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# SEASONAL INCIDENCE OF MAJOR INSECT PESTS OF OAK PLANT, *QUERCUS SERRATA THUNB.* DURING AUTUMN SEASON IN MANIPUR

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**ABSTRACT**

Field study were conducted during 2019-20 and 2021-22 to study the seasonal incidence of insect pest infesting the oak plant, *Quercus serrata*, in correlation with weather parameters during the autumn season in Regional Sericultural Research Station, Imphal, Manipur. During the observation five different species of insect pests were found infesting *Q. serrata* during autumn season. Among these, four insect pests *viz.,* the leaf roller, *Apoderus notatus* (Fabricius); shoot borer, *Auletobius densatus* Voss; semilooper, *Hybalea puera* (Cramer), hairy caterpillar, *Phalera raya* Moore were the major pests whereas the long horn weevil , *Aristobia approximator* Thomson were found as the minor pest. These insect pests belong to two orders (Coleoptera and Lepidoptera) and five families (Attelabidae, Rhynchitidae, Hyblaeidae, Notodontidae and Cerambycidae). While some of these pests were active for a brief period, others remained active throughout the duration of the study in both the years. *A. notatus* population showed peak during the second week of July, *A. densatus* during first week of September and *P. raya* was observed during the second week of July in both the years.

***Keywords***: *Quercus serrata*, seasonal incidence, correlation studies, insect pest, season.

## Introduction

Oak tasar culture is a lucrative agro-forest industry that serves as a significant source of income to the farmers. It is well suited to the socio-economic and climatic conditions of North eastern region of India providing livelihoodopportunities for numerous impoverished farmers in the area. However, the outdoor rearing of oak tasar silkworm, *Antheraea proylei* Jolly on oak trees exposes to various challenges such as unpredictable weather, pests, predators and disease outbreaks resulting in decreased crop yield. According to Rao *et al.* (1996), a significant number of insect pests from various groups have been identified as attacking and causing damage to *Q. serrata* at different stages of development. Singh and Kulshrestha, 1990 also reported that despite the presence of abundant oak trees, the primary challenge in oak tasar culture is the infestation of food plants by the insect pests. Previous studies (Singh, 1991, Devi and Singh, 2011, Singh *et al.,* 2002, Konthoujam *et al*., 2009) have reported several insect pests affecting the oak plant *Quercus serrata*. The insects attacking the oak plants cause damage at every stage of plant growth from sucking the sap to defoliating the leaves, boring the meristem, cutting the seedlings and decaying the roots, resulting in reduced growth and mortality. Earlier research by Devi and Singh (2011) revealed that *Q. serrata* harbours many insect pests that compete for food with the silkworm. Yi-Ren*et al.* (2013) reported *Phalera* species as a major defoliating pest of Oak. The hairy caterpillar, *Phalera raya* Moore is also reported as a major defoliator infesting *Q. serrata*, the primary food plant of oak tasar silkworm, *Antheraea proylei* (Subharani *et al*., 2019). The caterpillar of H. puera defoliates and damages the tender shoots (Shevale 2003). However, there is limited information on the insect pests' complex infesting the food plants and their management. Singh and Tikoo (1990) also noted that while oak tasar culture supports livelihood of many people research on the insect pests damaging the food plants has been largely neglected. The population growth of these insect pests is influenced by the both abiotic and biotic factors. Understanding the distribution pattern of the insect pests is crucial for establishing the relationship between an insect and their environment, providing essential information for designing effective sampling programme and population models. Considering the importance of the crop, losses caused by different insect pests and the need for development of a successful pest management strategy, this study was aimed to assess the seasonal incidence of insect pests infesting *Q. serrata* during autumn season.

## Materials and Methods

The study was conducted to analyse the seasonal incidence of insect pest infesting *Q. serrata.* The population assessment was carried out during autumn season at Regional Sericultural Research Station, Imphal. In order to allow the population of the pests to develop freely *Q. serrata* plantations were raised with application of recommended agronomical practices in the selected plots and the plants were not treated with any insecticides. To record pest population, twenty five infested plants from the plot were randomly selected from the plot, and numbers of insect present in each infested branch was counted at weekly intervals. Larvae of shoot borer borer, leaf roller, hairy caterpillar and semilooper were observed on leaves and twigs. Weevil population was visually counted from the infested plants. These insects were then collected and preserved in the laboratory with proper systematic positioning. The data were tabulated for different months and pest population for each month at weekly interval was calculated. Daily records of weather factors including maximum and minimum temperatures, relative humidity, total rainfall, were obtained from the State Sericulture Department and RSRS, Imphal for the duration of the field experimentation. The collected data were then analysed using statistical methods of correlation analysis to determine the relationships between environmental factors with the seasonal incidence of the individual insect pests.

