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Moths of Indian Himalayas: Data Digging for Climate Change Monitoring

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Abstract : Indian Himalayan Region (IHR), due to its sheer latitudinal and altitudinal expanse, acts as a mixing ground for different zoogeographic faunal elements. The innumerable unique and distributional restricted rare species of IHR are constantly being threatened with extinction by the ongoing climate change scenario. Many of which might have faced extinction without even being noticed or discovered. Monitoring the community dynamics of a suitable taxon is indispensable to assess the effect of this global perturbation at micro-habitat level. Lepidoptera, particularly moths are suitable for this purpose due to their huge diversity and strict herbivorous nature. The present study aimed to collate scattered historical records of moths from IHR and spatially disseminate the same in Geographic Information System (GIS) domain. The study also intended to identify moth species with significant altitudinal shifts which could be prioritised for monitoring programme to assess the effect of climate change on biodiversity. A robust database on moths recorded from IHR was prepared from voluminous secondary literature and museum collections. Historical sampling points were transformed into richness grids which were spatially overlaid on altitude, annual precipitation and vegetation layers separately to show moth richness patterns along major environmental gradients. Primary samplings were done by setting standard light traps at 11 Protected Areas representing five Indian Himalayan biogeographic provinces. To identify significant altitudinal shifts, past and present altitudinal records of the identified species from primary samplings were compared. A consolidated list of 4107 species belonging to 1726 genera of 62 families of moths was prepared from a total of 10,685 historical records from IHR. Family-wise assemblage revealed Erebidae to be the most speciose family with 913 species under 348 genera, followed by Geometridae with 879 species under 309 genera and Noctuidae with 525 species under 207 genera. Among biogeographic provinces, Central Himalaya represented maximum records with 2248 species, followed by Western and North-western Himalaya with 1799 and 877 species, respectively. Spatial analysis revealed species richness was more or less uniform (up to 150 species record per cell) across IHR. Throughout IHR, the middle elevation zones between 1000-2000m encompassed high species richness. Temperate coniferous forest associated with 1500-2000mm rainfall zone showed maximum species richness. Total 752 species of moths were identified representing 23 families from the present sampling. 13 genera were identified which were restricted to specialized habitats of alpine meadows over 3500m. Five historical localities with high richness of >150 species were selected which could be considered for repeat sampling to assess climate change influence on moth assemblage. Of the 7 species exhibiting significant altitudinal ascend of >2000m, Trachea auriplena, Diphtherocome fasciata (Noctuidae) and Actias winbrechlini (Saturniidae) showed maximum range shift of >2500m, indicating intensive monitoring of these species. Great Himalayan National Park harbours most diverse assemblage of high-altitude restricted species and should be a priority site for habitat conservation. Among the 13 range restricted genera, Arichanna, Opisthograptis, Photoscotosia (Geometridae), Phlogophora, Anaplectoides and Paraxestia (Noctuidae) were dominant and require rigorous monitoring, as they are most susceptible to climatic perturbations.

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