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Weather Based Forewarning of Predators in Tasar Silkworm (*Antheraea mylitta* D) at Kathikund, Dumka (Jharkhand - India)

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A B S T R A C T

An experiment was carried out during the year of 2016 in the first crop rearing of Tasar silkworm at Pilot Project Centre (PPC), Kathikund with replicated thrice in completely randomized block design. The treatments consists with three brushing date of tasar larva in the month of July (i.e., 16th, 21st and 26th at an interval of 5 days) and four directions (i.e., North, South, East and West). Daily weather and predator's data have been collected from rearing field and expressed in weekly basis. Interactive relationship was made between weather and predators in tasar silkworm by using weekly data. On the basis of interactive approach between weekly weather and predators' data, we found that congenial weather condition was favorable for high infestation of predators during 31st standard meteorological week (SMW). After and before 31st SMW, the predator's infestation was very low or absence in all date of brushing and direction, which indicates after and before 31st SMW week, weather condition was unfavorable for predators. On the basis of above results, we can forewarn to tasar sericulture farmers for adapting best integrated pest management practices before31st SMW or any weeks weather going to congenial for predators during 1st crop rearing.

Introduction

Tropical tasar silkworm, *Antheraea mylitta* D (Lepidoptera: Saturniidae) is a commercially important and valuable component of Asian non-mulberry silk industry. Forest dependent people rear its larvae on different forestry host plants for small household income. It is a backbone for tribal development because about 1.25 lakh tribal families are associated with tasar culture in the country (Reddy *et al.*, 2015). The rearing of Tasar silkworm, conducted in outdoor conditions by the tribal people on the forest grown *Terminalia arjuna* trees resulted in 80-90% crop loss due to pests, predators, natural calamities and diseases. There are several predators of tasar silkworm like Ichneumon fly, *Canthecona* bug, reduvid bug, *Hicrodulla bipapilla* (Praying mantis) etc., which is natural enemies in abundance in the rearing field resulting in low yield of cocoons (Shiva Kumar and

Shamitha, 2013). Solution of these problems will not only enhance the silk production but also enhance the living standard of tribal people.

The association and importance of the weather on the development of pest and diseases has been known for over two thousand years (Theophrastus 370-286 B.C). Weather is a key driver of most insect-pests disease, and a changing weather will alter the distribution, abundance and management of endemic pests and disease (Chakraborty, 2005). The impacts of weather change can positive, negative or have no impact on pest population, depending on specific location of each region or period (Das *et al.,* 2011). Predator's behavior (mainly dispersal habit) study with weather parameters can helps in formulating particular monitoring and recommendation methods for silkworm protection. Several methods / techniques are practiced for silkworm protection. Besides, practices such as selection of suitable brushing date and direction of silkworm rearing have also proved significant for reducing the pest's attacks (Singh *et al.,* 2016). Weather based forewarning of predators outbreak during rearing period of tasar silkworm at regional level; a simple practice will reduce the cost of silkworm protection, protect the environment and can be incorporated as a component of IPM. Hence, the main objective of the study was undertaken to assess the congenial weather for outbreak of predators in tasar culture.

Materials and Methods

An experiment was conducted during the years 2016 in the first crop rearing season of the Tasar silkworm at Pilot Project Centre (PPC), Kathikund, Dumaka, Jharkhand located at 24°21′32″N 87°25′11″E.The climate of Dumka (Kathikund) was moderately extreme type. It becomes quite cold in winter and is sufficiently hot in summer. The climate may be divided into three main seasons. The summer from March to May and the Mansoon season from June to September. Winter season starts from October and ends in February. The district receives 80% of annual rainfall in summer season, July is the rainiest month. The average rain fall of the district is 1419.3 mm per year. The variation in the rainfall, year to year, is very small. It comes under humid subtropical climate (Köppen climate classification *Cwa*).

