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LINK NATURAL PRODUCTS (PVT) LTD



CHAMOMILE an old world medicinal herb with a **promising future**





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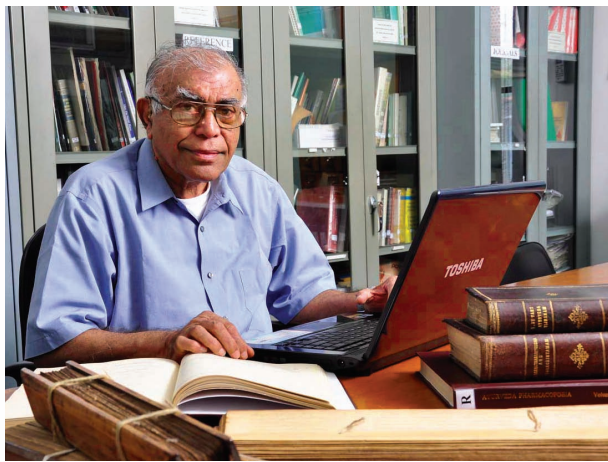
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EDITORIAL

GLOBAL DEMAND FOR NATURAL FRAGRANCES ON THE RISE?



Market indications and predictions tend to reveal an expected rise in the global demand for natural essential oils and fragrances in the coming years. Various figures are quoted in regard to estimated sales but by 2020 the global annual demand is expected to be in the region of over eleven billion dollars. This is certainly great news for the poor regions of the world which are the supply sources of natural essential oils and fragrances. The reasons for the estimated increased demands are interesting. The key driving factors are quoted as being: consumer preference for natural products, the growing popularity of relaxation therapies, increased middle class incomes resulting in improved standards of living and thus the availability of more disposable money, and a growing awareness of the harmful side effects of synthetic chemicals. The spa and relaxation sector is expected to grow at the highest level. This undoubtedly applies to the affluent regions of the

globe but what of those in the regions that are the supply source of the natural products? Will the benefits trickle down to them? Will the emerging partnerships between the suppliers and the consumer trades be enhanced and the profits that ensue be utilized in a manner to benefit the new clientele as well as those who eke out a meagre existence working for the supply trade? It is up to the affluent companies that trade in the supplies to ensure a healthy and steady relationship between those in the reach of the benefits of natural materials, and those who labour to maintain the supplies. That is the human equation that must endure.

R O B Wijesekera

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THE DEVIL'S CLAW

By R.O.B. Wijesekera

What is the mystery of this plant commonly known as the Devils Claw?

It refers to the dried root of an African plant used as a traditional remedy for pains, now being incorporated into western therapy.

Preamble

The plant is botanically identified as *Harpagophytum procumbens*, DC ex Meisn, and the tubers of this plant have earned a reputation of being a drug that can combat the pains of muscular skeletal disorders such as: rheumatoid and osteoarthritis. It has a long history of usage in traditional African medicine for the treatment of such conditions with success.



It has been recorded that a German soldier by the name of Menhert in circa prior to 1900 introduced Devil's claw to Europe as a herbal Tea. It is also recorded that the common name for the plant derives from a translation of the Namibian farmers' name *taufelskralle*.

In 2001 it is documented that devil's claw derived preparations accounted for 74% of the total number of prescriptions for rheumatism in Germany alone. There remains considerable interest in Germany of preparations made from the secondary tubers of the traditional herb itself based on several recent clinical studies showing

reduction of pain sensation and improved mobility in patients with arthritic conditions.

The plant is a tuber vegetable belonging to the family Pedaliaceae, the sesame seed family, found in the southern African region, and used in the traditional medicine of the region. It was originally employed as a medicine by the indigenous peoples of the Kalahari, for diseases ranging from digestive ailments to pains, and is now entrenched in the therapeutic armoury of modern medicine.

Chemical Composition

The tubers of the plant are the parts that bear the medicinal properties it is renowned for, but it is also termed grapple plant, and the trivial names come from the appearance of its fruit. The plant has been extensively investigated due to its promise in the cure of one of mankind's intractable diseases for which no satisfactory cure is available in western therapy. The main chemical constituents of the tubers are iridoid

glycosides which at around 3-4 % account for its therapeutic properties. The following are the major chemical constituents:

