

POLLINATING BEES

THE CONSERVATION LINK BETWEEN AGRICULTURE AND NATURE

Proceedings of the Workshop on the Conservation and Sustainable Use of Pollinators in Agriculture, with an Emphasis on Bees, held in S. Paulo, Brazil, in October 1998.

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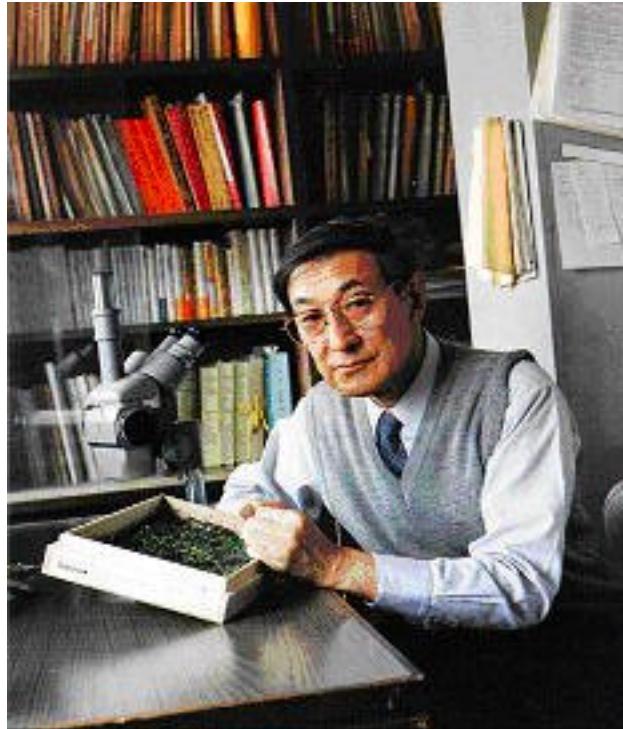
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International Commission for Plant-Bee Relationships – ICPBR
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DEDICATION & CELEBRATIONS - SHOICHI FRANCISCO SAKAGAMI

This book is dedicated to honour the memory of Professor Soichi Francisco Sakagami.



S. F. Sakagami, Emeritus Professor of the Hokkaido University, was born (January 4, 1927) in Ichikawa (Central Japan), and passed away (November 4, 1996) in Sapporo (North Japan). Prof. Sakagami was a very prolific scientist, as he authored over 320 papers and 8 books, of which although concentrated on the Hymenoptera, covered other taxa, as well, like beetles, domestic fowl and cats. As he used to mention, one of the most important milestone of his scientific career, was met around 1957 when he became acquainted with details of the bionomics of the stingless bees. Nicknamed by him as "my biological treasure", these fascinating social insects have motivated his two long visits to Brazil, namely 1962/63 – Curitiba (Father J. S. Moure) & Rio Claro (Prof. W. E. Kerr), and 1971/72 – (Prof. W. E. Kerr & Prof. R. Zucchi). His retirement (March, 1990) assisted the progressive decline of his health but, despite these restrictions, his impressive and indefatigable working capacity remained as before. Unfortunately, he could not accomplish his most cherished dream, that was, to return to Brazil to devote himself almost entirely to the study of "his biological treasure". Nevertheless, his love to Brazil and to the stingless bees will remain forever, as they are carved in the proper title of one of his books. Although published in Japanese (1975), only the book's title was printed in Portuguese following exactly as his own hand-writing: "O meu Brasil e as suas Abelizinhas" (sic) (= My Brazil and its Little Bees).

Celebrations: This book is presented to celebrate the life-time achievements of Professor Charles D. Michener and Padre Jesus S. Moure.

