



Asian Bees and Beekeeping

Progress of
Research and Development

Editors

**M. MATSUKA • L.R. VERMA
S. WONGSIRI • K.K. SHRESTHA
UMA PARTAP**

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Editors

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Foreword

The Asian continent is the richest in the world in honeybee species diversity. A number of species e.g. *Apis cerana*, *A. dorsata*, *A. florea* and *A. laboriosa* are indigenous to the region. In addition, *A. mellifera* has been introduced to the region and is being widely used for honey production. Recently more species of *Apis* have been identified in Asia, but firm confirmation of these is yet to be obtained. Beekeeping with the Asiatic hive bee, *Apis cerana* has been a tradition and a part of cultural heritage of people in Asia in general, and in mountain areas of the Hindu Kush-Himalayan (HKH) region, in particular. It is an important food and income generation activity for small and marginal farmers, the landless and weaker sections of society living at or below subsistence level. Beekeeping plays an equally important role in rural mountain development as pollinator of agricultural and horticultural crops. With integrated beekeeping efforts, there is a great potential for increasing crop productivity, and conserving forest and grassland ecosystems, thereby maintaining biological diversity.

Bee scientists in different institutions in Asia and the HKH region are making efforts to innovate new methods of beekeeping research and development. However, these efforts are being done on individual institution level and therefore, a need to have a common platform to share this scientific knowledge and information was felt. Asian Apicultural Association (AAA) created by some scientists of the Asian continent provides such a common platform to share knowledge and information on Asian bees and beekeeping. AAA is an organization networking scientists and development workers interested in Asian bees and beekeeping. AAA makes efforts to encourage research on biology and management of different honeybee species found in Asia. Thus, the main objective of AAA is to promote the exchange of scientific and general information relating to honeybee sciences and apiculture in Asia, and to encourage and assist international cooperation in the study of problems of common interest. In order to provide a platform to share knowledge and information, AAA had been organizing a conference every two years since 1992 when the first founding general meeting was held in Bangkok, Thailand.

AAA and ICIMOD jointly organised Fourth AAA International Conference in Kathmandu during March 23-28, 1998. Over 150 people including scientists, researchers, development workers, beekeepers, and donors from over 24 countries of Asia, Europe, and Australia attended this Conference. Two Workshops – one on Bee Diseases and Pests and another on Beekeeping Extension in Remote Mountain Areas – were also organised before the Conference. The former Workshop had been intended by the APIMONDIA Standing Commission on Bee Pathology, and co-organised with AAA and ICIMOD. This publication is an outcome of the knowledge and information shared during this Conference and the Workshops.

This book presents an overview of bees and beekeeping R&D in Asia and highlights the issues related to conservation and management of the Asian hive bee, *Apis cerana*. New frontiers of bee biology research covering diverse topics such as evaluation and selection of *Apis cerana* populations, and effect of synthetic queen pheromone on behaviour and honey production of *Apis cerana* and *Apis mellifera*. Recent findings in bee diseases and pest control and innovations in apiary management

are explained. A section on production, processing, properties, and marketing of different bee products - honey, beeswax, royal jelly, and propolis has been provided. In addition, new advances in crop pollination research through beekeeping and experiences in extension covering topics ranging from beekeeping needs and extension methodology in hills and mountain areas to the role of various research and development institutions in promoting sustainable beekeeping are given in detail.

We sincerely acknowledge the financial support provided by Austroprojekt for the Conference and publication of the Proceedings.

We appreciate the efforts of AAA members in their headquarters at Japan, particularly Dr. Jun Nakamura and Mrs. Hitomi Enomoto who were the key driving force in organising the Conference. Similarly, in ICIMOD, several people particularly Beekeeping Programme staff worked hard to make the Conference a success. Finally, we would like to express our appreciation for the efforts of the editors in compiling hundreds of papers presented during the Conference and bringing out the proceedings in the present form.

Finally, we do believe that this publication will be of use to scientists, development workers, students, beekeepers, NGOs, planners as well as donors committed towards the cause of Asian bees and beekeeping.

