Chapter VII

DISCUSSION

As noted by lepidopterists the trap designs are not particularly suitable for use in tropical conditions, primarily because they are too small to cope with the enormous catches which were frequently encountered (Barlow, 1982). The samples from the spread sheet proved extremely valuable for the production of checklist of moth fauna of North Maharashtra.

South-East Asia is one of the richest biodiversity areas on Earth; more than 6000 Micro-Lepidoptera species are known (Robinson, et al., 1994). The Moths of Borneo series in 18 parts Holloway (1983-2011), includes 4630 Macrolepidoptera species. Moth fauna of Thailand is published in Moths of Thailand series of 5 volumes i.e. Saturniidae (29 species) Pinratana & Lampe (1990); Sphingidae (175 species) Inoue et al. 1997; Noctuidae (715 species) Kononenko & Pinratana (2005); Lasiocampidae (112 species) Zolotuhin & Pinratana (2005); Notodontidae (285 species) Schintlmeister & Pinratana (2007). Kendrick (2002) studied moths of Hong Kong and recorded 1551 species from 48 families. Fatimah & Catherine (2002) catalogued 370 moth species belongs to 15 families from the Crocker Rangenational park, Sabah; wherein 156 geometrid and 73 noctuoid (including Erebidae) moth species recorded which represent the diverse families for the area. Khen (2010) reported 355 moth species from Tropical Rain Forest of Maliau Basin, Sabah, Malaysia; wherein Noctuidae including Erebidae (113 species) & Geometridae (69 species) was reported as dominating families. Kendrick (2010) investigated moths of Fung Yuen SSSI & Butterfly Reserve, Hong Kong and reported 387 moth species, wherein Erebidae (129 species) & Geometridae (59 species) was reported as dominating families. Aslam (2009) studied diversity of moths of Peshawar and Pyralidae & Noctuidae reported as dominating families.

The results obtained in the present study had shown less species richness on controversy with the data of moth fauna of the neighbouring states of India, particularly compared with Borneo, Thailand, Hong Kong and Sabah may be due to
the proper documentation and efforts towards the species conservation that lacks in the Northern Maharashtra.

Cotes & Swinhoe (1887-89) and Hampson (1892-1896) listed 4553 & 5277 moth species respectively from India; of which they have reported 789 & 611 moth species principally from Western Maharashtra. Ghosh (2003) studied the geometrid moths of Sikkim and reported 525 species, wherein records of 460 and 260 Geometridae species were mentioned from Meghalaya and West Bengal respectively. Mathew et al. (2004) cataloged 202 Lepidoptera species from Shendurny Wildlife Sanctuary, Kerala, of which 73 were butterflies, while the 129 moths species recorded were from nine families, where Noctuidae (including Erebidae) and Pyralidae dominant. In another study Mathew, et al., 2004 reported 87 moth species from Peppara Wildlife Santury, Kerala, India and pyralid moths found dominating group for the area. Rose & Pooni (2004, 2005) recorded 18 species belonging superfamily Pterophoroidea and 16 species belongs to superfamily Tortricoidae from North western part of India. There are only 58 pyralid moth species recorded in the present study compared to total 1646 pyralid species reported throughout India by Mathew, 2006. Pathania, et al., (2006) reported the 22 Gelechiid moth species from Siwalik hills of North western Himalaya in contrast to present study only 3 Gelechiid moth species recorded. Mathew, et al., (2007) studied insect fauna from Neyyar Wildlife Sanctuary, Kerala; and reported 90 moth species wherein Pyralidae reported as dominating family. In another study Pathania, et al., (2007) recorded Lecithocerid fauna from Siwaliks of North-western India and described 22 moth species. Chandra (2007) studied moth diversity of Madhya Pradesh & Chhattisgarh. Of the 142 moth species from 90 genera in 16 families, Noctuidae (including Erebidae) and Crambidae were the dominant families. Smetacek (2008) studied moth fauna from different elevations in Nainital district, Kumaon Himalaya, India and recorded 887 moth species; family Noctuidae & Geometridae reported as diverse families. Kakati, et al., (2009) reported 14 species of wild sericigenous moth from Nagaland, India. Gurule, et al., (2010) cataloged 70 species of moths from family Noctuidae (including Erebidae) from Nashik district of Maharashtra. Sidhu, et al., (2010) documented 109 species microlepidopteran moths from family Pterophoridae in online version of Zoological Survey of India.

The all above figure indicates that the moth fauna of Northern Maharashtra is highly diverse as compare to central states of India like Madhya Pradesh & Uttar Pradesh.
Pradesh. At the same time distribution of moth fauna of southern states of India like Kerala and Tamil Nadu found to be of similar pattern with noctuoid species dominating over geometrid species that attributes to similar ecological and climatic conditions. Despite the fact that the Northern Maharashtra shows low geometrid species as compared to Himalaya, Meghalaya, Siwaliks of Northwestern India and West Bengal may be due to high altitude and comparatively less disturbed forest patch as gemetrid moths represent true forest species (Kitching, et al., 2000b; Kendrick, 2010). The Geometrid to Noctuid (including quadrifine noctuoid taxa) ratio obtained in survey is 1: 5.7 ≈ 1: 6 (i.e. 43 geometrid moth species : 243 noctuoid moth species). There are some notable absences of species or low numbers of some families, mostly of forest species. The ratio suggest the moth assemblages recorded are typical of human-disturbed forest of wild and orchid plants with relatively low geometrid component and moderate agriculture and open habitats were found (Kendrick, 2010). Ratio indicates that area is rich with higher proportion of plants from families Cupressaceae, Menispermaceae, Fabaceae, Malvaceae, Solanaceae, Convolvulaceae, Tiliaceae, Euphorbiaceae, Mimosaceae, Ebenaceae, Sapotaceae, Sapindaceae, Brassicaceae, Asteraceae, Poaceae, Linaceae, Chenopodiaceae serve as indicator taxa for noctuid moths; with subsequent less proportion of true forest plants species from families Myrtaceae, Rutaceae, Rhizophoraceae, Periplocaceae, Combretaceae, Thymeliaceae, Fagaceae, Santalaceae indicating geometrid fauna (Kitching, et al., 2000b). It was also observed that due to topographical changes and habitat loss of natural habitats (Mahajan, 2004; Kharat, et al., 2012), the population of many species has also declined from Maharashtra (Gurule, et al., 2011).