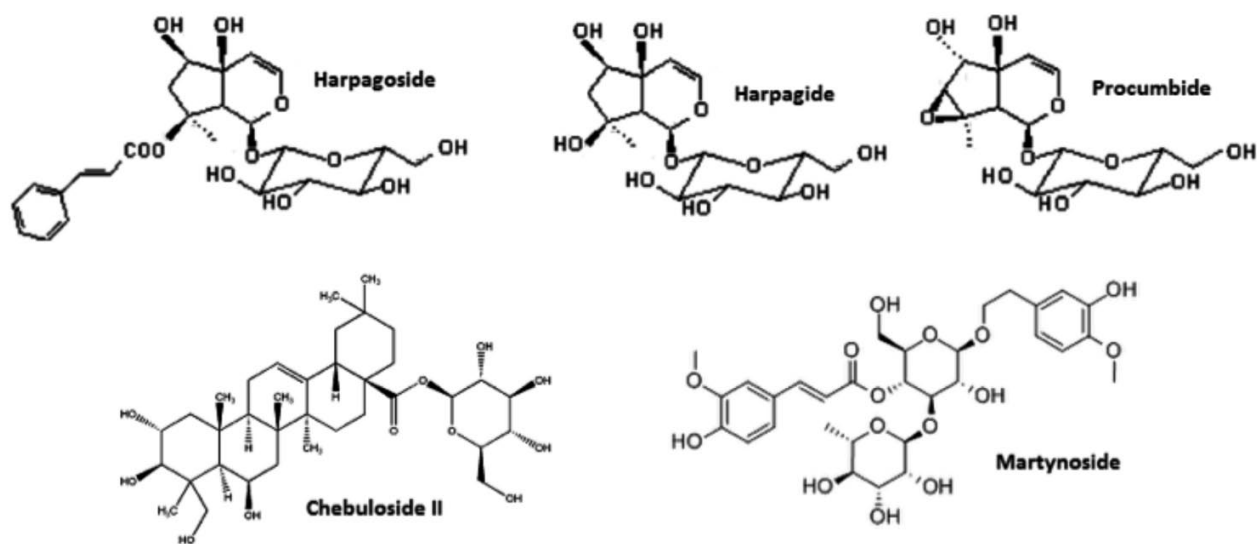
Harpagoside, Harpagide, Procumbide, together with several related compounds.

The active ingredients of the plant are not fully established but the compound Harpogoside is generally believed to be the one primarily responsible for the therapeutic properties associated with the plant. Detailed investigations have now shown that the iridoid compounds have a wide range of bioactivity. In addition the plant possesses other compound types such as flavanoid glycosides, ursolic and related triterpenoid glycosides which too could contribute to the overall activity profile. There is more to be done to complete the activity picture.

Harvesting & Sustainability

The secondary root tubers are the harvested entity that is processed today in





several forms and used in the treatment of various forms of muscular skeletal related disorders.

There is a major threat to the plant similar to that in the case of other medicinal plants due to overharvesting the natural resource. For most of those living in the Kalahari the harvesting of Devil's claw is a lucrative venture. There are two sub-species of *H.procumbens*, one the subspecies *procumbens* mainly found in South Africa, Botswana and Namibia and the other subspecies *transvaalense*, found in Zimbabwe as well as in South Africa. Devil's claw is classified as a protected species, and permits are needed for harvesting both species of *Harpogophytum* and they are listed under CITES in Annex D. No part of the tubers or roots can be traded with the European Union without authentic licenses. Improved methodologies for sharing of benefits are now in place in selected regions where the entrepreneurs and the harvesters share benefits of the plantation and this overcomes the dangers of overharvesting. These initiatives related to this benefit-sharing, also highlight the value of indigenous wisdom and knowledge, and such a project has contributed much to scientific knowledge in Namibia in regard to crop maintenance and development.

Scientific research on the impact of harvesting on growth and the optimization of factors such a yield and inputs towards growth

has vastly benefitted the cultivators and entrepreneurs. Commercial cultivation has proved a viable proposition and perhaps an answer to needed sustainability as well as an improved product.

The Devil's claw plant has been in long use as a medicinal plant with the San tribe of the Kalahari who are reputed to have been the initial users. A German soldier- explorer- G.H.Mehnert, had learnt about the medicinal properties of this plant and by the beginning of the 18th century it had been exported to Germany. A basic industry had developed probably with the efficacy of the extracts of this plant in respect of rheumatic pains, and this industry had sustained itself during the war years and had reached considerable proportions by the 1960 s. The original material had come to Europe from Botswana and Namibia. By the end of the twentieth century the global demand had reached considerable proportions. Towards the end of the century Namibia is reported to have exported at the rate of around 2000 tons of the dried tubers annually and this amounts to around 50 million plants per year. Devil's claw is widespread in the Kalahari Desert of southern Africa. It is found in Angola, Botswana, Zambia, Namibia, Zimbabwe, Mozambique, and South Africa.

