# Table of Content

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreword</td>
<td>iv</td>
</tr>
<tr>
<td>The Centurion Declaration</td>
<td>vii</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>viii</td>
</tr>
<tr>
<td>Acacia senegal</td>
<td>1</td>
</tr>
<tr>
<td>Adansonia digitata</td>
<td>7</td>
</tr>
<tr>
<td>Aframomum melegueta</td>
<td>14</td>
</tr>
<tr>
<td>Agathosma betulina</td>
<td>19</td>
</tr>
<tr>
<td>Aloe ferox</td>
<td>24</td>
</tr>
<tr>
<td>Antidesma madagascariense</td>
<td>29</td>
</tr>
<tr>
<td>Aphloia theiformis</td>
<td>33</td>
</tr>
<tr>
<td>Artemisia afra</td>
<td>37</td>
</tr>
<tr>
<td>Aspalathus linearis</td>
<td>43</td>
</tr>
<tr>
<td>Balanites aegyptiacus</td>
<td>48</td>
</tr>
<tr>
<td>Boswellia sacra</td>
<td>54</td>
</tr>
<tr>
<td>Bulbine frutescens</td>
<td>60</td>
</tr>
<tr>
<td>Cajanus cajan</td>
<td>64</td>
</tr>
<tr>
<td>Carissa edulis</td>
<td>70</td>
</tr>
<tr>
<td>Catharanthus roseus</td>
<td>73</td>
</tr>
<tr>
<td>Centella asiatica</td>
<td>78</td>
</tr>
<tr>
<td>Combretum micranthum</td>
<td>84</td>
</tr>
<tr>
<td>Commiphora myrrha</td>
<td>88</td>
</tr>
<tr>
<td>Cryptolepis sanguinolenta</td>
<td>94</td>
</tr>
<tr>
<td>Cyclopia spp.</td>
<td>103</td>
</tr>
<tr>
<td>Danais fragrans</td>
<td>108</td>
</tr>
<tr>
<td>Euphorbia hirta</td>
<td>111</td>
</tr>
<tr>
<td>Garcinia kola</td>
<td>117</td>
</tr>
<tr>
<td>Griffonia simplicifolia</td>
<td>121</td>
</tr>
<tr>
<td>Harpagophytum procumbens</td>
<td>127</td>
</tr>
<tr>
<td>Harungana madagascariensis</td>
<td>135</td>
</tr>
<tr>
<td>Hibiscus sabdariffa</td>
<td>141</td>
</tr>
<tr>
<td>Hoodia gordonii</td>
<td>147</td>
</tr>
<tr>
<td>Hypoxis hemaerocallidea</td>
<td>152</td>
</tr>
<tr>
<td>Ipomoea pes-caprae ssp. brasiliensis</td>
<td>157</td>
</tr>
<tr>
<td>Kigelia africana</td>
<td>162</td>
</tr>
<tr>
<td>Mondia whitei</td>
<td>167</td>
</tr>
<tr>
<td>Moringa oleifera</td>
<td>172</td>
</tr>
<tr>
<td>Nauclea latifolia</td>
<td>178</td>
</tr>
<tr>
<td>Pelargonium sidoides</td>
<td>184</td>
</tr>
<tr>
<td>Prunus africana</td>
<td>188</td>
</tr>
<tr>
<td>Rauvolfia vomitoria</td>
<td>194</td>
</tr>
<tr>
<td>Ravenala madagascariensis</td>
<td>201</td>
</tr>
<tr>
<td>Sceletium tortuosum</td>
<td>205</td>
</tr>
<tr>
<td>Siphonochilus aethiopiclus</td>
<td>209</td>
</tr>
<tr>
<td>Strophantus gratus</td>
<td>213</td>
</tr>
<tr>
<td>Sutherlandia frutescens</td>
<td>218</td>
</tr>
<tr>
<td>Terminalia sericea</td>
<td>223</td>
</tr>
<tr>
<td>Toddalia asiatica</td>
<td>228</td>
</tr>
<tr>
<td>Trichilia emetica</td>
<td>233</td>
</tr>
<tr>
<td>Vernonia amygdalina</td>
<td>238</td>
</tr>
<tr>
<td>Vernonia colorata</td>
<td>247</td>
</tr>
<tr>
<td>Voacanga africana</td>
<td>253</td>
</tr>
<tr>
<td>Warburgia salutaris</td>
<td>260</td>
</tr>
<tr>
<td>Xylopia aethiopica</td>
<td>264</td>
</tr>
<tr>
<td>Xysmalobium undulatum</td>
<td>269</td>
</tr>
<tr>
<td>Methods and procedures</td>
<td>274</td>
</tr>
<tr>
<td>Appendix 1 - Extractability and toxicity assays</td>
<td>286</td>
</tr>
<tr>
<td>Appendix 2 - Standard specifications</td>
<td>288</td>
</tr>
<tr>
<td>Appendix 3 - Full monograph template</td>
<td>289</td>
</tr>
</tbody>
</table>
Foreword

