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Influence of Weather Parameters on Pheromone Traps Catches of *Spodoptera litura* Febr.

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ABSTRACT

A study on influence of weather parameters on *Spodoptera litura* moth trapping pattern based on pheromone trap catch was carried out at Institute of Forest Productivity, Ranchi, (Jharkhand) during 2010-11 to 2011-12. During the year 2010-11,highest 76.00 moths/trap and in 2011-12 160.00 moth /trap were trapped in the month of July. Weather parameters viz. temperature and relative humidity was positively correlated with the moth trapping pattern. Rainfall negatively effects to *Spodoptera*. *Lituramoth* trapping during both the years.

Keywords: Weather effect, *Spodoptera litura*, Pheromone trap, moth trapping.

INTRODUCTION

Spodoptera litura Febr. (Lepidaoptera: Noctuid) is a moth also known as Cluster caterpillar, Cotton leafworm, Tobacco cutworm and Tropical armyworm in different part of the world. *S. litura* is an important polyphagous pest in India, China and Japan (Kandagal and Khetagoudar, 2013) of about 290 plants species belonging to 99 families (Wu *et al.*, 2004) of the agricultural and forestry importance such as cotton, chilli, caster, groundnut, tobacco, pulses and etc. (Armes *et al.*, 1997; Niranjankumar and Regupathy, 2001). It is believed that the increasing area of some economically important crops (mainly vegetable) and protected cultivation provide suitable sites for feeding and over wintering of *S. litura* (Gao *et al.*, 2004). This pest is also established on most Polynesian islands and cause 26-100% yield loss in ground nut (Dhir *et al.*, 1992); from 80-100% in tobacco crop (Chari *et al.*, 1986) and 10-25% in field crop (Sitaramaiah, *et al.*, 2001). In recent past due to prominent climatic changes and the non judicious use of agrochemical also aggravated the pest problem. It is realized that the inherent resistant power of plant is diminishing day by day (Singh and Kumar, 2009). Further Singh *et al.* (2012) noted that there is urgent need to enhancement of agricultural system productivity due to imminent climate change as agricultural system productivity is going down due complex problem; insect pests are posing serious threat to realize agricultural productivity. Due to the nocturnal nature, moth of *S. litura* are become active in night and move overnight for oviposion on a wide range of host plants, which promotes or even ensures survival of *S. litura* individual over a broad range of environmental conditions (Chelliah, 1985).

The use of chemical insecticides has been a fundamental tool for pest control, but leads to serious consequences such as intoxication of people and animals, contamination of water, air and soil, residues on food, high persistence in the environment, resistance in pests, and impact on beneficial insects, among other effects (Regnault-Roger *et al.*, 2005). Application of insecticide for the control of insect leads to resistance to insecticide also favourable weather conditions; cyclonic weather and heavy rainfall after a long dry spell appreciate population build-up of *S. litura* (Thanki *et al.*, 2003).

Insecticides are heavily used for managing the respective pest in vegetable ecosystem. However, such treatments fail to provide adequate control as they do not coincide with the susceptible stages of the pest but defiantly causes insecticide resistance to insects, pest resurgence, health hazards and environmental pollution. While, it has been proven that sex pheromone is a potential tool for monitoring of insect pest species and its management through mating disruption or male annihilation (Hall *et al.*,1993; Cork and Basu, 1996; Cork

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et al.,1996; Krishnaiah*et al.*,1998). Additionally, in way of developing any pest management programme for a specific agro-ecosystem, information on abundance and distribution of pest in relation to weather parameters is a basic requirement (Patel and Shekh, 2006).

Present investigation was undertaken to find-out the effect of weather parameters on trapping pattern of tobacco caterpillar *Spodoptera litura* Febr. using sex pheromone trap.