The homeland harvesters, of whom there are thousands are mostly from very poor families

living in near desert conditions. Many of these are rural women over 40 years of age, who have no means of other employment, and seek the modest means that come from harvesting the Devil's claw tubers. There is a strong need for a methodology of getting the homeland harvesters a regular share of the income generated from this medicinal plant crop and at the same time ensuring that harvesting techniques are in accord with the requirements of sustaining the resource.

It is not simple to develop cultivation techniques for devil's claw to replace the plant material that is largely now gathered from spontaneous growing sources. Micro propagation techniques will help to conserve the species ex-situ, and possibly provide an alternative to supplies now gathered from the spontaneous flora for the drug market. A propagation protocol that does not require water or artificially introduced fertilizer has been developed for use of small scale farmers in the dry regions of Africa where devil's claw grows naturally. Like in other instances in regard to medicinal plants, cultivation in a collaborative endeavour between growers and users will be the long term answer.

Botanical description & Habitat

Harpogophytum procumbens, is a perennial herb with a succulent tap root. It is naturally found growing in sandy forest soils particularly in over grazed lands, where grass and herb cover is low, but it can also be found in savannah and open woodlands. Devil's Claw belongs to the same botanical family as the familiar sesame seed namely Pedaliaceae, and its spiny fruits give rise to its common names- Devils Claw, and Grapple plant. The hooks on the fruits can get entangled in the hooves and fur of animals and the toxicity it possesses can endanger them just as overdoses of extracts of the drug can do if administered to humans. Another plant of the species *Harpogophytum* viz *H. zeyheri*, growing in the same region differs slightly in physical features and which can easily be distinguished, is often considered an adulterant. Gathered from the age old wisdom of the healers inhabiting the Kalahari comes the knowledge of its efficacy in the

treatment of a wide array of ailments ranging from digestive disorders to infections, to degenerative diseases like osteoarthritis. The leaves of the plant are simple and opposite 6-7 cm long and 3-4 cm wide and they are deeply or shallowly lobed. The flowers are tubular, 5-6 cm long and are usually light purple or pink and yellow on the inside. The fruits are large up to 15cm in diameter and have four rows of curved arms with recurved spines.

There are also two sub-species of *H.procumbens* sub-species *procumbensis* and subspecies *transvaalense*, found in the same region.

Healthcare Benefits

The initial studies on the pharmacological effects of devil's claw were made by B. Zorn, at the University of Jena, in Germany, more than forty years ago. This was followed by a trail of phytochemical, and pharmacological studies as well as clinical trials which gave rise to the satisfactory therapeutic profile of this phytomedicine.

In Europe the clinical use of Devil's claw is restricted to applications in rheumatism and dyspepsia. There are numerous studies that have attempted to assess the efficacy of Devil's claw, in terms of the relief of arthrosic (osteoporotic) and arthritic conditions. The studies are supportive of the approved indications in the monographs produced by ESCOP and the German Commission E, namely the following: Painful arthrosis and tendonitis, and for supportive and adjuvant treatment of degenerative disorders of the locomotor system. It would appear that the use of Devil's claw for degenerative rheumatic and similar disorders today is due to the positive data from pharmacological as well as clinical studies which also support adjuvant treatment. Devil's claw is used primarily to improve pain, mobility and motility of patients with arthrosic and arthritic conditions. Several emerging studies fortify the present usage and indicate possible extension of its versatility. In summary its effects cover the following:

1. Long term effects.

Ethnomedical evidence suggests that there are dangers in long term usage but there is insufficient evidence in scientific terms to address this concern. Short term usage does not reveal any significant side effects other than some gastrointestinal disturbances.

2. Relief of pain

Traditionally a root powder is given at a dosage of 250mg thrice daily as a pain reliever for pregnant women. Devil's claw extracts were noted to relieve pain, dose dependently.

In several studies carried out in Germany Devil's claw appears to be effective in combating chronic pain.

However it is advisable, since Devil's claw is associated with the usage for expelling placenta, and preliminary evidence that it is able to induce uterine contractions, the use of Devil's claw be avoided during pregnancy.

3. Anti-inflammatory effects.

Ethanollic extracts were found to be able to dose-dependently reduce the release of pro-inflammatory cytokines. The constituent Harpagoside is believed to be the agent primarily responsible.

