

Aloes



The genus *Aloe*

Edited by Tom Reynolds

Medicinal and Aromatic Plants — Industrial Profiles



CRC PRESS

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Aloes

The genus *Aloe*

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Aloes, edited by Tom Reynolds

To my wife

Si Monumentum Requirit Circumspice

Attr. Son of Sir Christopher Wren

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Preface to the series

There is increasing interest in industry, academia and the health sciences in medicinal and aromatic plants. In passing from plant production to the eventual product used by the public, many sciences are involved. This series brings together information which is currently scattered through an ever increasing number of journals. Each volume gives an in-depth look at one plant genus, about which an area specialist has assembled information ranging from the production of the plant to market trends and quality control.

Many industries are involved such as forestry, agriculture, chemical, food, flavour, beverage, pharmaceutical, cosmetic and fragrance. The plant raw materials are roots, rhizomes, bulbs, leaves, stems, barks, wood, flowers, fruits and seeds. These yield gums, resins, essential (volatile) oils, fixed oils, waxes, juices, extracts and spices for medicinal and aromatic purposes. All these commodities are traded worldwide. A dealer's market report for an item may say 'Drought in the country of origin has forced up prices'.

Natural products do not mean safe products and account of this has to be taken by the above industries, which are subject to regulation. For example, a number of plants which are approved for use in medicine must not be used in cosmetic products.

The assessment of safe to use starts with the harvested plant material which has to comply with an official monograph. This may require absence of, or prescribed limits of, radioactive material, heavy metals, aflatoxin, pesticide residue, as well as the required level of active principle. This analytical control is costly and tends to exclude small batches of plant material. Large scale contracted mechanized cultivation with designated seed or plantlets is now preferable.

Today, plant selection is not only for the yield of active principle, but for the plant's ability to overcome disease, climatic stress and the hazards caused by mankind. Such methods as *in vitro* fertilization, meristem cultures and somatic embryogenesis are used. The transfer of sections of DNA is giving rise to controversy in the case of some end-uses of the plant material.

Some suppliers of plant raw material are now able to certify that they are supplying organically-farmed medicinal plants, herbs and spices. The Economic Union directive (CVO/EU No. 2092/91) details the specifications for the *obligatory* quality controls to be carried out at all stages of production and processing of organic products.

Fascinating plant folklore and ethnopharmacology leads to medicinal potential. Examples are the muscle relaxants based on the arrow poison, curare, from species of *Chondrodendron*, and the anti-malarials derived from species of *Cinchona* and *Artemisia*.

The methods of detection of pharmacological activity have become increasingly reliable and specific, frequently involving enzymes in bioassays and avoiding the use of laboratory animals. By using bioassay linked fractionation of crude plant juices or extracts, compounds can be specifically targeted which, for example, inhibit blood platelet aggregation, or have anti-tumour, or anti-viral, or any other required activity. With the assistance of robotic devices, all the members of a genus may be readily screened. However, the plant material must be *fully* authenticated by a specialist.

The medicinal traditions of ancient civilizations such as those of China and India have a large armamentaria of plants in their pharmacopoeias which are used throughout South-East Asia. A similar situation exists in Africa and South America. Thus, a very high percentage of the World's population relies on medicinal and aromatic plants for their medicine. Western medicine is also responding. Already in Germany all medical practitioners have to pass an examination in phytotherapy before being allowed to practise. It is noticeable that throughout Europe and the USA, medical, pharmacy and health related schools are increasingly offering training in phytotherapy.

Multinational pharmaceutical companies have become less enamoured of the single compound magic bullet cure. The high costs of such ventures and the endless competition from 'me too' compounds from rival companies often discourage the attempt. Independent phytomedicine companies have been very strong in Germany. However, by the end of 1995, eleven (almost all) had been acquired by the multinational pharmaceutical firms, acknowledging the lay public's growing demand for phytomedicines in the Western World.

The business of dietary supplements in the Western World has expanded from the health store to the pharmacy. Alternative medicine includes plant-based, products. Appropriate measures to ensure the quality, safety and efficacy of these either already exist or are being answered by greater legislative control by such bodies as the Food and Drug Administration of the USA and the recently created European Agency for the Evaluation of Medicinal Products, based in London.

In the USA, the Dietary Supplement and Health Education Act of 1994 recognized the class of phytotherapeutic agents derived from medicinal and aromatic plants. Furthermore, under public pressure, the US Congress set up an Office of Alternative Medicine and this office in 1994 assisted the filing of several Investigational New Drug (IND) applications, required for clinical trials of some Chinese herbal preparations. The significance of these applications was that each Chinese preparation involved several plants and yet was handled as a *single* IND. A demonstration of the contribution to efficacy, of *each* ingredient of *each* plant, was not required. This was a major step forward towards more sensible regulations in regard to phytomedicines.

My thanks are due to the staffs of Harwood Academic Publishers and Taylor & Francis who have made this series possible and especially to the volume editors and their chapter contributors for the authoritative information.

Roland Hardman, 1997

Preface

Aloes provide a fascinating subject for research from a chemical, biochemical, pharmaceutical, taxonomic, horticultural and economic point of view. Their use as medicinal plants is mentioned in many ancient texts, including the Bible, although here as elsewhere there may be doubts as to the botanical identity of the material.

