INTRODUCTION

The most impressive aspect of the world of life is its diversity and the uniqueness of its components. The important biological discipline concerned with the scientific study of diversity is often indiscriminately referred to as Systematics or Taxonomy (Mayr and Ashlock, 1991). Taxonomy is an important component in our endeavours to achieve sustainable use of biological resources / biodiversity and to secure the future of human kind and the organisms with which we share the environment. Taxonomy is the foundation of all biological sciences, pure and applied alike, including agriculture, forestry, fisheries, plant, animal and human health, ecology, conservation, environmental and biodiversity management programmes, quarantine etc. The present research work falls within the domain of the basic discipline of taxonomy. This basic science had its heyday in the nineteenth century and once again made a marvelous comeback after the much celebrated 'Earth Summit' held at Rio De Janerio, Brazil in 1992.

Biodiversity is the biological capital of mother planet earth and is the essence of life. The United Nations General Assembly declared 2010 as “International Year of Biodiversity, IYB” on 11th January, 2010 in Berlin, Germany with the slogan “Biodiversity in Life. Biodiversity is our Life”. The richness in biodiversity is due to immense variety of climatic habitats in our beautiful country. These vary from the humid tropical Western Ghats to the hot deserts of Rajasthan, from the cold deserts of Ladakh and the icy mountain of Himalayas to the warm coasts of Peninsular India. As many as 1,26,656 species of various organisms are known from India (MoEF, 1998), which is one of the twelve mega biodiversity countries of the world.

Insects are ancient, ecologically significant and beautiful components of the living World. Insects are most numerous and their numerical abundance is amazing. The evolutionary history of insects justified their existence for million of years and with passage of time in no way has diminished the wonders of insect life. Numbering
over 1,000,000 animal species, insects were the first organisms to successfully colonize land. Insects occupy all possible niches that rule the mother planet earth. As many as 7,50,000 insect species are described from the Globe under 30 orders, three times as many as these are in the rest of the animal kingdom and many more are still undescribed.

Under class Insecta, order Lepidoptera including moths and butterflies is one of the most important and third largest group, with respect to its economic importance and aesthetic value. This group of insects is known by 1,65,000 species from the Globe and belongs to class Insecta which includes 121 families under 27 superfamilies (Watson and Whalley, 1975; Heppner, 1991). The present research work deals with Taxonomic studies on family Geometridae (Lepidoptera) from Western Ghats of India, an Internationally known hot spot of biodiversity.

Geometridae is one of the most important family of order Lepidoptera. The word Geometridae is comprised of two Greek words i.e. 'Geo' means earth and 'Metrous' means to measure. This character, usually diagnostic of Geometrid moths is exhibited by their caterpillars. The larvae of family Geometridae can be easily distinguished from those of other families by their 'looping' progression and i.e. why they are also known by common names like 'measuring worm', 'loopers', 'inchworm' and 'span worm'.

These moths are characterised as a monophyletic group by the presence of structurally unique tympanal organs at the base of the abdomen (Cook and Scoble, 1992). These insects can be easily recognized because at rest, the wings are typically
held outspread. They are neither usually folded over the body or held vertically with the dorsal surfaces of wing touching.

Species of Geometridae tend to be more specific to certain habitats, particularly at high altitudes (Holloway, 1985). Many species are bright coloured, but most are drab. Frequently, wavy lines transverse the wings, but strong, distinct pattern occur often. The Geometrids are characterised by the presence of a basal fork between vein 2A and 3A in the forewing and vein 1A is always absent.

