

PAPER FOR COSMETICS AND TOILETRIES

THE SEARCH FOR THE ELIXIR OF LIFE

Anthony C. Dweck FLS FRSH FRSC

Introduction

The chemist who waits for the raw material supplier to walk through his door with the next botanical extract of the future, is the chemist who is doomed to disappointment and depression.

The title of this paper might sound grandiose, almost the type of 'hype' that one might expect from an over-zealous copywriter working in the marketing department, rather than a heading to a serious scientific treatise. However, looking beyond our own industry and into the realms of pharmaceutical science, one finds that both from historical use and from modern research, the presence of medicinal plant materials and extracted complex molecules. Plants have often discovered unique complex molecules long before man, who obtains his materials from those botanical sources and then subsequently synthesises them.

In today's aggressive and eager "natural" market, the search is normally for those plants that look fantastic, have exotic names and can perform wonders in the product. Such a plant would provide glorious graphic potential for the label, inspire an empathy in the would be purchaser, and provide pack copy that should be enticing and truthful. It is those precepts that may pay the salary and spell success for the company, however, it can be a shallow task for anyone truly interested in the benefits of plant materials.

We will start with the definition of an Herbal Archivist, since it will be fundamental to the paper: it is a person who collects and collates historical and modern information on herbs and medicinal plants in a form that can be easily found and retrieved for other researchers both present and future. The purpose of this archive is to repudiate or substantiate the historical claims by means of findings achieved by modern scientific methods.

This paper will examine some of the processes that are required to seek out these new materials and highlight some of the pitfalls and frustrations that are likely to be encountered along the way.

Frequent use of the word 'medicinal' is made, this is quite simply because most of the uses stemmed from medicinal use. In our industry we are concerned primarily with the skin, and any preparation that can topically alleviate itching (pruritis), help maintain the skin against sores, eczema, dermatitis, and related skin disorders is to our credit. However, these benefits should be present but unclaimed. (Notice that we choose our words carefully, in order to avoid infringement of the Medicines Act).

DESIGNING A DATA BASE

Published benefits

Reference material

The source of reference material is abundant, with the oldest works often available as reprints.

These would include the writings of such herbalists as Gerard¹, Dioscorides, Pliny the elder², Abbess Hildegard von Bingen³, Culpeper⁴ and others.

The next important source is from the old Pharmacopoeias, such as the British Pharmacopoeia⁵ and the United States Dispensatory⁶, which are a valuable source of information from a time before the modern drugs had made their appearance. Other useful volumes include the old copies of the Merck Index⁷ and Martindale.

The next series of useful volumes are the modern herbals^{8,9,10,11,12,13,14,15} (usually plagiarised mercilessly from the original authors), books on pharmacognocny^{16,17} and foreign texts that have been translated into English^{18,19} (for those of us that do not read more than two or three languages!). The reference list is only a small cross section.

It is this information that forms the core of the study, and it is from here that the researcher must delve deeper.

Ethnobotany

Books on the cultural or ethnic use of plants is the greatest source of exciting new materials. There is a wealth of information and the main problem is finding it. The South American Indians (including the Aztecs, Incas and Mayans) had a great working knowledge of medicinal plants. Tribes that have survived through to today, such as the Waimiri-Atroari Indians²⁰ have a substantial amount of published data. Also the North American Indians²¹ and numerous tribes across America developed a sophisticated understanding of the functions of the local flora and fauna, much of which was adopted by the settlers of the New World.

The plants of India²² have been used for thousands of years in the practice of Ayurvedic medicine, as have the plants of China in Chinese Herbal Medicine^{23,24}. Many works are now being published as the interest in these areas grows in interest.

There are a growing number of reference works becoming available on Russian, Japanese and African²⁵ plants, which are adding to our knowledge.

Learnéd papers

The final source of information comes from learned papers, where specialists (often working in narrow fields of application) publish their findings. These contain the most interesting of information, but can be very difficult to 'trap'.

