Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.7710

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2019) *7*(4), 178-183

Research Article

Indian Journal of Pure & Applied Biosciences

Combination Trap Design to Control the Insect Pest of Various Agricultural Crops at Telangana and Kerala

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Received: 22.07.2019 | Revised: 25.08.2019 | Accepted: 29.08.2019

ABSTRACT

The resistance created for synthetic chemical pesticides by the insects and introduction of new synthetic pesticides have affected the nature and non-targeted organisms. These issues gave rise to 'organic farming and bio-control' a new method of controlling the insect pest which was cost effective and eco-friendly. Bio-control agents and trapping system are the major techniques which enable to facilitate and promote organic farming. In the similar sequence of trapping system, we are introducing a new trap design which is a single solution to variety of insect pest in the agricultural fields. This combination trap has the features of light trap, sticky trap and pheromone trap arranged in a detachable and replaceable form. It has a simple design and materials required can be easily procured. This trap can be used for any type of crops as it have trapping system for almost all type of insect pest. It is cost effective, portable and has less weight which will be useful to the farmers and agriculturist.

Keywords: *Bio control, Organic farming, Combination trap, Agricultural field, Cost effective.*

INTRODUCTION

Insects are major pest of the agricultural field leading to crop damage and loss. Till date many measures are adapted by the farmers and agriculturist for the control of these notorious insect pests (Oliveira et al., 2014). Previously chemical pesticides were the only options to control the pest population. Due to resistance created in insects and introduction of new synthetic pesticides, a great damage has occurred to the nature and the organisms are affected including the humans (Kaur Gill & Garg, 2014). There are many case histories related to accidents due to application of chemical pesticides on the crops. Mutation in genetic material is the worst case that would reflect the danger of using such chemical pesticides. Green revolution has been the best alternative to these prevailing problems. Use of bio-control agents and trapping system along with pheromone technology are the revolutionary findings for organic farming. Among the various measures suggested trapping system is wildly accepted and applied technique. It is possible due to nocturnal nature of the insects and their affinity towards the light source.

Cite this article: Gupta, S., Chaitanya, K., Sheela, B., V. J., & Pranav, P. (2019). Combination Trap Design to Control the Insect Pest of Various Agricultural Crops at Telangana and Kerala., *Ind. J. Pure App. Biosci. 7*(4), 178-183. doi: http://dx.doi.org/10.18782/2320-7051.7710

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Presently we find many types of light trap, sticky trap, funnel trap, delta trap and so on. Right time and number of these traps in the field have given effective results by interrupting the life cycle of the various insect pest including Lepidoptera and Hemiptera (Ram Prasad & Malathi, 2015, Manju et al., 2018). There are many such trap designs found in the market which will facilitate either one of the source of trapping system. In the present new design of introduced trap both light as well as sticky trap can be framed at a time in to the agricultural field. It is cost effective, portable and useful for any type of crop along with less manpower and more efficacies. The trap is evaluated in the field of Okra (*Abelmoschus esculentus)*, Cotton (*Gossypium herbaceum* L.) and Brinjal (*Solanum melongena)*. Species of insect pest along with their population and level of infestation is observed and recorded.

MATERIALS AND METHODS

Design specifications:

There are various components of the trap including the body of the trap including Funnel and Collecting bin along with a light source are represented through a 2D design (Fig 1). It is created with an aluminum sheet of 2mm thickness molded into cone and collector of the trap. The cone has attachment for LED lights and yellow sticky trap. Light source has solar panel assembled with light sensors and electric charging attached to the battery (Fig 2.a). Internally towards the slope of the trap is facilitated with pheromone lure port and externally along the line of solar light, there are plugs for sticky traps (Fig 2.c). The trap is having cumulative weight of 3 kgs requiring less area for installation. Materials used to construct this trap along with gross costing is enlisted (Table 1).