4. Arthritis

The positive effects on patients with forms of arthritis are well documented, but as yet no effective animal models are available for comparing the efficacy with other therapeutic options such as steroidal compounds.

Concluding Observations

The Devils's claw typifies several aspects in regard to the development of new agents of therapeutic interest to combat diseases in modern times. The need to study intensely the native peoples' wisdom and knowledge surrounding

the traditional use of the plant, the traditional resource maintenance strategies, and the response of long term users. The viewpoint of traditional healers is crucial to modern usage. The most important factor is to evolve strategies to overcome depletion of resources and here a joint partnership between the growers and caretakers of the indigenous resource, and those seeking to develop new therapeutic agents, must be evolved to substantially share the resultant benefits. Such strategies are now in place in many areas of the world in both the pharmaceutical as well as the fragrance industries which involve the guardians of the indigenous resource and the development agencies, and both are joint shareholders of the development exercise.

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"I saw few die of hunger; of eating, a hundred thousand."

- Benjamin Franklin

NUTRACEUTICALS NOW.....

By R.S.Raghavan*

Dietary supplements, nutraceuticals, fortified food and beverages, functional foods – or whatever the terminology is, this sector of value added herbal extracts has taken a multitude of dimensions during the past 30 years. I remember when I started my career with herbal extracts way back in 1985, the only specification was herb ratio. We used to say '10:1 extract of amla (*Phyllanthus embellica*)'.

However, rarely certain manufacturers were producing 'standardised extracts', for example, 'Calcium Sennosides 20% USP'. The current scenario is well specified products with controls in the active ingredient assay, limits of related molecules, residual solvent traces from the process, guarantee of absence of pesticides, aflatoxins, toxic metals & minerals, colour, aroma, stability & shelf life validation and much more. Added to this are the global certifications for non-GMO, Kosher fitness, Organic, etc. It is mandatory payments to these agencies, which labels the producer as disciplined or trained.

While countries like India and China are almost saturated in the business of herb-food cycle, Sri Lanka remains a goldmine to be exploited. During almost an year of travelling in Sri Lanka, I have understood a little about the opportunities, but products like gotu kola (*Centella asiatica*), Instant tea beverage, cinnamon extract, pepper products, *Garcinia cambogia*, ginger and certain fruit extracts are showing great potential for value addition. However, infrastructure and operation requirements for such an industry is lacking. They are –

1. Organised RM sources,
2. Equipment and Process engineering machinery,

3. Competent human resources for project promotion, operation and research.

This story is prepared with some basic information useful for promotion of an activity in herbal product value addition.

A : BRIEF NOTE ON PROSPECTIVE PRODUCTS

1. *Garcinia cambogia* (Goraka in Sinhala) is abundantly available in Sri Lanka, but largely exported as dried fruits. On extraction, yields 20 to 30% by weight of Hydroxy Citric Acids of various specifications. The mechanism of action is inhibiting an enzyme called Citric acid lysase which is required in the synthesis of fatty acids, known as de novo lipogenesis, leading to weight loss. There are not much clinical reports supporting this action. But this product is ruling the exports for more than two decades.

2. Cinnamon of Sri Lanka is unique among the various botanical species around the world. '*Cinnamomum zelanicum*' is almost free from the toxic 'Coumarins', a phytochemical found excessively in the other species of cinnamon. In addition to the valuable bark oil, the herb can be processed for extract powders useful in diabetes management.

3. Ceylon tea is popular across the globe for its characteristic flavour. Apart from the traditional grades of beverages, the dried leaves can be extracted for standardised Polyphenols and Catechins which are powerful anti oxidants. The waste tea generated in the estates can be value added for instant tea beverages as well.

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4. Black Pepper is one of the Ceylon specialties, with its unique aroma and pungent flavour. Among the various categories of pepper (white pepper, dehydrated green pepper, oleo resin, etc) the standard extract containing >95% of Piperine is in perennial demand. Piperine is a proven bio-availability enhancer which is added to many herbal drugs for accelerated absorption.

5. Ginger.....

6. Gotukola (*Centella asiatica*).....

7. Green coffee extract (chlorogenic acid).....

8. Moringa leaf, Bael fruit (beli), etc....

B : MANUFACTURING INFRASTRUCTURE

The facility should ideally comprise a multi-product manufacturing capacity enabling the general process operations in the extraction, purification and finishing of the natural ingredients. Isolation of bio-active phytochemicals vary from product to product, depending on the influencing physical & chemical properties of the active compounds and the interfering related compounds. The shop floor should facilitate quick change-over from product to product. Finished products should be handled in a microbe free, controlled environment. Since the quality assurance certifications are almost mandatory, design aspects are planned well before building the plant. Higher capacities may be planned for utilities depending on the future short-time expansion plans. It is very important to have a fully functional laboratory for both quality monitoring, and product development.

