PREFACE

The present book is an outcome of my interest in Zoology, which arose over four decades, to augment the long felt need of the students pursuing their studies in animal taxonomy. The study of classification and classifying animals is both fascinating and challenging. The fascination is generated by a natural inquisitiveness towards animals and the challenge is to assess the vast array of animals and give them a proper place in animal kingdom depending upon their similarities and differences.

I have observed during the course of my study as well as teaching that majority of students feel that study of taxonomy is tedious, therefore, this book is being presented with a hope that it will enthuse and invigorate interest among students who are novice to the subject. Since the students hardly get comprehensive resource material; this book addresses the problems of taxonomy in easy and lucid manner. The book has been written in simple language as far as possible, by conveying important aspects of taxonomy without neglecting the current status of development.

In compiling this book, I have made an attempt to present different topics associated with animal taxonomy in 23 chapters sequentially. I have tried to be careful by describing certain topics within limits, which otherwise would require lengthy explanation. The figures being simple have been drawn by the author himself. Throughout the book, the key terms have been presented in bold face. The subject index is comprehensive and especially designed to locate the important terms, topics and concepts. In addition to subject index, genus and author index has also been added. The references cited in the chapters are listed under bibliography and would provide sufficient details for those interested in learning more about a particular topic. The contents of the book are summarized as under:

Chapter 1 begins with a brief resume about the history of animal taxonomy. It also provides an idea about the way the foundation for classifying animal life was laid by Aristotle, Linnaeus and Darwin. It also includes a brief note about population systematics and phylogenetic systematics.

Chapter 2 explains the basic concept of animal taxonomy, systematics, hierarchical classification, taxonomic characters and different attributes for classifying animal

life along with associated characters. It also deals with the task of systematist and myths and conceptions of taxonomy and its significance.

Chapter 3 introduces the principles of zoological classification and types of classification along with their merits and demerits.

Chapter 4 is in sense the core of the text. It provides an account of binomial nomenclature, different types of nomenclature, necessity for rules of nomenclature, nomenclature Code and general principles of nomenclature. It also deals with the International Code of Zoological Nomenclature, the principles of priority, homonymy, synonymy, typification and its preamble and features. An account of International Commission of Zoological Nomenclature its powers, nomenclature versus taxonomy, taxonomic inflation and modern developments in classification have also been given.

Chapter 5 gives a brief account of micro and macro taxonomy, phenon, taxon and category.

Chapter 6 explains recapitulation theory, phylogenetic systematics, features and methodology of cladistic analysis, interpretation of cladogram and groupings in cladistic analysis. It also attempts to differentiate between evolutionary trees, phylogenetic tree and cladogram. Biosynthetic phylogeny and the significance of phylogenetic systematics have also been discussed.

Chapter 7 extends the discussion on features and different types of phylogenetic tree, the way to construct phylogeny, limitations in the constructions of phylogeny, common genes and new family tree and gene tree versus species tree.

Chapter 8 highlights the concept about molecular phylogeny, essentials of molecular phylogenetic analysis, database for phylogenetic analysis, tree building, measurement of immunological distances, protein sequencing, significance of hemoglobin and cytochrome. The chapter reviews the importance of molecular phylogeny, nucleic acid sequencing, DNA hybridization technique, comparison of DNA sequence and chromosome painting including Zoo FISH and BLAST and molecular clock. It also highlights the importance of molecular phylogeny.

Chapter 9 outlines the features of evolutionary taxonomy, taxon, concept of evolutionary taxonomy and its relationship with cladistics and phylogenetics. Limitations of evolutionary taxonomy along with its significance have also been discussed.

Chapter 10 signifies the features, basis and procedures of numerical taxonomy including character assessment. It also deals with essentials of taxonomic system, nested hierarchy, and frequency distribution of similarity coefficient, differential

shading of the similarity matrix, data, factor and cluster analyses along with limitations and importance of numerical taxonomy.

Chapter 11 gives an account of population taxonomy, characteristics and dynamics of population, different types of animal interaction, sources and types of variability in populations. Differentiation of population, genetic drift and gene pool has also been described. A brief note about mutation, natural selection and adaptations in populations has been added at the end of the chapter.

Chapter 12 deals with taxonomic characters, its role in systematics, measurement of characters, homology and homoplasy, weighting and analysis of different types of characters. The chapter discusses the significance of characters in biodiversity studies.