	
<p style="text-align: center;">CHARLES D. MICHENER</p> <p>Prof. Michener, the world's leading authority on bee taxonomy was born in Pasadena, California, in 1918. He became interested in bees at a young age, publishing his first paper at the age of 17. His PhD. Thesis, published in 1944, represented a milestone in bee classification. Prof. Michener has traveled all over the world studying bees and has spent long periods in Brazil, Africa and Australia. He has published over 400 papers, including several major revisions and books. Prof. Michener is also well-known for his important theoretical contributions to the study of social behavior among insects, in particular on bee societies. He has finished recently the award winning encyclopedic (over 900 pages) book "The Bees of the World", published by Johns Hopkins University Press in 2000.</p>	<p style="text-align: center;">JESUS SANTIAGO MOURE</p> <p>Prof. Moure, one of Brazil's most outstanding systematists, was born in Ribeirão Preto, São Paulo, on November 2, 1912. Prof. Moure has dedicated his whole life to the study of bees. His first paper, published in 1938, was on curculionid beetles, and soon after that he started working almost exclusively on bee taxonomy, and presently has over 180 publications and 434 described new species. He was one of the founders of the Brazilian Society of Science Progress. He has assembled, in Curitiba, one of the most important Brazilian zoological collections, as well as the world's largest and most representative collection of Neotropical bees. Prof. Moure has visited all of the most important Natural History museums in the world during his career. He is also recognized for establishing the Graduate program in Entomology at the Federal University of Paraná, in which countless Brazilian zoologists, many of whom are internationally recognized for their work, have obtained their degrees.</p>

Both apidologists have influenced us in one way or another, directly or indirectly. Their important scientific contributions, coupled with their friendship and stimulation, have been a guide and support in our professional lives. We use this book to express collectively our admiration and solidarity.

FOREWORD

The vital importance of biological diversity sustainable use for society is evident and is clearly demonstrated in this book. The decline in the diversity and number of pollinators and the risks this involves for agriculture sustainability clearly demonstrate the importance of pollination in this sphere. This ecosystem service provided by biodiversity is one of the simplest to demonstrate and for the public to comprehend. This is particularly opportune because the proposal described here could be the basis for a first global initiative to deal with the conservation and sustainable use of the components of biodiversity directly responsible for the maintenance of an ecosystem service.

At the second meeting of its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity (CBD) in Montreal, the Brazilian Government proposed to create a work program on Agricultural Biological Diversity which included a proposal for the establishment of an "*International Pollinator Conservation Initiative*". Based largely on the Brazilian proposal, the third Conference of the Parties (COP3) in Buenos Aires, 1996, approved Decision III/11 on the "*Conservation and Sustainable Use of Agricultural Biological Diversity*", which identified pollinators as one of the initial priorities.

As a contribution to the development of this program the Brazilian Ministry of the Environment held an international workshop of experts (Workshop on the Conservation and Sustainable Use of Pollinators in Agriculture, with Emphasis on Bees) to propose a framework for an International Initiative on Pollinators as a key element in this program. It was attended by 61 scientists from 15 countries and five international organisations (CBD Secretariat, FAO, IBRA, IUCN and ICPBR).

The workshop was very successful, with an intense programme that included individual presentations of case studies, poster presentations and workgroups on special topics. The participants agreed on the problem identification and on the steps to be developed. As a consequence, a document was created in Brasília entitled, The São Paulo Declaration on Pollinators (1999).

Afterwards, the mentioned document was submitted to the attention of all delegates to the fifth meeting of the Subsidiary Body for Scientific, Technical and Technological Advice – SBSTTA of the Convention on Biological Diversity to be held 31 January to 4 February, 2000 in Montreal, Canada. We hope this proposal will be recommended for endorsement by the fifth meeting of the Fifth Conference of the Parties of the CBD (COP5) in Nairobi, in May 2000. The framework for action recommended by the São Paulo workshop could provide the needed guidelines for the Global Environment Facility – GEF and other financing agencies in supporting projects in different countries on this theme.

