

cludes 146 most striking and commonly encountered trees in different ecological zones. The book begins with an introduction on the overview of the tree wealth of India. Salient and important floristic diversity (specially tree diversity) in the forests of West Himalaya, East Himalaya, northwest dry zone, Indo-Gangetic Plain, West coast or Malabar, Central Indian region, the Deccan Plateau, northeast India and Andaman and Nicobar Islands is briefly highlighted.

In the enumeration of the trees, the authors have broadly followed the Bentham and Hooker (1862–87) system of plant classification. Treatment of each tree species starts with its widely known English name followed by its correct scientific name with author name, common synonyms if any, and its taxonomic position. Although the nomenclature of tree species adopted is up-to-date and in conformity with the latest Botanical Code of Nomenclature, some discrepancies have crept in. For example, on p. 138, *Adenanthera pavonina* L. is treated as a synonym of *A. microsperma* Teijsm. But *A. pavonina* being a Linnaean name (Sp. pl. 384, 1753), must find priority over *A. microsperma* and hence *A. pavonina* should be the correct name. Again, the author citation for *Albizia lebbbeck* (p. 141) should be *A. lebbbeck* (L.) Benth. Apart from a clear description of the tree species, the etymology and origin of the scientific name are provided. Chromosome numbers (2n number) provided for each species add value to the work. The most striking feature of the work is information on closely allied and cultivated varieties under each species that are grown in gardens and parks. Phenology, mainly the flowering and fruiting periods, and propagation methods are useful for all tree growers and nurserymen. The authors certainly deserve compliments for the excellent colour photographs provided for each species. These photographs greatly help in the identification of tree species by both amateurs and botanists not only in India, but in all adjacent countries too. Vernacular names in different languages for the tree species dealt with are appended at the end of the book. Though I find the vernacular names for each species exhaustive, some vernacular names are still missing. The authors may consult the *Vernacular List of Trees, Shrubs and Woody Climbers in the Madras Presidency* by A. W. Lushington (1915, IIB, Madras) for future editions.

On the whole, the book has been excellently brought out and contains diverse and useful information on the prominent and commonly encountered tree flora of India. The production and get up of the book are excellent. The reviewer has little doubt that this book will not only be a source of useful information about the diverse tree wealth of the country, but will also stimulate us to appreciate more and more the plants that fulfil the diverse needs of humankind and sustain life on earth.

The book is a must for botanists, foresters, landscape architects, planners, environmentalists, conservationists and those seeking information on the tree wealth of India. Although considering the quality of the publication and the amount of valuable information contained in the book, the price is justifiable, low-cost paperback editions can reach more readers. The authors have surely laboured hard in collecting vast scattered information on trees at one place and deserve compliments by the entire botanical community for this high-quality publication.

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Applications of Plant Metabolic Engineering. R. Verpoorte, A. W. Alfermann and T. S. Johnson (eds). Springer, P.O. Box 17, 3300 AA Dordrecht, The Netherlands. 2007. 332 pp. Price: EUR 123.00.

Ever since the first book of its kind in the field of plant metabolic engineering by

Verpoorte and Alfermann in the year 2000, impressive progress has been made in this rapidly growing area of second-generation biotechnology. The present book by the same authors is an updated comprehensive reference on the applications of plant metabolic engineering. The book begins with an excellent introduction to the subject by Verpoorte that briefly covers aspects of secondary metabolism, including pathway elucidation, compartmentation, transport, storage and strategies for metabolic engineering. The remainder of the book is divided into 14 chapters written by leading authorities in their fields.

The first three chapters highlight the use of recombinant microorganisms, plant molecular farming and plastid-assisted plant metabolic engineering for targetted overexpression of aromatic, medicinal and industrial compounds of plant origin. Chapter 1 describes how recombinant microorganisms have been used for the elucidation of plant biosynthetic pathways as well as production of plant natural products. Examples are collated to show production of plant natural products, including medicinal and flavour/fragrance compounds in recombinant microbial systems. The concept and usefulness of microorganisms to produce both natural and designer secondary metabolites is clearly explained, considering both advantages and disadvantages. Chapter 2 on plant molecular farming, covers the background information, techniques involved in gene transfer to plants, host systems, optimization of recombinant protein expression in transgenic plants, commercialized products and products close to market. Cost of production comparisons of recombinant proteins in transgenic plants and animal systems is also highlighted. Chapter 3 reviews plastid-based pathways and chloroplast metabolic engineering for improvement of crop species as well as pharmaceutical and biopolymer production. Topics covered, like chloroplast genome, plastid operons and multigene engineering, pharmaceutical products and prospects for enhancing plant productivity, comparative aspects of nuclear and chloroplast genetic engineering approaches, provide necessary information to further advance this upcoming field. An important addition to the chapter is a table comprising an abbreviated list of nuclear-encoded metabolic enzymes post-translationally imported into the plastid.

Chapters 4–6 are devoted to the area of metabolic engineering of alkaloid biosynthetic pathways. Chapter 4 describes recent advances in the study of nicotine, terpenoid and tropane alkaloid pathways. The authors discuss the importance of functional genomics approaches to identify genes involved in alkaloid biosynthetic pathways. The role of transporter genes for accumulation and secretion of alkaloids is highlighted. The combinatorial biochemistry approach to engineer tropane alkaloid pathways in various plants using well-established concepts is covered. Chapter 5 highlights the prospects of engineering polyamine biosynthesis for enhanced alkaloid content. It illustrates how polyamine biosynthesis has been engineered for enhanced alkaloid content by over-expression of ornithine decarboxylase and arginine decarboxylase genes. The chapter gives good coverage of polyamine-derived pyrrolizidine, tropane, quinolizidine and other polyamine-derived alkaloids. Chapter 6 presents case studies on metabolic engineering of tyrosine-derived isoquinoline and putrescine-derived tropane and nicotine alkaloids. The review covers details of enzymes and genes in biosynthesis of alkaloids as well as potential of and pitfalls in metabolic engineering for alkaloid production. A general strategy for metabolic engineering is discussed as well.