Egbert Pelinck
Director General, ICIMOD
May 26, 1999

Mitsuo Matsuka
President, AAA
May 26, 1999

Preface

Asia is home to a number of honeybee species, the most common being *Apis cerana*, *Apis florea*, *Apis dorsata*, and *Apis laboriosa*. These species are native to the region whereas *Apis mellifera* has been introduced to increase honey production and is becoming popular among commercial beekeepers. In addition to these, a number of other species of *Apis* have been identified, confirmation of most of which has not been made so far. Beekeeping is an important food and income generating activity in countries of Asia. Asian Apicultural Association (AAA) devotes itself to address the issues related to Asian beekeeping organises Conference every two years to discuss the progress in beekeeping research and development in Asia. International Centre for Integrated Mountain Development (ICIMOD) is devoted to integrated mountain development to help promote an economically and environmentally sound mountain ecosystem and poverty alleviation in the Hindu Kush-Himalayan region is running a programme on promotion and development of beekeeping through indigenous *Apis cerana* for the past eight years.

In an effort to share knowledge and information, AAA and ICIMOD jointly organised Workshops on bee diseases and beekeeping extension and Fourth AAA International Conference in Kathmandu during March 23-28, 1998. The present book is an outcome of the papers presented in the Conference and Workshops. The book contains seventy-two chapters grouped into seven parts.

Part One has one major Chapter, which presents an overview of issues and initiatives in Asian Bees and Beekeeping. It describes the genetic diversity of *Apis cerana* in the Hindu Kush-Himalayan region particularly India and China, and at the same time highlights the issue of declining populations of the species in the region. The authors advocate the need to conserve *Apis cerana* and suggest strategies for conservation of this indigenous bee species. Country reports explaining the status of beekeeping in Bangladesh, Japan, India, South Korea, and Thailand are also included. Efforts of ICIMOD in promoting conservation of *Apis cerana* through developing and promoting beekeeping with this indigenous bee species in the Hindu Kush-Himalayan region are also highlighted. Excerpts from the Welcome Addresses by Director General of ICIMOD and President of AAA and the Chief Guest's Address have been adjusted within boxes. Resolutions passed during the Workshops and the Conference are also presented within boxes. The authors also emphasise the need of establishing a Regional *Apis cerana* Research and Training Centre for future development of beekeeping with *Apis cerana* in South and Southeast Asian region.

Part Two consists of eleven chapters explaining new frontiers of bee biology research. It covers diverse topics such as evaluation and selection of *Apis cerana* populations, differences in body colour expression between Asian and European bee species, and effect of synthetic queen pheromone on behaviour and honey production of *Apis cerana* and *Apis mellifera*. Migration of *Apis dorsata* in northern Thailand have been discussed in Chapter 9 and first ever report of occurrence of *Apis florea* in Saudi Arabia has been given in Chapter 10. In addition, findings on ecobiology of wild bee species, *Apis florea* and *Apis dorsata* in semi-arid and subtropical climates have been reported in Chapter 11 and 12 respectively.

Part Three reports recent findings in bee diseases and pest control. This part contains twelve chapters. Chapters 13-18 were presented and discussed during Workshop on Bee Diseases and Pests. Among these Chapters 13-15 are on Thai Sac Brood Virus disease and chapters 16-18 are on *Varroa* mites. There are three more papers on *Varroa*, other mites, and parasites (Chapter 19-21). There is an interesting paper (Chapter 24) on accelerated degradation of a commonly used highly toxic pesticide carbaryl by acclimated bacteria found in *Apis cerana* bees.

Part Four reports innovations in apiary management to maintain an apiary of healthy bee colonies and increase honey production and crop pollination through beekeeping. This part contains eleven chapters (Chapters 25-35) and explains innovative methods (sugar-feeding and liquid protein diets etc.) and techniques (beehives and other equipment) of managing different species and races of bees for enhanced production. Of specific interest is a paper by Dr. K. Amano (Chapter 28). Dr. Amano explains how non-stinging *Apis mellifera* bees can be induced using gamma radiation. Many people are still scared of being stung by the bees. Producing non-stinging *Apis mellifera* would bring revolution in using this bee for honey production and crop pollination. Research findings of different scientists on different types of beehives both traditional and improved, and performance of bees in them in different parts of Asia has been presented in four chapters 32 to 35.