This multitude of medicinal uses described and discussed over the centuries is sometimes difficult to evaluate. Authors such as Crosswhite and Crosswhite (1984) have given detailed accounts of the drug in classical antiquity, concentrating on the species *Aloe vera* which seems to be the main one in use, with *Aloe perryi* from Socotra mentioned more rarely. While the acquisition of Socotra by Alexandra the Great to ensure supplies of *A. perryi* to treat his troops is well known and presumed true, the origins of *A. vera* are obscure. The plant is recorded from lands around the Mediterranean back to Mesopotamian times and was subsequently carried to the Atlantic islands and the West Indies to the west and India and China to the east. It is almost impossible to distinguish stands of plants to be of either introduced or native origin, although Hepper (personal communication) claims to have seen specimens growing in Yemen in regions so remote as to preclude the possibility of introduction, while Newton (personal communication) also places the origin somewhere in the Arabian peninsula. An interesting commentary on the value accorded to *A. vera* is its use as a 'door plant' where a detached branch is suspended over the threshold where it remains alive and even flowers, with the connotation of immortality. This practice has been observed, albeit with *A. arborescens*, in Rhodes at the present day (Reynolds, unpublished observation) and is no doubt still widespread. In other parts of the world aloes have almost as long a history. Bruce (1975) and Morton (1961) mention varied uses in India, China and the East Indies while its cultivation and use in South America and the Caribbean has been described by Hodge (1953). A note of caution is needed for New World records because sometimes *Agave* and its products have been mentioned as 'American aloes', although they are not related. Hodge also describes the Cape aloes industry in South Africa which provides the purgative drug aloes. Aloe products in one form or another from a multitude of species are used throughout Africa for a variety of folk medicinal purposes. (Watt and Breyer-Brandwyk, 1962). Although the efficacy of these folk remedies has not been substantiated, there must surely be some validity in some of the many claims, enough at least to stimulate further research.

The sticky aloe gel from the interior of the leaves of many species has been valued as a sovereign cure for skin ailments and is still treasured as such, either directly from the plant or over-the-counter in a host of preparations. Other therapeutic effects are

claimed, some convincingly, some less so. Strangely, the active ingredients responsible for the healing have not been identified, nor has it been clear precisely what the biochemical targets are. Both these mysteries are gradually being resolved and are proving to have many aspects. Chapters in this book by researchers from Texas describe work which is starting to unravel this amazing story. At the same time precise descriptions of procedure are given on how and how not to prepare the commercial product from its best known source, *Aloe vera*. One wonders how many reports of therapeutic failure in the past have been due to the use of badly processed material.

The Japanese have long used *Aloe arborescens* medicinally and contributions from that country give much information about the plant and its products.

Quite apart from the gel, the outer layers of the leaf, when cut, produces an exudate which provides the drug bitter aloes, well known and perhaps dreaded as a purgative with a particular griping action. The source of this substance is usually either *Aloe ferox* from South Africa (Cape aloes) or *Aloe perryi* from Socotra (Socotran aloes) and sometimes *Aloe vera* (Curaçao aloes). Not all species produce bitter exudates nor are all purgative and in fact some species produce little or no exudate. Cells adjacent to the leaf vascular bundles contain the exudate which is released on cutting but it has not been established that these cells actually produce the exudate constituents. In some species fibres occupy the position of these secretory cells. The purgative principle is well known as an anthrone C-glucoside but many other compounds, mostly of a phenolic nature, have been recognized as zones on thin-layer chromatograms in one or other of the many species examined. From the 300 or so species so far investigated chemically, about 80 major chromatographic zones have been recognized. Of these entities, however, only about a third have chemical structures ascribed. The identification and distribution among the species of these compounds affords much stimulating research for the chemist and the taxonomist. Together with the wealth of folk medicine lore, apart from use of the gel, there is much scope for investigating the biological activity of the many aloe compounds.

We must not forget the plants themselves in this flurry of sophisticated research. About 400 species have been described so far, ranging in distribution from the Cape up to the Sahara and into Arabia and two well-known African botanists have contributed chapters describing them. Aloes occur in a wide range of sizes from a few inches to many tens of feet and have many habits. They are more or less succulent and although typical of semi-arid savannah, species are found in dry deserts, cliff faces and even under the spray of a waterfall. Some are very widespread in their distribution, while some occupy perhaps just a single hillside. The flowers are basically typical of the species but vary in form as well as in colour, being red, orange, yellow and even white. These attractive plants drew the attention of early explorers and several species were brought back to Europe for cultivation. In particular *Aloe arborescens* and *Aloe saponaria* are frequently seen as ornamentals, while *Aloe vera*, for its medicinal properties, was carried from an unknown provenance across the world from the West Indies to China.

So, this book is in a sense a milestone or perhaps a turning point. Together with other recent reviews it lays down knowledge of aloes acquired over the last half-century and also lays a foundation for an immense amount of further research into this fascinating genus, knowledge which will bring immense value, intellectually and practically.

This book was produced with the encouragement of Professor Monique Simmonds at Royal Botanic Gardens, Kew. I am grateful to all the authors for their painstaking efforts to prepare their chapters. I would like to thank Dr Roland Hardman, the series editor, for constant advice and reassurance during the book's production.

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Aloe vera plant growing in Barranco de Infierno, Tenerife, apparently native but in reality an escape from cultivation. (Photo, L.A. Reynolds) (see *Colour Plate 1*).

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