Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5587

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **7 (2):** 356-360 (2019)

Research Article

Development and Evaluation of Eco-Friendly Solar Energy Based Light Trap

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Received: 5.11.2018 | Revised: 8.12.2018 | Accepted: 17.12.2018

ABSTRACT

Insect light trap is one of the very effective tool of insect pest management in organic agriculture as it mass-traps both the sexes of insect pests and also substantially reduces the carryover pest population. By monitoring the light traps they will know better what types of insect are there in the field and whether they are in controllable level or not. Once the insect population in the light traps crosses a certain limit the farmer can decide on the type of pest management they have to take up. Among several types of traps, pheromone trap, light trap (electrical or solar), poison bait, alternate host (trap crop) are commonly used in the field of agriculture, but electrical operated light trap has many disadvantages keeping in view we developed a solar light based insect pest trap. The developed trap consists of solar panel of 10 W , 7aH battery, diode, funnel covered with tub, tripod stand and switch. The trap is evaluated at different crops like paddy, mango, brinjal and marigold and found successful results as compared to other trap. This device reduces the usage of poisonous chemical pesticide in the agriculture field.

Key words: *Solar light, Trap, Solar panel, Chemicals.*

INTRODUCTION

Agriculture in India increased its yields due to improved agronomic technology by introduction of high-yielding varieties of seeds (hybrid) , increased use of chemical fertilizers and irrigation led to the increase in production needed to make the country self-sufficient in food grains. The methods adopted included the use of high-yielding varieties (HYVs) of seeds with modern farming methods. Due to the rise in use of chemical pesticides and fertilizers there were negative effects on the soil and land. The defined integrated pest management is a plan that should be based on prevention, monitoring, and control which offers the opportunity to eliminate or drastically reduce the use of pesticides, to minimize the toxicity and exposure to any products which are used. IPM does this by utilizing a variety of methods and techniques, including cultural, biological and structural strategies to control a multitude of pest problems.

Cite this article: Dronachari, M. and Kumar, N., Development and Evaluation of Eco-Friendly Solar Energy Based Light Trap, *Int. J. Pure App. Biosci.* **7(2):** 356-360 (2019). doi: http://dx.doi.org/10.18782/2320-7051.5587

IPM involves proper monitoring of insect pests at the early stage of pest attack and control of those pests at early stage becomes most important. For proper monitoring and control at the early stages of pest attack, different types of techniques are adopted viz- survey through damage estimation, sweeping and pest population study, use of traps, etc. Among several types of traps, pheromone trap, light trap (electrical), poison bait, alternate host (trap crop) are commonly used in the field of agriculture.

Most of the light traps are used in the field of agriculture for monitor the insect pests of different crops is electrically operated and stationery in nature due to its dependence of electric connection. Besides, there is no possibility to avail the electric connection in the entire area of any crop field for smooth operation of the electrical light trap.

Solar light insect trap is one of the components of IPM that monitors and controls the pest populations without any use of pesticides. The solar LED pest control light is environmentally friendly, energy-saving, easy to use and independent of the electricity. Based on the phototaxis of targeted pests, it adopted the strobe light way to reduce power consumption and save energy, thus extending the working hours in the rainy days. It can save electrical energy and use solar energy which is a renewable energy source. Hence the solar light trap may be considered as the alternate solution that has several advantages over the electrical light trap.

The advantages of solar insect light trap are portable in nature, it can be easily fixed at any place of the crop field by the tripod stand, can be shifted easily from one plot to another and standard solar light system is attached with the model which will supply a continuous light up to 24 hrs if the battery is fully charged. Keeping in view these points solar light insect trap is developed and evaluated at different crops i.e., paddy, brinjal, marigold and mango fields in college of Sericulture, Chintamani.

Research Methodology:

The Solar light insect pest trap research is an experimental research. The purpose is, to produce and invent Solar Energy-Based Insect Pest Trap by using ultraviolet LED bulbs as light source. The ultraviolet is effective wavelength to tempt insects. Solar cells are used to change solar energy to electric energy and change to battery for pest trap. After that, bring the trap to test the effectiveness and results of pest trap in agricultural fields.

The processes are;

Design : The concept idea of Solar light insect pest trap design is using general stuffs; The Solar light insect pest trap consists of a) 10 watts Solar cell to change solar energy to electric energy for battery charging. b) 12 volt 7 Ah Sealed Lead Acid battery to save electric charge in day time and give electric energy to LEDs at nighttime. c) Ultraviolet LED bulb of 3 w and have 315-400 nm for wavelength; the most appropriate wavelength for insect tempting[1,2]. d) A Diode is used to avoid the reverse the flow of current from battery to the panel. e) Switch for on/off to LED light. e) Funnel with insect collecting tub: the funnel is placed above the insect collecting tub which drives the insects to fall to the tub. A plastic funnel of upper diameter of 26 cm and 3.5 of lower diameter. A portion of 5.5 cm is maintained in the funnel for easy entrance of the insect pests. f) Tripod stand for fixing and support of solar light insect pest trap as shown in fig.1

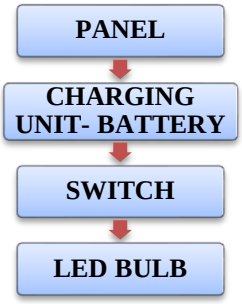


Fig. 1: Flow chart of Solar Light Insect Pest Trap

2. Invention. The main structure of Solar Light Insect Pest Trap is made from angle iron for durable using in agricultural fields. Its height is 125 centimeters. On the top of Insect Pest Trap, install the 10 watts solar cells panel, area of the panel is 0.0925 m^2, 10-15 degrees of elevation angle for solar effective. Other stuffs are 5 amps battery charger, 12 V 7 Ah Sealed Lead Acid battery and switch circuit The base of the trap is tripod stand to mount the ground. The insects tempt with 3 W LED light which placed above the funnel, and insect collecting tub which drives the insects to fall to the tub placed below the funnel. A plastic funnel of upper diameter of 26 cm and 3.5 of lower diameter. A portion of 5.5 cm is maintained in the funnel for easy entrance of the insect pests as shown in Figure 2.