This book is dedicated to all the African healers, whose recorded and unrecorded wisdom and experience forms the basis of scientific enquiry into the manufacture and use of traditional herbal remedies in African Society. We would also like to pay homage to all those scientists and researchers who have dedicated their careers to the study of African medicinal plants and herbal medicine.

Although Sub-Saharan Africa and the Indian Ocean Islands contain about 60,000 of the world’s higher plant species, roughly a quarter of the world’s total, less than 8% of the 1,100 medicinal plants commercialised internationally are African in origin. This situation has largely arisen because information on the traditional uses of African plants has seldom been written down but rather transferred orally from generation to generation by story tellers and traditional healers.

Medicinal plants constitute an extremely important resource for the development of the global pharmaceutical, cosmetic, and fragrance industry. More than 40% of licensed drugs are originally of plant origin. In Africa, indigenous medicine is usually the most important form of treatment, a culturally accepted practice that forms part of a diverse local health system. WHO estimate that 80% of the world’s population depends on medicinal plants for their primary healthcare. In much of rural Africa it is the only form of therapy that exists.

African herbal medicine relies more on wild harvested plants than any continent on earth yet the sustainability of this indigenous resource is increasingly endangered. It has been estimated that the continent has some 216 million hectares of closed forest with a calculated loss through deforestation of 1% per annum (The global average loss rate is 0.6%) This means Africa has the highest rate of deforestation in the world. The direct impact of this massive loss of bio-diversity is that many medicinal plants will become extinct even before they are documented.

Loss of plants also means loss of accompanying traditional knowledge. The value of countless generations of observations of the application of certain plants on human and animal disorders is impossible to value, especially in relation to present day global bio-prospecting activities. The preparation of the African Herbal Pharmacopoeia hence comes at a critical moment in the history of African herbal medicine.

In 2000 a Commonwealth Medicinal Plants Business Forum was held in Cape Town with delegates from across Africa. One of the major constraints to the growth of a modern African phytomedicines industry identified by the Forum is the lack of suitable technical specifications and quality control standards. This makes it extremely difficult for buyers whether national or international to evaluate the safety and efficacy of plants and extracts or compare batches of product from different places or from year to year. This is in marked contrast with Europe and Asia where traditional methods and formulations have been recorded and evaluated both at the local and national level. Consequently the level of world trade in European and Asian medicinal plants and extracts is far greater than those from Africa. This situation will not change unless Africa also publishes an internationally recognised herbal pharmacopoeia prepared by researchers of international standing and integrity.

It was against this background that the EU-ACP Centre for the Development of Enterprise in 2003 approved a project to identify the fifty most important African Medicinal Plants in commerce and to prepare a set of quality control standards/monographs for the chosen species. The complete set would include the key African plants presently traded regionally or internationally as well as plants considered
as having long term future potential. These standards were to combine data used for scientific plant monographs with information normally contained in trade specifications and quality control data sheets. The resulting monographs are designed for both local users of medicinal plants as well as the international pharmaceutical industry.

Six African institutions were short listed to prepare the standards. In 2004 the contract was awarded to the Phytomedicine Programme of the University of Pretoria on the understanding that scientists from across Africa were recruited to help prepare monographs in their respective regions.

There have been previous attempts to develop herbal pharmacopoeias in Africa. These had three main limitations. Firstly they were usually regional in scope, secondly plant selection was largely random, often including plants of non-African origin, and thirdly the research work was usually conducted by small groups of academic researchers with limited input from growers, processors and end users of African medicinal plants and extracts. If the AAMPS Pharmacopoeia was to be accepted throughout Africa and beyond it was vital that as many stakeholders as possible be involved in the preparation process and leading national and international experts on African herbal medicine be consulted.