## Results and Discussions

*Quercus serrata*, is vulnerable to a variety of insects pests that adversely affect the quality and quantity of leaves as well as overall health of the plant resulting in reduced crop yield (Devi and Singh, 2011). During the period of investigation it was noted that *Q. serrata* was attacked by five different species of insect pests *viz.*, leaf roller, *Apoderus notatus* (Fabricius); shoot borer, *Auletobius densatus* Voss; semilooper, *Hybalea puera* (cramer); hairy caterpillar, *Phalera raya* Moore and long horn weevil, *Aristobia approximator* Thomson, belonging to two different orders (coleopteran and lepidoptera) and five families (Attelabidae, Rhynchitidae, Hyblaeidae, Notodontidae and Cerambycidae). While some of these pests were active for a short period, others remained prevalent throughout the study. Among them, some were considered major pests due to the severity of their attacks while the remaining was classified as minor pests. The present study did not observe the presence of natural enemies of the insect pests. The data collected on the insect pests infesting *Q. serrata* during autumn season are presented in Table 1 and Fig.1.

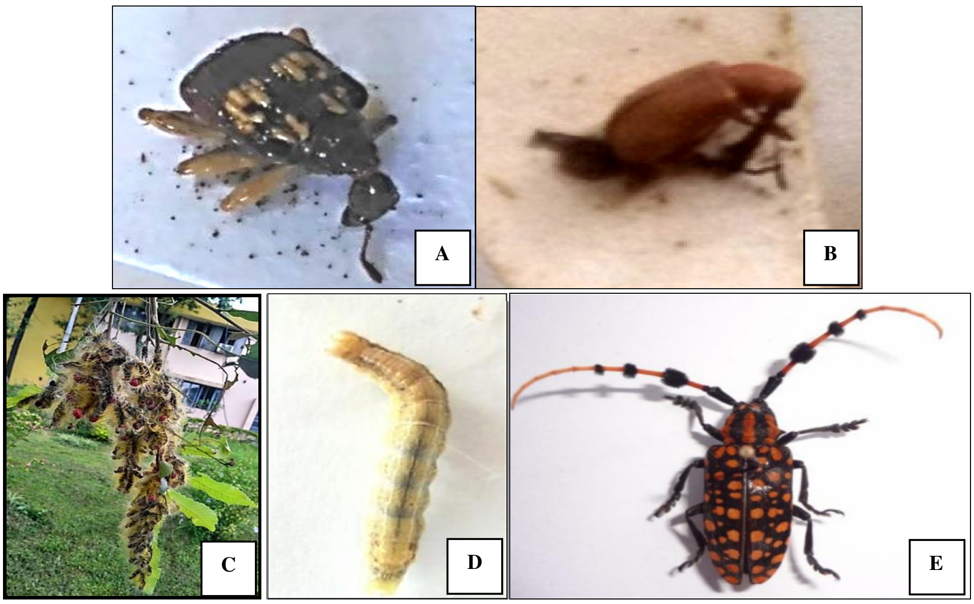


**Fig. 1:** A). *Apoderus notatus* B). *Auletobius densatus* C). *Phalera raya* D). *Hybalea puera* and E). *Aristobia approximator*

**Table 1:** Insect pest infesting *Q. serrata* during autumn season

| Sl. No. | Common name | Scientific name | Order | Family | Status | Nature of Damage |
|---|---|---|---|---|---|---|
| 1 | Leaf roller | *Apoderus notatus* (Fabricius) | Coleoptera | Attelabidae | Major | The female weevil in its adult stage slices through both the sides of the leaf until it reaches the midrib close to its leaf base. Subsequently, it rolls the terminal part of the leaf into a cylindrical shape, resembling a light cigar, in order to lay its eggs. Additionally, the adult weevil also consumes the plant for nourishment. |
| 2 | Shoot borer | *Auletobius densatus* Voss | Coleoptera | Rhynchitidae | Major | The adults partly cut through the shoots and move down a short distance. Dry infested shoots wilt and descend at a steep angle and drop on the ground. |
| 3 | Semi looper | *Hybalea puera* (cramer) | Lepidoptera | Hyblaeidae | Major | The adult defoliates the leaf and damage the tender shoots. At rest the larvae fold leaves together forming an enclosure for its protection and rest when not feeding. |
| 4 | Hairy caterpillar | *Phalera raya* Moore | Lepidoptera | Notodontidae | Major | The larvae feed and totally skeletonize the leaf. |
| 5 | Longhorn beetle | *Aristobia approximator* Thomson | Coleoptera | Cerambycidae | Minor | The adult beetles scrape and damage the branches. |

