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Research Article

Impact of Abiotic Factors on the Seasonal Incidence of Major Insect Pest of *Quercus serrata* Thunb., Primary Food Plant of Oak Tasar Silkworm, *Antheraea proylei* J. In Manipur, India

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Abstract

The present study was aimed at observing the incidence pattern of major insect pest infesting oak plant, *Quercus serrata.* The oak plant was found to be infested by a number of insect pest out of which the two major pests *i.e.*, hairy caterpillar, *Phalera raya* (Moore) and semilooper, *Hyblaea puera* (Cramer) was studied. The infestation of *P. raya* started in May and reached peak in July during 2017-18 and 2018-19 respectively. This pest disappeared from the field from November to April due to hibernation of the pupal stage in both the years. The semilooper was observed attacking the plant throughout the year except the months when oak plant sheds off their leaves. The infestation started from February and reached peak in May. The maximum, minimum temperatures and rainfall showed significant positive correlation with *P. raya* and *H. puera*, whereas, correlation with relative humidity was not significant in both the years.

Keywords: *Hairy caterpillar, Phalera raya, semilooper, Hyblaea puera, seasonal incidence, abiotic factors, correlation*

Introduction

Oak tasar silkworm, *Antheraea proylei* Jolly is semi-domesticated lepidopteran insect producing silk. Oak tasar culture is ideally suited to the socio-economic and climatic conditions of North eastern region of India and supports the livelihood of thousands of poor farmers of this region. About 40,000 hectares of naturally grown oak flora are available in Manipur and out of which 20,000 hectares can be easily utilized for oak tasar culture. Inspite of having abundant oak, the main constraints being faced in oak tasar culture is the attack of the silkworm and food plants by a large number of insect pests (Singh and Kulshrestha. 1990) causing serious depredations in silk productivity. (Rao *et al*., 1996) had also reported that fairly large number of insect pests of diversified groups have been found to be attacking and damaging *Quercus* spp. during their different developmental stages. The insects attacking the oak plants destroy all the stages of the plant by sucking the sap, defoliating the leaves, boring the meristem, cutting the seedlings and decaying the root leading to growth loss and mortality whereas the predators and parasitoids feeding on the silkworm either kill the silkworm larvae or force them to spin flimsy cocoons. Some of the major insect pests are hairy caterpillar, *Phalera raya* Moore, semilooper, *Hyblaea puera* Cramer, Leaf roller, *Apoderus notatus* Fabricius, black beetle, *Cleoporus lefeverei* Duvivier and stem borer, *Batocera lineolata* Chevrolat. Of these, the hairy caterpillar, *Phalera raya* and semilooper, *Hyblaea puera* are major insect pest infesting *Quercus serrata* in Manipur (Subharani *et al*., 2019 and 2020). The

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highest infestation of 12.1 population density per plant was reported by Goel and Rao (2004). *Hyblaea puera* Cramer is a well-known pest of teak plantations in India. (Chandrasekhar *et al.,* 2005) reported *H. puera* a pest of major concern infesting teak as it is involved in complete defoliation of trees during the early part of the growing season in India and other tropical regions. (Nair *et al.,* 1985) also reported that 44 % of the potential volume growth of teak plantation is lost due to defoliation caused by *H. puera*. (Singh and Tikoo. 1990) reported that though oak tasar farming supports livelihood of a number of people of this region, the work on the insect pests damaging the food plants are more or less neglected. The knowledge of seasonal incidence of insect pests infesting *Q. serrata* in different stages will be helpful in evolving proper management schedule. The information on seasonal incidence of *P. raya* and *H. puera* infesting *Q. serrata* is very scanty. Therefore, it is necessary to study the effect of abiotic factors on population fluctuation of hairy caterpillar and semilooper infesting *Q. serrata*. Hence, investigations on seasonal incidence of major pests of *Q. serrata* in relation to abiotic factors were undertaken and the results were presented.

Materials and methods

In order to study the seasonal incidence of *P. raya* and *H. puera* infesting *Q. serrata* in relation to abiotic factors, an experiment was conducted during 2017-18 and 2018-19 in the experimental farm of Regional Sericultural Research Station, Imphal. The experiment was laid out in plots of size 50 x 50 sq. ft. *Q. serrata* plantations in the selected plots were kept without any insecticidal treatment, so that population of the pests could build up freely. The observations on the incidence of major insect pests were recorded from the appearance on the plant during both the years. *Q. serrata* was found to be heavily infested with hairy caterpillar and semilooper. Observation was made from 25 randomly selected plants from each corner of the plot and centre at weekly intervals by plant inspection methods. Daily weather factors such as maximum and minimum temperatures, relative humidity, and total rainfall were recorded at Regional Sericultural Research Station, Imphal. In order to find out the specific impact of the weather parameters on the insect population, the data taken on the incidence of major insect pests, *viz.,* hairy caterpillar and semilooper were correlated with the different weather parameters, *viz.,* maximum and minimum temperature, relative humidity and total rainfall.