With funding from the European Union a large number of role players were brought together to determine what components should be included in each monograph and to select the most important species to research. Despite large regional variations it was very encouraging to note that amongst the scientists, healers, harvesters, exporters and importers attending these meetings there was little disagreement as to which species to select and what components should be included in the individual standards/monographs.

It was during one of these consultation meetings at Centurion in May 2005 that delegates decided that the preparation of the African Herbal Pharmacopoeia (AfrHP) was of sufficient importance to establish an organisation dedicated specifically to this task. As a result the African Association of Medicinal Plants Standards (AAMPS) was set up in Mauritius with a mandate, enshrined in the Centurion Declaration, to prepare and disseminate a comprehensive, internationally acceptable Pharmacopoeia and to build a living database to continuously upgrade and expand this work.

AAMPS monographs provide comprehensive and up to date botanical, biochemical, pharmacological and commercial information on more than fifty of the most important medicinal plants used in Africa. They have been prepared by many of Africa’s leading scientists and subsequently reviewed by an international expert panel. Plant samples for each monograph were sourced from around the continent and subject to biochemical analysis and fingerprinting. After evaluation by the AAMPS Scientific Committee several additional features were suggested including the micro morphology of the plant material, distribution maps, HPLC traces and TLC chromatograms of adulterants. While the printed version of the Pharmacopoeia does not include all these features they will be added at a later stage. The scope and quality of AAMPS herbal monographs are, however, similar to those prepared in Europe, North America and Asia. Each monograph contains information required by producers, collectors and traders in medicinal plants and extracts as well as technical data needed by researchers, manufacturers and practitioners.

It has always been AAMPS intention that the African Herbal Pharmacopoeia is a living database which could be accessed on the World Wide Web. One important advantage of the living database is that gaps in our knowledge can be identified as research projects and new information and new plants added. This makes it possible to continuously expand and enhance the African Herbal Pharmacopoeia and keep it relevant and up to date.

The preparation of the African Herbal Pharmacopoeia has taken more than six years of dedicated work by thirty-one experts in African medicinal plants and herbal medicine. We are fully aware that there are gaps in our knowledge and understanding. Some plants have been the subject of intensive study over
many years; others have received little or no attention. For some monographs we obtained help from the undisputed world authorities in the field. In others such in depth expertise was simply not available to us. This made it very difficult to prepare monographs to a uniform standard. In some instances significant gaps meant we had to leave out certain monographs that were to be included in the AfrHP. These will now be included in the living database or in later versions of the printed Pharmacopoeia.

There is clearly much more work to be done both in expanding and upgrading the AfrHP and equally important promoting these standards nationally and internationally. Our dream is that this work will not only generate income and employment for all those working in Africa in this sector but also unlock the health benefits of these unrealised medicinal plants.

Thomas Brendler, Kobus Eloff, Ameenah Gurib-Fakim, Denzil Phillips
Editors. June 2010
THE CENTURION DECLARATION

“We, the undersigned, with a view to improving the health, safety, welfare and livelihood of the people of Africa, hereby declare the intention:

To establish an Association with a registered office in Mauritius to support the African herbal industry and regulatory authorities by developing quality control and quality assurance standards for African medicinal plants and herbal medicines.

To offer membership of the newly formed association to any individual or organisations dedicated to the establishment of such standards and to the creation of an African Herbal Pharmacopoeia

To jointly review and promote the 20 African herbal profiles currently being prepared by the Phytomedicine Programme, University of Pretoria. These herbal profiles include plants of African origin, which are considered of regional and international importance and which can be sustainably sourced in Africa.

To raise funds to prepare and disseminate a further 30 African herbal profiles selected by the founding members of the association at the Centurion Lake Hotel review meeting on May 2005.

To prepare and publish an African Herbal Pharmacopoeia as a living database drawn initially from the 50 herbal profiles and to promote its use nationally and internationally.

To help obtain international acceptance of these herbal standards and the subsequent herbal pharmacopoeia and to lobby health authorities throughout Africa to use such standards to facilitate licensing safe and effective herbal medicines in Africa.

To promote capacity building in Africa for the establishment of regional training centres for certification, compliance and quality control of herbal medicines.

To promote the safe, sustainable national and international trade in the fifty-one profiled African medicinal plants.

To carry out any other activities deemed by the members of the association to further the objectives of the Association.

Signed 29th May 2005
Acknowledgements

THE EDITORS GRATEFULLY ACKNOWLEDGE CONTRIBUTIONS MADE BY INDIVIDUALS AND ORGANIZATIONS. THIS PUBLICATION WOULD NOT HAVE BEEN POSSIBLE WITHOUT THEIR DEDICATION.