We would like to support strongly the recommendation that COP5 formally establish an *International Pollinators Initiative* based on the framework for action contained in this book and the request that SBSTTA should co-ordinate, with support from the Executive Secretary, the preparation of a first *Global Biodiversity Outlook Report on Pollinators*. The Workshop participants also requested that COP5 call for international co-operation to develop the *International Pollinators Initiative* and requested the financial support of the Global Environment Facility - GEF for this initiative and, finally, proposed the creation of a *Pollinators Specialist Group* within the Species Survival Commission of the IUCN.

We thank the following institutions for their support to this initiative: the University of São Paulo – USP, the Brazilian Corporation for Agricultural Research – EMBRAPA, the Brazilian Council for Scientific and Technological Development – CNPq, the United Nations Development Program – UNDP (Project BRA 95/012), the Food and Agriculture Organisation – FAO, the International Union for

Conservation of Nature and Natural Resources - IUCN, the International Bee Research Association – IBRA, the International Commission for Plant-Bee Relationships – ICPBR, and the Secretariat of the Convention on Biological Diversity. Finally, we thank and congratulate the participants of the São Paulo workshop for their significant contribution.

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Brasília, 1999.

Editors' Note

The papers presented at the Workshop were assembled and reviewed in order to be published, and the necessary support for this purpose has become available this year.

The **S. Paulo Declaration on Pollinators** was endorsed in May 2000 by the Conference of Parties 5, held in Nairobi, Africa (section II of the decision V/5, that reviewed the implementation of decisions III/11 and IV/6, and further elaborated a program of work). It was established an International Initiative for the Conservation and Sustainable Use of Pollinators, hereafter referred to as International Pollinator Initiative (IPI).

The aim of the IPI is to promote coordinated action world-wide to:

- a. Monitor pollinator decline, its cause and its impact on pollinators services;
- b. Address the lack of taxonomic information on pollinators;
- c. Assess the economic value of pollination and the economic impact of the decline of pollination service;
- d. Promote the conservation and the restoration and sustainable use of pollinator diversity in agriculture and related ecosystems.

It contains four programme elements: 1. Assessments; 2. Adaptative management; 3. Capacity-building; 4. Mainstreaming.

Through decision V/5, the Executive Secretary was requested to undertake the steps for the implementation of the programme of work. FAO (Food and Agriculture Organization of the United Nations) was invited to facilitate and coordinate the International Pollinators Initiative.

The progress report on the implementation of the programme of work (UNEP/CBD/SBSTTA/7/9/Add.1) was submitted by FAO to SBSTTA 7, in Montreal, November 2001, that recommended it to COP6, held in May 2002.

The editorial team thanks all participants of this book. We also thank Dr. Braulio S. F. Dias who was personally involved in this project; the Brazilian Environment Ministry that promoted this opportunity; and all support received from sponsors of the Workshop.

Brasília, June 2002.

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[excerpts from “ Report on the recommendations of the Workshop on the conservation and sustainable use of Pollinators in Agriculture with Emphasis on bees”. Brazilian Ministry of Environment, Brasilia, December 1999.]

PREFACE

This book has arisen from an international initiative brought to the present state through activities in Brazil, one of the leading countries in bee biology. The **International Workshop on the Conservation and Sustainable Use of Pollinators in Agriculture, with Emphasis on Bees** was held in São Paulo from 7 to 9 October, 1998 and it is from that event that we present this book. The arrangement we follow is more or less that of the presentations at the Workshop and its intensive discussion sessions.

Session I “The Main Issues in Pollinator and Bee Conservation” comprises 5 Chapters. The eminent Professor Paulo Nogueira-Neto sets the stage in Brazil by considering not only pollination, but also frugivory and seed dispersal as crucial ecological processes to sustainable productivity (**Chapter 1**). The United States of America has become very much concerned about saving wild pollinators and several U.S. federal agencies have taken up the cause (**Chapter 2**). Although the plight of pollinators has been recognized in many countries, there are major problems in their identification because of lack of presently qualified personnel and of funding. Change in funding priorities to include systematics is urgently needed to allow conservation efforts to be scientifically based globally (**Chapter 3**) and nationally (**Chapter 4**). The importance of pollinators to agriculture is presented in **Chapter 5** in a general overview of the pollinator crisis for crop production.