Results and Discussion

The studies revealed that the oak plant was infested by two major insect pests, *viz.,* hairy caterpillar, *P. raya* and semilooper, *H. puera.* These pests have also been reported as serious pests of *Q. serrata* by (Turcani. *et al.,* 2010; Devi and Singh. 2011; Yi-Ren. *et al.,* 2013; Kalapanida and Petrakis. 2012) which support the present findings.

Fig1: Life stages of *Phalera raya* a) Egg; b) Larva; c) Pupa; d) Adult

Fig 2: Life stages of *Hyblaea puera* a) Egg; b) Larva; c) Pupa; d) Adult

The hairy caterpillar, *P. raya* was observed as a major pest infesting *Q. serrata* completing two generations in a year. The infestation started from May and reached maximum (23.3 nos. and 16.8 nos. per plant) in the month of July during 2017-18 and 2018-19 respectively and thereafter started declining (Fig. 3, 4). The findings are in conformity with Devi and Singh (2011), who reported that population build-up of *P. raya* on *Q. serrata* started from May and reached peak in July. Likewise, (Goel and Rao. 2004) also reported maximum infestation of *P. raya* during July with highest infestation (12.1 population density per plant) which support the present findings. The hairy caterpillar population had significant positive correlation with maximum and minimum temperatures (r = 0.517 and r = 0.795) and non-significant with relative humidity (r = 0.345) and significant with rainfall (r = 0.765) during 2017-18. It had significant positive correlation with all the weather factors *viz*., maximum temperature (r = 0.503), minimum temperature (r = 0.748), relative humidity (r = 0.640) and rainfall (r = 0.581) during 2018-19 (Table-1). The present findings are also in conformity with that of (Devi and Singh. 2011) who reported that hairy caterpillar population was significantly influenced by minimum and maximum temperature. The semilooper was observed attacking the plant throughout the year except the months when oak plant sheds off their leaves. The present findings are in conformity with (Goel and Rao. 2004) and (Devi and Singh. 2011) who reported semilooper as regular and major pest of *Q. serrata*. The infestation started from February and reached to maximum (14.67 and 13.15 nos. per plant) in May thereafter, population started declining (Fig 3, 4). The present findings are in conformity with those of (Devi & Singh. 2011) who reported peak infestation during May. The population had positive correlation with maximum (r = 0.668 and r = 0.533) and minimum temperatures (r = 0.582 and r = 0.601) and no significant correlation with relative humidity (r = 0.227 and r =0.135) and significant positive correlation with rainfall (r = 0.506 and r = 0.590) in 2018-19 (Table-1). There are two generations of semilooper and the findings are in conformity with (Goel and Rao. 2004). The present findings are in conformity with Devi and Singh (2011) who reported that semilooper population was strongly influenced by maximum temperature.

