

THE MANGOES

Their Botany, Nomenclature, Horticulture and Utilization

A. J. G. H. Kostermans & J. M. Bompard



**Published for the
International Board for Plant Genetic Resources
and the
Linnean Society of London**

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This book is dedicated to Mr F.R. van Blommestein

Preface

This book is aimed mainly at horticulturists and mango growers, and will provide information on existing mango species and their value in the common mango (*Mangifera indica*) industry. Information is provided on mango (*Mangifera*) species growing in very dry areas, like savannahs; on species growing on permanently or temporarily inundated lands; on species growing at altitudes over 1000 m in the tropics, and on species growing at higher latitudes, outside the tropics; on those that grow under monsoon climate conditions (the common mango) and on those growing under ever wet conditions and still producing a good crop; there are also so-called wild species that compete in flavour with the common mango and will be a source for new products and will have possibilities for hybridizing and grafting. It is possible that, among all these species, there is one immune to the scourge of mango growers: anthracnose.

To bring all this knowledge together, we produced a complete overview of all species of the genus *Mangifera*, their description, distribution, occurrence, phenology, etc. and the nomenclature, which makes this book an asset for the scientific botanist, ecologist, student and teachers.

For half a century, working as a botanist in S.E. Asia, stationed in Bogor (formerly Buitenzorg) in W. Java in the Forest Research Institute and the Herbarium Bogoriense and for some time at BIOTROP (S.E. Asian Ministers of Education Organization), my attention during my numerous field trips (nowadays called expeditions) was inevitably attracted by the rare and huge mango trees in the Malay Peninsula, Sumatra, Java, Borneo, Thailand and Ceylon.

Why is there so little known of fruit in tropical Asia? My answer to this question, after having produced an overview of the durians (*Durio*) and the dukus (*Lansium*), the kedondongs (*Spondias*) and now the mangoes (*Mangifera*), is as follows. Relatively unknown, but often of excellent quality, fruit appears seasonally in small remote markets. The fruit is usually not exported from its direct place of origin. The local population enjoys it, but is not interested in its origin, a phenomenon also found in the better educated western man (scientific interest is not a common feature in man). Foreigners are inclined not to touch or to try fruit that they do not know and as they have a different taste from the local people, they tend to dislike the smell of the fruit, which is however, held in high esteem by local people.

The above results in the most controversial printed information; once upon a time the common mango was described as inedible and having a horrible taste. An Agricultural Handbook of the USDA (Martin *et al.*, 1987) is very unreliable for mangoes: on pp.178–179, more than 10 errors are presented and a species is

mentioned that does not even exist. Many popular books have recently appeared with coloured reproductions of local fruit, but these represent only a small part of the fruit available.

Our inadequate knowledge of mangoes is also due to another fact. The different species occur as single individuals (not populations), widely scattered over extensive areas. Sometimes one huge tree is found in an area of 1–100 km². They often flower rather irregularly and after prolonged periods, and the fruit has seldom the opportunity to come to full maturity, as it is consumed immature or half mature by monkeys, squirrels, civet cats, hornbills, etc. as well as by man.

The average botanist, coming upon an enormous mango tree with a very long, straight, branchless bole, may require binoculars to observe any flowers or fruit and, if these are present, will not be in a position to collect them.

This is the main reason why mango species are so badly represented in herbaria allowing for the fact, that, although widely scattered, they are not uncommon. Mukherjee's assumption that some species are rare, derived from counting herbarium specimens alone, is thus an error.

In 1981, BIOTROP decided to set up a project creating an encyclopaedia of the useful plants of S.E. Asia, and I was put in charge. One of the stipulations of the project was that groups of plants (c.q. fruit trees), for which little or no reliable information was available in the literature, should be investigated by intensive field exploration. Although this would considerably delay progress of the project, it was deemed essential if we were to provide reliable facts and not simply reiterate unreliable and usually faulty information. The project remained dormant, as little financial help was available, except from the MAB (Man and Biosphere) programme of UNESCO, Jakarta and for this especially created Foundation for Useful Plants of Indonesia, Jakarta (Secretary-Treasurer Mr F.R. van Blommestein).