C : HUMAN RESOURCES

The operations are labour intensive at handling of bulk herbal raw materials while charging and unloading the batches. However, a suitable labour policy may be adopted, where routine un-skilled operations are managed with contract. In practice, the technical shop floor

personnel are selected to remain faithful rather than being an expert. One team leader with a fair experience and competency is enough to handle and co-ordinate the entire team.

D : FORMULATED NUTRACEUTICAL PRODUCTS

An extraction plant can always be integrated with a formulation facility for the following reasons – Nutraceuticals ingredients manufactured in-house, better specifications control on supplies, sustainability, confidentiality management, quick access for newer ingredients, sharing of testing, R&D facilities, and consistency of production and distribution.

The increasing awareness of dietary supplements is encouraging. Flooding of harmful packed food and beverages in the consumer sector has lead to chronic debilities. Some of such harmful ingredients we find in the packed food are – gluten, fructose, sucrose, soy lecithin, triglycerides, hydrogenated fats, synthetic colours & flavours, toxic agro chemicals, heavy metals, pathogens and many more. These substances hinder the healthy function of body organs, leading to chronic diabetes, heart ailments, obesity, arthritis, etc. Nutraceuticals play a responsible role in the elimination of toxins and prevention of degeneration due to environment and lifestyle.

The formulation of a nutraceutical product takes its cue from the time tested traditions of ayurveda and other alternative medicine. But, it is enhanced by marking a quantified ingredient which claims the therapeutic action. Also, other purity specifications are ensured and validated for the shelf-life and exact dosages. All these factors make the modern formulation, better accepted in the global market.

Some of the nutraceutical products worth show-casing for SriLanka market are –

1. Lipid profile regulators – Garcinia, gingerols
2. *Aegle marmalasin* – Ulcerative disorders

3. Arthritis & cancer prevention – Curcumin with piperine.
4. Degenerative disorders – Moringa extract with piperine.
5. Diabetes management – Cinnamon extract
6. Memory enhancer – gotu kola extract (asiaticosides) And cosmetic products of coconut oil base & many more.

Frequently, formulations involve several ingredients, excipients, taste enhancers. While the key ingredients are made in-house, few additives may also be outsourced. Other than products in capsules, nutraceuticals can also be promoted as health promoting, disease preventing consumer products as sachets, beverage powders, fortified tea (herbal tea) or fortified food.

The Views and information included in this article are the solely of the author, who has over 35 years in several manufacturing facilities of plant based products (HERBAL), in the functions of product development research, process engineering design, technical consultation, project management, quality assurance, production, regulatory administration and market communication.



FENUGREEK: THE LESSER KNOWN SPICE

By Nadeesha Gunasekera



Introduction

Fenugreek, or *Trigonella foenum-graecum* L. as is known botanically, is a semiarid herb that is commonly found growing in the Mediterranean region of the world. In Sri Lanka, is known as Ulu hal. It is also referred to as Greek hay, Iholva, Bird's Foot, Boyotu, Chinagreya, Fenegriek, Fenugreek, Foenum Graecum, , Halva, Sickle Fruit Fenugreek and many other names.

Fenugreek seeds were used for embalming in Egypt and also used as a medicine by roasting the seeds as a coffee. In ancient times fenugreek, had less importance in culinary use but was cultivated later on a large scale as a medicine. It was used as cattle fodder in Greece and Rome and grown extensively in the imperial gardens of Charlemagne.

Presently major fenugreek-producing countries are Afghanistan, Pakistan, India, Iran, Nepal, Bangladesh, Argentina, Egypt, France, Spain, Turkey, and Morocco. The largest producer is India.

More about the Plant

Fenugreek plant is an erect annual herb, about 60 cm high, with tender stalks, and trifoliate, triangular acuminate light green, leaves, and yellow or pale whitish pea-like

flowers. It is a cold season crop and is tolerant to frost and very low temperature. It is best suited to tracts of moderate to low rainfall and is sown in all types of soil, but performs better in loam and clay loam with proper drainage.



Fenugreek seed

Fenugreek seed is 2.5 to 5 mm long, small, hard, smooth and oblong with a deep furrow running obliquely from one side dividing the seed into a larger and smaller part. Seed becomes coated when soaked in water. When the seeds are mature, the whole plant is uprooted and hung for drying. After the plant dries completely the plant is threshed to separate the seeds. The seeds are then cleaned and packaged. Seeds are farinaceous and bitter in taste but lose their bitterness if roasted slightly. The leaves of the plant have high medicinal and nutritional value.

