

Insect Collections as a Reservoir of Insect Genetic Resources

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Insect museums across the globe are gaining immense attention post issues of biodiversity loss estimation. The biggest question during the present times is the accurate assessment of insect species diversity and biodiversity accountability in terms of what amount of insect biodiversity is lost due to anthropogenic factors. However, many of the countries still do not possess a precise and standard dataset of their insect biodiversity and thus it is not possible to assess the loss holistically. Here comes the inevitable role of insect museums in documentation of the species present in their collections and furthermore translation of their dataset into extant and extinct species. This paper presents the role of insect collections and their databases in Insect Genetic Resources.

Introduction

Often the concept of Insect Genetic Resources is considered to be confined to the live forms present in the fields or the ones amenable to mass culturing in the laboratories. Since decades, the insect museums across the globe have contributed immensely in unravelling and documenting the mystery of insect species diversity. These collections lay a strong foundation for research scientists, quarantine personnel, taxonomists, farmers, and students as based on the dataset of these, precise and timely identification of pests and their natural enemies can be undertaken. They are also authoritative resources for systematics, evolutionary biology, ecology, natural resource management, biosecurity and biogeography. Mostly all renowned museums offer identification services as it serves as the first line of defence in protecting their respective biological resources and environment. The species identification is key to understanding the native biodiversity and threats that may destabilize it. In this article, a brief overview of various online insect sources is mentioned which serve as a reservoir of knowledge for insect genetic resources in multiple forms.

Insect Databases as Identification and Information Tools

A Glimpse of a Few Global Insect Collections and their Databases

Presently the United States Department of Agriculture-APHIS–Identification Technology Program–ITP is one of the most successful and reliable source for insect identification in the United States. Under ITP, three

means are in use with the aim of sustainable agriculture: ID tool websites, mobile apps, and CAPS screening aids (USDA, 2022) (<https://idtools.org/identify.php>). Likewise, the renowned Natural History Museum, London has some of the most unique insect specimen databases besides having the information rich database like the Universal Chalcidoidea Database (Noyes, 2019). The digitized insect records of Australian National Insect Collection (ANIC), Australia are served through Online Zoological Collections of Australian Museums, the Atlas of Living Australia, and the Global Biodiversity Information Facility. The U.S. National Entomological Collection (USNM), one of the world's largest and most important accessible entomological collections with over 33 million specimens, which is collectively maintained by: Smithsonian Institution; Systematic Entomology Laboratory (Agricultural Research Service, United States Department of Agriculture); and Walter Reed Biosystematics Unit (Walter Reed Army Institute of Research), has online portal for its primary types, specimens and species.

Indian Insect Museums and their Databases

Even though India comes under 17 mega-diverse countries of the world, our insect collections and museum digitization are still not at par with the insect museums of developed countries and needs lots of attention on priority basis. In India, the premier and historic insect collections are housed at the Zoological Survey of India- Kolkata, the National Pusa Collection, ICAR-IARI-New Delhi, the National Insect Museum of ICAR- NBAIR-Bengaluru, Forest Research Institute, Dehradun, etc. The species

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rich and neatly illustrated exhaustive insect databases of ICAR-NBAIR serve as major identification aid and taxonomic source, which is globally available, for many agriculturally important and diversity rich speciose taxa <https://www.nbair.res.in/databases> (NBAIR, 2022). The National PUSA Collection, IARI-New Delhi has also initiated its online insect database for selected taxa. Few of the insect repositories in India have been nominated as designated repositories by the Ministry of Environment, Forest and Climate Change which amass vouchers of National Biodiversity Authority of India.

Citizen Science Concept in Insect Diversity Documentation

Some of the most voluminous Indian insect databases are with the involvement of citizen science thus making the conservation of insect biodiversity more appealing and approachable. ‘Butterflies of India’ by Kunte *et al.*, 2022- <https://www.ifoundbutterflies.org> and ‘Moths of India’ <https://www.mothsofindia.org> by Sondhi *et al.*, 2022 are some of the successful examples of involvement of ‘citizen science concept’ in documentation and conservation of insect diversity.

Insect DNA Database

Cockburn detailed the need and referenced majority of the insect related databases way back in 1998. With the present era of DNA barcoding, all the insect museums are presently aiming for establishing their DNA library for the species housed in their collections. Many insect museums are already sharing their data with some of the upcoming reliable DNA database like Consortium

for the Barcode of Life (CBOL). However, the NCBI Taxonomy Browser, still remains as one of the most exhaustive, dependable and expanding resources for insect germplasm.

Conclusion

The need for authentically identified and scientifically well preserved and catalogued insect collections is gaining momentum as the world is realising the need for insect conservation and biodiversity assessment. These collections should be looked upon as one of the national assets rather than considering them as a liability and a resource sink.

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