CLASSIFICATION

Like most of the other families of order Lepidoptera, family Geometridae has a long and complex history of nomenclature. During the early years, the group was recognised as a sub tribe, tribe, subfamily or family under the names 'Phalaenides', Phalaenidi', 'Geometrides' or 'Geometridae' respectively. Hampson (1895) was one of the first Lepidopterist to establish this group under the family name Geometridae and subdivided it further into six subfamilies viz., Boarmiinae, Geometrinae, Orthostixinae, Acidaliinae, Oenochrominae and Larentiinae. Prout changed the subfamily name Geometrinae to Hemitheinae in 1912. Likewise, another change in the system of classification suggested by Hampson was the suppression of subfamily Orthostixinae in favour of Oenochrominae by Prout (1912a). Later on, name of subfamily Acidaliinae was first changed to Sterrhinae (Prout, 1933) and further to
Scopulinae by Paclt in 1975 due to priority given to genus *Scopula* Schrank over *Sterrha* Hübner. Later on, subfamily name Oenochrominae was considered to be mis-spelt and finally was revised as Oenochromatinae by Paclt (*loc. cit.*). Therefore, according to Paclt’s classification of family Geometridae, only six subfamilies viz., Archiearinae, Larentiinae, Boarmiinae, Oenochromatinae, Geometrinae and Scopulinae were known. Scoble (1999) added three more subfamilies to the list of subfamilies of the family Geometridae and revised and raised the number of subfamilies to nine namely Ennominae, Sterrhinae, Oenochrominae, Orthostixinae, Archiearinae, Larentiinae, Geometrinae, Alsophilinae and Desmobathrini.

**Classification of family Geometridae**

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**Economic Importance**

Herbivorous insects comprise a significant fraction of any insect fauna due to their sheer numerical preponderance (Ødegaard, 2000; Basset *et al.*, 2001; Novotny *et al.*, 2002). These are also expected to respond sensitively to deforestation and subsequent forest regeneration, since they have a close relationship with the
vegetation they live in. Family Geometridae drives its name from the characteristic locomotion of its caterpillars which are commonly called as 'Loopers'. Among insects the members of family Geometridae are of great economic importance as the loopers of a large number of species defoliate the leaves of the agricultural crops, fruit plants and forest trees. The caterpillar of *Hyposidra successaria* (Walker) besides attacking common fruit trees such as ‘Jamun’ and ‘Mango’, also destroy many oil seed crops and sweet potato. The loopers of *Chlorissa punctifimbria* (Warren) attack the leaves of *Acacia nilotica* and *Carissa spinarum*. *Mixochlora vittata* (Moore) damages the leaves of many species of *Quercus* and *Castanea crenata*. The larvae of *Agathia hilarata* Guenée defoliate the leaves of *Nerium indicum* and *Trachospermum Carissa*. Some other important pests like *Rhomborista devexata* (Walker) attacks foliage of *Bauhiria variegata* and *Jodis aegutaria* (Walker) feeds on plants of families Caprifoliaceae, Cercidiphyllaceae, Rosaceae and Staphyleaceae. The larvae of *Pingasa ruginaria* (Guenée) feed on red gram whereas, those of *Pelagodes veraria* (Hampson) and *Thalassodes quadraria* Guenée are associated with litchi plants (Nair, 1975). *Pingasa ruginaria* (Guenée) damages the foliage of plants belonging to families Compositae, Lauraceae and Myrtaceae. In general the food plants of Geometrid moths included members of Compositae (*Gerbera jamesonii*), Lauraceae (*Cinnamomum zeylanicum, Litsea elongata, Litsea polyantha*), Leguminosae (*Crotalaria*), Myrtaceae (*Psidium guajava*), Rhamnaceae (*Ziziphus jujube, Ziziphus nucronata*), Sapindaceae (*Dimocarpus longan; Lepisanthes rubiginosa; Lichi chinensis; Nephelem lappaceum*) and Sterdliaceae (*Triplochiton scleroxylon*) (Scoble, 1999). Similarly, *Hyposidra talaca* (Walker) was found to be inhabiting plant species of Apocynaceae (*Carissa spinarum*), Bombaceae (*Combretum; Terminalia tomentosa*), Euphorbiaceae (*Cassava; Glochidion hongkongense; Hevea brasiliensis; Jatropha curcas; Mallotus; Ricinus communis*), Fagaceae (*Castanopsis fissa*), Geraniaceae (*Pelargonium*), Lauraceae (*Cinnamomum zeylanicum*), Leguminosae
Introduction