Unpublished manuscripts

Included in this category is the provision of manuscripts from other herbal archivists, and I was fortunate enough to be entrusted with the "William Gardener Collection of Chinese Plants", which contained many unique translations from previously unpublished Chinese texts, most of which has now been computerised.

I have also received an extremely useful text (anon) on the Ethnobotanical use of African plants.

Cooperation with other parties

It has become increasingly apparent that many people know a great deal about certain materials, but that no single individual has a complete picture.

For example, the aromatherapist^{26,27,28} has the knowledge of massage and the effect of an essential oil on the body. The herbalist recognises the importance of the whole patient and seeks the cause as well as the cure, whilst recognising the plants that will give that cure. The pharmacognocist understands the chemical composition of the plant and the best means to extract it. The ethnobotanist knows the source of the plant and how the plant is used locally, the taxonomist can ensure that the plant mentioned in the text is the plant that is submitted for extraction. The pharmacologist recognises the need to obtain the maximum quantity of the drug from the plant. Chinese herbalists, homoeopaths, phytotherapists, dietitians, cosmetologists, dermatologists and a myriad of other related professions fit into this picture, each with a different perspective and each equally important to the discussion.

The next headings are a brief cross section of typical sources which illustrate the kinds of lead that can be found.

Botanical drug research companies

For example, talking to a botanical drug research company, we heard that a sample sent over from Uganda was a week late in arriving for the clinical trial. It had been standing around in a warm hotel room in all that time. Yet, when the sample eventually arrived at the clinic, it was found to be virtually sterile. Normally, locally extracted plant material is microbiologically dirty, full of spore bearers and other undesirables. This material seemed to shun contamination, and as a result we may have found a natural preservative

Consultant pharmacognocist

Recently, I had a visit from a Fellow of the Royal Pharmaceutical Society, who had read some of my papers, and decided to come in and see me. We were discussing natural antiseptics, when he suddenly became very excited and said that he knew of a plant used in Nigeria as a mouthwash ingredient. It also happened to turn the product a deep red. Nothing extraordinary about that I hear you say, however, if you had been working in the field of natural colours, you would know that natural reds, usually from the xanthocyanins and β -carotenes are notoriously unstable and fade very quickly. Studies done on this material in Nigeria²⁹, showed it to be acid and light stable. This is a tremendous bonus, since it yields a red colour that is not only natural and stable, but also an antiseptic.

Traditional textiles

I have almost given up trying to encourage the food colour producers to make natural dyes for me. The project was dying on its feet (if you will pardon the pun!) and the number of new ideas was fast drying up.

It was on a visit to a traditional country fair (often spelt fayre) at Wimbourne St. Giles (a small village in southern England) that I met a group of spinners and weavers. They dyed and spun their own yarn on a spinning wheel, and subsequently weaved their own cloth on an old traditional loom.

Somewhat excited by this prospect of finding natural colours, it was asked how they obtained their dyes. It transpired that they were bought as dried plant material from a wholesaler, who imported them from around the world. These materials were boiled up to obtain the dye solutions, and then used with various mordants to achieve the yarn colour wanted. They also grew various traditional plants (such as woad or *Isatis tinctoria*) for their own use, where these materials were not commercially available.

[A note on natural colours.]

These colours are not permitted by law, in as much as many of them are not in the permitted list of colourant materials. It was never said that these materials were to be used as colourants, indeed these materials are being evaluated for their benefit to the skin.

For example, chamomile oil extracted from *Matricaria chamomilla* (the German Chamomile)³⁰ contains chamazulene. This blue compound is formed during the watersteam distillation from a colourless matricaria-proazulene (guaianolide) named matricine. Other components of the essential oil are (-)-alpha-bisabolol (INN: Lecomamol), the bisabolol oxides A and B, cis-and trans-en-yn-dicycloether.

Other important constituents of *Matricaria chamomilla* are many flavonoids (among other apigenin, luteolin, quercitrin, as well as their corresponding glycosides), chlorogenic acid, umbelligerone and herniarin (coumarin-compounds).

