CHAPTER I
INTRODUCTION

Insects are of interest to man because of two major reasons— the large diversity exhibited by the group, and man’s conflict with insects for food and other resources. Insects that draw our attention because of the latter reason are called pests. In most cases, being a pest is a matter of abundance of individuals. At some times, the population density increases to cause economic damage but at other times the density remains low. This increase and decrease of population density of different species of insects has intrigued the population biologists for long. Although it is generally agreed that this fluctuation is related to the availability of food and other resources, other factors such as natural enemies and climate are also thought to regulate the size of a population.

The teak defoliator, *Hyblaea puera* Cramer (Lepidoptera, Hyblaeidae) which is recognized as a serious pest of the teak tree (*Tectona grandis* L.f.) is a typical pest that exhibits this characteristic shift in population density. Teak is a multipurpose timber species, which naturally occurs in India, Myanmar, Thailand and Laos. During the last century when the natural teak stands could not cater to the needs, plantations of teak became a necessity. The first plantations in India were established at Nilambur (Kerala) during 1842-44. Since then, the area under teak has steadily increased and plantations have been raised in several other tropical countries of the world as well. Presently, in Kerala, the teak plantations extend to an area of about 78,800 ha (Shanmuganathan, 1997). This is 46.5% of the total area under forest plantations in Kerala. The major teak growing areas in Kerala are Wayanad, Nilambur, Parambikulam, Nelliampathy, Achenkoil, Aryankavu, Konni, Ranni and Malayattoor.

Although 171 species of insects are recorded as associated with teak, only a few have attained pest status (Beeson, 1941). These are the white grubs, which attack seedling in the nurseries, the sapling borer (*Sahyadrassus malabaricus*)
(Nair, 1987), the trunk borer (*Alcterogystia cadambae*) (Mathew, 1991), the teak skeletonizer (*Eutectona macheralis*) (Beeson, 1941), and the teak defoliator (*Hyblaea puera*) (Beeson, 1941). While the white grubs are usually found restricted to the nurseries, the sapling borer to young trees; the trunk borer to specific regions; and the skeletonizer, to a period in the year when teak is about to shed its leaves, the teak defoliator occurs in almost all teak plantations during the active growing period of the tree. This characteristic makes it the most serious pest of teak. It has been estimated that damage caused by this insect in 4-8 year old plantations leads to an increment loss of 3 m³/ha/year (Nair et al, 1996).

Realizing the economic loss caused by the insect, attempts were made in the past to standardize control methods, which included biological control as well as aerial spraying of chemical insecticides. Biological control using insect parasitoids did not prove successful and the environmental impact of insecticides makes them unsuitable. Biological control using a recently identified Nuclear Polyhedrosis Virus (NPV) (Sudheendrakumar et al, 1988) is seen as a promising alternative because it is quick acting (Nair et al, 1996) and is highly specific to this insect.

However, the major problem in using any control agent is the difficulty in detecting the teak defoliator outbreaks early enough to apply the control measures. The vast extent of the plantations and the hilly terrain in which the search has to be made to detect the early sites of outbreaks pose practical problems. The larval life span of the insect lasts only for about 15 days within which the entire foliage on the tree may be eaten off. To prevent damage, the early instars of the larvae have to be detected and controlled. The sudden appearance of infestations in widely separated patches during the early outbreak period, suggests that successful control of the pest could only be achieved by understanding the population dynamics of the insect.

Recent research has shown that the population trend of the teak defoliator exhibits several distinct phases (Mohanadas, 1995). The first phase which start
with the onset of premonsoon showers is characterized by small patch infestations, which may appear erratically in some areas. The next phase is characterized by heavy and widespread infestations, which result in total defoliation of large extent of plantations. In the third phase, the population density declines and infestations again become erratic. Following a lull period, erratic populations appear again in August, September or October and subside. From then on, until the first phase begins again next year, the population remains very low, almost untraceable.

Based on this temporal pattern of infestations and the detection of early outbreaks in small patches, it was hypothesized that outbreaks originate, by population build up in small epicentres from where it spreads to larger and larger areas over successive generations (Nair and Mohanadas, 1996) until the population exhausts its resources and/or causes increases in the populations of natural enemies causing its decline. From a practical pest control point of view, this hypothesis is interesting because controlling the small epicentres during the phase of population build up is relatively easy. The major objective of the present investigation was to verify this hypothesis. This was sought to be accomplished by recording the spatial and temporal sequence of outbreaks in large study areas and examining whether the initial populations could cause the subsequent populations.

The opportunity was also utilized to examine whether suitable monitoring techniques could be developed to detect and predict the outbreaks, through light-trap catches of moths and/or field observation of early signs of infestation. Observations were also made on the flight, reproductive, and feeding behaviour of defoliator moths in the field to understand their influence on the population dynamics of the insect.

The study has yielded valuable information on each of the above aspects. Following a review of literature in the next Chapter, Chapter 3 describes the general methods employed in the study. Chapter 4 presents the results of a three-year study on spatial dynamics of outbreaks at one of the teak plantations of Nilambur, viz. Kariem Muriem and Chapter 5, the results of a similar study
covering the entire plantations of Nilambur in one year. Behavioural studies on defoliator moths are given in Chapter 6. Attempts to develop monitoring techniques to detect outbreaks are presented in Chapter 7. In Chapter 8, an attempt is made to synthesize all available empirical information on the population dynamics of *Hyblaea puera* in the light of recent advances in theory. The literature referred to for this work is presented next, as per guidelines given by Anderson *et al* (1970). The algorithm used for the computation of auto correlation indices is given in Appendix A and light-trap data in relation to incidence of defoliator outbreak and local moth emergence is given in Appendix B.