

## Economic Botany

Written primarily to cater to the needs of senior undergraduate and graduate students of botany, horticulture, food and nutrition, forestry, plant breeding, environment science, ethnobotanical studies and biotechnology, this book has use-value for a wide range of people stretching from an anthropologist to a lay-person interested in information about the natural sources of antioxidants and phytonutrients. It provides an up-to-date account of important crops grown worldwide, with insights into the history of plant exploration, plant migration, domestication and distribution, and crop improvement efforts.

The text begins with an enquiry into the origin and diversification of cultivated plants, followed by a discussion on tropical, subtropical and temperate crops that are sources of food, beverages, spices, medicines, plant insecticides, timber plants and essential oil-yielding plants. The genetic and evolutionary aspects of different plants and their health benefits are highlighted. It also covers topics dealing with biodiversity conservation, petro-crops, ethnobotanical studies and commercially important plants. The significance of major plant species under each category is described in detail. This book, on plant resource utilisation, is illustrated with numerous well-labelled diagrams and pictures.

**S. L. Kochhar** taught courses in economic botany and plant physiology at Khalsa College, a constituent college of the University of Delhi, for more than four decades (1965–2007). His areas of interest include botany, crop science, tropical crops and plant physiology.

# Economic Botany

## A Comprehensive Study

5th edition

S. L. Kochhar



**CAMBRIDGE**  
UNIVERSITY PRESS



Shaftesbury Road, Cambridge CB2 8EA, United Kingdom  
One Liberty Plaza, 20th Floor, New York, NY 10006, USA  
477 Williamstown Road, Port Melbourne, VIC 3207, Australia  
314-321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India  
103 Penang Road, #05-06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

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[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781107112940](http://www.cambridge.org/9781107112940)

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First published 2016

*A catalogue record for this publication is available from the British Library*

*Library of Congress Cataloging-in-Publication data*

Names: Kochhar, S. L., author.

Title: Economic botany : a comprehensive study / Suraj Lal Kochhar.

Description: Fifth edition. | New York : Cambridge University Press, 2016. |

Includes bibliographical references and index.

Identifiers: LCCN 2016012281 | ISBN 9781107112940 (hardback : alk. paper)

Subjects: LCSH: Botany, Economic. | Plants, Useful. | Crop improvement.

Classification: LCC SB107 .K64 2016 | DDC 581.6/3--dc23 LC record available

at <https://lcn.loc.gov/2016012281>

ISBN 978-1-107-11294-0 Hardback

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*With much love and affection to my granddaughter Myra  
and grandsons Anish and Sarthak*

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## Foreword

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Professor S. L. Kochhar is one of the most distinguished authorities in the field of economic botany in the world. He has not only been a great teacher but also an eminent author of many books in the area of botany. The present book is the 5th edition of his earlier book “Economic Botany in the Tropics” which was first published in 1981. During the last 35 years he has published several other books introducing both students and the public to the beauty and utility of many of our flowering plants.

The present book deals, in a comprehensive way, with a variety of crops including cereals, grain legumes, fruits, vegetables, oil seeds and root and tuber crops. It also deals with many interesting issues like the origin of maize and the health risks associated with tobacco. In particular, the author has dealt in an authoritative manner with issues relating to transgenic crops. As far as I know, there is no other book which covers with such great scientific authority and clarity the range of topics dealt with by Professor Kochhar. This is a gift, in particular, to the student of botany as well as to all interested in economic botany.

Professor Kochhar’s dedication to the science of economic botany and to spreading a love of plants is practically unmatched. This, latest, book is the outcome of his dedication to the cause of spreading scientific literacy in the area of economic botany. I hope the book will be widely read and used not only by university students and teachers but by all interested in the world of botany. We should always recall that we live on this planet as guests of green plants, sunlight and farmers. This book as well as the earlier books of Professor Kochhar will help to strengthen our bonds with nature.

M. S. Swaminathan

## Preface

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*Economic Botany in the Tropics* was first published in 1981, and its fourth edition appeared in 2011, and in between the book has been reprinted several times. It is a matter of great privilege and honour that its new edition is being published by Cambridge University Press, under the new title 'Economic Botany: A Comprehensive Study' 5th edition. During the course of revision I have been influenced by review inputs from subject experts, across the world, as well as from advice offered to me by the editorial staff of the Cambridge University Press, India. It gives me pleasure in presenting to the readers an expanded and updated edition and I hope it will prove to be even more useful than the previous ones.

Salient features of this edition are as follows:

The production data for different crops is given for the year 2012–13, alongside top ten producers of cereals, grain legumes, fruits, vegetables, oil crops and root and tuber crops. The role of essential fatty acids (EFAs), such as linoleic and linolenic acids in human nutrition has been emphasised. These fatty acids if not supplemented in the diet can lead to many functional disorders.

