CHAPTER 2

REVIEW OF LITERATURE

History of Entomology in India

Insects are known from the Vedic times as early as 1200-1000 B.C. as recorded in the treatises of Charaka and Sushruta. Classification of ants, flies and mosquitoes are to be found in Sushruta's treatise *'Sushruta samhita'*, while in *'Charaka Samhita'* we find classification of bees. The term 'Shatpada' (six legged insects) was coined by Amara Simha, some one thousand years before the European naturalist Latrielle coined the term Hexapoda.

It was not until the early 17th century that major advances were made in Entomology.

The first entomologist to make extensive collection of Indian insects was J.C Fabricius. Beginning of Indian Entomology can be traced in 1758 when *Systema Naturae* was published. Its tenth edition by Carl Linnaeus contained the earliest record of Indian insects, mentioning 28 species. Fabricius, Edward Donovan, Gerard Koenig, Westwood and Hope are some notable entomologists during the period 1745-1922.

19th Century Entomologists were Annandale, Ernest Green, Maxwell Lefroy and T.B Fletcher. The major volumes *'Indian Insect Life'* by Lefroy and *'Some south Indian insects'* by Fletcher are even today works of references. Many manuals on the fauna of British India appeared from 1864 and it was Hampson who contributed first to that series by publishing four volumes on moths of India.

Entomologists like T.V.Ramakrishna Ayyar, Y.Ramachandra Rao, Richard Coleman., S.Pradhan, and M.S.Mani raised the status of Entomology by considering Entomology as a special subject in the traditional and agricultural universities. The Bombay Natural History Society and the Forest

Research Institute of Dehradun have played an equally important role in raising the status of Entomology to the present level.

Present status of Entomology in India

At present, the Zoological Survey of India (ZSI), Kolkata, Indian Agricultural Research Institute (IARI), New Delhi, Indian Institute of Science (IISc), Bangluru, Forest Research Institute (FRI) of Dehradun and few traditional and agricultural Universities carry out taxonomic research on Indian insects to a limited extent.

Diversity study

Vasudeva *et al.* (2007) reported 20 species of Tabanids belonging to 5 genera of 3 sub families in Rajiv Gandhi National Park, Karnataka. Rai *et al.* (2007) reported 43 species belonging to 29 genera from 7 families of butterflies from the reserve in Tadoba National park Chandrapur, Maharashtra from Western Ghats .Sabu (2006) reported twenty-one dung beetle species belonging to the 3 major functional guilds and Thirumalai (2006) reported 128 species belonging to 44 genera of aquatic hemipterans. Swaminathan, R. (2005) reported 19 species of predatory Coccinellids in different agroecosystems of Southern India. Subramanian, K (2005) worked on diversity of Odonata in peninsular India. Sundararaj, R. (2005) reported 1420 species of white flies in India. Singh *et al.* (2005) reported 13 % increase in the yield of *Brassica rapa* with pollination of bees. Unniyal (2004) of Forest Research Institute, Dehradun reported 35 species of 25 genera belonging to 4 families within Nanda Devi National Park. Hiriyan *et al.* (2003) described twenty one species of family Culicidae of Diptera. Gupta (2003) accounted 633 species in 60 genera of bees in India. Maicykutty and Usha (2002) described nineteen species of Hemiptera from Western Ghats of India .Mathew (2002) recorded 860 species of insects belonging to 13 orders from Western Ghats.This fauna contained a high proportion of rare and endemic species particularly of Lepidoptera. Prasad and Kulkarni (2001) described thirty new species belonging to 8 families of Odonata in Western Ghats of India. Shishodra and Kulkarni (2001) described twenty seven new species belonging to family

Acrididae of Orthoptera from Western Ghats .Narendran *et al.* (2001) described two new species of Hymenoptera. In 1986 Zoological Survey of India published records on insect diversity of Silent valley. In 1998, Alfred *et al*, of ZSI reported 60,000 insect species in India.

