

Conservation and collection of insects in India are mutually beneficial, NOT harmful – a simple reality explained

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'Simplicity is attained after learning, Lack of this profound knowledge creates confusion.'

Some fundamental truths

Chris Thompson, who was my postdoctoral advisor at the Smithsonian National Museum of Natural History in Washington DC, made these some but basic introductory pronouncements in a specialist research paper¹ about the importance of biodiversity being researched² and not, very unscientifically and shortsightedly, just be conserved (entombed!) by nations. It is important to understand that we humans can only hope to live normally if the planet's tremendous biodiversity is in a continuous, evolving balance. However, human greed and ignorance (confusion) has resulted in the well-documented global warming (climate change) and what Thomas Lovejoy, also of the Smithsonian Institution, had termed ecosystem decay. A 'faunal collapse' (extinctions) is now happening all over the world³ and hence conservation is being hesitatingly, but increasingly attempted by the more aware and informed responsible governments seeking 'sustainable development' and survival. But the manner of legislation and execution varies. In India, it is threatening basic science and the documentation of a near total inventory (with related information on species) of our flora and fauna, evaluation of their impact on the earth's natural balance and our selection choices for a sustainable lifestyle.

Much has been written⁴⁻¹³ about the extremely unfair and deleterious Biological Diversity Act (BDA). This Act bans even *bona fide* research scientists in India from sampling either the overwhelmingly frequent and abundant (common) peregrine wild species, or the rarely encountered, narrowly specialized and thus occasional (rare) palaeogene species of animals and plants that inhabit our country possessing, roughly, some 10% of all species diversity on earth. This commentary fervently hopes that some wisdom may prevail even now and

makes a genuine case for the revision or repeal of that detrimental (to science and to effective conservation) BDA, as soon as may be possible. The 'Draft Report of the Task Forces constituted to make Recommendations to the Government for strengthening of Botanical and Zoological Surveys of India' is a welcome initiative, but even this does not adequately cure the disease of our ignorant conservation policies and irrational developmental plans for an irresponsibly uncontrolled human population.

The reality – an explanation

Hundreds of overseas investigators have contributed to the inventorying and documentation of the natural wealth of the Indian subcontinent, principal among them being the servants of the erstwhile British Empire (*Raj*, 1772–1947) since the late 1700s to when independence happened to components of the now divided British India of yore. There never was a tradition of natural history learning in India^{10,14} until European travellers (explorers) started sailing to India in search of the objects of their interest and passion, animate or inanimate. The earliest among them were the Swede Olaf Torén in 1751 and J. G. Koenig (a Baltic-German student), in 1768 – they were called 'Apostles' of Linnaeus, the pioneering 'father' of biological nomenclature, Carl von Linné.

Before the Indian Museum in Calcutta was founded in 1814 (which is now a part of the Zoological Survey of India) many foreign naturalists had begun to explore remote undisturbed ecosystems in this subcontinent. Most of these men were associated, then, with the pioneering Asiatic Society of Bengal (its journal initiated as far back as 1832) and employed in survey departments of the government of the British Empire. It may be mentioned here that Darjeeling, Sikkim and the areas around had become known as a 'Butterfly El Dorado' before the 20th century commenced. This biogeographical 'track', from east-central Nepal to northern Burma, possesses the maxi-

mum diversity of biota found in any area in our subcontinent. The geology and resulting climate there have helped evolve a rich flora over geological periods which sustains an incredible variety of insects and other fauna. True, these lands and other undisturbed areas must be scrupulously protected and their natural wealth be allowed to survive and evolve in the future. But, preventing the inventorying and documentation (research) of what this wealth actually is, thereby disabling an understanding of ways to conserve or restore them, is painfully counterproductive. We still do not know 60–70% of the living insect species in our country and almost all of these yet unnamed species probably occur only in our Protected Areas (PAs) now! No 'permits to survey in' or 'unrestricted access to these areas given to qualified specialist scientists' means no knowledge about three quarters of our subcontinent's biota. Sad, but true!

Conservation is directly dependent on collecting samples for research

The BDA is a poorly framed legislation making it impossible for taxonomists to carry out research on the biosystematics, phylogeny, biogeography and molecular biology of our insects and other fauna. This law prevents trained experts to even take working samples (our 'raw material') of the still dominantly unknown existing species. This is because of the practical difficulty in obtaining suitable permits to work in the many PAs, that chiefly abound in a wealth of our usable laboratory and museum reference (voucher) specimens. Some questions and explanations are put forth here.

Question: Has collecting and trapping of 'insects' been proved to be a major factor in depleting the living population of our known and unknown species?