Table 1: Requirements and price of combination trap for insect pest in agricultural field

Sr.No.	Structure	Requirement	Quantity/ capacity	Price in Rs.
1.	Conical funnel	Aluminum sheet	4 sq feet	380.00
2.	Collecting bin	Aluminum sheet	3.5 sq feet	310.00
3.	Light source	LED light Panel	5 mm x	60.00
4.	Power source I	Solar panel	16 sq cm	20.00
5.	Power source II	Two pin electric power cable	DC 6 V/ 1.5 A	50.00
6.	Battery	Chargeable lead battery	(1 each)	90.00
7.	Hanging for yellow sticky trap	Aluminum rod (4mm)	2.5 feet	50.00
8.	Yellow sticky trap	Corrugated plastic sheet	12 x 8 sq cm (2 no.)	36.00
Making charges				400.00
Total costing				**1396.00**

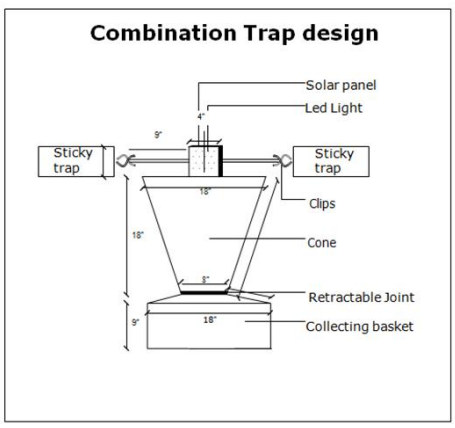
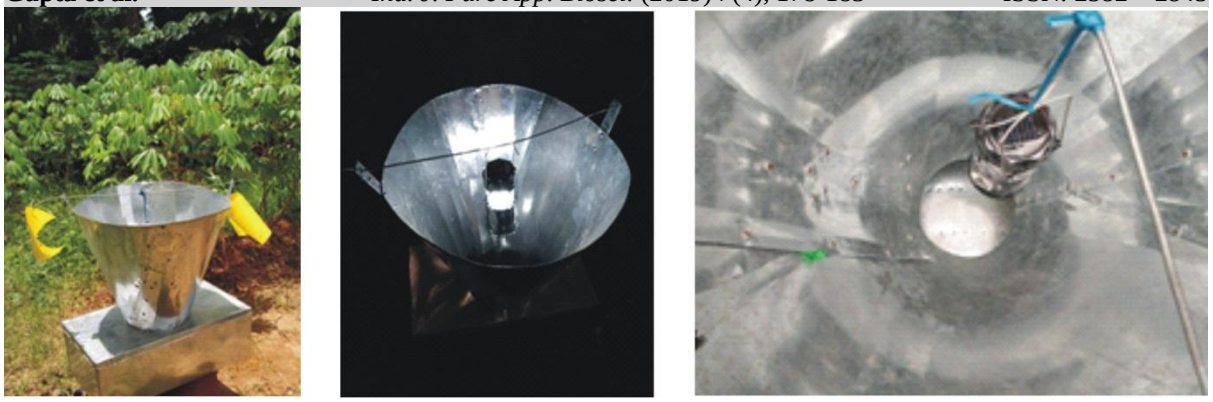


Fig. 1: 2D design of combination trap



a **b** **c**

Fig. 2 : a. Trap placed in tapioca field for evaluation
b. Light eliminating from trap at night
c. Trap internally facilitated with Pheromone lure port

Area of investigations:

1. **Telangana :** The trap is studied at Algunur village in Thimmapur mandal of karimnagar (18° 26' 18.7980" N and 79° 7' 43.8168" E). The climatic conditions in this region is suitable for variety of crops like paddy, sorghum, okra, brinjal, cauliflower, cotton, pomegranate, etc. The temperature, relative humidity and rainfall recorded at Karimnagar is 19˚C - 44 ˚C, 51% to 82 % and average rainfall occurs 907 mm per year.
2. **Kerala :** Thalassery, Kannur dictrict (11.7491° N, 75.4890° E) of Kerala is selected as second region for field trials of combination trap design. Fifteen principle crops like Rice, pulses, coconut, rubber, tea, coffee, pepper, cardamom, areca nut, ginger, nutmeg, cinnamon are cultivated from in the State. The temperature in Kerala normally ranges from 28° to 32° C (82° to 90° F), 68 % to 89% relative humidity and rainfall is average 3000 mm each year.

