Chapter-1

INTRODUCTION

Forests are valued for a wide range of economic, social and environmental benefits that are critical for human well-being. According to a report by FAO (2000), the total forest cover on the globe is about 3870 million hectares. Of this, roughly 1818 million hectares lie in the tropics (47%) and 323 million hectares in the subtropics (8%). Compared to the temperate forests which are only recently colonised, the tropical forests are very rich in number and diversity of species. These are one of the nature’s most complex landscapes and deserve special attention as they not only harbour unique and very rich biodiversity but also function as invaluable gene banks. Moreover, these forests and forest products are of multiple uses to human societies for supply of food, fuel and fodder, for protection of flood and soil erosion, for conservation of biological resources including wildlife and for safeguarding the environment from pollution and so on. Thus forest wealth is constantly being deteriorated by various natural forces, such as, pest, disease, fire, climate changes, etc.

Among these natural forces, insects act as one of the most destructive forces and affect either directly or indirectly the overall productivity of forests, particularly at their outbreak stage. The insects which constitute about 75% of all animal life forms found on earth are economically as well as ecologically play significant role. Insects being one of the most essential biotic components of different ecosystems provide effective ecosystem services towards their smooth functioning. Although all insects have part to play in the ecosystems but all roles are not of equal importance. Among the insects, wood boring insects always attract our attention because they disrupt the structure and function of forest ecosystem.

Wood boring is carried out by various groups of insects either to obtain food or as means of protection of their eggs, larvae and pupae. Few species of insects are found to attack only the living trees, but majority of them infest mainly the freshly felled or dying trees, trunks or logs. Among the wood boring insects of the freshly felled logs, the long horned beetles or roundhead borers belonging to the
order Coleoptera and family Cerambycidae are found in large varieties and abundance in the tropics and are very successful in colonising most of the tropical islands of the world including the islands of Andaman & Nicobar, India.

Andaman & Nicobar islands popularly known as Bay islands are located between 10° 13' N and 13° 30' N latitudes and 92°15'E and 93°10' E longitude, stretching over 800 km in the Bay of Bengal and comprising of 572 islands, reefs and rocks. These islands with their contrasting physiography, climate, vegetation, etc., create some ideal situation to support rich forest stands, which harbour a very rich diversity of insects including rich wood boring insect fauna. It is well known that wood boring insects maintain their destructive existence due to their characteristic biological features and unique ecological adjustment with the biotic and abiotic factors within the micro-habitat inside the wood. Abiotic and biotic factors may directly or indirectly contribute to a pest outbreak threshold and may lead to increased pest population densities. Abiotic variables, such as, climate (e.g., temperature, rainfall, draught) and biotic variables, such as, predation, parasitism, disease and nutrition (e.g., competition for limited resources, resource availability, changes in resource quality, and shift in food source) can influence changes in such insect population.

The characteristic tropical climate of Andaman & Nicobar Islands in the Bay of Bengal supports a wide variety of timber yielding plants, which provide unique habitats to the cerambycid borers. The members of the family Cerambycidae are one of the fascinating groups of insects, essentially because of their both diurnal and nocturnal activities, camouflaging nature of lifestyle, striking colour and characteristic antennal size, phytophagous habit of adults and xylophagous habit of immature stages, cryptobiotic mode of life, unique resource sharing pattern with other wood inhabiting fauna and lastly, for the colossal damage done to the wood towards the process of their survival. Economically, these insects both in their larval and adult stages usually cause enormous damage to live, dead and dying trees in the forest stands, to felled logs in extraction centres, to timber in storage
and in human use, and even to the fruits and sometimes in other parts of the plants.

However, the problem of control of these beetles is a real dream to the entomologists all around the globe. Because it is difficult to locate and control these borer species as they feed mostly beneath the surface of wood, where ordinary insecticidal control measures are less effective as well as more expensive. Such limitation in control measures, has now-a-days led to an unique concept of sound ecological basis of pest management proved to be the most rewarding ventures to fight against these noxious insects. However, whatever may be the mode of suppression of these wood borers, the identification of the borer species by their morphological characters and knowing the biology of the concerned species are the prerequisite in formulating an effective control measure. Therefore, both taxonomic recognition and biological information of economically important species as in the case of Cerambycidae is a vital area of continued research.

Interestingly, the progress of taxonomic and biological studies on the cerambycid borers does not commensurate at all with their economic importance. In addition, comparatively little research has been conducted on the relationships between wood-borers and their host plants. Moreover, there is no such research work till date on the quantum of damage done by these borers. It is also not known, the detailed enumeration of cerambycid species of the major timber yielding plants of Andaman & Nicobar Islands. No holistic approach has also been made so far to update the scientific nomenclature of cerambycids in the light of modern classification. Taxonomic knowledge and biological information of these beetles till date are based on their stray collections only.

In this context, the present study on cerambycid beetles, infesting forest plants in the Andaman & Nicobar Islands has been initiated to fill in the above mentioned lacunae. Thus, the major objectives of this work are:
i. To enumerate the cerambycid beetle borers of Andaman & Nicobar Islands.

ii. To identify these borers up to species level, using their updated taxonomic characters and keys.

iii. To prepare a generalized list of host plants of these destructive borers along with their host-range and host-specificity.

iv. To study biology, ecology, host-range and host-specificity as well as microhabitat diversity of the most destructive cerambycid borers of widely used and highly priced timber yielding plant species of Andaman & Nicobar Islands.

v. To analyse the quantum of damage and economical loss caused by important cerambycid borer species of Andaman & Nicobar Islands.

For the convenience of dealing the objectives of thesis properly, it is subdivided in two broad chapters, namely, Taxonomy and Bioecology. However, any critical analysis of faunal composition and affinity will never be completed, unless it takes into account the physiography, climate, forest, etc., of the area concerned. As such, these characteristic features of the islands of Andaman & Nicobar are also briefly incorporated in the next chapter under the study area. The collection methodology, collection localities for general and bioecological studies, identification of the samples and the morpho-taxonomic key of the borers for their easy identification up to species level are also dealt in this chapter. Next chapter deals with taxonomy of the cerambycid beetles, systematic list of cerambycid species, general morphology, diagnostic characters of the family, subfamilies and species.

In the bioecology chapter, generalized description of egg, larva and pupa of cerambycid borer, their development inside the wood and life table study of cerambycid borer has been made. List of borer species collected during the present investigation and their bioecological characteristics, host range and specificity, microhabitat diversity has also been furnished. Next chapter deals with those borer species which infest economically important timber yielding plant species of these islands. Their microhabitat diversity, host range and host specificity, spatial...
distribution pattern in four widely used timber yielding plant species has also been dealt in this chapter.

Quantification of diversity, species richness and dominance of the borer species have been analysed in the following chapter through statistical analysis. Lastly, general discussion on the present work has been furnished. Scope of further research work is also discussed for future workers. Exhaustive literature list, illustrations, tables, maps, etc. are the added features of the present study.