The α -bisabolol and the apigenin in particular have anti-inflammatory, antiphlogistic and healing effect. The use of the oil is justified for these reasons, and the blue colouration might be termed an unfortunate side effect, in the same way that the hypericin in St. John's Wort oil is a nuisance red colour.

Herbalists

There are a number of very successful herbalists who have practiced their skills on patients with skin diseases, sores and infected ulcerations and subsequently become involved in plant research. As a result, it is known that many plant oils exhibit antibacterial activity, and that their action is due to specific chemicals.

There is already a grapefruit seed oil on the market which has some encouraging results as a preservative. The use of *Mimosa tenuiflora*³¹ has also had some success. However, there are many plant oils which have horrendous odours, such as thyme, marjoram, margosa and tea tree oil, which contain active principles that give preservative action. For example, Tea tree oil (*Melaleuca alternifolia*)³² is listed as an hospital disinfectant and was found to be eleven times more potent than phenol.

Why no one seems to have isolated the active materials as yet, is a bit of a mystery, since in most cases we know what those chemical entities are.

[A note on natural preservatives]

Again, it is recognised that these materials are not permitted preservatives. However, we are using

the plant material for its skin antiseptic properties, and any preservative action is an important side-effect that would require some study, probably to remove some of the potentially irritating synthetic preservative loading.

For the person that really wants to use a permitted preservative extracted from a natural source, there are some alternatives.

It would probably come as no surprise if it was revealed that there are at least two plant species that contain substantial levels of benzoic acid (up to 20%), and others that contain significant levels of benzyl alcohol (which, it has to be said, is less efficient, but still useful). Other plants contain ascorbic acid and another sorbic acid, presumably with trace amounts of the sorbate salt. These in combination will not give wonderful results as broad spectrum preservatives, but they will certainly give a moderate performance.

Unfortunately, these materials have not come from plant sources since the turn of the century, for example, when the aromatic solvents such as toluene became a more economic starting point for the benzyl derivatives.

Botanic Gardens and Physic Gardens

The final source of information comes from the most respected sources of all. These are the fountains of all learning from which springs the knowledge both ancient and modern. It has been both an honour and a great privilege to not only work with the Royal Botanic of Kew, but also to deliver a paper to them. The Library, the Herbarium and the research facilities are amongst the very best in the world, housing a treasure house of material, from the botanical remains of Tutankhamen's tomb and the collected and dried botanicals of Charles Darwin to original editions of Culpeper and Pliny the elder.

The Physic Gardens work hard to preserve the original plant stock in its least hybridised form, and have an immense store of knowledge on ancient and modern herbalism, as well as a wealth of experience in their usage.

The Search for the Elixir of Life

The input of data is the longest and often dreariest of tasks, however, in order to be of any use, the data base has to reach a critical mass. A point at which it 'knows' most of the medicinal plants, their composition, their habitat, their reported uses, folklore, toxicological profile, dosage levels, Linnean names, common names, botanical form and reference source. This information is compiled from the information collected above, and facts both positive and negative recorded.

We may now search for the elixir of life.

Preliminary thoughts

It is not intended to begin a discourse on those areas that are the true medicinal panaceas, for example, research into cures for AIDS, HIV, diabetes, cancer, etc. Nor is it intended to discuss insecticides, molluscicides, anthelmintics, or other areas in which there is a search for natural solutions.

The area of major concern in this context is the skin, and it is in this area that greatest concentration will be given.

Let us look at some of the problems that the body's largest organ can suffer, and consider some of the solutions that herbal materials can offer. Notice that the solution is not always a single material and that in many cases the whole plant is used and not a specific chemical extracted from it.

It has been said before, and it is worthy of repeating, that plant materials should never be judged in direct comparison to modern concentrated drugs. The same yardstick does not apply. Plants often work extremely slowly, but frequently without the side effects experienced by modern preparations.