Individuals

Abegaz, Berhanu (Botswana)
Addy, Marian (Ghana)
Aigwekwe, Ngozi (Nigeria)
Bah, Sekou (Mali)
Brendler, Thomas (Germany)
Cole, Dave (Namibia)
Dagne, Ermias (Ethiopia)
Diallo, Drissa (Mali)
Eloff, Kobus (South Africa)
Feiter, Ulrich (South Africa)
Gericke, Nigel (South Africa)
Gurib-Fakim, Ameenah (Mauritius)
Houghton, Peter (UK)
Juliani, Rodolfo (USA)
Lombard, Cyril (Namibia)
McGaw, Lyndy (South Africa)
Millogo, Hassanata (Burkina Faso)
Mortensen, Danielle (USA)
Phillips, Denzil (UK)
Rasoanaivo, Philippe (Madagascar)
Sanogo, Rokia (Mali)
Simmonds, Monique (UK)
Simon, Jim (USA)
Sittie, Archibald (Ghana)
Scott, Gillian (South Africa)
van Damme, Patrick (Belgium)
van Wyk, Ben-Erik (South Africa)
Vlietinck, Arnold (Belgium)
Wambebe, Charles (Nigeria)
Wegner, Susan (Canada)
Willcox, Merlin (UK)
Organisations

Agribusiness in Sustainable Natural African Plant Products, Accra, Ghana
American Botanical Council, Austin, Texas, USA
American Herbal Manufacturers Association, Washington D.C., USA
American Herbal Pharmacopoeia, Scott Valley, California, USA
Bioresources Conservation and Development Programme, Nsukka, Nigeria
Bio-Enterprise Development Programme, Laikipia, Kenya
Biomox Pharmaceuticals, Pretoria, RSA
Centre for Research Information Action in Africa, Windhoek, Namibia
Council for Scientific and Industrial Research, Accra, Ghana
Council for Scientific and Industrial Research, Pretoria, RSA
Department of Traditional Medicine, Bamako, Mali
Fairwild Foundation, Weinfelden, Switzerland
Indigenous Plants Use Forum for Southern Africa, Johannesburg, RSA
International Centre for Agro-Forestry, Nairobi, Kenya
International Foundation for Science, Stockholm, Sweden
Kings College London, London, England
Natural Product Research Network for East and Central Africa, Nairobi, Kenya
Parceval (Pty) Ltd, Wellington, RSA
Phytomedica Ltd, Rumuruti, Kenya
Phytotrade, Harare, Zimbabwe
Plant Resources of Tropical Africa, Nairobi, Kenya
Research Initiative on Traditional Anti Malarial Methods, Oxford, England
Royal Botanic Gardens, Kew, Richmond, England
Rutgers University, New Brunswick, USA
Society for Medicinal Plant Research, Neunkirchen am Brand, Germany
South African National Biodiversity Institute, Pretoria, RSA
University of Addis Ababa, Addis Ababa, Ethiopia
University of Antwerp, Antwerp, Belgium
University of Botswana, Gaborone, Botswana
University of Cape Town, Cape Town, RSA
University of Ghana, Accra, Ghana
University of Johannesburg, Johannesburg, RSA
University of Mauritius, Re„duit, Mauritius
University of Nairobi, Nairobi, Kenya
University of Ouagadougou, Ouagadougou, Burkina Faso
University of Pretoria, Pretoria, RSA
University of the Western Cape, Cape Town, RSA
Vicdoris Pharmaceuticals, Accra, Ghana
West Africa Network Natural Products Research Scientists, Burkina Faso
WHO Drug Monitoring Centre, Uppsala, Sweden

Image Credits

Addy, Marian
Archive Aidemet
Brendler, Thomas
Dagne, Ermias
Feiter, Ulrich
Gurib-Fakim, Ameenah
Juliani, Rodolfo

van Wyk, Ben-Erik
Wambebe, Charles
Willcox, Merlin

TLC and NIR images: Phytomedicine Programme, University of Pretoria, RSA.
Distribution maps: Royal Botanic Gardens, Kew, Richmond, England
Monographs
Acacia senegal

GENERAL DESCRIPTION

Scientific Name with Author: *Acacia senegal* Willd.


