

Beekeeping

A Compressive Guide to Bees and Beekeeping



D.P. Abrol

BEEKEEPING

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SCIENTIFIC
PUBLISHERS (INDIA)
www.scientificpub.com

Published by:

Scientific Publishers (India)
5 A, New Pali Road, P.O. Box 91
Jodhpur 342 001 (India)

E-mail: info@scientificpub.com
Website: www.scientificpub.com

Branch Office

Scientific Publishers (India)
4806/24, Ansari Road, Daryaganj
New Delhi - 110 002 (India)

Print : 2013

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ISBN: 978-81-7233-669-1 (HB)

ISBN: 978-81-7233-670-7 (PB)

eISBN: 978-93-86237-62-0

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Printed in India

Foreword

Honeybees are wonderful social insects which have fascinated the humanity since the prehistoric times. The biological evolution of honeybees is much older than human civilization, dating back to 50,000,000 years ago or so. Commercial beekeeping (apiculture) is perhaps the only industry exploiting the domesticated species of honeybees for enhance crop productivity, honey from nectar of (floral and extra floral nectaries) from plants, beeswax and several other products of medicinal value, and help in conservation of global biodiversity through propagation of plant species as well as enablighit speciation of new flora in nature. A wide human interest to investigate their biology of this marvellous insect in the quest of their interesting ways of life and methods of their colony management led to deploy such knowledge in social evolution of human society and commercial exploitation through their domenstication.

'Beekeeping - a comprehensive guide on bees and beekeeping' by Dr. D.P. Abrol, a distinguished entomologist, is yet another knowledge resource on the subject, towards enthusing entrepreneurs and practitioners of apiculture. Ever since the discovery of movable frame hives, many advances have been made in the field of apiculture or beekeeping particularly in the west with the European honeybee *Apis mellifera* L. However, in India exploitation of the rich floral diversity and congenial climates for exploitation of beekeeping of this bee species is yet to be an agricultural activity. Recognising the yeomen role of pollinators in the enhancement of crop productivity and quality of commodities, Indian Council of Agricultural Research recognized the science of pollination during the XIth five year plan period. It is in this context, that this book offers practical knowledge on beekeeping and apicultural technology to provide package of information as guide for efficient commercial apiculture. The voluminous book is a testimony to the enormous research work that has been done on this subject. The book, suitable for practical and class room reference, is an excellent presentation of worldwide comprehensive picture of beekeeping. It contains a wealth of knowledge that would prove extremely useful to students, teachers, researchers and beekeepers all over the world. I am sure that the book will enlighten us with the latest technological developments in beekeeping and shall be useful to agricultural and applied scientists, extension workers, policy makers and would motivate young minds to the wonderful world of beekeeping to improve rural economy and conservation of biodiversity.

Dr. Abrol has made serious efforts to write the book in a very popular and lucid language and in a form of running story which will provide enjoyable reading. Several recommendations/suggestions for boosting apiculture in India in a big way have found a place in this book.

It is very apt for its launch at a time when the National Bee Board in liaison with National Horticulture Mission and National Agricultural Development Project of the Ministry of Agriculture, Government of India.

I congratulate the author for this excellent book.



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Acknowledgments

A vast spectrum of people has helped in one way or the other in the writing of this book which would have remained a distant dream without their active help and support. The list is so long that it would not be possible to thank each of them individually. This book is outcome of my personal experiences and the contributions of several workers which have been incorporated. I express my humble and profound thank to all of them whose hard work has enabled me to compile the suitable information in such a manner that it would be useful to those interested in bees and beekeeping. The illustrations and figures are either original or redrawn from other sources which have been cited individually in the figure legends. All the authors whose work has been used/refereed deserve special appreciation and heartiest acknowledgments.

I owe deep sense of gratitude and indebtedness to my teachers who had a particular impact on my thinking about Science and Bees. I am greatly indebted to My Guide Late Professor Dr. R.P. Kapil, the then Dean Post Graduate Studies, CCS Haryana Agricultural University, Hisar who introduced me into the fascinating world of bees and beekeeping Professors Dr. R.C. Sihag, Dr. B.N. Putatunda, Dr. K.L. Jain, Dr. S.K. Garg, Dr. S.C. Paschan, Dr. N.K. Yadava, Dr.V.P. Sablok, Dr. R.B. Mathur, and late Professor Dr. Mahavir Gupta; Late Professor Dr. (Mrs.) Sudha Mathur had special impact on my thinking about the science of beekeeping.

Professor Dr. Raghavendra Gadagkar Chairman Centre for Ecological Sciences, Indian Institute of Sciences Bangalore deserves special thanks as he has always been a source of inspiration, needed help, guidance and encouragement throughout my career. Without his active support and inspiration I could have never ventured to compile such a book.

I am fortunate enough to have had the opportunity to spend past 20 years in different but complimentary intellectual environments where I had the opportunity to work with Professor Dr. M. Amin Masoodi former Director Research SKUAST Kashmir who was always available for help and get me out of the hole as when needed. Dr. F.A. Zaki Professor & Head Entomology SKUAST Kashmir deserves special thanks for his encouraging attitude and working atmosphere provided during my services in SKUAST Kashmir. I am also thankful to my students in beekeeping, bee biology and social insect classes through the years and hope this book will stimulate them to ask more questions.

I express a deep sense of gratitude to my university authorities for the excellent working atmosphere provided in the University for Smooth sailing of my work and needed encouragement for compiling such a voluminous book.

I am also extremely thankful to M/S Scientific Publishers (India), Jodhpur especially Mr. Pawan Kumar Sharma who took great pains and keen interest in publication of this book in a very impressive way.