Neither is the concept any longer viewed as "quackery", since herbal medicine is now being clinically evaluated in a number of hospitals as an alternative solution to difficult conditions. The Great Ormond Street Hospital for Sick Children in London is carrying out a study on Chinese medicinal plant preparations in their search for a cure to paediatric dermatitis and eczema. There will also be a study on three preparations in which the author had an input to select European medicinal plant extracts.

DESIGNING A PRODUCT

Skin problems

Many skin problems are disfiguring both mentally and physically, so that to those people afflicted, a cure is an elixir, since without a cure the quality of life may not seem worth living.

Let us consider one project, which involved the treatment of a rather specific area of the skin, namely the breast. This area is extraordinarily sensitive and prone to all manner of problems. These include:

1. The pain of cracked nipples in nursing mothers
2. The worry of nodules within the breast, that are caused by lymphoedema.
3. Breast pain or mastalgia.
4. The effects following the treatment of malignant tumours by radiation therapy.
5. The treatment of the skin site after severe surgical intervention - mastectomy.

It is not possible to reveal all of the details of this research, but it will serve to illustrate the philosophy and approach of our method. We will consider in this paper the first, and most simple of these conditions.

Cracked nipples

The first criteria is to consider the attributes required by the product. These would be that it should have plant materials:

- (i) specific to the condition
- (ii) appealing to the customer
- (iii) moisturising
- (iv) healing
- (v) soothing

(i) specific to the condition

A search of the data base turns up specific information for the words "cracked nipples", the relevant extracts from the texts are reprinted below for the eleven materials found:

NIPPLEWORT, *Lapsana communis*³³, in the 16th century this was called papillaris by the Apothecaries, after the Latin meaning nipple, since it was used traditionally to treat cracked nipples - a use which may have originally been suggested by the nipple-shaped unopened flower buds. In some parts of Europe ointments made from the fresh juice are still used for this purpose. Traditionally used externally to treat cracked nipples or to promote the flow of milk from the breast.

WORMWOOD or ABSINTHE, *Artemisia absinthium*³⁴, appears in antiseptic ointments, creams, and gels to treat cracked nipples and sore feet, sore gums and inflammations and for wound healing, not to mention preparations for preventing sun burns and creams and lotions for softening the skin. (Leung B49).

ARARоба, *Andira araroba*⁹. The 2% ointment is good for eczema (after exudation has ceased), fissured nipples, and tyolosis of the palms and soles after the skin has been removed by salicylic acid plaster etc.

SELFHEAL, *Prunella vulgaris*¹⁵, it has been used in the treatment of rhagades of the breast (a cracked condition of the nipple).

INDIGO, WILD INDIGO, *Baptisia tinctoria*¹², Topically it is used for indolent ulcers when applied as an ointment. It is also used on sore nipples and infected ulcers.

SQUAW VINE, *Mitchella repens*²¹, externally, the berries are also highly spoken of as an ointment fore sore nipples. The application is made by boiling a strong decoction down to a thick liquid and then adding cream to it.

BENZOIN, *Styrax benzoin*^{8,35}, Friar's Balsam, for rheumatoid arthritic joints, for skin irritations, sores, cracked skin, dermatitis and irritable skin and wounds. It is good for skin conditions where there is a redness, irritation or itching, such as, dermatitis. It is also good for skin which is cracked or dry , and for wounds.

TRILLIUM, *Trillium erectum*, *Trillium flavum*³⁶, early American colonists and, later, the Shaker community, used purple trillium to assist in uterine problems, to stop haemorrhaging and excessive menstruation. The root has astringent, antiseptic properties which gave rise to its external use for treating sores, ulcers and gangrene, and, made into a lotion, as a wash for sore nipples. The roots boiled in milk were considered helpful for diarrhoea and it was thought that smelling the fresh roots would stop a nose bleed.

ACACIA, SHIKAKAI, *Acacia senegal*, *Acacia concinna*³⁷, acacia is an old remedy for applying to the sore nipples of nursing mothers, for which purpose it is most effective and quite harmless to baby.

CARROT, *Daucus carota*³⁸, carrots are a strong antiseptic. Can be used on raw nipples.