Fig. 2: Solar Light Insect Pest Trap

3. Evaluation of Developed Solar Light Insect Pest Trap

Evaluation of solar Light insect pest trap were carried out at brinjal, marigold, paddy and mango fields and collected insects are mentioned. The solar insect pest trap is switched on 6.00 pm and switched off at 12.00am and identified different insects in the field and classified.

1. Evaluation of Solar Light trap in Brinjal plot for two days and observed

Observations:

ORDER	NO. OF INSECTS TRAPPED	
1. Hemiptera	176	786
2. Lepidoptera	7	23
3. Hymenoptera	25	17
4. Dermoptera	5	--
5. Orthoptera	1	--
6. Diptera	54	69
7. Coleoptera	12	67
TOTAL	280	962

Inference: The order Hemiptera was trapped in large numbers. It involves various bugs of family Miridae and *Alydidae*. Also plant hoppers were trapped in the order Hemiptera. The total no. of insects collected in the brinjal for 2 days is 1242.

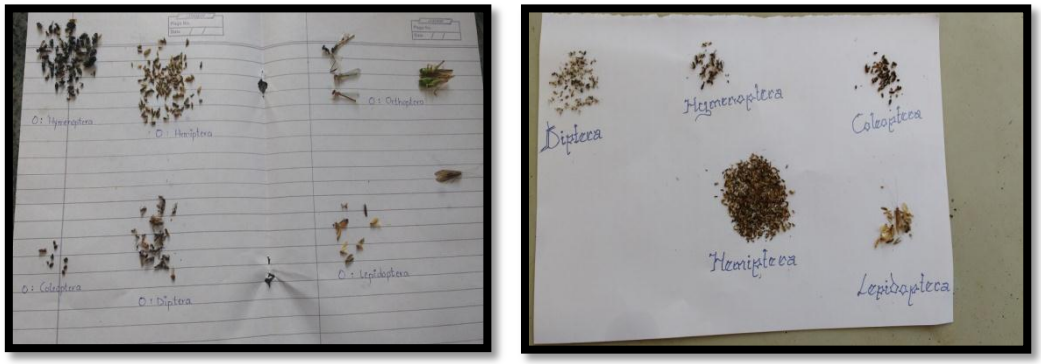
2. Evaluations of Solar Light trap in Marigold plot

Order	No. Of insects trapped
1. Hemiptera	404
2. Lepidoptera	15
3. Hymenoptera	30
4. Diptera	6
5. Coleoptera	5
TOTAL	460

Inference: The insects of order Hemiptera were trapped in large numbers. It involves various bugs of family Miridae and Alydidae. Also plant hoppers were trapped in the order Hemiptera. The total no. of insects collected is 460.

3. Evaluation of Solar Light trap in Paddy plot

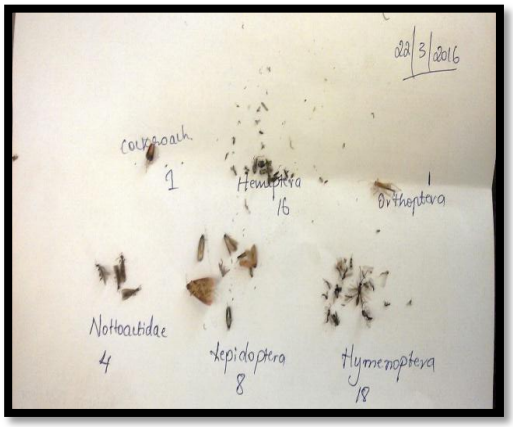
Order	No. Of insects trapped	
1. Hemiptera	141	786
2. Lepidoptera	6	23
3. Hymenoptera	29	17
4. Diptera	65	110
5. Coleoptera	9	67
6. Orthoptera	6	786
TOTAL	256	1003



Inference: The insects of order Hemiptera were trapped in large numbers of 786, followed by the order Diptera 110. Also plant hoppers were trapped in the order Hemiptera. The total no. of insects collected is 1003.

4. Evaluation of Solar Light trap in Mango plot

Order		No. Of insects trapped	
1.	Hemiptera	61	20
1.	Lepidoptera	1	8
2.	Hymenoptera	20	18
3.	Diptera	32	2
4.	Coleoptera	6	--
5.	Orthoptera	--	20
TOTAL		**120**	**48**



Inference: The no. of insects trapped is low in mango. This is because of plant protection sprays were already taken up in it.

The model is very much suitable for the farmers to be utilized easily at any portion of area of their single or multiple crop fields in village surroundings. As most of the crop areas in a village are lacking with electric connection, the use of this solar light trap model is the most suitable instrument for monitoring and partial control of insect pest population of all crops at the village surroundings. As an alternate of chemical pesticide, this tool will be considered as important for its eco friendly nature and low cost involvement to both the farmers and agricultural experts. Our study reveals that the solar light trap model will be very much effective for the control of different insect pests of all crops without much use of chemical pesticides in the agricultural fields.

CONCLUSION

The experiment is carried out by placing the designed trap in four different crops. The important pests of each crop were trapped in it, collected and analyzed the different pests trapped.The developed solar light trap may be considered as important tool for its eco friendly nature and low cost involvement to both the farmers and agricultural experts. So for a better agricultural production and pest control can be done with the use of solar insect light trap which is one of the important of component of Integrated Pest Management.

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