The research was aimed to study brushing date and direction of larva on Asan leaf to assess the congenial weather for outbreak of predators in tasar silkworm with three replications in randomized block design. We selected three date of brushing from first viz., B_1- first (16-07-2016), B_2- second (21-07-2016), B_3 - third (26-07-2016) and four direction viz., N- north, S-south, E- east and W-west respectively. We download daily weather data viz., maximum temperature (Tmax), temperature minimum (Tmin), relative humidity morning (RHI), relative humidity evening (RHII) and rainfall (Rf) data from India Meteorological Department (IMD), New Delhi and it converted into weekly. The Collection of pest/predators in Tasar silkworm viz., Reduviid bug, Canthecona and Wasp respectively collected with the help of gummy stick and sweep net/DFL/Direction.

Results and Discussion

Assess the congenial weather for outbreak of predators during rearing period of silkworm in different brushing date and direction

We modify the environmental condition with the help of different date of brushing and direction of silkworm larva during rearing period. Which date of brushing and direction is beneficial for silk production we adapt and which date of brushing and direction is responsible for outbreak of predators we ignore during first crop rearing at regional

level. The impact of different brushing date and directions on pest infestation (reduvid bug, canthecona and wasp) on Tasar silkworm are given in figure 1. Both date of brushing and directions showed highly significant (** - significant at 1 %,) for predators infestation.

The lowest reduvid infestation (2) was found in treatment 3 (first date of brushing in east direction) whereas maximum (16) was observed in the treatment 12 (third date of brushing in west direction) (Table 1). Similar results also found with canthecona bug and wasp in tasar culture. The high pest population of reduvid bugs canthecona bug and wasp in the late brushing date (third brushing date) could be due to a build-up of insect population partly because of availability of food provided for development by the early brushing. First date of brushing showed minimum pest infestation in all direction as compare to second and third date of brushing. The decreasing trend was observed for pest infestation in various date of brushing of tasar silkworm viz., first date of brushing < second date of brushing < third date of brushing respectively. Similar results have been reported by Omoloye *et al.,* (2015) for sucking bug in soybean crop. During experiment we observed east and north direction showed minimum pest infestation than west and south direction. The decreasing trends was found for reduvid bug, canthecon bug and wasp in various direction viz., east < north<south < west in all date of brushing.

Generally east and north direction showed low pest infestation, it might be east and north directions make suppress microenvironment for pest infestation whereas south and west direction make favourable microenvironment for pest infestation. Delay date of brushing (third date of brushing) showed high predators' infestation as compared to first date of brushing. Date of brushing has a great impact on the incidence of the predators which may be attributed to the difference in weather conditions which are favourable or unfavourable for predators on tasar silkworm.

Table.1 Treatment combinations for experiments at PPC, Kathikund, Dumka- Jharkhand

S.N.	Treatment	Sub - treat	Treatment combinations details
1	Brushing dates	Directions	**B_1 x N-** First date of brushing and North direction
2	B_1	N	**B_1 x S-**First date of brushing and South direction
3	B_2	S	**B_1 x E-** First date of brushing and East direction
4	B_3	E	**B_1 x W-**First date of brushing and West direction
5		W	**B_2 x N-**Second date of brushing and North direction
6			**B_2 x S-**Second date of brushing and South direction
7			**B_2 x E-**Second date of brushing and East direction
8			**B_2 x W-**Second date of brushing and West direction
9			**B_3 x N-**Third date of brushing and North direction
10			**B_3 x S-**Third date of brushing and South direction
11			**B_3 x E-**Third date of brushing and East direction
12			**B_3 x W-**Third date of brushing and west direction
Note: B_1,B_2,B_3- Date of brushing and N,S,E,W – Direction			

Fig.1 Effect of brushing date and direction on predator infestation in tasar silkworm