Selected crop plants:

1. **Telangana region :** Three crops Okra (*Abelmoschus esculentus)*, Cotton (*Gossypium herbaceum L*) and Brinjal (*Solanum melongena)* are selected for evaluating the present trap design. The field (one acre / sample crop) is made available from the local small farmers of Algunur village.
2. **Kerala region :** Topioca (*Manihot esculenta*), Red spinach (*Amaranthus tricolor* L), Yardlong bean (*Asparagus bean*) are the three crops studied to check the efficacy of trap from various regions of Thalassery, Kannur district of kerala.

Duration of the study : The trap is evaluated for the period of nine months and several replications per sample crop. Data is recorded for the insect pest trapped and thereby the efficacy of trap on different types of crops in varying climatic conditions.

Statistical data : The data collected from the field was applied for One Way Anova to check the accuracy of the study.

RESULT AND DISCUSSION

1. **Efficacy of the components of Combination trap for insect pest:**

The trap is composed of various components such as the body part, light source and power source. Working efficiency of all these parts ensures its usage by the agriculturist in varying climatic conditions. Body part of the trap is observed with effective collecting ability, also no climatic reactions and dislocations of the joints or parts. Light source made by series of LED emitting white colour light was measured with frequency of 3 mts per area at the field (Fig. 2.b). There was no interruption in the working of the LED lights in changing weather and climatic conditions. The Power source made available through solar panel was

found to be effective even in the dim light. Alternative power back up of battery through electric charging and light sensors assembled with the solar light is found compatible for the farmers and worth for usage. Additional application of replaceable sticky trap and pheromone lure is found to increase the efficacy of the combination trap for insect pest.

2. Evaluating Combination trap for controlling insect pest population in different crops :

The trap was placed in one acre field and was illuminating from 6 pm to 4 am for the period of nine months to estimate the insect pest population and thereby efficacy of the trap design. Okra (*Abelmoschus esculentus)*, Cotton (*Gossypium herbaceum* L.) and Brinjal (*Solanum melongena)* are the test crops from Karimnagar, Telangana. Also, similar experimental setup was placed at Thalassery, Kannur district, Kerala in three crops, Topioca (*Manihot esculenta*), Red spinach (*Amaranthus tricolor* L.) and Yardlong bean (*Asparagus bean*). Similar study was conducted by N. Akhila et al. (2019) Raju et al. (2017) and Pratibha et al. (2018) on the pest of Okra. In case of cotton crops from Telangana and other parts of India S Vennila, et al. and S Anusha et al. (2017) have worked on insect pest from Lepidoptera and Hemiptera from Cotton crop. P. Sudha Jacob and Revathi (2019) have observed the shoot and fruit borer insect pest infestation in Brinjal crops and their control through IPM stratergies. Study on crops such as Topioca, Red spinach and Yardlong bean is been studied by Mani (2017), Ebert et al. (2011) and Uddin et al. (Uddin et al., 2013) from different regions of India and Bangladesh observing various insect pest infestation.

Table 2: Efficacy of trap to control insect population in various field crops at Karimnagar, Telangana and Thalassery, Kerala