Answer: No. Most insect species exist in their millions provided their special habitats are left undisturbed by humans. To equate insects with larger animals is scientifically and absolutely wrong.

Question: Does the number of insect collectors now active in India merit the continuance of this tough, bureaucrat-monitored Act?

Answer: No. Students of postgraduate degrees (mainly in agriculture, botany and zoology) taking a course in taxonomy (rarely offered or opted for!) are required to submit a properly curated collection (less than 100 specimens are expected from each student, these being only 2–15 in each class). Besides them, India has almost no other field biologists or entomologists going about sampling insects or other biota for study nowadays, either as a hobby or as a profession. Our institutional reference collections of insects, compared to the numbers now existing in western countries' museums and universities (now in China also), are ridiculously small. The US National Entomological Collection in Washington DC has over 35 million specimens (including more than 100,000 holotypes), but even this is second to the larger collection in the Natural History Museum in London! This starkly compares to just around a maximum of 1 million insects now stored in all the collections in India put together¹⁵. The valuable (for research) collections here are badly maintained due to lack of properly appointed and paid trained curatorial staff. A hopeful alternate situation has begun in around a dozen centres where, a centrally funded taxonomy project (AICOPTAX) is in place and headed by emeritus professors. The bulk of our existing collections were made during the British *Raj*, well before independence. Even the number of professionally active plant and animal taxonomists in India who continue to sample specimens today (after completing their masters or doctoral degrees) are probably less than a hundred at most! Professors use their research students mainly to do the field work necessary for working specimens of some selected taxa only. The so-called poachers of insect specimens in India, obtaining assumed, ridiculously false, high prices in the relatively small commercial insect collectors' market, are also very few and far between. In Taiwan, however, a small, focused insect specimens 'industry' exists, but these insects are mostly home-bred specimens. It is similar to our silk (sericulture) industry which depends on rearing and killing millions of silkworm moth larvae, month after month, year after year, for their co-

coon threads that are used to manufacture silk cloth. Most insects are *sampled only for research purposes, which is fundamental to science*. Biodiversity loss is primarily due to the mass destruction of forests and conversion of pristine habitats to agro-ecosystems to feed growing human and domestic animal populations.

Question: Why is insect sampling for research still badly required in our area?

Answer: The very process of taxonomic research is based on using insect specimens as basic working tools in comparative zoology. The International Code of Zoological Nomenclature (ICZN) requires that every new species named and described is based on a voucher specimen (designated as a holotype) which must be preferably deposited in a major institutional collection to enable its access to other specialist taxonomists whenever required. The recent 'Bugun Liocichla' bird species (*Liocichla bugunorum*)¹⁶ from Arunachal Pradesh, heralded by the media and (in)formally 'described' based only on photographs and a written description and diagnosis but without designation of a holotype specimen, is scientifically invalid, a *nomen nudum*, whatever the author and 'supporters' of that invalid name have proclaimed (see also Banks *et al.*¹⁷; Peterson and Papeş¹⁸)! A binomen, constituting of genus and species names, contributes to information retrieval. Without a scientific name that can be universally applied ('common' or vernacular names are restrictive and are no substitutes), data on that particular species cannot be stored or even retrieved later.

Activist 'conservationists' with little or no scientific learning, research background or field experience, can have no real idea of the *complexity* of taxonomy and the difficulty of assigning valid names to animal or plant specimens, which alone can open doors to recorded databases in literature and collections, and assist applied scientific research in pest- or bio-control, medical and veterinary sciences as well as in forensics. The BDA legislation has resulted only in smothering important and fundamental taxonomic research in India (in contrast to most other countries where sampling is largely permitted, to promote discovery of science novelty for their impressive biodiversity inventories). It has put major roadblocks before specialist systematists here, in pursuing their critical

and paid research careers! The ability of this Act in helping to conserve our radically diminished biota in the remaining minimal undisturbed ecosystems (barely 3% of our land area), is beyond any scientific reasoning or logic. The Indian government machinery has completely destroyed the pursuance of significant basic biological science research here, the real worth of which may not currently be valued properly by people who have only looked at 'utilitarian' (applied, economic) reasons for pursuing anything and everything (see Gaonkar^{10,14}). Centuries of singular, diverse, subcontinental cultural and scientific evolution has been 'murdered' in a stroke of thoughtless legislation! This is like hesitatingly permitting poor quality 'patchwork' science without caring about philosophy, which a Ph D graduate is supposed to be a 'doctor' of!

Question: How will repeal or suitable amendment of this Act enable quality and usable research to be conducted here, like the uninterrupted scientific investigations that were carried out by foreigners and Indians in the past couple of hundred years and more? How will this be more beneficial than harmful in the conservation of our biodiversity?