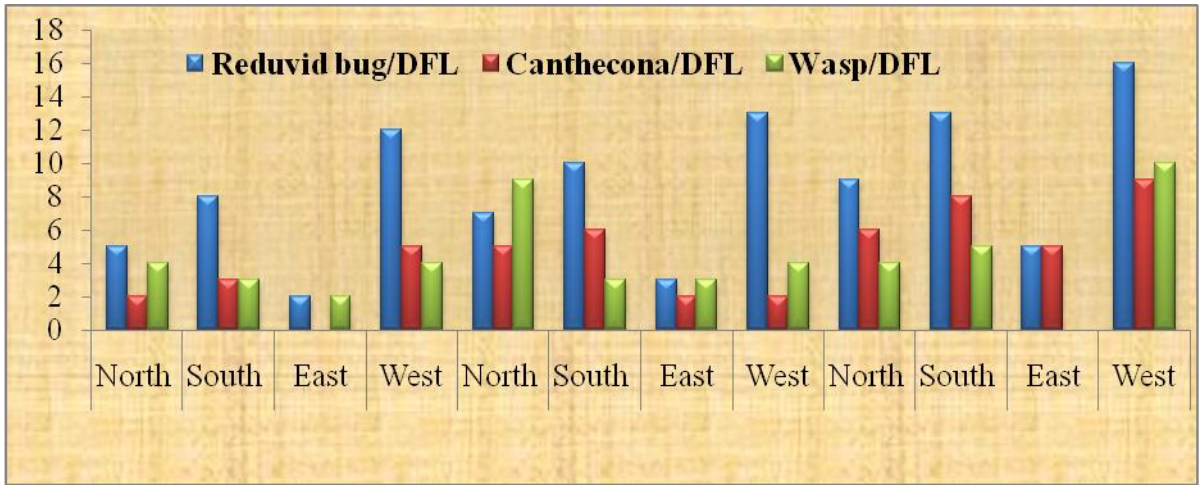
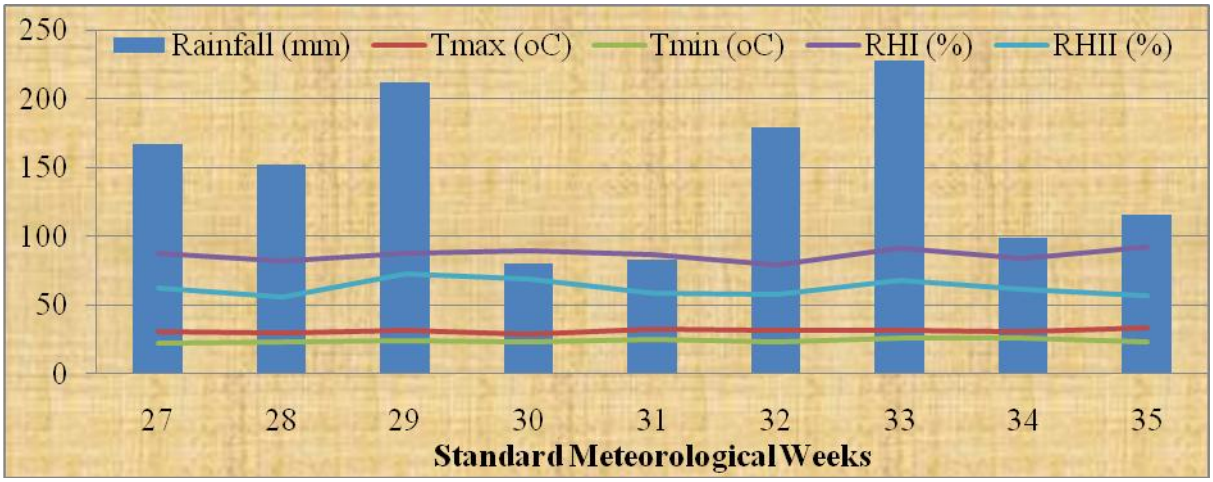
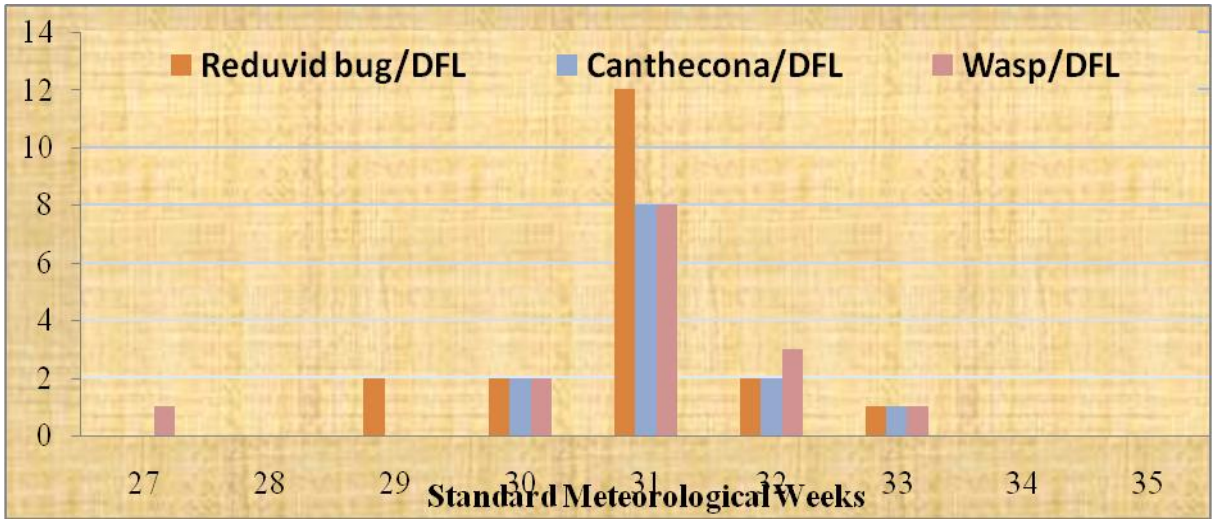


