CURRENT SCIENCE

Volume 118 Number 1 10 January 2020

EDITORIAL

Conservation of species, all; big and small

Six-Legged Science by Brian Hocking is a little gem of a book that should adorn the bookshelf of every biologist. I was completely unaware of this book until a colleague hunting for it, found it hidden with yet another colleague! The book of 200 pages is a passionate eulogy, offered in eighteen charming essays on all matters concerning insects. The essay, 'Gall enough in thy ink', beautifully dramatizes the two important inventions of mankind that have had a huge impact on human civilization for over two thousand years – ink and paper. The essay dramatizes the discovery of paper by a Chinese character observing a wasp as it repeatedly visits a tree to collect fibre to build its paper envelope nest. In the fantasy spun by Hocking, the character Leng fu painstakingly observes the nest construction by the wasp and proceeds to make paper from plant fibre. Epaminondas (not the warrior-statesman), likewise, almost magically discovers how to make 'galantine ink' from the marble galls made by the *Cynips* wasp. Recent findings seem to suggest that the former may not, after all be fantasy, and may yet turn out to be the first case of bio-inspired technology from 300 BCE. The galantine ink, of course, had been in use in the Roman Empire (AD 300–500) and was used to write on papyrus, parchment and cloth centuries before paper making from China reached the Romans. Even today artists using calligraphy make their own gall ink using the century old recipe of mixing the extract of insect gall with ferrous sulphate (or copperas) and gum arabic as a binding agent.

The essays published in 1968 also describe several other important roles of insects in the functioning of ecosystems such as regulation of populations of other insects, pollination, nutrient cycling, necrophagy, etc. To avoid sounding clichéd these roles today are described as 'ecosystem services', a term that was not yet invented during Hocking's time since 'ecosystem' studies themselves were in their infancy. Similarly, the essay mentioned above makes a strong case for 'bio-mimetic engineering', a discipline that is perhaps only a decade old. Hocking, quite passionately, pleads for a much greater 'tangible recognition' to the wasp *Cynips gallae-tinctctoriae* for its inestimable role in human affairs from signing peace treaties to evolution and preservation of language by 'inking' the words. Hocking would be pleased to know that in the new millennium insects are beginning to receive the tangible recognition he had advocated, the 'services' of insects are being measured in the only tangible measure we know – monetizing. The estimates of the ecosystem services offered by insects in monetary terms have served to sensitize us and stoked the social and political will essential for appreciating and conserving not just insects but all living organisms or biodiversity to sustain the planet in a healthy state.

The civilizational progress of human societies has been one of conquering, mastering and even subduing nature for better survival. The very act of migration out of Africa, colonization of every part of the earth, even the most hostile of the environments, the use of technology to maximally exploit resources, both living and non-living and intensive exploration of space exemplify the uneasy restlessness of human societies in subjugating nature for its own ends. However, human societies, at least the pre-industrialized ones, were far more tuned into nature and had evolved to use resources more prudently. Examples of such societies are still found in many remote parts of the world, mostly in Asia, Africa, South America and Australia. Gilbert White was the first to draw attention to the intricate interdependence of life in his letters to fellow naturalists which were later published as *The Natural History of Selborne* covering the pre-industrialized period in England.

The industrialized societies too were aware of the impact of human activities on nature but the political economy of the market forces swamped the calls for slowdown in industrialization. Notwithstanding the rapid and ruthless industrial growth, the modern discipline of ecology slowly took hold in the beginning of the 20th century. Five decades later, ecological studies had sufficient understanding of various natural processes to spawn the birth of environmental science in 1960s. Ironically, the increasing use of nuclear energy brought the much required recognition to ecology as a field of scientific inquiry. This recognition was also bolstered by the publication of *Silent Spring* by Rachael Carson in 1962. A decade later the energy crisis of the 1970s gave momentum to the idea of conservation of resources and the conservation science emerged as a sub-discipline of ecology. In an important development environmental assessment requirement was introduced in the USA in 1969 through the National Environmental Policy Act (NEPA) which was soon adopted by many countries across the world. Even as these developments were taking

place there was immediate realization of the importance of conservation and the UN launched the Man and the Biosphere programme in 1971 in several countries including India to bolster conservation through protected areas. On its heels the Wild Life Protection Act was also passed in India in 1972 which continues to be improved through amendments. Several taxon-specific conservation efforts were initiated in the latter half of the twentieth century bringing back from the brink species like the panda, the tiger, the Asian elephant, marine turtles and other large 'flagship species'.

