

***Garcinia* Plant Species of African Origin:**

Ethnobotanical, Pharmacological and Phytochemical Studies



Joseph Jangu Magadula & Zakaria Heriel Mbwambo

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Phytochemical Studies**

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*This book is dedicated to
the late Professor Zakaria H. Mbwambo who
passed away
on 19th July 2014 while it was at its
publishing/printing stage*

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Foreword

The search for plants that heal still represents a fascinating task. Before the Synthetic Era, almost all medicines were obtained from plant tissues and organs: roots, barks, stems, leaves, flowers and fruits. Self-medication was also observed in non-human primates to control parasitic infections and provide relief from gastrointestinal upsets. Therefore, in these terms, it seems that medicinal plant-animal coevolution is more ancient than the medicinal plant-human one, and that self-meditative behavior of non-human primates represented the evolutionary force for human traditional herbal medicine. The history of pharmacognosy is full of famous examples: the antimalarial alkaloid quinine from *Cinchona* tree, cardiac glycosides from *Digitalis* spp., curare from *Chondrodendron tomentosum*, the antipsychotic indole alkaloid reserpine from *Rauwolfia serpentina* and, among anticancer drugs, taxol from *Taxus brevifolia*, vincristine and vinblastine from *Catharanthus roseus* and camptothecin for *Camptotheca acuminata*. *Garcinia* species enrich this plentiful scenario, by virtue of their bio- and chemodiversity and healthy properties. In this book, the authors provide a comprehensive and updated survey on African *Garcinia* plants, with emphasis on eastern Africa species, focusing on botanical, ethnobotanical, ethnopharmacological and phytochemical aspects. The authors are very expert in the field of *Garcinia* research, as shown by their relevant publications on these topics.

Professor, Marcello Iriti, 2014

Editor-in-Chief

European Journal of Medicinal Plants

Preamble (About This Book)

This book has been written as a way of documenting the research results done by the authors and other researchers over years on the African *Garcinia* plants. Generally, the book is based on the area of academic training of the authors, which is the organic chemistry and in particular, the Chemistry of Natural Products.

This book has been arranged in four chapters. The first chapter gives an overview of the *Garcinia* plant species growing in Tanzania, a country of domicile of the authors of this book. Furthermore, the localities in Tanzania where the plants are collected are included together with the basic features of some *Garcinia* plants growing in Tanzania.

Chapter two is devoted to the ethnobotanical information on the genus *Garcinia* whereby general botanical description of a *Garcinia* plant is given. In addition, the traditional uses (ethnopharmacological information) of *Garcinia* plants growing in Africa are included in a tabular form.

Chapter three is committed to the pharmacological activities of African *Garcinia* plants. This includes the biological activities on various crude extracts and compounds from African *Garcinia* plants, including antibacterial, antimalarial, cytotoxic, antioxidant, antifungal and antiviral activities. The table included in this chapter contains biological activities of extracts from 13 African *Garcinia* plant species tested either *in vitro* or *in vivo* for various microorganisms. Furthermore, the **structures** (1-40) of some biologically active compounds are presented.

Chapter four deals with the phytochemistry of African *Garcinia* plants, from which over 100 natural product compounds have been isolated. The major

classes of compounds reported being benzophenones, flavonoids, triterpenoids and xanthenes. In this chapter, it has been revealed that *G. kola* which is reported to grow in many West and Central African countries is the most studied plant among the African *Garcinia* species both pharmacologically and phytochemically points of view.

It is our trust that, this book will provide potential and useful reference materials for the natural products researchers. It will also offer useful academic and technical information to ethnobotanists, ethnopharmacologists, pharmacologists, phytochemists and foresters in Africa and all over the global.

We hope that you will enjoy reading this book.



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&

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Dar es Salaam, 2014

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General Introduction

The genus *Garcinia* belongs to the family Clusiaceae, subfamily Clusioideae and the tribe Garcinieae. The name *Garcinia* honors a French botanist, Laurent Garcin (1683-1751) who lived and worked in India, where the genus is highly varied (Glen, 2004). This genus is considered to have over 450 plant species worldwide out of which about 300 species are found to the tropical Africa, Madagascar, tropical Asia, NE Australia, Polynesia, tropical America and China (Perry and Metzger, 1980).

