CHAPTER 1

INTRODUCTION
Insects are the most dominant creatures on this earth. It is commonly believed that 75 to 80% of the total animal species on this planet are insects. The world contains at least 10 to 30 million species of arthropods most of them being the insects (May, 1988; Stork, 1988). They form by far the largest group among animals and plants in the world (Ehrlich and Wilson, 1991; Varshney, 1998). Hammond (1992) estimated 9, 50,000 described species of insects, although lower figures of around 7, 50, 00 and 7, 90,000 are generally quoted. There is hardly any place on the earth, which is not invaded by these creatures. In this context, characters such as their minute size, high fecundity, capacity for flight and dispersal ability to feed on a variety of materials, water retention capability, presence of chitinous exoskeleton, etc. are important for their survival in different type of ecosystems with success. Thus, both in quality (number of species) and quantity (number of individuals), they outnumber all other biota (May, 1990).

The Insects are believed to have appeared on this planet in the Devonian period, some 200 million years ago and since then survived the glacial periods and evolved into myriad forms. They are essentially terrestrial and are distributed through the permafrost line of the Arctic to the ice cap of the Antarctica, and through the mountain tops to the depths of caverns. These offer a most diversified biological component of a forest ecosystem and have a great role in maintaining the cycling of nutrients, soil regeneration and protection, pollination of phanerogamic plants as well as natural regulation of pests (Ehrlich and Wilson, 1991; Varshney, 1998).

Biological diversity or biodiversity is the total variability within all living organisms and the ecological complexes they inhabit. It is in fact, a synonym for ‘Life on Mother Earth’ and therefore, can also be considered as the biological capital of the world. Biodiversity has three levels - ecosystem, species and genetic diversity-reflected in the number of different species, the different combinations of species and the different combination of genes within each species. All levels of biodiversity are required for the continued
survival of species and natural communities and all are important for the well-being of humans. Current estimates of this diversity range from 5 to 50 million, of which only about 1.7 million are known to humans and the flowering plants constituting 14 per cent of this total. Around 1,27,000 species of plants, animals and micro-organisms have been reported so far from India, of which the animal species is about 89, 500 including protozoa which constitute the major share and comprise 7.28% of the total world animal species (Alfred et al., 1998).

India is very rich in terms of biological diversity along with the presence of a large number of endemic species, due to its unique biogeographical location, diversified climatic conditions and enormous ecodiversity and geodiversity. It embraces three major biological realms i.e. Indo-Malayan, Eurasian and Afro-tropical, and is adorned with 10 biogeographical zones and 26 biotic provinces. This country recognised as one of the twelve mega-diversity countries of the world with two biodiversity hot spots, the Northeast region and the Western Ghats, of a total of 18 such sites identified throughout the globe.

Relation of man with biodiversity is as old as the evolution of man itself. He has been dependent upon the biodiversity for fulfilment of his entire livelihood needs. The ancient Indian literature is replete with references to animal and plant life affecting the lives of human beings on day to day basis. Many of the plants and animals have been domesticated over a period of time. Man has also discovered curative uses of plants and animals found in his immediate vicinity, and have associated religious value to most important of such plants (Sharma, 2002).

Study of biodiversity contributes to the requirements of conservation and monitoring for environmental change. Therefore, through systematics, the basic information required to confirm the change in environment can be measured. The goal of systematic is to understand species, what they are and how they are related to reflect such relationships in a formal classification and
to provide distinctive names for the group recognized. Systematic gives basic identification, makes information available, assembles information from a comparative perspective and thus allows synthesis, generates and stimulates idea and hypothesis applicable to other fields. Thus, Systematic and biodiversity are quite closely related because understanding the biodiversity is the basis of systematics (Lovejoy, 1977; Sperling, 1993).

To understand the extent and significance of biodiversity, it is important to carry studies on the systematics of plants and animals. Systematic provide the basic framework for the whole of the biology and is the fundamental discipline of biodiversity. Taxonomy performs four basic functions i.e. differentiation, identification, symbolization, and comparison. Vernacular or folk taxonomies provide local systems for the first three, but have little to tell us about the last. Individuals and the characters are the most basic units of biological classification (Groombridge, 1992).

Therefore, on the basis of features held in common, individuals can be grouped together into a large number of different classes and groups. Systematists and ecologists have measured diversity either by estimating species richness in an area, or by one or more indexes combining species richness and relative abundance within an area. Some attempts have also been made to measure change in species richness between areas. These solutions to the problems of measuring biodiversity are limited because species richness takes no account of the difference between species in relation to their place in the natural hierarchy, and because relative abundance is not a fixed property of species, varying widely from time to time and place to place (Williams et al., 1991).

The term systematics stems from the Latinized Greek word ‘Systema’ as applied to the systems of classification developed by the early naturalists, notably Linnaeus. For biologist, systematics is defined as the study of diversity of life (Simpson, 1961) or which deals with biodiversity of organisms (Wilson, 1988). Ross (1974 a, b) defined systematics as the field of biology
mainly dealing with biosystematics and classification of organisms. Mayr (1969) described systematics as the study of the kinds and diversity of organisms and of any and all relationships among them. Systematics, therefore, includes both taxonomy and biosystematics and all others aspects dealing with kinds of organisms and their diversity (Hawksworth and Bisby, 1988). Thus, systematics can provide the basic framework for the whole of biology and is the fundamental discipline of biodiversity (Groombridge, 1992).