MANGO, *Mangifera indica*⁴¹, the pulp of the fruit is used in some parts when ripe as a poultice for tender breasts and sore nipples.

Normally, we would continue our search by searching for a list of equivalent words, such as 'fissures', 'sore breast' etc. We would also search for 'problems feeding' and other similar areas.

(ii) appealing to the customer

Suppose that the product was intended for the North American market, then obviously it would make sense to choose a plant that was recognised by the consumer and incorporate it into the graphics. The choice for Trillium looks almost irresistible.

However, before confirming this plant, it is worth looking fully at the data and comparing it to known facts on other members of the *Trillium* family.

Trillium erectum, *Trillium flavum*, *Trillium grandiflorum*, *Trillium pendulum* are the major species mentioned.

We might also want to include other materials from this list, for example, carrot oil rich in provitamin A would certainly help the healing process whilst being mentioned as a specific remedy in itself.

(iii) moisturising

There are literally hundreds of materials that are specific to the breast and which are also excellent moisturisers. The most significant materials to show up in the search are, Evening primrose oil from the seeds of *Oenothera biennis*, Vitamin E, and a simple humectant like glycerine.

All three of these materials should be included.

Evening primrose oil is already pharmaceutically licensed for the relief of mastalgia or breast pain, as well as being excellent for dry skin conditions. It can also be taken orally.

Vitamin E, is a first rate moisturiser and has been used to reduce erythema. It has also been used in breast care and is safe for oral ingestion.

The properties and safety of glycerine are too well known to require mention.

(iv) healing

Red Puccoon³⁹ or *Sanguinaria canadensis* is specifically used as a remedy for deficient capillary circulation. It was officinal in the U.S. Pharmacopoeia from 1820 to 1926, and has been used extensively in the treatment of breast diseases and skin problems.

The incorporation of Aloe vera gel as a soothing and healing agent is well documented in the literature, and recent literature has shown that aloe vera gel has been used in specific breast conditions.

Comfrey used externally is perfectly safe, and there are few plants with such a large natural allantoin content. Allantoin is an excellent healing agent, with excellent reported clinical benefits.

(v) Soothing

One of the materials reported for its anti-pruritic (or anti-itching) activity is propolis, which has been marketed in an ointment as a commercial preparation for this purpose. Since propolis is a bee-hive product, and used by the bees for its cementing qualities, it is quite safe to ingest orally. There is considerable research into its reputed antibiotic qualities, as well as to its ability to reduce skin tenderness and promote skin cell regeneration.

Many of the other materials already discussed also have soothing properties.

The final product

We have searched some 8,000 plants and 7,000 pages of data to achieve a product that has the best known and most suitable and specific of plant extracts. Safety has been the ultimate concern.

Our final product would contain the following ingredients:-

Trillium rhizome extract, Nipplewort, Carrot oil. Evening primrose oil, Vitamin E, Red Puccoon, Aloe vera, Comfrey, Glycerine, and Propolis. The choice of base should be cosmetically elegant and preferably nonionic, the incorporation of natural waxes and oils would complete the natural theme.

The total level of this mixture should be at least 15-25%.

The use of colour and perfume is a matter of choice, it is probably best left bland and naturally coloured, however, the addition of a small percentage of Bois de Rose oil might give the product an unobtrusive but delicate smell.

Conclusions on the product

To formulate one product we have examined 20,000 references and abstracts taken from over 160 herbals, books on medicinal plants and scientific papers. The result is a product that has incorporated those materials specific for the terms of reference that were set.

SEARCHING FOR THE TITLE

The last word belongs to the title of the paper.

In a search for the "Elixir of Life" we find a number of possibilities, since there are many who believe that they have found the elixir of life:

The South Americans have "Rio Amazon Guarana Jungle Elixir", made of the fruits of *Paullinia cupana* and supposed to preserve eternal youth.

The ancient Egyptians had a mixture of some 80 different fragrant materials called "Theriaque" which they considered an "Elixir of Life"

In Russia, the simple dandelion (*Taraxacum officinale*) was considered in an ancient home medicine to be the "Life Elixir".