The population studies carried out during autumn season revealed that *Q. serrata* remained vulnerable to a number of insect pests throughout the season. The dominant pests observed were the leaf roller, *Apoderus notatus*, the shoot borer, *Auleotobius densatus* and the hairy caterpillar, *P. raya*. The maximum population of *A. notatus* and *P.raya* was recorded in second week of July during 2019-20 and 2020-21. The peak occurrence of *H. peura* was observed during second week of July in 2020-21 whereas it occurred in the first week of August during 2019-20. The long horn beetle, *A. approximator* exhibited a weak population in both the years.

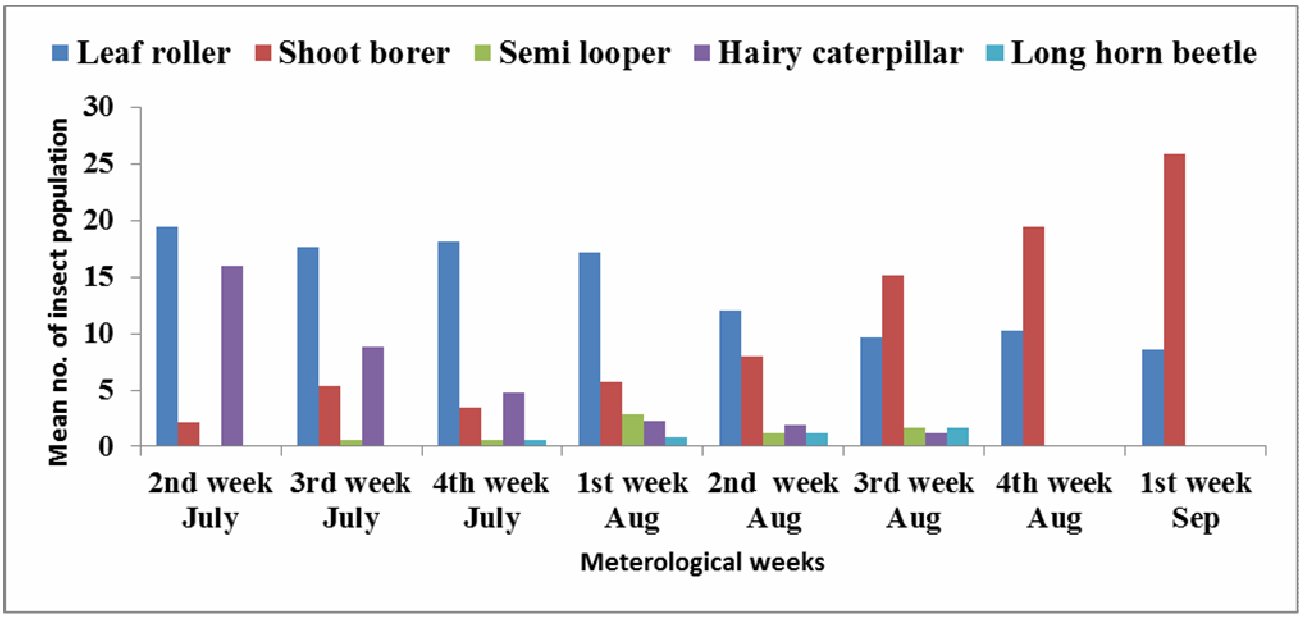


**Fig. 2 :** Seasonal incidence of insect pests infesting *Q. serrata* during 2019-20

**Table 2:** Correlation of coefficient between insect pests and abiotic factors during 2019-20

| Insect Pest | Abiotic factors | | | | |
|---|---|---|---|---|---|
| | Max. Temp. | Min temp. | Min R.H | Max R.H | Rainfall |
| *A. notatus* | -0.12 | -0.67* | 0.63* | 0.58* | 0.17 |
| *A. densatus* | -0.08 | 0.68* | -0.47 | -0.35 | 0.05 |
| *H. peura* | 0.61* | 0.60* | -0.79** | -0.58* | -0.69* |
| *P. raya* | -0.14 | -0.34 | 0.70** | 0.40 | 0.96** |
| *A. approximator* | 0.92** | 0.89** | -0.55* | -0.92** | 0.35 |