A few years later IBPGR (International Board for Plant Genetic Resources) and WWF (World Wide Fund For Nature) set up a project to conserve useful plants *in situ*, i.e. to protect them in National Parks and the like. The first task was to find the species, make an inventory, study their ecology, distribution, and how to propagate them, etc.

Funds were obtained from IBPGR, the World Wide Fund For Nature, the local Malaysian WWF, and also from other sources to start exploration in Borneo, Sumatra and the Malay Peninsula, and for extensive herbarium work to study all collections in Kew, Paris, Leiden, Kyoto, Tokyo, Singapore and Bangkok (funds made available from the French and Dutch Governments and the Ford Foundation, Jakarta).

We were fortunate to have the help of Mr J.M. Bompard, a young botanist from the Laboratory of Botany, University of Montpellier, France, who after a short indoctrination, started field work on his own, starting with my trodden paths in E. Kalimantan. Mr Bompard was an excellent field explorer, quickly picking up the roots of local languages and thus easily communicating with and befriending local people. He was also a good photographer (most of the coloured photographs illustrating this book are his).

Our method of field work was based, as I had discovered long ago, on the fact that the primitive shifting cultivator (swidden cultivation) never destroyed trees which had any use to him. These trees were left standing when the primary forest was cut down and burnt, and seasonally visited in the upcoming secondary vegetation, when the land could no longer be used for agriculture. These trees remained the property

of the original cultivator. He collected the fruit and brought it home to his house on the river bank, where, after consumption, the seeds were thrown away. They germinated and thus a population of a species was created. In some Dayak tribes in Borneo, for example on the road from Lundu to the sea coast in Sarawak, gardens with enormous trees of different species are laid out around the houses.

We visited local markets, even very small ones far from the cities, and collected the available fruit, trying to find out where it had come from. If we were lucky, we found an old man (the younger generation knew nothing) who could provide us with the proper name of the species, its use, cultivation, etc. In this way we were able to find almost all the species in Borneo.

Not all the problems have been solved, of course, but we hope we have built a foundation for future investigations. These should mainly be based on field work, in order to prevent oversights like those of Ding Hou (cf. Chapter 4). Several species, notably from Indo-China, remain badly known. There must be unknown species, for instance in Sulawesi (Celebes), an island poorly explored, and the Moluccas. Of the species mentioned by Rumphius in 1741, half are still unknown.

Seeds and plants should be collected and widely distributed to interested mango growers all over the world and the species re-introduced in protected areas, although the latter may not be safe in Asia.

In the good old times, collectors were convinced that the number of species was limited and that a poor sterile twig was sufficient to characterize a species. These poor specimens, on which older species descriptions are based, are a headache for a taxonomist and interpretations can perhaps only be reliable, when one goes back to the type locality, where the first specimen was collected. Much sleuthing must be based on ethnobotany, which requires a sound knowledge of the local language(s) and a knowledge of the plants themselves. Uncritical lists of vernacular names, as produced in *Flora Malesiana* do more harm than good as they create confusion.

Although drawings are usually better than photographs, we ultimately preferred to illustrate this book with photographs, as salient characters were very difficult to show in line drawings.

Some of the enumerated references of the species are not repeated in the general reference list.

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Acknowledgements

I express my sincere thanks to my younger colleague Mr J.M. Bompard for the valuable field work that he performed in Kalimantan, Sumatra and the Malay Peninsula, for his constant co-operation and help in the herbarium, and for finalizing the manuscript of this book.

For financial support we have to thank UNESCO, Jakarta through the intermediary of Dr Kuswata Kartawinata, the Foundation for Useful Plants of Indonesia for their generous support of our work, through the co-operation of its Secretary Mr F.R. van Blommestein, who has always shown great interest in our work and supported us in many ways, not least by giving us the means to survive and carry on our scientific work.