The Herbalist, Philipp Theophrastus Bombastus von Hohenheim (mercifully, better known as Paracelsus), sold the herb Lemon Balm or *Melissa officinalis* to kings as an "Elixir of Life". While other herbalists regarded honey as the "Elixir".

The Chinese believed that where a bolt of lightning struck a clear stream that ginseng (*Panax ginseng*) would spring up, from which only the Emperor could distil the "Elixir of Life".

A favourite reference is to the rosehip oil of *Rosa mosqueta*, considered by some to be the "Fountain of Youth", a secret protected by the Araucanians of ancient Chile.

To the homoeopathist it is the very purity of the water in which he makes his extracts. To the alchemist it was the water that collected on the leaves of *Alchemilla vulgaris* and would (with other materials) transform base metals into gold. To the apothecary it was the alcohol distilled from his retort flask.

In truth, the "Elixir of Life" is all around us. For any given complaint there should be a cure, given the right plant, using the right part, at the right concentration and administered in the right way. It may be a pantheist's view of the world, but that view, and the last word on the subject, is best left to the Alexandrian sage Jesus ben Sirach who wrote some two thousand years ago:

"God created the plants that heal, and a sensible man will not despise them."

REFERENCES

1. Gerard: Gerard's Herbal. Ed. Marcus Woodward. Studio editions. First published 1985, this edition 1990, ISBN No. 0-94649-527-0.
2. J.I.Whalley. Pliny the Elder - Historia Naturalis. Victoria & Albert Musuem. (Oregon Press). 1982. ISBN No. 0-905209-21-4.
3. Strehlow, W. & Hertzgard, G.: Hildegard of Bingen's Medicine. Bear & Company (Santa Fe, New Mexico). 1988.
ISBN NO. 0-939680-44-0
4. D.Potterton (ed): Culpeper's Colour Herbal. 1983. W.Foulsham ISBN 0-572-01152-0
5. The British Pharmaceutical Codex, 1923. An Imperial Dispensatory for the use of Medical Proctitioners and Pharmacists. The Pharmaceutical Press. London.
6. G.Wood and F.Bache. The Dispensatory of the United States of America. 15th edition. 1883. J.B.Lippincott & Co.
7. The Merck Index 5th Edition. An encyclopaedia for the chemist, pharmacist, physician, dentist and veterinarian. 1940. published Merck & Co. Inc.

8. R.C.Wren: Potter's New Cyclopaedia of Botanical Drugs and Preparations, 1985 8th impression, published C.W.Daniels. ISBN 0-85032-009-7
9. M.Grieve: A Modern Herbal, 1984 Savvas Publishing.
ISBN unknown.
10. J.Lust: The Herb Book, 1986, 16th. impression, Bantam Publishing. ISBN 0-553-17273-5
- 11a. C.F.Leyel: Herbal Delights. 1987 Faber and Faber
ISBN 0-571-14850-6
- 11b C.F.Leyel: Elixirs of Life. 1987 Faber and Faber
ISBN 0-571-14849-2
12. B.H.M.A.: The British Herbal Pharmacopoeia 1983
ISBN 0-903032-07-4
13. A.Y.Leung: Encyclopedia of Common Natural Ingredients used in food,drugs and cosmetics.
John Wiley 1980 ISBN No. 0-471-04954-9
14. S.Y.Mills: The A-Z of Modern Herbalism, A comprehensive guide to Practical Herbal
Therapy. Thorsons 1989 (retitled) ISBN No. 0-7225-1882-X
15. Chiej, R.: The Macdonald Encyclopaedia of Medicinal Plants. 1984, reprinted 1988.
Macdonald Orbis. ISBN No. 0-356-10541-5 (hb), -10542-3 (pb).