Programmes to monitor and document biodiversity were initiated by many countries following the signing of Convention on Biological Diversity (CBD), a multilateral treaty signed at the Rio Global Earth Summit in 1992. A direct fallout of this effort was that the focus of conservation programmers shifted from 'large charismatic' animals to the 'largest group of organisms', namely the insects and other lesser known taxa.

The global decline in the diversity of abundance of insects was first suggested in a report by the Zoological Society of London in 2012. The report also warned about the disruption that might be caused in the world food supply due to the loss of insect pollinator species. The report was based on the findings of studies on long-term insect surveys such as the Rothamsted Insect Survey. A paper published in 2017 by a German team provided detailed analysis of decline in insect abundance based on monitoring carried out over a 27-year period (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809). The study reported an overall decline of insect biomass up to 76% over seasons and more severe in midsummer with biomass declining by 86% over the study period. This decline of the 'flying insect community as a whole' was noted across habitats and was not attributable to changes in weather, land use of habitat characteristics. Despite its limitations of the data which relied only on biomass and not species and discontinuity in sampling, the study prompted a flurry of interest in insect monitoring and new action programmes for insect conservation were initiated. The study also attracted much media attention declaring 'Insect Apocalypse', the exaggeration however reinforced the decline in insect abundance into public consciousness. Such decline had already been reported across several countries through what has come to be known as the 'windscreen phenomenon'. An anecdotal evidence of insect decline widely observed wherein a drive through the countryside even in summer did not require the windscreens to be frequently cleaned of insects as in the past.

The findings of the German team prompted many such studies to report their own data and within two years a comprehensive review of worldwide decline in entomofauna was published (https://www.sciencedirect.com/science/article/pii/S0006320718313636). The major drivers of decline in insect abundance were identified as habitat loss, intensification of agriculture, use of insecticides, urbanization, invasive species, climate change and light pollution. These developments also forced a relook at the ecological role of insects and possible valuation of the 'ecological services' not view them merely as sources of pestilence and nuisance. The total valuation of pollination services, dung burial, pest control and recreation services of insects in the USA alone was rather conservatively estimated at US$ 57 billion. This valuation does not take into consideration the role of insects in maintaining other forms of life as an ecosystem service. Not surprisingly several ecologists have called for including insects as an important component of biodiversity in all social and economic policies and strategies designed towards attaining the sustainable developmental goals (SDG). Many nations have already initiated actions for insect conservation, ranging from promoting civic action to nationwide research programmes.

Long-term studies on insect diversity in India are virtually absent though several research groups have been working on specific taxa and simple methodology for assessing insect diversity has been standardized. The reasons could be many, ranging from a lack of well-trained entomologists to a lack of commitment towards such studies on the part of science policy makers. The poor awareness in India about factors driving decline in insect abundance was recently evident when LED light traps were to be distributed to farmers for pest control. The idea was fortunately scrapped following a late realization that these light traps would contribute to decline of all insects and not just a few target pests. The late entry of India in the International Pollinator Initiative launched in 2000 and is part of the action plan for 2018–2030 to monitor and conserve native pollinators is another indication of the lack of urgency in efforts towards insect conservation. It is perhaps time for change and a national progamme on insect biodiversity monitoring, documentation and conservation needs to put in place to generate long-term data to design better strategies for biodiversity conservation.

Under these difficult circumstances when humanity is hurtling itself towards an impending ecological crisis due mainly to recklessness and arrogance towards nature, it may well be time to pay heed to the words of E. O. Wilson, 'If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed ten thousand years ago. If insects were to vanish, the environment would collapse into chaos.' To forestall such a scenario, an action plan to arrest the decline of insect diversity has been announced by an international team of scientists (https://www.nature.com/articles/s41559-019-1079-8) and the news came in as we go to the press.

K. Chandrashekara

Former Professor and Head,
Department of Entomology, UAS, GKVK,
Bengaluru 560 065, India
e-mail: kchandra58@gmail.com