Family: Leguminosae: Mimosoideae

Vernacular Names: Akovia, aiti, bulbi, gum acacia, gum arabic tree, gum tree, gommier, gommier blanc, kikwata, kouait, mgunga, patuki, shagar samgh arabi, three-thorned acacia, white gum-acacia.

Botanical Description: This deciduous shrub or small to medium-sized tree can reach a height of up to 15 m tall. The bark is yellowish-brown to purplish-black, rough or smooth, papery and sometimes peeling off in strips, deeply fissured and blackish on old trees. The crown is slightly rounded and somewhat spreading. The branches are spindly; branchlets glabrous to densely pubescent, with prickles just below the nodes. Leaves alternate, bipinnate; petiole, rachis sparingly to densely dressed with spreading hairs but rarely glabrous. Inflorescence is an axillary spike, reaching up to 12 cm long, axis densely pubescent or glabrous. The bisexual flowers are white or cream in colour; corolla 3 – 4 mm long; stamens numerous. Fruit is an oblong pod, greyish brown in colour, dehiscent and containing up to 7 seeds. The latter are horseshoe-shaped. Sapwood pale to creamy yellow, heartwood pale to dark brown.

Origin and Distribution: *Acacia senegal* is widely distributed in the drier parts of tropical Africa, from Senegal and Mauritania in the west to Eritrea and Ethiopia in the northeast and to South Africa in the south. Of the 4 recognized varieties, var. *senegal* is the most widespread and is found throughout the area of distribution of *Acacia senegal* except along the west coast of central and southern Africa; outside Africa it occurs in Oman, Pakistan and India and has been introduced into Egypt, Australia, Puerto Rico, and the Virgin Islands. This variety is the major source of gum arabic. *Acacia senegal* var. *kerensis* Schweinf. occurs in Ethiopia, Somalia, Uganda, Kenya, and Tanzania; var. *leiorhachis* Brenan throughout eastern Africa from Ethiopia to South Africa; var. *rostrata* (Sim) Brenan in the same area and in Namibia and Angola, and possibly also in Oman (Schmelzer & Gurib-Fakim, 2008).

Plant Part Used: Gum exudates. Gum arabic is defined as a dried exudation obtained from the stems and branches of *Acacia senegal* or related species of *Acacia* (Billaud et al., 1996).
ETHNOBOTANICAL INFORMATION

Major Ethnopharmacological Uses: The root decoction is used in East Africa against constipation and gonorrhoea while the decoction of the bark is drunk to treat diarrhoea and stomach disorders (Kokwaro, 1993). Bark, leaves, and gum are antitussive, expectorant and astringent, and used to treat colds, ophthalmia, diarrhoea, haemorrhages, coughs, dysentery, gonorrhoea, haemorrhage, sore throat, typhoid, urinary tract infection. In causing partial destruction of many alkaloids including atropine, hyoscyamine, scopolamine, homatropine, morphine, apomorphine, cocaine, and physostigmine, gum arabic might be viewed as a possible antidote (Burkill, 1995). The seed contains a fat which is used both in medicine and for soap making.

*Acacia* is commonly present in chewing sticks, mainly as an antimicrobial with activity against *Streptococcus fecalis*.

Other Relevant Uses: Food: Gum arabic from *Acacia senegal* is commonly used as an additive in foodstuffs. It is easily soluble in water and forms solutions over a wide range of concentrations. It has highly valued emulsifying, stabilizing, thickening and suspending properties and does not become viscous. The food industry uses 60–75% of the world production. In confectionery, gum arabic is used to prevent crystallization of sugar, as an emulsifier, and as a glaze or topping in bakery products; in soft drinks and alcoholic drinks it is used either as a vehicle for flavouring or as a stabilizer or clouding agent; in frozen dairy products gum arabic is used for encapsulating flavours such as citrus oils. Gum arabic is used locally in special dishes and as chewing gum.

Industry: Gum arabic is used in the printing industry for coating offset lithographic plates to prevent oxidation, to increase their hydrophilic properties, and to make them repellent to ink. It is also a base for photosensitive chemicals. In ceramics, gum arabic helps to strengthen the clay. Other technical applications include pyrotechnics and ink manufacturing. In textiles, paints, paper size and adhesives (including the traditional office glue and postage stamps) its use has decreased to very low levels in recent years.