Sr.no	Crop	Scientific name	Part of combination trap	Insect pest trapped	Insects trapped		
					Population dynamics	F valve	P value
1.	Okra	*Abelmoschus esculentus*	Light trap	Spiny bollworm (Earias vitella)	22.60	48.66	0.0
				Spotted ballworm *(Earias insulana)*	11.93	34.05	0.0
				Tobacco cutworm (*Spodoptera litura*)	10.06	25.32	0.0
			Sticky trap	Jassid (*Amrasca biguttula*)	19.33	28.61	0.0
				Whitefly (*Bemisia tabaci*)	14.73	22.97	0.0001
				Thrips *(Scirtothrips dorsalis)*	24.53	59.13	0.0
2.	Cotton	*Gossypium herbaceum L*	Light trap	*Pink bollworm* (*Pectinophora gossypiella)*	26.40	153.48	-0.0
				Spotted ballworm *(Earias insulana)*	12.00	28.76	0.0
			Pheromone trap	*Ballworm (Helicoverpa armigera)*	13.00	61.89	0.0
			Sticky trap	Thrips *(Scirtothrips dorsalis)*	36.200	440.88	-0.0
				Jassid (*Amrasca biguttula biguttula)*	20.66	58.78	0.0
				Aphid (*Aphis gossyppi*)	11.06	59.29	0.0
3.	Brinjal	*Solanum melongena*	Pheromone trap	Brinjal shoot and fruit borer (BSFB) (*Leucinodes orbonalis*)	26.46	273.87	-0.0
			Light trap	Tobacco cutworm (*Spodoptera litura*)	37.26	472.46	-0.0

			Sticky trap	Aphid (*Aphis gossypii*)	40.13	560.03	-0.0
				whitefly (*Bemisia tabaci*)	49.73	966.46	-0.0
4.	Tapioca	*Manihot esculenta*	Sticky trap	Spiralling whitefly *(Aleurodicus disperses)*	29.800	39.20	0.0
				Thrips (*Retithrips syriacus*)	30.40	1041.4	-0.0001
5.	Red spinach	*Amaranthus tricolor* L	Light trap	Tobacco cutworm (*Spodoptera litura*)	17.200	89.39	0.0
			Sticky trap	Spiralling whitefly *(Aleurodicus disperses)*	27.33	89.60	0.0
6.	Yardlong bean	*Asparagus bean*	Light trap	legume *pod-borer* (*Maruca vitrata*)	14.93	834.66	-0.0
			Sticky trap	Spiralling whitefly *(Aleurodicus disperses)*	17.60	689.4	-0.0

In the present study in evaluating the Combination trap, it is observed that the insects from order Lepidoptera and Hemiptera were effectively captured per day of experimental period in all the test crops from the region of Telangana and Kerala. The insects were trapped more in rainy and winter season. Yellow sticky trap was found efficient to trap and control the population of Whiteflies, Jassids and Aphid. At Karimnagar, Telangana the pest level is found high in cotton and brinjal with maximum number of Thrips, Pink ballworm and Aphid, Tobaco cutworm respectively (Shanmuga Prema et al., 2018). Okra crops were with least pest population among the three crops at karimnagar with maximum insect infestation by Thrips and Spiny ballworm (Singh, & Gupta, 1996). Cotton crops from this region was most infected with Thrips and pink ballworm (Makwana et al., 2018). The study data at kerala suggest that among the three crop Tapioca, Res spinach and Yardlong bean, maximum infestation is observed in Tapioca by Thrips, spirally whitefly and least infestation in Yardlong bean by spirally whitefly and legume pod borer whereas, Red spinach is with least infestation with Spirally whitefly and Tobacco cutworm (Litty Varghese & Celine, 2015, Ramani et al., 2001).

CONCLUSION

The present study reflects the the new design of Combination insect trap as an effective and cheap alternative to the available sources for trapping and monitoring of the insect pest population at agricultural field. This will promote organic farming to be economical and sustainable for farmers around the globe.

Acknowledgement

This project is made possible with collaboration of many people working at various areas of trap design. Thus, first author is grateful to Mata Amritanandamayi Devi to give her blessings and opportunity to complete this research work in her institution at Thalassery, Kerala. Also, thankful to E. Prasad Rao and Rashmitha Prasad for their unconditional support to work for this project from their institution at Karimnagar, Telangana. First author is much thankful to Mr. Manikandan for creating the structure and fetch other accessories for this trap and Mr. Vicky Ashok P for adding light sensors to the solar light used for this trap.

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