Another significant feature is the inclusion of well-known 'natural sources' of antioxidants and phytonutrients, which, if made a part of our diet, can prevent cardiovascular, cancerous and neurodegenerative disorders, etc. The health benefits of many of our food plants have been given special coverage, along with a listing of the physiological basis of the chemical constituents present in them. Besides these, I have included discussions on 'the catastrophic sexual transmutation theory' of the origin of maize; 'pseudocereals' such as grain amaranth, quinoa, buckwheat, chia seeds and eel-grass; forage grasses of different regions (in Chapter 3); sugarcane propagation and its breeding strategies, and other sweetening plant materials (in Chapter 4); winged bean and fodder legumes as well as green manures (in Chapter 5); canola oilseed crop (in Chapter 6); kinnow mandarin, Brazil nut and many other sources of exotic fruits (in Chapter 7); True Potato Seed (TPS) Technology and select varieties of potato, turnip and pea (in Chapter 8); the risks associated with the use of Smokeless Tobacco, *bidi* and E-cigarettes (in Chapter 10); wines, beers, distilled spirits and liqueurs (in Chapter 11); and medicinal yams and Madagascar periwinkle (in chapter 15). The inclusion of the write-up on 'Terminator Gene Technology' will be of great value to students and scholars in various fields.

The earlier less-focused photographs have been substituted with high-quality images. Many line diagrams have been recast and have been made more informative in content.

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The online resource material includes topics such as green revolution – an overview; transgenic crops – objectives, achievements and concerns; plant biotechnology and sustainable agriculture; plant diversity and its conservation (including the work of N.I. Vavilov); plant introduction activities; and several appendices dealing with horticulture, forestry, archaeology as well as food and nutrition.

University and college students preparing for their degrees and diplomas in botany, agriculture, and horticulture as well as those engaged in studies of forestry, food science and nutrition, ethnobotany, archaeology, plant breeding and biotechnology or indeed anyone with a concern for our natural resources, will hopefully find this book useful. For a commoner, it can serve as a customized window to the fascinating world of useful plants as the book also emphasises the health benefits of some common food plants which should be made a part of one's regular diet. The book does not sermonise; it instead seeks to explain the necessity of and the rationale behind the usage of such plants. The information presented in this book is not intended to provide medical advice or treatment: do check with your physician/dietitian.

## Acknowledgements

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There are several people whom I want to warmly thank. I wish to express my utmost gratitude to Professor M. S. Swaminathan FRS, Founder Chairman and Chief Mentor, UNESCO Chair in Ecotechnology, M. S. Swaminathan Research Foundation, Chennai (India), not only for his kindness in writing the Foreword to the 5th edition but also for his great encouragement and continued interest in this project.

I could not have compiled a textbook of this magnitude without the willing cooperation of all the people and organisations who kindly sent or arranged pictures, and even accorded permission to use their illustrative material: Professor Scott A. Mori, Emeritus Curator, NYBG, Bronx, USA; Dr Robert Stewart Zeigler, Director General, IRRI, Manila, Philippines; Dr Claude M. Fauquet, Director, GCP 21, CIAT, Cali, Colombia; Dr Gudev S. Khush FRS, Adjunct Professor, University of California, Davis, CA, USA; Professor Elena Conti, Director, Institute of Systematic Botany and Botanical Garden, University of Zurich, Switzerland; Professor Igor G. Loskutov, N.I.Vavilov Institute of Plant Industry, St. Petersburg, Russia; Professor Dan Perlman, Department of Biology, Brandeis University, Waltham, MA (USA); Professor Steve Busby, School of Biosciences, University of Birmingham, Great Britain; Professor German Bollero, Department of Crop Sciences, University of Illinois at Urbana-Champaign, USA; Dr Theodore Hymowitz, Professor Emeritus, University of Illinois, Urbana-Champaign, USA; Dr Gene Hettel, Executive Director, Asia Research Foundation, IRRI, Philippines; Professor Sara Maldonado, Faculty of Exact, Physical and Natural Sciences, University of Buenos Aires, Argentina; Dr Enrique A. Martinez, Northern Catholic University at Coquimbo, CEAZA, La Serena, Chile; Professor H.H. Iltis, University of Wisconsin, USA; Mr. Dilip Tambyrajah, Secretary, International Natural Fiber Organisation, the Netherlands; Dr Valerie Cawoy, Universite Catholique de Louvain, Belgium; Dr Anupam Varma, Adjunct Professor and INSA Honorary Scientist, IARI, New Delhi; Dr Anil Kumar Singh ( Ex Chief Scientist) CSIR-CIMAP, Lucknow, India; Professor H.Y. Mohan Ram, INSA Srinivasa Ramanujan Research Professor, New Delhi; Professor Satish C Maheshwari, Honorary Scientist INSA and Visiting Professor, CCT, University of Rajasthan, Jaipur; Dr Rameshwar Singh, Project Director, DKMA, ICAR, New Delhi; Directorate of Extension, Ministry of Agriculture, Govt. of India; Dr James Jacob, Director, RRII, Kottayam, Kerala; Dr B.S. Sreeramu, University of Agricultural Sciences, Bangalore; The Wealth of India, NISCAIR-CSIR, New Delhi; Dr Priya Ranjan, Director IC and Training, Ministry of Rural Development, Govt. of India; Dr Gurcharan Singh, Former Associate Professor, SGTB Khalsa College, University of Delhi; Dr Godofredo U.