Ecology study

Mathew et al (2007) reported 215 species from Neyyar Wildlife Sanctuary of Kerala. Unniyal and Bhargav (2007) emphasized on role of Tiger Beetles as bioindicators in the Shivaliks of Himachal Pradesh. Kunte (2006) reported that Pune district may harbour about 170 species, of which 104 are far from Pune urban area. Misra *et al.* (2005) compared diversity of some insect fauna in industrial and non-industrial areas of West Bengal and found a decline of 23.33% in the insect fauna of industrial areas concluding that even in homogeneous ecological condition species richness may drastically change with the influence of industries. J.K.Maheshwari (2003) from Lucknow has reported that population of the bees and butterflies in India is dwindling due to indiscriminate use of pesticides and atmospheric pollution.

Conservation study

Jayakumar *et al.* (2007) recommended points of conservation of insect's diversity in India. Suryaprakash (2007) has given some action plans for conservation of butterflies in Delhi. Kumar & Khanna (2004)of Zoological Survey of India, Northern Regional Station, Dehradun listed 5 species of Hymenoptera,4 species of Lepidoptera, 3 species of Odonata and 1 species of Anoplura as threatened Indian insect fauna in IUCN .

Status of Entomology in Gujarat

Tank *et al* (2007) reported that out of nine species of Coccinellids, *Coccinella sexmaculata* was dominant in agricultural fields of Anand. Soni *et al* (2005) reported 35 species represented by 22 genera belonging to 15 families of butterfly in Sardar Patel University campus, Vallabh Vidya Nagar. Ahir (2004) reported nearly 355 insect species in deciduous forests of Gir Sanctuary. Study

on Butterfly Fauna of Jessore sloath bear Sanctury was carried out by Pilo *et al.* in 2001

Vazirani (1997) reported some water insects of Gujarat. Sabnis and N. Radhakrishnan recorded about 250 species of insects belonging to several orders from Narmada Valley in Gujarat region during the faunal survey conducted in 1990-92.

Status of Entomology in Vadodara

Pardeshi (2008) identified 15 species of termite from the Agricultural fields of Vadodara. Kumar Dolly and Shivkumar (2003) reported 42 species belonging to 31 genera and 5 families of butterflies from Vadodara. Kumar Dolly and Naidu Bhumika (2006) worked on the role of *Coccinella septumpunctata, Gongylus gongyloides, Chrysoperla carnia* and *Allocotasia aurata* as bio-control agents in agro ecosystem of Vadodara district.

Status of Entomology Abroad

Diversity study

Work on diversity of insects is done by various entomologists worldwide. Pereira *et al.* (2006) reported 39 bee species and 11 social wasps species in Campos rupestris, Bahia, Brazil. Matteson (2006) documented diversity and conservation of 24 species of butterflies, 49 species of bee, 27 family groups of wasps and a myriad of arthropods in the community gardens and parks of New York city, USA .Virues and Eben (2005) compared parasitoids on the beetle diversity in cucurbitaceous plants of Varacruz, Mexico and concluded that parasitoids attacked more beetle species on non bitter cucurbits than on bitter cucurbits. Frederie and Terry (2005) described 338 species of Brachycera from sedge meadows of Quebec, Canada. Prayoonrat (2004) reported 36 species of 32 genera belonging to 32 families of Diptera in Mangrove forest in Bangpagong, Thailand. James Hayden (2004) did insect survey in New York identifying 89 families of different orders. Desender and Bosman (2004) recorded 53 species of Carabidae in set aside fields in Campine region of Belgium. Klein and Tscharntke (2003) reported that fruit set of highland coffee

increases with the diversity of pollinating bees in Germany. Giberson et al (2001) reported forty three species of nematocerous flies in coastal salt marshes of Prince Edward islan , Canada. Stickler and Kamel (2001) listed out 21 bee pollinators of Alfalfa and Egyptian clover in Suez canal. Andrew (2000) reported 97 species of dungbeetles in the rain forest of Sabah, Malaysia. Peck *et al.* (1998) recorded 53 cave inhabiting species of beetles and described their ecology and distribution.