Fig.2 Weather condition during rearing period





Weather based forewarning of predators in tasar silkworm

"Weather health" is one of the most crucial prerequisite for successful incidence of insect pests as their bionomics is intimately related with congenial weather parameters. For example (temperature), each pest has a threshold temperature (lower and upper) where development of pest is zero. Above lower and below higher a range which indicates maximum development of pest, this range of temperature is congenial temperature for that pest (Fig. 2). Three components are essential for emergence and severity of pest viz., host, pest and environmental condition. Forewarning refers to prediction of forthcoming infestation of pest in numbers which would cause economic damage to the crop. On the basis of interactive approach between weekly weather and predators' data, we found that congenial weather condition was favorable for high infestation of predators during 31st standard meteorological week (SMW). During this period, weekly mean maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall were 32.67^{o}C, 24.67^{o}C, 87.17%, 58.50%, < 83 mm, respectively. In this week, highest predator infestation per disease free laying egg (Dfl) was observed viz., reduvid bug (12), canthecona bug (8) and wasp (8). After and before 31st SMW, the predator's infestation was very low or absence in all date of brushing and direction, which indicates after and before 31st SMW week weather condition was unfavorable for predators. On the basis of above results, we can forewarn to tasar sericulture farmers for adapting best integrated management practices before31st SMW or any week during the period of 1st crop rearing, the weather going on near congenial weather range for prevailing of predators outbreak. Thus, the finding of congenial weather is robust for use in tasar advisory for tasar farmers at Dumka region, Jharkhand. Such tasar advisory (forewarning) for predators would help growers to be in preparedness at times of anticipated economic damage by predators and to optimize the time of insecticidal application for increased production and profit. Thus, the finding of congenial weather is robust for use in tasar advisory for tasar farmers at Dumka region, Jharkhand. Such tasar advisory (forewarning) for predators would help growers to be in preparedness at times of anticipated economic damage by predators and to optimize the time of insecticidal application for increased production and profit.

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