Significant Chemical Constituents of the Plant

Diosgenin, a steroid sapogenin found in fenugreek is the starting compound for over 60% of the total steroid production by the pharmaceutical industry. Whole Fenugreek seeds also contain 4.8% saponins. Fenugreek seed saponins are of steroidal nature (type furostanol saponins) with diosgenin as the principal steroidal saponin. Other sapogenins found in fenugreek seed include yamogenin, gitogenin, tigogenin, and neotigogens. Fenugreek seeds contain alkaloids, including trigonelline, gentianine and carpaine compounds. The seeds also contain fiber, 4-hydroxyisoleucine and fenugreekine, a component that may have hypoglycemic activity. Other constituents of fenugreek include mucilage, bitter fixed oil, volatile oil, and the alkaloids choline and trigonelline. Extract of fenugreek is obtained by alcoholic extraction. The chemical composition of Fenugreek seeds and defatted Fenugreek seeds is given in the following table.

Component	Whole Seeds	Defatted Seeds
Moisture	9.0	9.0
Ash	3.0	3.5
Lipids	8.0	Negligible
Protein	26.0	28.3
Starch	6.0	6.5
Total Fiber	48.0	51.7
Gum	20.0	19.2
Neutral Detergent Fiber	28.0	32.5

These seeds are a rich source of fibre and protein. They are also rich in vitamins such as Thiamin, Folic acid, Riboflavin, Niacin, vitamins A, B6, and C, and are a storehouse of minerals such as Copper, Potassium, Calcium, Iron, Selenium, Zinc, Manganese, and Magnesium. Fenugreek leaves are a rich source of vitamin K as well. They have a strong, pleasant, sweetish odour reminiscent of that of burnt sugar. The fibre may be further classed as gum (gel fibre) and neutral detergent fibre.

Medicinal Uses

Fenugreek has a long history of medicinal uses in Ayurvedic and Chinese medicine, and has been used for numerous indications, including labour induction, aiding digestion, and as a general tonic to improve metabolism and health. Preliminary animal and human trials suggest possible hypoglycemic and anti-hyperlipidemic properties of oral fenugreek seed powder.

Therapeutic importance of fenugreek

a) Treatment of Diabetes

In animal and human trials, fenugreek seeds have been found to lower fasting serum glucose levels. It is thus used as antidiabetic remedy for both type I and II diabetes. Saponins and diosgenin present in fenugreek are responsible for hypolipidemic and anti-diabetic action. Fenugreek is described as an antihyperglycemic herb.

b) In cancer therapy

Fenugreek is a medicinal herb for therapy in cancer patients under chemotherapeutic interventions. Fenugreek extract shows a protective effect by modifying the cyclophosphamide induced apoptosis and free radical-mediated lipid peroxidation in the urinary bladder of mice. Flavonoids and catechins were first shown to be apoptotic in human carcinoma cells. Diosgenin present in fenugreek prevents cell growth and induced apoptosis in the H-29 human colon cancer cell

line. Fenugreek seed was also found to have hepatoprotective properties. Polyphenolic extract of fenugreek seed acts as a protective agent against ethanol induced abnormalities in the liver.

c) As an antioxidant

Fenugreek has antioxidant properties due to the presence of Flavonoids and polyphenols. Fenugreek seeds are rich in polyphenol which showed protective effects against hydrogen peroxide-induced oxidation by protecting the erythrocytes from haemolysis and lipid peroxidation.

d) In lowering cholesterol

The abnormal deficiency of cholesterol level in the blood is known as hypocholesterolemic problem. Fenugreek increases the fecal bile acid and cholesterol excretion. It may be secondary to a reaction between the bile acids and saponins causing the formation of micelles too large for the digestive tract to absorb. Another effect is that, the fiber-rich gum portion of the seed reduces the rate of hepatic synthesis of cholesterol. Both these mechanisms contribute to cholesterol lowering.

e) Fenugreek in anthelmintic activity

Seeds of fenugreek showed marked and potent anthelmintic activity. It is the alcoholic extracts which showed promising results of anthelmintic activity, the water extract showing lesser activity.