MATERIAL AND METHODS

Experiment on moth trapping pattern of *Spodoptera litura* was conducted at Institute of Forest Productivity, Ranchi, Jharkhand, geographically situated at latitude $23^0$21'26"N, longitude $84^0$14'44" from June 2010 to June 2012. The plastic made funnel pheromone traps (Biotrap) and sex pheromone septamanufactured by Pest Control (India) Pvt. Limited, Bangalore was used for monitoring of pest population. Three pheromone traps were installed on a wooden stick at different localities of nearby area of research campus of the Institute growing vegetable, ornamental, forestry and medicinal plants. The trap height was 1.25 m above the ground level. The best control effects of *S. litura* were obtained when the placement of traps at the heights of 1 m or 1.5 m above the ground (Lee, 1989). Pheromone traps were undisturbed with the activity of cultivation of crops and installed throughout the year. Sex pheromone septa of *S. litura* were changed regularly at weekly interval and observation was pulled for monthly data. Observations were recorded on number of moths trapped in each pheromone trap at fortnight interval from the day after installation of trap. Trapped moths were collected, counted and destroyed. The recorded data was subjected to statistical analysis with simple RBD and correlated with weather parameters.

RESULTS AND DISCUSSION

The observation was started after one week of installation of trap and total 24 moths were trapped in the first month of observation in the first year 2010-11(Fig.1). The maximum number of moths were trapped in the month of July (78.00/trap/month), while the lowest (3/trap/month) in the month of January, 2011 ($F_{11,24}$=38.70; P<0.001). In the second year 2011-12 minimum number of moth (12.33/trap/month) were trapped in the month of February, 2012, while the maximum (160/trap/month) moths were trapped in the month of July, 2011 ($F_{11,24}$=94.22; P<0.001). Based on moth trapping observation of both the years, it was found that the most favorable period for *S. litura* was June to August. Kumar *et al.* (2009) installed yellow pheromone traps and attracted maximum 22.01 moths/trap/week moths of *S. litura* and Selvaraj *et al.* (2010) has observed *S. litura* population built up progressively from April and acquired its peak in the month of May.

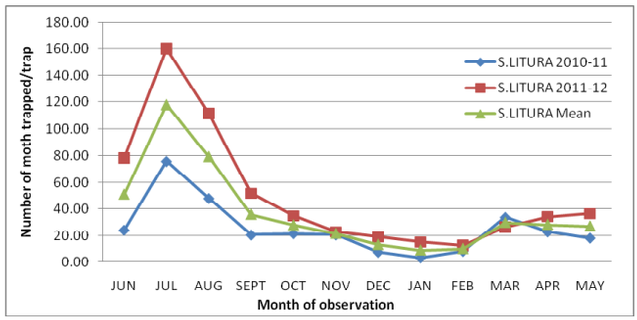

Fig.1: Month wise moth trapping pattern of S. lituramoth in Ranchi

The moth trapping data was also correlated with the weather parameter of both the years and it was found that in the year 2010-11, moth trapping was positively but non-significantly correlated with the maximum temperature (r = 0.164) and significantly correlated with minimum temperature (r = 0.625). Moth trapping positively and significantly correlated with the maximum and minimum relative humidity (r=0.526 and 0.691). The rainfall negatively and non-significantly correlated with the rainfall (r = -0.495) (fig. 2).

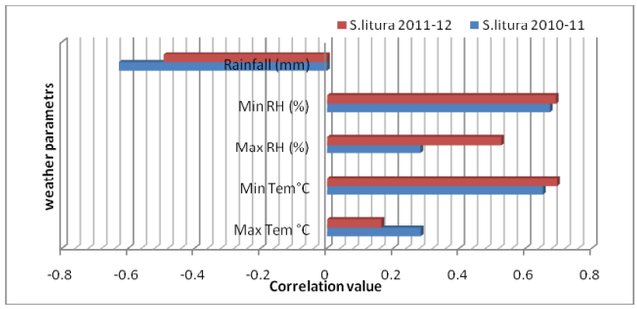

Fig. 2: Correlation coefficient with moth trapping and weather parameters

The moth trapping pattern in the year 2011-12, was similarly positively but non-significantly correlated with the maximum temperature (r = 0.283) and significantly correlated with minimum temperature (r = 0.652). Moth trapping positively but non-significantly correlated with the maximum relative humidity (r=0.282) and positively and significantly correlated with minimum relative humidity (r = 0.673). The rainfall negatively and significantly correlated with the rainfall (r = -0.629) (fig. 2). Correlation result showed that moth trapping increases with increasing temperature and relative humidity but deceases when rainfall increases.