Ecology study

Carpaneto et al. (2007) reported that the main factor inducing decline and local extinction of roller species was gradual change in land use during the last three decades, consisting of a reduced extension of grasslands in favour of either intensive agriculture or reforestation after abandonment of livestock raising, in Italy.Santos (2007) reported that the Tropical Atlantic Forest physiognomy had higher species richness (18 species) of Polistinae, followed by the restinga (lowland sandy ecosystems located between the mountain range and the sea) (16 species) and the mangrove (8 species) ecosystems. Nummelin (2007) showed that waterstriders are good in detecting differences in iron and manganese, but seem to be poor in accumulating nickel and lead. Antlions are efficient in detecting differences in iron and accumulating cadmium and manganese .Waterstriders are poor in accumulating lead, but antlions and ants are effective.Finland. Namwanda *et al* (2006) reported that the undisturbed forest had higher abundance and diversity of coleopteran families as compared to disturbed forest in Amani Nature reserve of East Africa .Winter and Kim (2006) reported that many pollinator populations are declining precipitously around the world . Zanette *et al* (2005) reported the loss of vegetation cover associated with urbanization had a negative effect on the abundance and species richness of advanced eusocial wasps in the Brazilian metropolis. Scheffler (2005) reported that diversity of dung beetles was same in logged and intact forests of Brazil. Edsall *et al.* (2005) reported that polluted sediments are likely responsible for the absence or low density and biomass of nymphs of ephemera species observed on fine-grained substrates in western Lake Erie, Saginaw Bay, and Green Bay, all of which historically supported

abundant populations in Stanford, U.S.A . Elazna (2005) found that the characteristics of Carabidae communities in the habitats of forests adjacent to cities do not show essential disturbances in their bio-equilibrium, and so they can constitute a control in research into the biodiversity of entomofauna from the areas of heavy anthropogenic stress. Kadoya (2004) reported that the species richness of the dragonflies was enhanced by the increasing immigration rate of species which favor well-vegetated ponds in Tokyo, Japan. Zahoor *et al.* (2003) reported 22 species of coccinellids and concluded that species were most diverse in the forest area than crop area in Faisalabad, Pakistan. Ishitani *et al* (2003) found a significant effect of urbanisation on the composition of carabid beetle assemblages in Hiroshima City. ehounek (2002) found that the grass & herb cover is the most important environmental factor influencing the Chrysomelidae species composition in Lowland of central Bohemia. Niemela and Rainio (2002) from *Helsinki*, Finland concluded that carabids are useful bioindicators.Hughes *et al.* (2001) compared diversity of insects in three habitat types viz, meadow, aspen and conifer and reported that Dipteran and Hymenopteran communities were clearly differentiated by habitat type rather than geographic proximity..Lobo (2000) suggested that urban development of the coastal zones for tourism since 1950 has probably contributed greatly to the disappearance of many roller populations in the Iberian Peninsula. Bohac (1999) reported Staphylinid beetles as bioindicators in Czech Republic.Sommaggio (1999) reported that Syrphidae are probably most suitable for environmental evaluation at a larger scale, e.g. for assessment of landscape diversity.

Conservation study

Eardley (2008) worked on conservation of Pollinators.After working on insect conservation in San Francisco bay area, Connor *et al.* (2002) observed that the primary effect of urbanization on insects is via habitat loss. Ragaei and Alam (1997) worked on insect diversity, the scientific interest and potential value of insects, insect conservation, and measurements of insect diversity and future of insect diversity in Egypt. R.Pyle (1981) *et al.* also worked on conservation in U.S. The Xerces Society maintains a Red List of Pollinators

(http://www.xerces. org/Pollinator_Red_List /index.htm) that describes the pollinating butterflies, moths, and bees in need of conservation attention in the U.S., Canada, and Mexico. The society identifies 35 additional butterflies, and 58 bees, nearly half of which are Hylaeus species in Hawaii that either need additional study or may need additional conservation measures

Southern African Butterfly Conservation Assessment (2007) is a institute run by South African National Biodiversity Institute (SANBI), the Lepidopterists' Society of Africa (LepSoc) and the University of Cape Town's Avian Demography Unit (ADU) in Pretoria, Africa for conservation of butterflies. More such organizations should be made which cover all orders of Insects.

Hence combining the approaches of systematics, ecology and conservation better understanding of insect diversity can be developed.