Part Five reports the production, processing, properties, and marketing of different bee products such as honey, beeswax, royal jelly, and propolis through seven chapters (Chapters 36-42). A very interesting piece of research, the role of honey produced by different bee species in Ayurvedic medicines, has been discussed in Chapter 39. Part six reports new advances in crop pollination research through beekeeping. It contains seventeen chapters (Chapters 43-59) explaining how to manage bees for crop pollination, pollination strategies to enhance fruit set in apples, research on the use of bees in pollination of fruit, vegetable and oilseed crops in hilly and mountain areas. This section also includes research results explaining comparative effectiveness of *Apis cerana* and *Apis mellifera* in pollinating different crops. In addition, comparative attractiveness to bees of different crops blossoming simultaneously in the same area and its impact on their pollination has been given in Chapter 54. Another paper on foraging competition between *Apis cerana* and *Apis mellifera* and its impact on crop pollination has been presented in chapter 55. Findings of these two studies are very important in planning / managing pollination of different crops blooming at the same time using beekeeping. Chapter 56 explains the importance of managing agroforestry to enhance crop pollination and promote beekeeping in an area. In addition, a new computer based method to identify bee flora has also been given in chapter 58.

Part seven presents experiences in beekeeping extension. There are thirteen chapters (Chapters 60-72) in this section. Chapters range from beekeeping needs and extension methodology in hills and mountain areas to the role of various research and development institutions in promoting sustainable beekeeping. In addition this sections provides information on traditional beekeeping methods and indigenous knowledge of beekeeping and potential of beekeeping as a self-employment opportunity for women in hilly and mountain areas.

As pre-Conference exercise two Workshops were organised - one on Bee Diseases and Pests and another on Beekeeping Extension in Remote Mountain areas. However, there were two full-fledged Sessions on these topics in the Conference also. So we found it confusing to present papers on the same subject under separate sections for Workshop and Conference Sessions. Therefore, the Workshops papers have been included in the relevant Parts to avoid unnecessary confusion to the readers. Six papers including three papers on Thai Sac Brood Virus Disease and three on *Varroa* mites were presented in Workshop on Bees Diseases and Pests. These papers are included as Chapters 13 to 18 under Part 3 on Recent Findings in Bee Diseases and Pest Control. In Beekeeping Extension

Workshop, only one paper was presented by Dr. Naomi M. Saville, which is included as Chapter 61 under Part 7 on Experiences in Beekeeping Extension.

Some of the authors submitted only abstracts and some of the papers were very small (abstracts) of half a page length. We therefore, decided to put such papers as box with relevant papers. These papers are fully acknowledged with authors' affiliation etc. in the boxes as well as in the Contents page.

As is true with every publication, it comes into shape because of the co-operation, support, and encouragement of several individuals. Editors have done their part and their names are there, but at this stage we shall like to thank and record appreciation of 'behind the scene' remarkable efforts of few key people. We sincerely appreciate the efforts of Mrs. Hitomi Enomoto and Dr. Jun Nakamura of Asian Apicultural Association in Honeybee Science Research Centre, Japan who helped compiling the papers. Mrs Enomoto was also a vital link between AAA and ICIMOD.

It would not have been possible for AAA to bring out this publication without the support and personal efforts of Mr. Egbert Pelinck, Director General of ICIMOD. Since ICIMOD took the responsibility to publish it, he was the driving force behind pushing the whole process of publication and offering generous financial support and staff time. Similarly, Dr. Tej Partap, Head, Mountain Farming Systems Division, ICIMOD supervised the whole process of publication. He deserves special appreciation in putting the present publication in shape by providing his constructive comments in reorganising and reshaping the contents of the publication. Not only that, he also played a key role in negotiating with the publisher - Oxford and IBH, New Delhi.

Likewise, we appreciate co-operation of authors to share their research findings and observe time schedules. Lastly, ICIMOD as an institution deserves much appreciation and thanks from members of AAA for being an excellent host and for co-operation in publishing this Volume. We also appreciate interest shown by Oxford and IBH, New Delhi in publishing the proceedings.

May, 1999

Editors

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