Financial support from IBPGR and WWF enabled Mr Bompard to carry out field work in Kalimantan (in co-operation with the Indonesian Institute for Science (LIPI), the Indonesian Commission on Germplasm and WWF Indonesia) and in W. Malaysia (in co-operation with the Forest Research Institute, Malaysia), whereas I myself could explore Sabah, N. Borneo and Sarawak. The IBPGR also contributed funds for printing the coloured photographs.

I also thank the Netherlands' and French Governments and the Ford Foundation, Jakarta, for their financial assistance, enabling me to study the herbarium collections in London, Leiden, Paris, Bangkok and Singapore.

We are much indebted to the Directors/Keepers of the herbaria at Bangkok, British Museum, Florence, Geneva, Kew, Kyoto, Leiden, Montpellier, Paris and Singapore for the privilege of studying their mango materials and for the extensive loans of material to Bogor through the Rijksherbarium, Leiden.

Some time was spent at the Forest Research Institutes of Bogor, Kepong in Malaysia, Kuching in Sarawak and Sandakan in Sabah. We are very grateful for their hospitality.

A special word of thanks is due to Mr Anthony Lamb, Sabah Agriculture Department, who assisted us in many ways during our stays in Sabah.

Our thanks also go to Professor J.E. Vidal (P) for assistance in checking vernacular names from Indochina and to Claude Saint Pierre for the translation of the Chinese description of *M. persiciformis*.

I express also my thanks to the former Director of the Herbarium Bogoriense (Dr Soedarsono Riswan), Bogor, Indonesia, for providing me ample working space in his institute. The Data Bank of Useful Plants of S.E. Asia is now properly housed (55 large metal archive cupboards with information on 8000 species) in an adequate room.

Last, but not least, I have to thank many young Indonesian botanists for providing

material and information on obscure mango species and varieties and their proper names.

We greatly appreciate the willingness of Dr R. Hegnauer to contribute a chapter on the chemistry of the mangoes.

A.J.G.H. Kostermans

List of Illustrations

Cover photograph

A Minangkabau farmer from Rao, West Sumatra presenting the mature fruits of a semi-wild mango (*M. longipetiolata* King). This wise man planted the tree in his garden from a fruit collected in the surrounding forest. A good illustration of the contribution made by farmers to the conservation of wild crop relatives (Herb. Bompard 998, December 1989).

Illustrations in the text

Map 1. Density of *Mangifera* species (the number of endemic species of each region/ island (group) above the hyphen; the total number of species below the hyphen).

Map 2. Distribution of *M. indica* L. (in black: important areas of cultivation).

Figure A (p. 22) *M. indica* L. oldest drawing of a mango tree and its fruit. From: Bontius (1658).

Figure B (p. 23) *M. indica* L. oldest correct drawing of the fruit: *M. domestica*. From: Gaertner (1791, tab. 100).

Figure C (p. 130) *M. sylvatica* Roxb. Drawing of Indian plants, Botanical survey India, Calcutta Botanical Garden, fasc. 4.

Figure D (p. 177) *M. hiemalis* J.Y. Liang. From: Liang (1983).

Figure E (p. 180) *M. persiciformis* C.Y. Wu & T.L. Ming. From: Anon. (1980).

Illustrations in the plate section (between pages 112 and 113)

1. *M. gedebe* Miq.: Branch, fruits and stones. The fruits are much compressed, with very thin pulp (Herb. Bompard 713, Bogor Bot. Garden, VI.D.5., November 1986).
2. *M. gedebe* Miq.: Labyrinthine seed with folded cotyledons (length of the match = 4 cm).
3. *M. pentandra* Hooker f.: Inflorescence. Densely flowered and hairy panicle (Herb. Bompard 928, Kota Kinabalu, Sabah, July 1988).
4. *M. pentandra* Hooker f.: Fruits and leaves. Photograph by A. Lamb.
5. *M. griffithii* Hooker f.: The common small-fruited form, called raba takuyung (kuyung = snail) in Southern Sarawak (Herb. Bompard 952, Lundu, Sarawak, June 1989). When fully ripe, the rose red fruits turn purplish black with a rose red blush near the base.
6. *M. griffithii* Hooker f.: commonly found in orchards in Western Borneo.