In the present study more macro-moth species were recorded than micro-moth species may due to more recording efforts by light sheet and light trap methods rather than other methods (such as larval searching and rearing, baiting and pheromone trapping) and also due to difficulty with identification of micro-moth species as many of the specimens were pending further investigation. Low number of microlepidoptera may due to fragmentation in the area by human culture and may they have potential to meet the IUCN Red list Criteria and require conservation programmes for their prevalence. Moreover, it must be noted that all the species of India be regarded as data deficient for IUCN Red list analysis, as there is little published data available on the distribution and assemblages of moths in Indian
region. The exact reason for the occurrence of low micro-moth species in this survey is remain unclear. Also, there is considerable lack of data regarding endemic moth species of India so it is irrelevant to discuss the result obtained in present study.

Individual surveys from India, however, generally show comparatively lower species richness; this may be attributed to loss of habitat (Mahajan, 2004; Kharat, et al., 2012) and fragmentation due to unplanned water management systems that has created large artificial dams (Forest Survey of India, 2001). It implies the need of standard sampling methods during surveys and potential strategies for conservation of both habitat and invertebrate fauna principally the moths. Besides adopting conservation strategies for survival of lepidopteran species efforts should be done towards natural habitat conservation and monitoring of ecological processes in order to protect the species and genetic diversity in the community (Mathew, et al., 1993; Aslam, 2009).

The data obtained for 2 years since February 2010 to January 2012, while survey were analysed using Shannon’s diversity index (H’), Margalef’s index (M), Pielou’s index (J’) and Sorensen’s similarity index. The results of diversity measurement showed that the diversity of moths at Nashik district was constantly high for first and second year (374 species; H’ = 5.690, M = 41.22, and H’ = 5.732, M= 39.85, respectively); whereas diversity of moths found lowest in Jalgaon district in both years (145 species; H’ = 4.888, M = 16.98, and H’ = 4.909, M = 17.24, respectively). The reasons for high moth diversity values in Nashik district is due to, the rich vegetation in this area and the area is bounded on North-West by Dang’s thick forest of Gujrat; while Jalgaon district had comparatively less vegetation due to less rainfall and the area bounded on North side by semi-dried Madhya Pradesh state with dry deciduous forest (Chandra, 2007; Gurule, et al. 2011). The moth diversity values of Dhule and Nandurbar districts found nearly equal in terms of number for both the years (Dhule: 241 species; H’ = 5.302, M = 27.48 and H’ = 5.346, M = 27.71 respectively; Nandurbar: 240 species; H’ = 5.312, M = 27.57 and H’ = 5.366, M = 27.28 respectively), however the species composition was different as only 175 moth species found common to both districts.

The Pielou’s evenness index (J’) found to be above 0.9 for all the four districts; that attributes less variation i.e. less uniqueness and some what uniform distribution of moth species in the entire regions. The qualitative Sorensen similarity
index (β) value (refer Table 6.6) obtained in respective districts is less indicating less uniform nature of the communities in terms of species composition. The Sorensen similarity index (β) value 1 or closer to 1 indicates highly similar species composition or low β- diversity within two communities on contraversey less value indicates distinction in species composition or high β- diversity. Highest value obtained for Sorensen similarity index (β) was 0.7317 for the Nashik and Dhule which share 225 common moth species indicating less variation in species composition low β- diversity. While lowest value obtained for Sorensen similarity index was 0.5010 for Nashik and Jalgaon that share only 130 common moth species indicating more variation in species composition or high β- diversity.

The moth diversity at Sebangau Peat Swamp and Busang River secondary Rain forest was studied by Sutrisno (2005) has showned the high value of H’= 6.643 & 8.139 respectively as that found in present study indicating high moth diversity. Though, diversity indices, particularly the Shannon-Wiener index (H’), have extensively been used in analysing patterns of diversity at different geographic and ecological scales. These indices have conceptual and statistical problems which make comparisons of species richness or species abundances across communities nearly impossible (Gilbert, et al., 2009). For instance, the total number of individuals recorded in light trap is an indication of biomass which greatly influenced by methods and recording efforts of researcher; which is not precise of all the individuals present in that community reasonably the term species density is used against the species abundance; thus the data of species density is generally used to calculate diversity as measurement of species abundance is practically impossible.

The above discussion indicates the rich moth diversity of North Maharashtra. Present work helps to describe some aspects of biodiversity of moth fauna of Maharashtra as well as India, still further extensive study of all the regions is required to understand detailed estimate of faunal diversity. Ultimately it is hoped that the present work may lead to development of stdared monitoring protocol that could give the values in assessing the environmental stability of the areas under cultivation for different crop and determining conservation strategies for moth species (Barlow, et al., 1989; Aslam, 2009).