f) In antibacterial activity

The water extracts of the seed have been found to have antibacterial activity, and is effective against *Escherichia coli*, *Salmonella typhi* and *Staphylococcus aureus*. To make this aqueous extract, the seeds are boiled in water. The synthetic α - on abdomen such as abdominal distension because of excessive inhibition of pancreatic enzymes which results in the abnormal bacterial fermentation of undigested

carbohydrates in the colon. Therefore, research on the development and utilization of antidiabetic plants with mild inhibition of pancreatic enzymes will be beneficial. The glycolytic activity of α -amylase may occur through the direct blockage of the active centre at several subsites of the enzyme as also suggested for other inhibitors. The fenugreek extract contains α -amylase inhibitory factors which probably interact with the active sites of the enzyme in a substrate specific manner. To inhibit the growth of *Pseudomonas* spp., *E. coli*, *Shigella dysenteriae*, and *Salmonella typhi*, fenugreek is effective.

g) In combating obesity

Obesity is one of the major risk factors for morbidity and mortality. It may be defined as abnormal growth of adipose tissue. In some research studies it is indicated that fenugreek seed extract supplementation reduces the body and adipose tissue weight. The probable mechanism of fenugreek decreasing the total body and adipose tissue weight may be that fenugreek flushes out the carbohydrates from the body before they enter the blood stream resulting in weight loss. Fenugreek seeds contain a high proportion (40%) of soluble fibre. These fibres form a gelatinous structure which may have effects on slowing the digestion and absorption of food from the intestine and create a sense of fullness in the abdomen, thus suppressing appetite and promoting weight loss.

h) In Gastro protection

The fenugreek seeds are effective against gastric ulcers. The aqueous extract and a gel fraction isolated from the seeds of fenugreek showed significant ulcer protective effects. The cytoprotective effect of the seeds is due to the anti-secretory action and effects on mucosal glycoproteins. The rise in lipid peroxidation induced by ethanol is also prevented by fenugreek seeds. The mechanism behind it is that it enhances the antioxidant potential of the gastric mucosa hence lowering mucosal injury. Through several research studies, it was revealed that the soluble gel fraction derived from the seeds was

more effective than omeprazole in preventing lesion formation. These observations show that fenugreek seeds possess antiulcer potential.

i) Influence on Digestion

It has been reported that spices consumed in the diet influenced the pancreatic digestive enzymes. This was shown to be so in the case of fenugreek where rats fed with spicy diets for eight weeks displayed enhanced pancreatic lipase activity. High fibre of fenugreek helps in relieving constipation problems

j) In Inflammation

The 100 and 200 mg/kg dose of fenugreek reduced carrageenan induced paw edema in rats. Fenugreek extract contains several alkaloids and it has been reported that these alkaloids are essential to produce anti-inflammatory properties and antipyretic properties by significantly reducing hyperthermia induced by Brewer's Yeast. The anti-inflammatory property of fenugreek is probably due to the presence of saponins and flavonoids. Flavonoids act as antioxidants and potential inhibitors of cyclooxygenase, lipoxygenase, and nitric oxide synthase.

k) In hypertension

Endothelial dysfunction is a devastating condition which is associated with inducing various disorders such as atherosclerosis, hypertension, diabetes mellitus etc. The essential oil obtained from fenugreek in combination with other essential oils has been employed to reduce systolic blood pressure in spontaneously hypertensive rats.

Other Uses

An essential oil obtained from the seeds of fenugreek is used as a food flavouring and a medicinal preparation. The dried plant has a strong aroma of hay. The crushed seed, mixed with oil and massaged into the scalp, is recommended for glossy hair. An infusion of the seed, used as a skin lotion,

is said to be good for the complexion. A good green manure crop, it is fast growing and vigorous, producing a lot of bulk and fixing a large quantity of atmospheric nitrogen. A yellow dye is obtained from the seed.

Fenugreek Extract

For many years, the extract of fenugreek has been used as an ingredient of flavours and to a lesser extent fragrance compositions. Fenugreek extracts are generally prepared by initially extracting the ground seed with alcohol or aqueous alcoholic solutions. Numerous types of fenugreek extracts are available. Most of the differences between the extracts relate to the timed heat treatment of the seed up to roasting temperatures prior to extraction. A survey of the literature reveals that quite a lot is known (Leung 1980) about the nonvolatile portion but until recently nothing was published on the volatile portion of this commonly used extract.

In 1985 Girardon et al. examined the chemical composition of the headspace of fenugreek seeds and compared this to a steam distillate and an ether extract of the same material. The authors used a combination of retention times data on a polar and nonpolar capillary column in combination with GC/MS to characterize numerous components. A summary of their data can be seen in Table II.