‘Biosystematics’ was originally proposed as the word ‘Boisystematy’ by Camp and Gilly (1943) who defined it as an attempt to delimit the natural biotic units and to apply to these units a system of nomenclature adequate to the task of conveying precise information regarding their defined limits, relationships, variability and dynamic structure. They felt that the binomial system of nomenclature did not express the evolutionary aspects of speciation then being realized. Thus, biosystematy was proposed to recognize between systematic biologist, who restricted their studies to herbarium specimens (Taxonomist) and those who employed character system (Biosystematists) for which knowledge of living or recently preserved specimens was required (Camp and Gilly, 1943).

Lepidoptera, one of the highly specialized insect orders, includes scale winged insects of the holometabolous-endoperygote series. This order includes butterflies and months that show total metamorphosis and pass through egg, larva, pupa and adult stages. Lepidoptera is a large and well-known group with cosmopolitan distribution of which India is no exception. The members are of great value both for conservation and environmental planning in local scale. Individuals have a great potential of inclusion in the faunistic analysis and environmental monitoring. This is particularly true for the butterflies due to the colour and pattern of their wings, variegated food plants, wide range of habitats, and abundant local and weedy species along with diverse forms.
Butterflies have always been a subject of fascination to mankind and they are considered as one of the best-known species of insects. The term 'butterfly' is derived from the butter-yellow colour of the male of ‘Common Brimstone’ of the Family Pieridae. These are most easily recognizable of all the other insects and second in number in their universal popularity after birds. Because of their charming colour patterns and most interesting phenomenon of mimicry and migration, these evoke curiosity and fondness among all the people on the earth, particularly among children, naturalists and scientists. The butterflies are cosmopolitan in distribution and occur in every suitable environment, from forests to deserts and plains to valleys and hills (Mani, 1986). Mouthparts are modified into coiled proboscises; the antennae are either knobbed or clubbed at the anterior end. Butterfly larvae feed on their host plants and some are predaceous on members of families, Aphididae and Membracidae. Some lycaenid larvae live in nests of ants and often devour ant-larvae. They are good pollinators of many agricultural and horticultural crops. The adults visit flowers for nectar, while some of the male species congregate on damp or moist places near streams. Some of the species are attracted in large number over ripe fruits, animal dung and bird-droppings, etc., while majority of butterflies are found in sheltered and shaded areas; several others occur in open ground, among bushes and over tree tops (Wynter-Blyth, 1957).

Butterflies are suitable for ecological studies as the taxonomy, geographic distribution and status of many species is relatively well known. Those insects, which are mostly phytophagous, serve as primary herbivores in the food chain. As many butterflies are food bio-indicators of the environment, they can be used to identify ecologically important landscapes for conservation purposes (Sudheendrakumar et al., 1999). Butterflies show distinct pattern of habitat utilization. The nature of vegetation is an important factor, which determines the dependence and survival of a species on a particular habitat. Being highly sensitive to environmental changes, they are easily affected by even relatively minor disturbances in the habitat so much
that they have been considered as indicators of environmental quality and are also treated as indicators of the health of an ecosystem. The presence of butterflies emphasizes availability of larval food plants in great abundance. As stated earlier, most of the butterflies have specific habitat requirements, as females usually tend to lay eggs only on selective food plants occurring in the area.

On the basis of eco-faunistic surveys carried out at different parts of India by various workers like Mani (1986) and Alfred et al. (1998), it has been revealed that niches and habitats of lepidoptera sprawl from the mangrove ecosystems also the major insular belts like the Andaman and Nicobar and the Lakashadweep group of Islands. Though India principally falls in the jurisdiction of the tropical biome, the country nevertheless shows large faunistic affinities with the equatorial, temperate and even, to certain extent, arctic parts of the globe. Such a distributional pattern of Lepidoptera is necessary to be considered to define the geographical units for conservation (Mandal, 1991). Maximum degree of faunistic stagnation is found in the eastern Himalayas particularly along the Myanmar border, while in other areas like the western Himalaya, Southern and Insular parts of India: the number of lepidopteran species is proportionately less. Many more species are, however, yet to be explored from the remote corners of plains, arid, waterlands and forest covers in different areas from east to west and north to south India (D’Abrera, 1982-86).

Many investigators have studied the diversity, distribution, relative abundance, taxonomy and ecology of butterflies from different parts of the country (Evans, 1932; Talbot, 1939, 1947; Wynter-Blyth, 1982; Alfred et al., 1998; Alfred, 2005; Thakur et al., 2006 a), but only a few studies have been conducted on biosystematics and ecology of butterflies from the Himalayan region (Mani, 1986; Mehta et al., 2002, 2003; Arora et al., 1995, 2005). However, a little has been done to survey the insect fauna from Himachal Pradesh (Uniyal and Mathur, 1998; Thakur et al., 2002, 2006 b; Singh, 2007).
Therefore, present investigations were undertaken with the following objectives in mind:

1. To study the diversity and distribution of butterflies from different agroclimatic zones of Himachal Pradesh.

2. To examine the taxonomically significant morphological features and wing venation for characterizing species/sub-species of butterflies in Himachal Pradesh.

3. Scanning electron microscope studies on some morphological features of some butterfly species of Himachal Pradesh.

4. To study habit and habitats of different butterflies species and their interrelationship with flora of Himachal Pradesh.

5. To study the life cycle of an economically important species of butterflies in Himachal Pradesh.

These studies were urgently needed for making the old taxonomical work more meaningful and for the enumeration of endemic taxa of insects in India.