(Acacia catechu; Acacia mangium; Acacia nilotica; Albizia procera; Derris, Glycine hispida); Miliaceae (Khaya anthotheca), Moraceae (Ficus parasiticus), Myrtaceae (Eugenia aquea; Eugenia cumin; Eugenia), Rubiaceae (Coffee arabica; Coffee liberica), Rutaceae (Citrus maxima; Citrus), Sapindaceae (Lichi chinensis; Nephelium lappaceum; Schleichera oleosa) and Verbenaceae (Tectona grandis) (Scoble, loc. cit.). The caterpillars of Antitrygodes cuneilinea (Walker) are serious defoliators of Anthocepalus cadamba. The forest trees like Rumex sp. and Acacia catechu are damaged by loopers of Anisephyra ocularia Fabricius and Traminda mundissima (Walker) respectively. Ascotis selenaria (Dennis and Schiffermüller) is a known pest of coffee in East Africa and Kenya respectively and its larvae feeds on leaves, fruits and flowers.

Besides this, there are some Geometrids which are also of great medical importance. Buttiker (1964) collected eight species of Geometrid moths including four Indian species i.e., Scopula attentata (Walker), Somatina anthophilata Guénée, Pingasa chlora (Stoll) and Semiothisa fasciata (Fabricius) from the eyes of cattle like Water buffalo, Sambar, Pig, Horse, Mule, Donkey and Elephant of North Thailand. Similarly, Antitrygodes cuneilinea (Walker) was reported from the eyes of Ox and Cattle in East Pakistan (Buttiker, 1969). Banziger and Buttiker (1969) have also reported three Geometrid species frequenting human eyes in Thailand and causing increased flow of tears which is imbibed by the moths. Adults of a few species of sub families Ennominae and Sterrhinae are also known to frequent the eyes of cattle and human being and are considered as potential vectors of Trachoma virus and causal agents of other eye diseases such as kerato-conjunctivitis, Ophthalmia and 'Pink eye' in human beings.

Thus from above, it becomes crystal clear that the moths of family Geometridae affect human activities in number of ways. A perusal of previous literature reveals that the host plants of only 0.0112% of Indian species are known till
date against 0.0496% species of the world. It is worthwhile to record here that in order to undertake any study on ecology and the control of the pests, it becomes imperative to understand taxonomical and morphological attributes of various taxa. Proper nomenclature and classification of these organisms is an important prerequisite for any such research project / programme to plan control measures.

**WESTERN GHATS OF INDIA**

Western Ghats are one of the most important hot biodiversity spots of the World. It covers an area of about 160,000 Km\(^2\) and stretches for 1600 km from the mouth of river Tapti in the North to Cape Camorin in the South. The mountain ranges are known with an average height of about 1200m running parallel to the Western border of South India through the states of Gujarat, Maharashtra, Goa, Karnataka, Tamilnadu and Kerala. These ranges of the Western Ghats are continuous except a single major gap of about 24 km called as ‘Pal Ghat gap’ along with some small passes like ‘Goa gap’, ‘Bhor Ghat’, and ‘Thal Ghat’. The Western Ghats are known as the Sahyadri mountains in Maharashtra and Karnataka, Nilagirimalai in Tamilnadu and Sahyaparvatam in Kerala. Anaimudi peak with an elevation of 2,695 metres is the highest mountain of Western Ghats which lies in the Southern part of the ranges in the state of Kerala. The Anaimudi peak also act as a nodal point from which three ranges radiate to three different
directions i.e., the Anaimalai hills in the North, the Palni hills in the North-East and the Cardamom hills in the South. The monsoon season of the Western Ghats lies between months of June to September and due to geographic conditions, Western slopes of mountains experience heavy annual rainfall, while the Eastern slopes are drier. This wide variation of rain fall pattern in the Western Ghats coupled with the region’s complex geography, produces a great variety of flora and fauna. The hilly ranges of Western Ghats also act as a home for many endemic species of plants and animals.