** Significant at p < 0.01; * Significant at p < 0.05

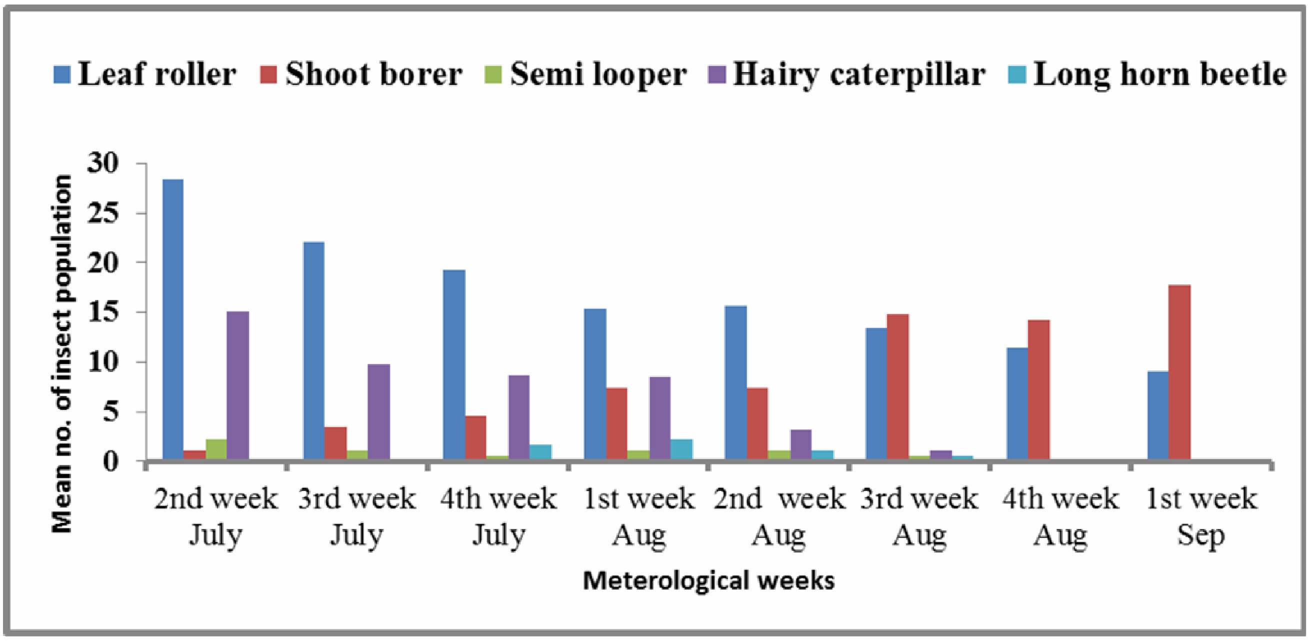


**Fig. 3:** Seasonal incidence of insect pests infesting *Q. serrata* during 2021-22

**Table 3:** Correlation of coefficient between insect pests and abiotic factors during 2021-22

| Insect Pest | Abiotic factors | | | | |
|---|---|---|---|---|---|
| | Max. temp | Min. temp | Min R.H | Max R.H | Rainfall |
| *A. notatus* | 0.60* | 0.24 | 0.56* | 0.45 | 0.45 |
| *A. densatus* | -0.59* | -0.20 | -0.42 | -0.62* | -0.27 |
| *H. peura* | 0.32 | -0.10 | 0.41 | 0.02 | 0.81** |
| *P. raya* | 0.86** | 0.42 | 0.79** | 0.54* | 0.69* |
| *A. approximator* | 0.63* | 0.49 | 0.26 | 0.81** | -0.72** |