There are four chapters related to metabolic engineering involving aroma, flavour and nutritive value of the crops. Chapter 7 gives a detailed account of vanillin biosynthetic pathway in *Vanilla planifolia*, along with the potential applications of metabolic engineering to the vanilla industry. The focus here is more on the biosynthetic enzymes of vanillin. Chapter 8 presents a detailed summary of pathway engineering of plant vitamin C metabolic network. It summarizes different independent pathways such as D-mannose/L-galactose pathway, L-glucose pathway, D-galacturonic acid pathway and myo-inositol pathway for vitamin C (L-ascorbic acid) formation in plants and provides the most comprehensive discussion on strategies to enhance vitamin C levels in plants. The authors also discuss the chemistry of ascorbic acid and its role in human health and plant metabolism. Metabolic engineering of terpenoid biosynthesis in plants is described in Chapter 9. The authors review the recent progress in terpenoid metabolic engineering in plants using several well-

characterized examples and discuss some future opportunities in the existing field. This comprehensive review provides much detailed information on terpenoid biosynthesis and functional implications of engineering terpenoids. Chapter 10 describes the metabolic engineering of seed oil biosynthetic pathways to produce omega-3 long chain polyunsaturated fatty acids (LCPUFAs), such as eicosapentaenoic acid and docosahexaenoic acid for human health. The reconstitution of microbial LCPUFAs pathways in plants and beneficial value of a plant-based fish oil substitute are discussed. Chapter 11 summarizes the progress, potential and limitations in metabolic engineering of sugarcane for enhanced yield of sucrose, high-value novel sugars and sugar derivatives, sugar-derived polymers, bioplastics, aromatic compounds and waxes. In the backdrop of high biomass production and useful precursor flux in sugarcane, this chapter highlights the role of metabolic engineering in the production of renewable materials in this well-studied plant.

Chapter 12 describes the expression of anti-solamargine (As)-scFv gene in *Escherichia coli* and its characterization. It describes antibody-based metabolic engineering in plants with respect to As scFv-enhanced production of solamargine glycosides in transgenic hairy root cultures of *S. khasianum*. Chapter 13 describes the results of experiments on the over-expression of cysteine synthase and serine acetyltransferase genes for metabolic engineering of sulphur assimilation in plants. A brief review of sulphur and sulphur-containing products under various scenarios in plant cells, such as detoxification of environmental pollutants and heavy metals is provided. The last chapter deals with plant-based medicine and describes general rules and problems associated with this area. This chapter also covers *Hypericum perforatum* (St. John's wort) products as an example of chemical profiling. It summarizes the chemical contents of St. John's wort preparations and addresses the benefits of controlled environment production of plants to obtain uniform chemical profile.

This book will prove useful for researchers and professionals alike who are into the field of plant metabolic engineering. It must be emphasized that each chapter in the book is well referenced with current literature, which highlights the task of editing a book in this ever-

expanding field, while still adhering to the basic requirement to give background information and concepts for understanding. The authors have done a commendable job.

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Geology of Haryana and Delhi. J. L. Thussu. Geological Society of India, P.B. No. 1922, Gavipuram, Bangalore 560 019. 2006. 191 pp. Price: Rs 250.

The Geological Society of India (GSI) has been publishing state-wise geology textbooks. The book under review deals with the geology of Haryana and Delhi. This is a commendable effort on part of the GSI. These books provide up-to-date knowledge and help planners in developmental activities in the respective states. Understanding of the physical features and geology of a state plays an important role in its overall development and also that of mankind in the future. State-of-the-art books on the geology of most states are now available because of the concerted efforts of the GSI.

This book is divided in two parts. Part I provides a comprehensive account on geomorphology, geology, palaeontology, mineral and geothermal resources and geoenvironmental aspects of the Haryana. Part II deals in concise manner with the geology, mineral resources and geoenvironment of Delhi.

I read the book with interest, as it is one of its kind attempting at providing data on geological history, mineral and geothermal resources, abiotic and biotic hazards, and most interesting, on the drainage migration in the Indo-Gangetic Plains of Punjab and Haryana. The geological data are well synthesized and provide a good compendium. The initial pages in both parts provide a physiographic set-up and summary of geological history. The section dealing with the geology synthesizes up-to-date status of knowledge on Proterozoic Aravalli and Delhi Supergroup, followed by Neoproterozoic of the Himalayan foothills and

Tertiary and Quaternary sequences. The description on Quaternary sequences, which cover a large part of Haryana, comprises of the author's previous published work, which he connects in a coherent manner. The book also addresses groundwater conditions and the causes of salinity in Haryana. The section on drainage migration and geomorphic evolution of the Punjab-Haryana plains condenses the work of experts into readable syntheses. The book is written in a lucid

manner and is organized under various headings supported by excellent illustrations, good photographs and tables. The overall presentation of the book is good. It will serve as a good reference book for researchers and students interested in the geology of these two states. However, I feel that the portion of the book dealing with palaeontology, mineral and geothermal resources and geophysical surveys could have been synthesized in a better way. The reference list given at the end

is quite exhaustive. The author has done a commendable job in writing this book. Anyone interested in the geology of Haryana and Delhi would like to procure a copy of this book.

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