Answer: The simple truth about the present status quo of the knowledge of our insect diversity is that except for extremely limited taxa, like mosquitoes and butterflies, all other groups are still very poorly sampled, researched and documented. Even mosquitoes and butterflies need more sampling and study, to unravel incorrectly 'lumped' species and genera and suppress others that may just be synonyms. Most taxa (families, tribes, genera) have just the beginnings done on their databases, like preliminary naming and describing, of 5–75% of the existing species in each taxon. Usable databases involving the biology, ecology and other life cycle observations of our species are predominantly unknown and unavailable even today¹⁵. We do not know the biology and life requirements of even the taxa in our Red Data Book; several of these are in no danger and incorrectly included. Research is necessary to be able to devise sound methodologies for protecting and augmenting existing wild populations. Even the complete spatial distributions of 90% of our insect species have scarcely been documented; this needs extensive sampling all over the subcontinent in every season of the year.

Intraspecific variation and population biology is critical to the correct understanding of actual species limits and *large collections of every species are still required* for this. In fact, it must also be understood that the number of select insects that any field entomologist, however experienced, can hopefully manage to locate and collect through hard, tiring fieldwork each day (most adult insects are very small and hide effectively and the immature ones are much more difficult to spot!), is but a tiny fraction of any species' natural population in each of its many generations. Therefore collection activity is absolutely unrelated to the safe existence of stable populations of any insect species. It is habitat encroachment by humans and large scale logging, mining, farming, road and dam building, that are the most dangerous and prime reasons for our recent extensive biodiversity loss since independence – several 'rare' species exist now only in a threatened status in small populations in select microhabitats.

The current expanding molecular biology discipline, which is in the forefront as a 'sexy science' now, is being well funded by nations abroad as a priority. However, this needs more sampling of insects (in absolute alcohol) to be done afresh. But our 'clever' draconian Act (BDA) will deny this new research need to scientists and science in India, in the guise of conservationists, legislators and the government wanting to 'conserve' what we do not know even exist! It is us scientists in this country, therefore, who are actually being wrongly and sadly targeted and refused specimens for our research, our very career! Every insect species lives and dies in millions; collection of a few, trifling samples by the (now) rare field entomologists can hardly threaten their natural populations and bring about extinction. Allowing collection of only 1–10 specimens of each species (many currently unidentifiable and nameless!) in PAs, which is the only possible permission from the Ministry of Environmental and Forests (National Biodiversity Authority) by law, is ridiculous and will not help top class taxonomic research and understanding of our insect fauna at all! Those who have drafted the BDA have worked in oblivion of the fundamental scientific base, without consulting the specialists who would be affected by the Act. They themselves

are made aware of species names (where possible) only by qualified, experienced taxonomists here and abroad, through research based on reference specimens. They presumptively categorize species as 'rare' in their 'schedules' and bar them from being legitimately sampled even for important research. Without taxonomists' factual inputs, what truthful knowledge on our biodiversity can really be acquired?

Lessons may be learnt from laudable changes that were made possible in Brazil because of strong protests by scientists¹¹. In the same manner, I appeal to entomologists the world over and to their governments (as have Prathapan *et al.*^{4,7,12,13} and others^{5,6,8,9,11}) to protest loudly and persistently against this unscientific Indian Act and try to get it revised sensibly, if not repealed *in toto*. In fact, the BDA has put up a notice on its website for suggestive amendments.

Basic entomological science is therefore threatened in India with extinction and oblivion¹⁹ given this unfair, counter-productive legislation (BDA). We may never know or be able to use or manage the insect wealth that evolution has created in this unique subcontinent, which holds 1 in 10 of all known species on earth. Hence it is recommended here that *bona fide* taxonomists and ecologists, Indian or foreign, should be granted quick and unhindered access to our PAs and Reserve Forests for research and also discovery of the unknown. This would increase knowledge of our biodiversity and its efficient conservation as well as hinder poachers and wilderness destroyers (developers, trappers and fuel woodcutters) 'freeloading' in these areas, through the presence of researchers operating together with Forest Department staff; these latter also need to be enhanced, educated and empowered, as in western countries.

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ACKNOWLEDGEMENTS. I am grateful to the following colleagues for comments on my manuscript drafts: Dr J. Poorani, Project Directorate of Biological Control, Bangalore; Dr A. Prabhuraj, University of Agricultural Sciences, Raichur and Dr K. D. Prathapan, Kerala Agricultural University, Vellayani Campus, Thiruvananthapuram. I also thank the anonymous reviewer(s) for helpful suggestions to shorten and improve the manuscript.

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