** Significant at p < 0.01; * Significant at p < 0.05

### *Apoderus notatus*

The *A. notatus* population peaked during the first week of observation, specifically in the second week of July with a population of 19.40, and 28.42, during 2019-20 and 2021-22 respectively. This coincided with a minimum temperature of 23.14 ℃ and a maximum temperature of 32.14 ℃ along with a maximum relative humidity of 84.66% and a minimum relative humidity of 71.10 % with a total rainfall was 6.32 cm. Subsequently the population exhibited a gradual decline, reaching its lowest in the first week of September with population of 8.75 and 9.14 respectively (Fig 2 and 3). The study showed that amongst the different weather factors influencing the leaf roller population, the maximum and minimum relative humidity (r=0.63 and r=0.58) during 2019-20 and maximum temperature and relative humidity (r=0.60 and r=0.56) during 2020-21 were the most dominant factor which showed a positive and significant correlation. This relationship suggested that as the maximum and minimum relative humidity and maximum temperature increased in the specific locations, the leaf roller population also increased proportionately. However, the correlation studies between insect population and total rainfall did not show a significant influence on pest population throughout the entire period of observation. On the contrary, the minimum temperature (r =-0.67 and r =-0.57) exhibited a negative significant correlation with the leaf roller population during 2019-20 suggesting a suppression of the pest population (Table 2 & 3).

***Aeuletobius densatus*:**

The shoot borer, *Aeuletobius densatus* was first observed during second week of July in both the years. The highest population of the pest was recorded during first week of September with a population of 25.85 and 17.71 in 2019-20 and 2021-22 respectively. During this period, the minimum and maximum temperature were 21.32 ºC and 27.00 ºC and maximum and minimum relative humidity were 83.61% and 70.16 % with a total rainfall of 0.89 cm (Table no. 2 and 3). The study revealed that among the various weather factors influencing the shoot borer population, the minimum temperature had the most significant effect showing a positive and strong correlation (r = 0.68). This correlation suggested that as the minimum temperature increased, the pest population also increased proportionately during 2019-20. On the contrary, the maximum temperature (r =-0.59) during 2020-21 showed a negative correlation with shoot borer population indicating a suppression of the pest population (Table 3). However, the correlation analysis of other weather factors in the both the years did not seem to have significant influence on pest population during the study period.

***Hyblaca puera*:**

The *Hyblaca peura* activity was observed starting from the third week of July with population of 0.57 during 2019-20. During this period the minimum and maximum temperatures were recorded as 23.14 ºC and 32.14 ºC while the maximum and minimum relative humidity were 84.66% and 71.10 %. The total rainfall during this period was 6.32 cm. The highest population of 2.85 was observed in the first week of August in 2019-20 (Fig. 2). The activity of this pest started from the third week of July during 2020-21 which was a week later compared to 2019-20. The study revealed that among the various weather factors influencing the semilooper population during 2019-20, there was a positive and significant correlation with the minimum and maximum temperature (r=0.61 and r=0.60) while the minimum and maximum relative humidity (r = -0.79 and r = -0.58) and total rainfall (-0.69) showed negative significant correlation. This relationship suggested that as the minimum and maximum temperature increased, the pest population also increased proportionately, whereas an increase in minimum and maximum relative humidity and total rainfall suppressed the semilooper population during 2019-20. The total rainfall during 2020-21 exhibited a significant positive correlation with semilooper population (Table 3).

***Phalera araya*:**

The occurrence of *Phalera raya* reached its peak during the initial period of study, with peak population of 16.00 and 15.14 during the second week of July in 2019-20 and 2020-21 respectively (Table no. 2 and 3). The minimum and maximum temperatures were 23.14 ºC and 32.14 ºC while maximum and minimum relative humidity were 84.66 % and 71.10 % with a total rainfall was 6.32 cm. The pests activity gradually decreased, persisting until third week of August in 2019-20 and 2020-21. The study revealed that various weather factors such as maximum temperature, minimum and maximum relative humidity, and total rainfall during 2020-21 exhibited a positive and significant correlation (r=0.86, r=0.79, r=0.54 & r= 0.69). In 2019-20, only the maximum relative humidity (r=0.70) and total rainfall (r=0.96) showed significant positive association with the caterpillar population (Table 2).

***Aristobia approximator*:**

The pest activity was minimal in both the years. The pest was first observed from fourth week of July to the third week of August (Table 2 and 3) in both the years. The findings are in conformity with (Devi *et al.,* 2018). The study showed that among the various weather factors influencing the beetle population, the maximum temperature (r=0.63) during 2020-21 were the most significant factors showing a positive and significant correlation. This relationship suggests that with the increase in the weather factors, the beetle population also increased proportionately. On the other hand, the correlation studies of total rainfall had a significant negative influence (r = -0.72) on pest population in 2020-21. Similarly, minimum and maximum relative humidity (r = -0.55 and r =-0.92) had showed a negative significant correlation with beetle population during 2019-20 indicating a suppression of the pest population (Table 2).

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