Chapter 13 adequately explains the species concept and the different types of species and sub-species. Detailed account describing the way new species occur in nature, the process and pattern of speciation, types of speciation, isolation and its role in speciation has also been given. Further, a note has been added on natural selection, environment and speciation in the establishment of new species along with speciation and biodiversity.

Chapter 14 describes the types and principles of typification in taxonomic studies and significance of type specimens.

Chapter 15 reviews the Linnaean system of hierarchical classification in brief, different types of taxonomic category and its features, origin of categories and demerits of higher categories.

Chapter 16 discusses about the data analysis, morphological variability in natural populations, meristic and non-meristic characters in fishes and insects and other characters of importance during identification of specimens.

Chapter 17 introduces the concept of biodiversity its distribution and assessment, different types of biodiversity, species richness and different indices used to assess the vast array of populations in an ecosystem. A brief note has also been added on phylogenetic measurements of biodiversity, taxonomic surrogacy, biodiversity hotspots, genetic pollution and role of biodiversity in ecosystem, climate change, evolution, food security, agriculture and sustainable development, human health, trade and commerce, in refreshing moods and developing aesthetic sense, informatics and threats to biodiversity. Different legal provisions for conservation of nature and natural resources also find mention.

Chapter 18 explains about the construction of taxonomic keys, its features, presentation and applications for the identification of animals and the use of

computer generated keys, description of genera along with merits and demerits of taxonomic keys.

Chapter 19 is devoted to different types of taxonomic publications and its various features. The form and style of taxonomic publications has been given to enable the worker to know the method a taxonomic paper is submitted in different leading journals on systematics and the way a new name of any specimen is registered in the records, the zoological records, index to organisms names, electronic publications and significance of taxonomic publications have also been given.

Chapter 20 presents a detailed account of collection and preservation of natural history specimens including different collection procedures and equipments, chemicals used as narcotizing agents, preparation of killing bottle and how to display preserved specimens. A note has been added regarding the manner in which a specimen is sent to the authority/agency for identification. Significance of natural history specimens has been described in detail.

Chapter 21 gives an account of information retrieval and its working along with the concept of biological names and taxonomies, meta-ontology of biological names. It also describes the ways to manage the vast array of animal diversity digitally, including object oriented taxonomic databases. Description about different internet resources providing wealth of information for information retrieval including universal register, zoological record, animal diversity web, the electronic zoo, DELTA, global names architecture, index to organism names, the global biodiversity information system, taxon tree, SysTax Database system, BAMBE, Mantis, TreeBASE, Pandora, BioNet International, Diana, Platypus, Taxis, UBio Portal, OCEAN, *Systeam Naturae* 2000, Taxonomicon, Tree of life project, Species 2000, ITIS , ZooBank and the Catalogue of life.

Chapter 22 attempts to enrich reader's understanding of taxonomy by describing the current trends in taxonomy. The chapter includes role of morphology, embryology, ecology and behaviour on the basis of current tools. Importance of cytotaxonomy, chemotaxonomy, molecular phylogeny, chromatography, electrophoresis, infrared spectroscopy, histochemistry, and comparative serology, numerical and molecular taxonomy has also been discussed in detail. A basic of DNA barcoding along with its applications has been explained. Description about Molecular operational taxonomic units, integrated operational taxonomic units, cataloguing ancient life, constraints of DNA taxonomy, convention on biodiversity, the global taxonomic initiative and integrative taxonomy earn special mention. The chapter ends with a brief note regarding difficulties encountered while totally relying on barcode taxonomy.

Chapter 23 summarizes the discussion about the significance and applications of biosystematics and its role in conservation biology. The role of taxonomy *vis-a vis* biodiversity has been described adequately along with the present scenario of taxonomy.

I have also tried to make this presentation exact but definitely it is not, and if I had to wait for this, it would never have come to this shape as it is. I have very much enjoyed the process of putting the scattered information together and hope that you would enjoy using it to the same degree. I am confident that the present book will enable the students pursuing taxonomic studies to understand the fundamentals of animal taxonomy with greater ease.

I would appreciate it very much, if this book creates continuing curiosity and interest in the students and researchers alike in the field of animal taxonomy. Though, every care has been taken while preparing this book, but shortcomings are inevitable; therefore I would welcome receiving valuable comments, constructive criticism and suggestions.

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