Last but not the least my sincere thanks are due to my wife Professor Dr. Asha Abrol, son Rajat and daughter Vitasta for their endurance and help while writing this book.

Dr. D.P. Abrol

Preface

India is a country of diverse climates, cultures, mysteries and amazing phenomenon. The land resources are being limited but increased agricultural production is to be obtained through intensive farming i.e. higher cropping intensity, better seed and greater use of fertilizers. New cropping patterns are likely to create new problems, new pests may appear or pests now considered minor may become major. In some crops, any amount of fertilizer, irrigation or pesticide use may not give even a fraction of yield unless pollinated by bees. Honeybees play an important role in the pollination of large portion of the angiosperms of the world and maintain natural vegetation needed for survival of the ecosystems and the world as whole. Honeybees have always fascinated the mankind since the times immemorial. One comes across a number of folklores praising the honeybees diligence, usefulness and sacrifice. These winged creatures find mention in all the religious epics of the world. The carving of honeybees, their combs and hives can be found in tombs, coffins, crowns and maces of both ancient and modern empires. Honey and bees wax are used in many rituals, ceremonies and festivals and on many occasions in the life of individuals. In earlier times, honey was considered as a commodity of trade exchange between different nations of the world.

Honeybee civilization is much older than the human civilization. The first bee evolved in the tertiary period (Eocene) about 50,000,000 years ago. Beekeeping in India has been practiced from times immemorial and their mention can be found in epics such as Rigveda (4500-1500 BC), Upanishad, Mahabhartar and Ramayana (400 BC).

People of all ages carried on a tide of interest into a relationship with this marvelous insect have always wanted to know whether beekeeping could be carried in their circumstances? The beekeeping is possible in all those areas which have sufficient floral resources. However, it is essential for a prospective beekeeper to know the handling of bees before handling the honeybee colonies.

In this book I have tried to give the beginner the basic information, he will require to start up his colonies. Here I have tried to put over the latest scientific advancements as well as my own experience and philosophy of beekeeping and practical methods that have proved very productive and rewarding. The last few years have seen many strides in beekeeping and it has been my endeavor to capture the richness and flavour of many approaches which will be most rewarding to the prospective and enthusiastic, new recruits to the science of beekeeping. In this book I have pointed the ways towards the running of small scale units to large enterprises. If what is written in this book is able to motivate

and smoothen the path of some future beekeepers and hobbyists, I shall feel highly rewarded.

The success of beekeeping depends upon understanding of the biology and behaviour of honeybees, their management techniques including knowledge of their diseases and enemies and latest equipment for handling them. In this book an attempt has been made to put the authentic and up to date information in a concise and popular style. It is intended to serve as a reference and guide book for students of agriculture, teachers, scientists, horticulturists, plant breeders, geneticists, extension workers and all those who are interested in bees and beekeeping either as hobby or profession. Efforts have been made to present the book in the form of a continuous story. In addition to basic concepts of beekeeping some topics of general interest have also been included.

This book is one of the complete readings in apiculture dealing with the theoretical and practical approaches. The book contains 34 chapters covering all aspects of beekeeping which include important events and pioneers in beekeeping, history of beekeeping, type of bees, their evolution and biodiversity, honeybee species, their biology, form and function, beginning beekeeping, establishing apiary, bee appliances, bee behaviour, bee pasturage, management of colonies and their manipulations, mass rearing of queens, honeybee nutrition, two queen management system, migratory beekeeping, breeding of honeybees, use of honeybees and wild bees for pollination, bee products and their value addition, diseases and enemies of bees, breeding bees for disease resistance, inbreeding depression in honeybees, quarantine control of bee diseases, artificial insemination, pesticide toxicity to bees, biotechnological potential of bees, honeybees as biosensors, ancillary industries, marketing of bee products, future strategies for development of beekeeping, bibliography and glossary of beekeeping terms etc. Besides this, information is also provided on books, CDs, Vedio and important websites.

"The simple language and lucid treatment of the subject shall make this book easily readable and highly useful. This book shall serve as a reference book for students, teachers, and researchers and for all those interested in bees and beekeeping. This book will be useful to all those who wish to make beekeeping their hobby or as profession, entrepreneurs and even layman. Besides, the information provided in this book will be useful to pollination biologists, students, teachers, scientists of agriculture, animal behaviour, botany, conservation, biology, ecology, entomology, environmental biology, forestry, genetics, plant breeding, horticulture, toxicology, zoology, seed growers and seed agencies." It will be highly useful to motivate the young generation to fascinating world of honeybees and adopt beekeeping as a profession. The extension workers and policy planners will find this book as a guide for their problems and evolving strategies.

There is certainly a room for more honey production as the vast areas of forage remain unexplored and unexploited or underutilized with little benefit to man or nature. Taking honey from an area removes very little other than carbon

dioxide and water and is the sort of exploitation of the environment that most will be prepared to forgive.

In case the tone and temper of the book is appealing to the lovers of beekeeping I shall feel highly elevated and properly rewarded.

Although there are large number of standard and good books available on the subject but they are not in accordance with the local needs of the people and are very costly. Furthermore, much technological advancements have been made, for instance, the number of honeybees species has increased from 4 to 9 and some new diseases/pests have been discovered over the years which warrant their documentation for the benefit of beekeepers. Hence, a book fulfilling the basic needs and latest technological advancements was considered to be of immense importance.

This book is not a literary work of mine but is the mirror of facts and fundamentals of beekeeping. If linguistic errors might have crept they may be ignored, as language is the only means of relaying ideas and they do not defeat my purpose if I am able to let others know how the beekeeping could be carried out successfully.

Finally the criticism and suggestions for further improvement of the book shall be most welcome and highly appreciated.

Jammu

D.P. Abrol

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