CHEMICAL CONSTITUENTS

Compounds: Chemically, gum arabic is a slightly acidic complex composite of glycoproteins and polysaccharides and their calcium, magnesium and potassium salts. The main polysaccharide is arabic acid, a branched polysaccharide with a (1,3)-linked D-galactose backbone with (1,6)-linked ramified branches composed of L-arabinose, L-rhamnose and D-glucuronic acids. The proteins are characterized as hydroxyproline-rich arabinogalactan proteins. Commercial samples of gum arabic showed the following composition: arabinose 24–29%, galactose 32–41%, rhamnose 12–18%, uronic acid 14–17% and protein about 2%. The molecular weight is 47,000–3,000,000 Da, representing a number of basic monomeric sugars of 290–18,500. In human nutrition, gum arabic has less than 1 cal/g (Schmelzer & Gurib-Fakim, 2008).
QUALITY CONTROL

Identification: Gum from wild trees is variable and somewhat darker in colour than that from cultivated plants (Duke, 1981a).

Organoleptic Properties: Gum arabic is odourless with a bland taste, yellowish and some tears are vermiform in shape. Ripened or bleached gum occurs in rounded or ovoid tears over 2.5 cm in diameter, and in broken fragments. Tears are nearly white or pale yellow and break readily with a glassy fracture. Kordofan (Sudan) Gum is yellow or pinkish, has fewer cracks, and is more transparent (Duke, 1981a).

Macroscopic Characteristics: The powdered gum is white to white-yellowish.

Microscopic Characteristics: The powdered gum is white to white-yellowish presenting angular particles on microscope, no starch, and few particles of vegetal tissues (Organisation de l’Unité Africaine, 1985).

Growth rings of the stem consists of flattened marginal parenchyma or thick-walled fibres. Vessels solitary, in pairs or radial groups, 70–200 μm; perforation plates simple; intervessel pits alternate, vestured; vessel-ray pits similar to intervessel pits. Fibres with simple pits. Axial parenchyma confluent (var. leiorhachis) or banded (var. rostrata). Rays 1–5-seriate, homogenous, average length is 270 μm (var. leiorhachis) to 420 μm (var. rostrata). Prismatic crystals in chambered axial parenchyma cells.

Solubility: The gum arabic is totally soluble in an equal volume of water and gives a translucent, viscous, slightly acid solution; 1g of gum arabic is dissolved readily in 2 ml water (Organisation de l’Unité Africaine, 1985). It is almost insoluble in ethanol (96%).

TLC / HPLC / GC

Chromatograms of acetone extract separated by BEA, CEF and EMW from left to right and visualized under UV 235 nm and by using the vanillin and anisaldehyde spray reagents.

NIR Spectroscopy

Adulterants and Adulterations: Gums from other acacias, and sometimes from Albizia and Combretum, are also marketed as gum arabic. Although regulations for the admission of gum arabic no longer distinguish between gums from Acacia senegal and Acacia seyal, and although the gum of Acacia seyal is most often marketed as gum arabic, its properties are inferior to those of the gum from Acacia senegal. In exports from Sudan, the distinction is clearly made where gum from Acacia senegal is marketed as ‘gum hashab’, while gum from Acacia seyal is sold under the name ‘gum talha’. In Zimbabwe, gum from Acacia karroo is locally traded as gum arabic. Synthetic substitutes for gum arabic are ‘modified starches’, such as xanthan and gellan, which increasingly replace gum arabic as food hydrocolloids (Schmelzer & Gurib-Fakim Ed., 2008).

Standard specifications cf. appendix 2

PHARMACOLOGICAL PROPERTIES

*Acacia* is commonly present in chewing sticks, mainly as an antimicrobial with activity against *Streptococcus fecalis*. *Acacia* has also shown some cholesterol-lowering and antidiabetic properties, although there is insufficient evidence in support of these uses (Leung & Foster, 1980). *Acacia* gum has been shown to inhibit the growth of periodontic bacteria and the early deposition of plaque (Clark et al., 1993).

Treatment with gum arabic from *A. senegal* resulted in moderate but significant increases of creatinine clearance and altered electrolyte excretion in healthy wild-type 129S1/SvImJ mice. It may thus effect favourably renal insufficiency (Nasir et al., 2008).

Gum arabic has a trophic effect on the large intestine mucosa (and possibly also on the small intestine) and supply of cations in the large bowel, where some of them such as Mg$^{2+}$ and Ca$^{2+}$, are efficiently absorbed when studied in rats previously adapted to a high starch, fiber-free diet (Tulung et al., 1987).