To obtain a global panorama of the approaches to management and conservation of pollinators, 12 Chapters have been grouped into **Session II “The State of the Art in Bee Conservation for Agriculture and Nature”**. A broad European perspective is presented in **Chapter 6**, followed by the special and illustrative cases in the Netherlands (**Chapter 7**) and Russia (**Chapter 8**). Activities in Canada, and advanced centre of applied Melittology (more usually but less accurately termed Apidology), are discussed in **Chapter 9**. The situations in subtropical and tropical regions are discussed for Africa (**Chapters 10 and 11**), South America (Brazil (**Chapters 12, 13, 14**), Chile (**Chapter 15**)), and North America (Mexico (**Chapter 16**)). A historical and updated review of the now highly managed and cultured common European bumblebee (*Bombus terrestris*) used especially for greenhouse pollination is the subject of **Chapter 17**.

Methodology for Assessing Pollinator Diversity and Abundance (Session III) was very high on the list of priorities at the Workshop in São Paulo. Four highly interesting Chapters are presented. **Chapter 18** makes recommendations on the basic concepts and methods used for monitoring bee diversity and populations, with specific instances drawn from California and Costa Rica. The next contribution (**Chapter 19**) presents aspects of theoretical ecology to application in crop and pollinator systems. The taxonomic impediment to monitoring is raised as a serious problem which may be overcome, in part, through efficient use of computer technology for identification of species of bees through the Automated Bee Identification System (ABIS) (**Chapter 20**). **Chapter 21** describes how bee diversity and abundance can be approached from the perspective of community ecology (melissocoenology).

Examination of the world literature on crop pollination and pollinator-crop relations reveals that there are major shortfalls in current understandings. Much literature, even for well-known crops of the temperate zone, is now dated because new and improved cultivars that have not been adequately studied dominate modern agriculture and horticulture. Some reports lack scientific and experimental rigour.

There is an urgent need for reliable and up-to-date information in crop pollination, and this is especially true for tropical crops, the subject of **Session IV. Chapter 22** presents modern research on pollination in Brazilian cashew, **Chapter 23** similarly explores Brazil Nut, and **Chapter 24** exposes the erroneous myth that coffee does not benefit from insect pollination. Also of special importance is a review of pollination in Algaroba trees (*Prosopis*) in the desert regions of Chile (**Chapter 25**). **Chapter 26** opens the whole novel panorama of pollination of economically important fruit trees in Brazil with commentary of their actual and potential pollinators.

Session V presents other contributions by abstract. These are included for the sake of completeness and span the gamut of the four Sessions described above.

It was emphasized at the Workshop in São Paulo that the huge diversity of bees in Brazil

has major and crucial roles in ecosystem function and sustainability, not only in agricultural environments, but also in forests and urban areas. That emphasis is not peculiarly applicable to Brazil, but, as the Workshop elucidated, is a global issue in almost all terrestrial ecosystems. The Workshop provided an opportunity for the exchange of information between countries of the Southern and Northern Hemispheres. Sorely missing from this book, and from the Workshop, were contributions for Asia, Australia and the Pacific, and even the Mediterranean heartland of bee-keeping, practical pollination, and pollination biology. Future meetings are planned to address these missing elements. **Section VI** presents excerpts of the **São Paulo Declaration on Pollinators** that lead up to the Workshop and have since been embraced by the Convention on Biodiversity and taken up as the **International Pollinators Initiative** by the Food and Agricultural Organization of the United Nations in Rome.

P. G. Kevan, V. Imperatriz-Fonseca, G. W. Frankie, C. O'Toole, and C. H. Vergara
(Editorial team)