Stuart MD, Stuartxchange. com, Philippine Medicinal Plants; Dr Ruth Baker Grimes, California, USA; Mr. Carl Davies, Photographer, CSIRO, Australia; Dr Brian J. Weir, Office of the Gene Technology Regulator, Canberra, Australia; Mr. Andrew Grygus, Automation Access, La Crescenta, CA, USA; U S Canola Com; Canola Council of Canada; USDA-Agricultural Research Service, Beltsville, Maryland; FAO of the United Nations ( Photo Library ); California Agriculture-Regents of the University of California; Dr Madhu Aneja, Cook College, Rutgers University, New Jersey, USA; and Dr Foong Swee Yeok, School of Biological Sciences, Penang, Malaysia; Dr. V. Selvam, Director, Coastal System Research, MSSRF, Annamalai Nagar, Tamil Nadu, India; Drs S. Gopala Krishnan and Navinder Saini, Senior Scientists (Rice and Cotton Breeding respectively), Division of Genetics, IARI, New Delhi; Dr Ranbir Singh, Ex. Principal Scientist, NBPGR, Pusa Campus, New Delhi, India; Dr. Sanjeet Kumar, Senior Research Fellow, Regional Plant Resource Center, Bhubaneswar, Odisha, India.

For pictures originating from more than one sources, the author expresses his deep appreciation to: International Natural Fiber Organization, the Netherlands and The Fiber Industry Development Authority, Philippines (for abaca) and The Institute of Bast Fiber Crops (IBFC) Changsha, Hunan Province-Chinese Academy of Agricultural Sciences and International Natural Fiber Organization, the Netherlands (for ramie)

I am grateful to Professor Ashwani Pareek of School of Life Sciences, Jawaharlal Nehru University, New Delhi for contributing a write-up on 'Terminator Gene Technology', appearing in the Chapter on 'Transgenic Crops: Objectives, achievements and concerns'. I do hope this information will be quite useful to students, scholars and teachers alike.

I am indebted above all to my wife Urmil for her understanding and continuous encouragement without which the revised version of this book would not have materialized. She has been a source of strength to my family and me. It was very thoughtful of my children to have gifted me a laptop and an iPad so that I could easily handle web communications and effectively make use of web resources. I wish to express my deep gratitude to my children Monica, Shaloo and Saurabh, whose knowledge in computer application was very helpful in preparing Excel sheets for illustrative material, consolidating permissions-clearance and reorganising the textual material in its final format.

Sincere thanks are also due to my other family members Puneet and Monica, Atul and Shaloo, Saurabh and Namita for their deep interest, support and genuine concern about the Cambridge edition. A special word of appreciation goes to my beloved grandchildren Sarthak, Anish and Myra for their excitement and wait over the years to see the book in print.

I would also like to express my sincere thanks to my former colleagues at Khalsa College, University of Delhi, especially Dr G. N. Dixit, Dr Sukhbir Kaur Gujral and Dr Vivek Chopra for their help in providing information relating to this edition. Special thanks are due to Dr Jaswinder Singh, Principal of Khalsa College for his interest in my research and for providing me ready use of the library facilities. In addition, I am thankful to Neeraj and Reema Gulati for preparing high-resolution images of the illustrative material used in the book.

I wish to express my deep gratitude to the editorial and production staff of the Cambridge University Press, India for the courtesy, co-operation and technical guidance to details, and for their sincere and meticulous efforts in bringing out this edition well in time and in the best possible shape.

Data on world production of various crops was obtained principally from FAO Stats by the Food and Agriculture Organisation of the United Nations, Rome, Italy. While every effort has been made to acknowledge the sources of information and any other copyrighted material, omissions may have been made inadvertently. If these are brought to the author's or publisher's attention, appropriate acknowledgements will be made in future editions.