16. W.C.Evans: Trease and Evans, Pharmacognosy. 13th edition. Balliere Tindall ISBN 0-7020-1357-9
17. Tyler, V.E., Brady L.R., Robbers, J.E.: Pharmacognosy. 9th edition. Lea & Febiger. 1988. ISBN No. 0-8121-1071-4
18. R.F.Weiss. Herbal Medicine. (translated from the 6th. German edition of Lehrbuch der Phytotherapie by A.R.Meuss). The Bath Press 1986. ISBN 0-906584-19-1.
19. Hans Fluck: Medicinal Plants, 1988 W.Foulsham & Co. Ltd. ISBN 0-572-00996-8
20. Milliken,W., Miller, R.P., Pollard, S.R., and Wandelli, E.V.: The Ethnobotany of the Waimiri Atroari Indians of Brazil. Royal Botanic Gardens Kew. 1992. ISBN No. 0-947643-50-8.
21. Hutchens, A.R.: Indian Herbalogy of North America. 1973 First paperback edition. Shambhala. ISBN No. 0-87773-639-1.
22. Heyn, Birgit. Ayurvedic Medicine - the gentle strength of Indian Healing. Thorsons. 1987. ISBN No. 0-7224-1417-4.
23. Tang.S., Palmer.M.: Chinese Herbal Prescriptions - A practical and authoritative self-help guide. 1986. Rider & Company, an imprint of Century Hutchinson Ltd. ISBN no. 0-7126-9470-6
24. Keys, D.: Chinese Herbs - Their Botany, Chemistry and Pharmacodynamics. 1976 (1990 in paperback) Charles E.Tuttle. ISBN No.0-8048-1667-0.
25. Abbiw, D.K.: Useful plants of Ghana - West African use of wild and cultivated plants. Intermediate Technology Publications and the Royal Botanic Gardens Kew. 1990. ISBN No. 1-85339-043-7 or 1-85339-080-1 Hardback).
26. R.Tisserand: The Art of Aromatherapy. 1987 C.W.Daniel & Co. Ltd. ISBN 0-85207-140-X
27. J.Valnet: The Practice of Aromatherapy. 1986. C.W.Daniel Co. Ltd. ISBN 0-85207-140-X
28. R.Lautier, A.Passebecq: Aromatherapy, the use of plant essences in healing. 1979 Thorsons Publishers. ISBN 0-7225-1145-0
29. Stabilisation of the red colour of bridelia bark extract. 'Lara O. Orafidiya, A. Lamikanra and Ify Aghawa. Dept. of Pharmaceutics, Obafemi Awolowo University, Ile-Ife, Nigeria.
30. Council of Europe. Plant Preparations used as ingredients of cosmetic products. 1st. edition. Strasbourg 1989. HMSO. ISBN No. 92-871-1689-X

31. In an article in French (from the "La vie naturelle", Natural Life supplement Sept/Oct 1990), Jean Francois Olivier discusses under Natural Medicine the 'rediscovered Mayan medicine' The tree of Life.
32. P.M.Altman. Australian Tea Tree Oil - a natural antiseptic. Australian Journal of Biotechnology Vol.3 No.4 October 1989.
33. M.Stuart: The Encyclopaedia of Herbs and Herbalism. 1986. Orbis ISBN 0-85613-700-6
34. In a file from Dr Stephen Greenburg (Lipo Chemicals Inc.) entitled "Ethnic Botanical Literature) author anon.
35. S.Price: Practical Aromatherapy. 1987 Thorsons Publishing ISBN 0-7225-1525-1
36. Roger Phillips & Nicky Fox. Herbs. Pan Books. 1990. ISBN No. 0-330-32600-7.
37. E.F.W.Powell: The Natural Home Physician, A Book for Every Household. Health Science Press 1981 reprinted 2nd ed. ISBN No. 0-85032-092-5.
38. D.D.Buchman: Herbal Medicine: The Natural way to get well and stay well. 1987. Century Hutchinson ISBN 0-09-153691-X
39. Keville, K.: The Illustrated Herb Encyclopaedia - a complete culinary, cosmetic, medicinal and ornamental guide to herbs. Grange Books. 1991. ISBN No. 1-85627-175-7.