Here underneath is the taxonomic hierarchy of the genus *Garcinia*:

KINGDOM	Plantae
DIVISION	Magnoliophyta
CLASS	Eudicotyledoneae
ORDER	Malpighiales
FAMILY	Clusiaceae
TRIBE	Garcinieae
GENUS	<i>Garcinia</i>
SPECIES	(Ca 600 species worldwide)

Currently, it is not well documented on the exact number of *Garcinia* species available in Africa, only scattered reports can be cited. For instances, in Madagascar and the Comoros alone there are about 32 *Garcinia* species reported to grow in the rain forests, with almost all of them being endemic to this country (Sweeney and Rogers, 2008) while in Tanzania only 15 *Garcinia* species are reported, most of them being scattered along the Eastern Arc Mountains (Magadula and Tewtrakul, 2010). In West Africa, about 50 *Garcinia*

species are reported to grow, with 20 of them been reported from Cameroon (Agyili et al., 2007) and the rest distributed in other West African countries. In South Africa, only two (2) *Garcinia* species namely *G. gerrardii* and *G. livingstoneii* (African mangosteen) are reported to be indigenous and they are famous in traditional medicine (Palgrave et al., 2002). The distribution of *Garcinia* plant species in Africa indicated the plants to grow and being reported phytochemically and pharmacologically from only 20 African countries mainly in the south of Sahara region (Fig. 1).

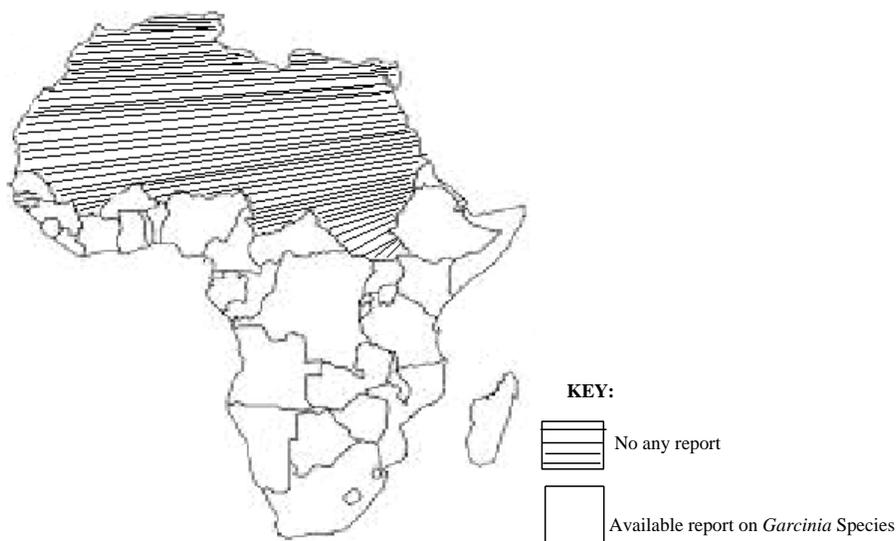


Fig. 1. Distribution map of African *Garcinia* plants showing countries reported to have *Garcinia* species.

In total, about 80 *Garcinia* species are reported to grow in Africa. However, only 21 *Garcinia* species have been investigated phytochemically and/or pharmacologically. Currently, more than 130 compounds have been identified in *Garcinia* plants, of these 39% are xanthenes, 27% are flavonoids, 10% are triterpenoids, 8% are benzophenones and 16% are other classes of compounds, with some of them being isolated from *Garcinia* plants for the first time. The

phytochemical reports included in this book indicate that only a small fraction of African *Garcinia* plants have been studied for their chemical constituents. This necessitates further work to be done on an uninvestigated species.

Due to the importance of *Garcinia* plants in terms of medicine, food and in plant species distribution and biodiversity, this report therefore intends to put together a record of what is known about the genus *Garcinia* in Africa. If not assembled and documented, such information, which is usually scattered in various literatures, herbaria records and other unpublished sources, will not be easily accessible to give comprehensive picture of the value of the African *Garcinia* species. It is anticipated that compilation of the information will also provide new direction in conservation and sustainable management of these important medicinal plants.

Despite recent progress in phytochemical and pharmacological studies from the African *Garcinia* species, significant gaps still exist concerning both safety and toxicity aspects of some extracts and pure compounds. Further investigations have to be done including clinical studies, more phytochemical discoveries and subsequent screening tests aiming at opening new opportunities to develop drugs from *Garcinia* constituents. This book, therefore, provides useful clues to promote further investigations for the development of new phytopharmaceuticals or lead compounds from the genus *Garcinia*. Furthermore, this book will give basic information on sustainable exploitation and possible conservation strategies for African *Garcinia* plants.

