenal) in bottles.

monitoring followed by rubber cup septum (1064 moths) and least effective septum was found to be cotton single septum with total moth catches of 35 (Table-1) Rubber septa were found to most useful for the sex pheromone loading and for trapping (Knight 2002, Trimble *et al* 1999, Kakizaki and Suzie 2003, Hughes *et al* 2002)

The possible reason for rubber eraser septa is more efficient in comparison to other septa may be due to slower loss of pheromone blend, thus pheromone release from the septa for longer period of time in threshold quantity and making septa more effective. In whole we can say that rubber septa are more effective than other septa.

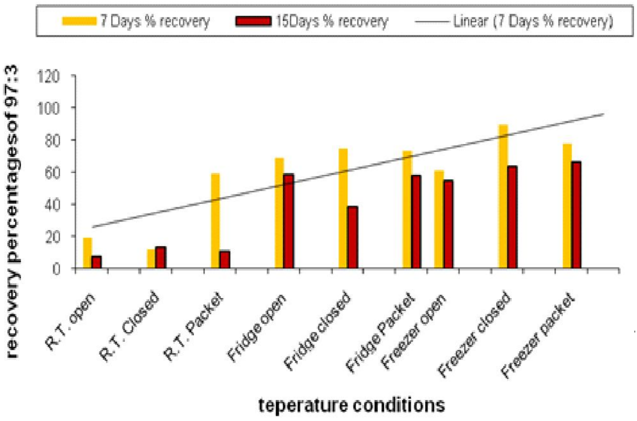


Fig 3: Recovery percentage of 97:3 blends (Z-11 and Z-9 Hexadecenal) in rubber eraser septa.

The longevity of septa (shelf life) impregnated with pheromone component Hexadecenal and 97:3 blends (Z-11-hexadecenal and Z-9-Hexadecenal) were studied by gas chromatographic estimation of the residual pheromone remaining on the septa at different time interval and temperature conditions. While for 97:3 blend on glass bottles –10°C temperatures (freezer) is the best condition for storing the blend for more than 8 weeks (Fig 2). The percent recoveries were more than 100% with time; it means that we can store the 97:3 blends at this temperature. Shelf life study on rubber septa by GC analysis showed that recovery percen tages decreases just after one week and it again decreases in second week i.e. after fifteen days in all condi tions (Fig 3).

CONCLUSION

We can conclude that the best septum for the loading of pheromone blend of *H.armigera* is rubber eraser that loses its efficiency after 15 days in field conditions so we have to replace that in 15 days of interval. The shelf life may be increased for the loaded septa if they can be stored in freezer for up to 8 weeks.

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