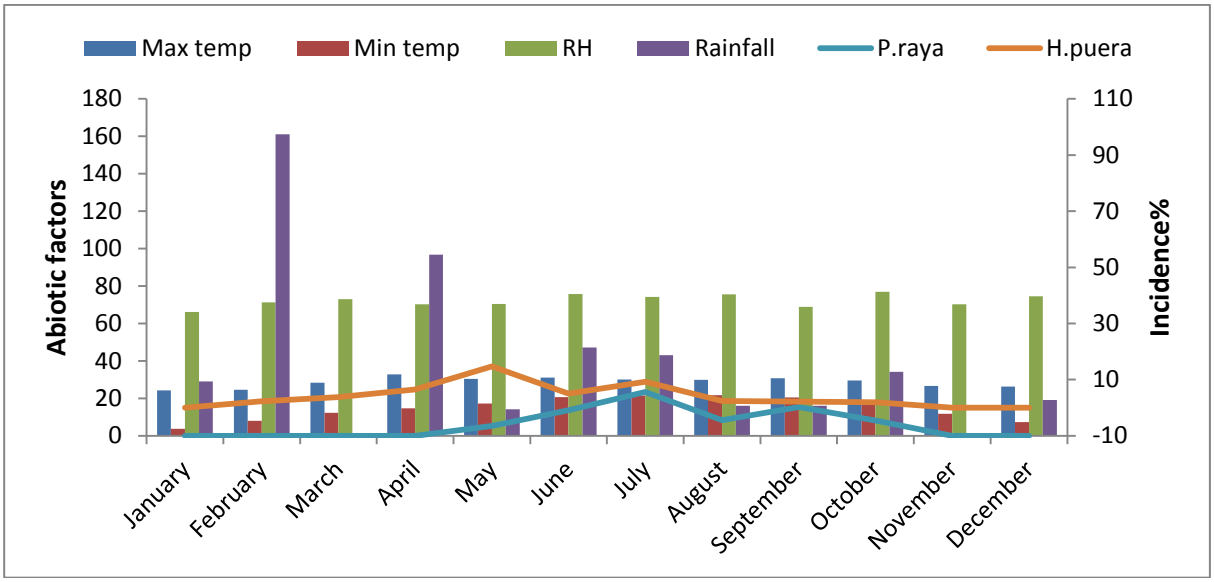

Fig 3: Incidence pattern of major insect pests in relation to meteorological observations during 2017-18

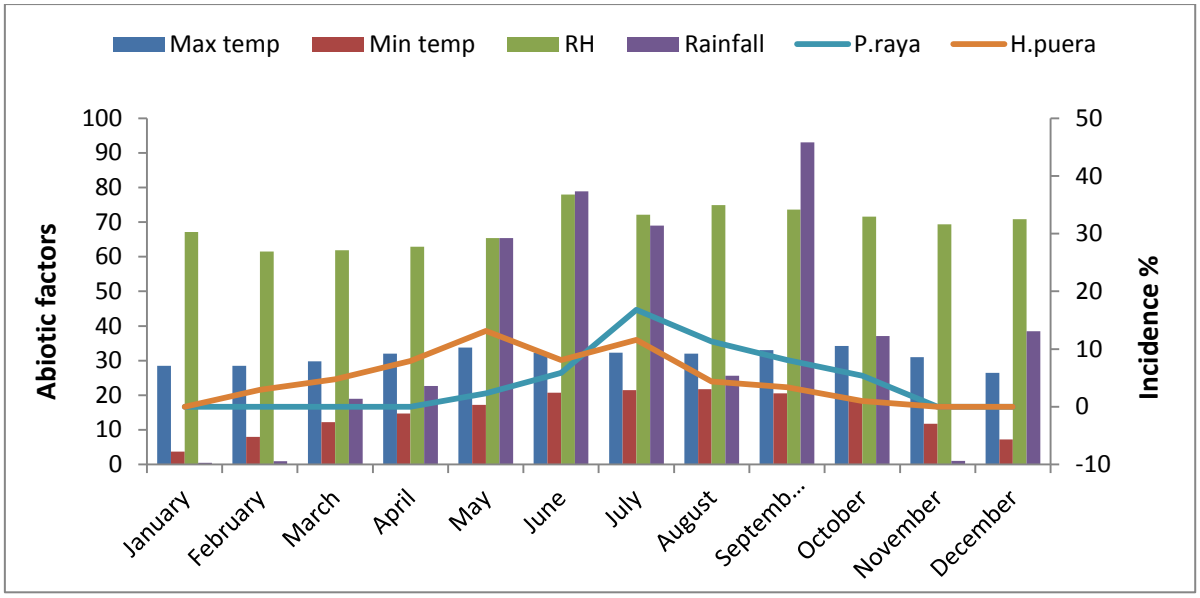

Fig 4: Incidence pattern of major insect pests in relation to meteorological observations during 2018-19.

Table-1: Relationship between abiotic factors and larval population of *P. raya* and *H. puera* infesting *Q. serrata*

Year	Pest	Max Temp	Min. Temp	R.H (%)	Rainfall
2017-18	***P. raya***	0.517*	0.795**	0.345	0.765**
	H. puera	0.668*	0.582*	0.227	0.506*
2018-19	***P. raya***	0.503*	0.748**	0.640*	0.581*
	H. puera	0.533*	0.601*	0.135	0.590*

* Significant at 5 % level **Significant at 1 % level

Conclusion

The present findings reveal that different weather parameters determined the seasonal incidence of the major insect pest, *Phalera raya* and *Hyblaea puera* infesting *Q. serrata*. It can be concluded that seasonal population fluctuation of major insect pests on *Q. serrata* is greatly influenced by abiotic factors and peak population levels were observed during the month of July. The maximum, minimum temperatures and rainfall showed significant positive correlation with *P. raya* and *H. puera*, whereas relative humidity did not show any significant association. This relationship indicated that as the maximum and minimum temperature increased in the specific locations, the population of the pest also went up proportionately.

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