7. *M. similis* Bl.: The fruits becoming black at maturity resemble those of *M. quadrifida* Jack, but the leaves are different (Herb. Bompard 743, S. Kalimantan, Kandangan, January 1987).
8. *M. torquenda* Kosterm.: Trunk and fruiting branch. The very thick and woody infructescence axis is characteristic.
9. *M. torquenda* Kosterm.: The fruit is opened for consumption by making a cross-section and twisting the two halves in opposite directions; the pulp easily detaches from the stone because of the few short thin fibres (E. Kalimantan, market of Tengarong, February 1985).
10. *M. torquenda* Kosterm.: fruiting material collected from a wild tree in lowland dipterocarp forest (Herb. Laumonier & Budih TFB 4161, Sumatra, Bengkulu, Pesisir Selatan, February 1983). Photograph by Y. Laumonier.
11. *M. applanata* Kosterm.: Fruits and leaves. Note the strongly compressed stone, with high longitudinal ridges and short fibres (Herb. Bompard 852, W. Kalimantan, Toho, January 1988).
12. *M. longipetiolata* King: The superficially fissured bark of an old tree in a fruit garden near Malacca in Malaysia.
13. *M. longipetiolata* King: Fruits and branch collected from a tree planted by this Minangkabau farmer. Note the long petioles (Herb. Bompard 998, W. Sumatra, Rao, December 1989).
14. *M. quadrifida* Jack.: Flowering tree (Sarawak, road to Lundu, June 1989).
15. *M. quadrifida* Jack.: Leaves and fruits. The fruits are first green then become covered with black dots, ultimately turning completely black (Herb. Bompard KMS 19, E. Kalimantan, Melak area, March 1985).
16. *M. quadrifida* Jack.: Form with spatulate leaves and much smaller fruits. Note the thick twigs and the pulp tinged with purple near the leathery stone (Herb. Bompard KMS 23, E. Kalimantan, Samarinda Sebrang, March 1985).
17. *M. magnifica* Kochummen: Fruits and leaves. Note the very stout petiole with its much thickened basal part. The stone is completely fibreless (Herb. Bompard 854, W. Kalimantan, Sungei Pinyu, January 1988).
18. *M. swintonioides* Kosterm.: Characteristic are the leaves with slender, long petioles, and intricate very dense conspicuous, fine reticulation (Herb. Bompard 696, E. Kalimantan, Melak, near Keai, Oct. 1986).
19. *M. swintonioides* Kosterm.: Slightly flattened and broadly pointed fruits (Herb. Bompard 701, E. Kalimantan, near Melak, Pintu Benung, Village Benung, October 1986).
20. *M. dewildei* Kosterm. Herb. de Wilde & de Wilde-Duyfjes 14469, N. Sumatra, Ketambe.
21. *M. casturi* Kosterm.: Fruit and branch (Central Kalimantan, Palangkaraya). Photograph by E. Torquebiau.
22. *M. casturi* Kosterm.: Fruits of three varieties collected near Martapura in S. Kalimantan (January 1987). (A) Kasturi; (B) Cuban: fruit rose red, not becoming fully black at maturity; (C) Pelipisan masak hijau: fruit more flattened, remaining partly green at maturity.
23. *M. zeylanica* (Bl.) Hooker f.: Branch bearing fruits (Fruit & Spice Park, Miami, July 1992).
24. *M. oblongifolia* Hooker f.: Leaves (Herb. Bompard 918, Pen. Malaysia, Negri Sembilan, S. Menyala For. Res.).