Increasing temperature and humidity positively affects *S. litura* moth catch (Geethalakshmi *et al*., 2004) while, negatively affected by the rainfall (Prasannakumar *et al*., 2011) because, moth flight activity disrupted by the raindrops (Gedia *et al*., 2007).

The moth trapping was more at the maximum temperature range of 30-36°C and minimum temperatures 20-22°C in presence of relative humidity range of 90-93% and 50-63% maximum and minimum respectively, when light rainfall occurs (Fig. 3 & 4).Also in the month of June when rainfall starts, emergence of moth from hibernating pupal stages also starts and moth trapping increases in subsequent months. But the months in which heavy rainfall occurred, moth emergence and their flight activities were disrupted thus, moth trapping was decreased. Selvaraj *et al*. (2010) has observed 25.46% of *S. litura* annual population was built up at temperature range from 26.0°C to 35.1°C, relative humidity range from 62% to 89%. The increasing temperature and relative humidity increases the trapping of moth population as compared to cooled month which supports the observation of Geethalakshmi *et al*., (2004) where, moth activity was high under maximum and minimum temperatures of 26°C and 18°C, respectively and population increased with increasing relative humidity.

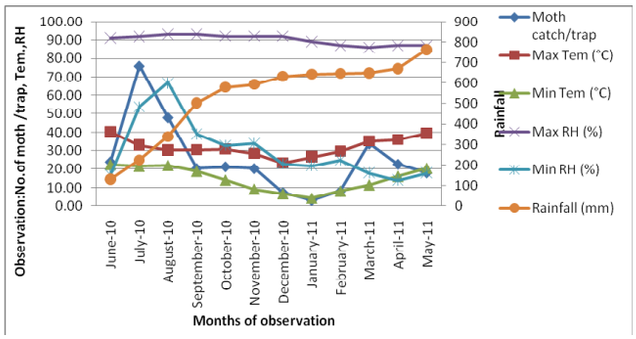

Fig. 3: Weather parameters and *S. litura* moth trapping pattern (2010-11)

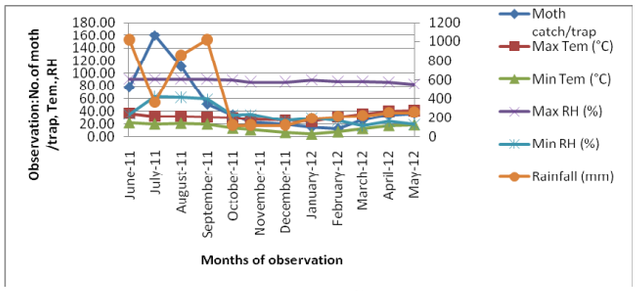

Fig. 4: Weather parameters and *S. litura* moth trapping pattern (2011-12)

CONCLUSION

The weather parameter plays an important role in growth and development of any organism on the earth. Similarly, weather parameters influence to trapping pattern of *S.litura* moth, which was observed from June to May regularly for two years. In this period maximum moth /trap were trapped in the month of July. While, it was noticed that moth emergence from the hibernating pupa was started after first rain in the month of June and moths were become very active in their favourable month up to first fortnight of September. Thus, it is concluded that the increasing temperature and relative humidity with slight rainfall favours to population build-up *S. litura*. It is also concluded that, favourable period for polyphagous insect pest *S. litura* is from June to first fortnight of September. Thus, farmers should get ready to manage the *S. litura* population after first rainfall in the month of June.

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