Gum arabic reduced dietary lipid emulsification and lowered triacylglycerol lipolysis, suggesting a mechanism by which gum acacia may limit lipid absorption (Pasquier et al., 1996).

*Acacia* can be digested by rats to an extent of 71%; guinea pigs and rabbits also seem to utilize it for energy (Fötisch et al., 1998). Gum arabic may actually elevate serum or tissue cholesterol levels in rats.

Clinical Studies: Ali et al. (2008) assessed the effect of gum arabic (*Acacia senegal*) oral treatment on the metabolic profile of chronic renal failure (CRF) patients. By the end of the 3 months of treatment, serum urea, serum creatinine, serum phosphorus, and serum uric acid levels significantly decreased for gum users compared with the baseline and control group (p < 0.05). Serum calcium levels increased for gum users, and these increases were significantly different (0.05 < p < 0.001) from baseline and control group. Thus, oral administration of gum arabic could conceivably alleviate adverse effects of CRF.

A further two studies have documented gum acacia consumption lowered serum cholesterol levels (Ross et al., 1983; Eastwood et al., 1986).

SAFETY DATA

Preclinical Safety Data: Toxicity data on gum arabic indicates little or no acute, short-term, or subchronic toxicity. Gum arabic is negative in several genotoxicity assays, is not a reproductive or developmental toxin, and is not carcinogenic when given intraperitoneally or orally. Clinical testing indicated some evidence of skin sensitization with gum arabic. Ingested orally, acacia is nontoxic. A recent study on the toxicity of gum arabic indicated the toxic level of SUPER GUM (naturally processed polysaccharide exudates from gum acacia trees) to be more than 5.0%, and the ‘No Observed Adverse Effect Level’ (NOAEL) was concluded to be 5.0% (3,117 mg/kg body weight/day for males, and 3,296 mg/kg body weight/day for males) (Doi et al., 2006). No teratogenic effect was observed in rats during investigating the teratogenic effect of Gum arabic (Collins et al., 1987).

Single Dose Toxicity cf. appendix 1

Sensitizing Potential: Sensitization to gum arabic carbohydrate structures may occur in atopic patients with pollen sensitization. Allergy to gum arabic is mediated preferentially by IgE antibodies directed to polypeptide chains of gum arabic (Sander et al., 2006).

KEY [PROPOSED] USAGE

Therapeutic Indications: Anti-inflammatory and demulcent.
TRADE INFORMATION

Nature of plant material: Gum exudes from cracks in the bark of wild trees, mostly in the dry season, with little or none in the rainy season when flowers are out. In some areas, a long strip of the bark is torn off and the gum is allowed to exude. In Africa, it is regularly tapped from trees, which are about 6 years old by making narrow transverse incisions in bark in February and March. Within a month, tears of gum form on surface and are gathered. Trees begin to bear between 4–18 years of age and are said to yield only when they are in unhealthy state due to poor soil, lack of moisture, or damaged. Attempts to improve conditions tend to reduce yield.

Flower from January to March; fruit from January to April, July, August or October (Duke, 1981a).

Conservation status: In Mali, the species is protected and in India, Nigeria, and Pakistan, it is under cultivation. In Sudan, the trees are cultivated over a very large area in special “gum gardens.” In Pakistan, the best period for afforestation is in the early monsoon between the months of April and June. The plant is best propagated from seeds, which are produced once every few years, and surface sowing is recommended in mildly alkaline sandy soils. However, the plant can also be reproduced by shoot cutting. Trees coppice well (N.A.S., 1980).

Nature of plant products: The plant is wildcrafted to some extent but quantities of cultivated material is available.

Gum arabic is traded in a large number of qualities but can grouped into 3 grades. The best quality is large or round vermiform tears, white, pale cherry, or brownish yellow. Second from best is in rounded, vermiform or branched tears, smaller in size than the top quality and generally darker in colour. The poorest grade is in small brown grains or lightly coloured vermiform tears with a tendency to coalesce in masses (Burkill, 1995).

Processing and storage: The gum is collected from the cracked or cut bark. Collected gum is carefully freed of extraneous matter, sorted and sometimes ripened in sun before export.

The product is highly stable when dried. Conserved in tightly closed containers.

Gum arabic solutions can be sterilized by autoclaving at 121-122°C for 1h (Organisation de l’Unité Africaine, 1985).

REFERENCES


carbohydrates in a patient allergic to gum arabic (*Acacia senegal*). Allergy 53: 1043-1051.