Although several studies were carried out researchers were unable to characterize any single component that was thought to capture the aroma characteristics of fenugreek. In a more recent study, the same authors (Girardon et al. 1986) used a combination of modern analytical techniques to characterize the presence of 3-hydroxy-4,5-dimethyl-2(5H)-furanone in a fraction of an alcoholic extract of fenugreek. The authors further reported that this furanone possessed the characteristic aroma of fenugreek seed. It was also found that on dilution 3-hydroxy-4,5-dimethyl-2(5H)-furanone had a very persistent aroma.

Fenugreek : Trends in consumption and prospects

Due to environment and health concerns there has been a growth in the sale of organic spices. There is no doubt that organically certified spices will be seen more and more in the market. At present, none of the major brands have entered this field largely because of the lack of assured quality suppliers. Another related development has been that of “diet spices”: low sodium, low calories or fat-free sauces and seasonings (Commonwealth Secretariat).

Elsewhere, the Middle East is fast becoming the major outlet for fenugreek seed and there could be possibilities in the region for new suppliers. The reason for the growth in demand in the Middle East is probably the same as that given for the other spices, namely the influx of migrant workers from South Asia. The other important area where there are prospects for expanded trade is Asia, but imports into many countries in the region vary.

One possible application, for which it is claimed that fenugreek has good prospects, is in the production of diosgenin, a steroid precursor. The main source of diosgenin is wild yams of certain *Dioscorea* sp. (See also Link Digest Vol. 10, Issue 02, pg. 25) The main source of diosgenin is wild yams of certain *Dioscorea* sp. Owing to supply problems in the principal producing country, Mexico, diosgenin has become expensive bringing about a switch to cheaper steroid precursors such as steroids from soya beans. This has led to a sharp fall in the proportion of diosgenin to other materials used in the production of steroids. For some oral contraception uses, steroids are also produced by total synthesis nowadays. However, it is most unlikely that the extraction of diosgenin from fenugreek will become economically viable, as a considerable fall in the price of fenugreek would be required, which would also reduce its attraction to growers. Therefore, this usage is thought to offer little prospect for producers.

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To such an extent does nature delight and abound in variety that among her trees there is not one plant to be found which is exactly like another; and not only among the plants, but among the boughs, the leaves and the fruits, you will not find one which is exactly similar to another. Leonardo da Vinci

CHAMOMILE– AN OLD WORLD MEDICINAL HERB WITH A PROMISING FUTURE.

By VIKRAMA

Introduction

If one is in Europe, West or East, one becomes very familiar with this plant, used as a medicine, popular herbal beverage, and even in preparations used as fragrances. However it is not so well known in the countries of the British Commonwealth. This explains why it is unknown to the south Asian region where herbal medicine is otherwise so well recognized. The ignorance of the virtues of Chamomile is a vast lacuna in the medical systems of these countries, and here Sri Lanka is an example.



Chamomile figures in the writings of Hippocrates, the celebrated Greek Botanist cum Physician in the 5th century BCE, the records of Dioscorides, a Greek scientist of the 1st century CE, and the Roman Physician Galen of the 2nd century CE.



There are two main varieties of Chamomile recognized as German and Roman. Botanically, they are identified as follows: German Chamomile as *Matricaria chamomilla* and Roman Chamomile as *Chamaemelum nobile*, both being representatives of the daisy family, Asteraceae, or Compositae. Chamomile is one of the oldest known medicinal plants and extensively used during the times of the Romans and the Greeks, and even earlier in ancient Egypt and since then continuously figuring prominently in the therapeutic armory of European medicine.

It is now identified as a medicinal plant with a noble past but more importantly a more than promising future as far as the global therapeutic scenario is concerned. It has been incorporated into Indian medicine as well as Chinese and Japanese medicine of the present time.

Traditional Uses

The therapeutic texts of ancient times that is the Egyptian, Roman, Greek medical texts identified chamomile as a calming tisane for the treatment of the superficial reddening of the skin, and abnormally dry skin caused by specially dry weather. Egyptians as well as Saxons are reputed to have held Chamomile as sacred, and in Slovakia too the plant was held in reverence. In the Unani system of Medicine Chamomile, known as: Gul-e-Babuna is used singly or in combination with other herbs for a wide range of conditions ranging from headaches, gonorrhoea, conjunctivitis, chest pains, kidney stones, and fevers.

The water extract of the flowers and stems of the attractive flowering plant was for centuries used as a medicine for soothing and healing of wounds. It was used as a mild astringent, antiseptic and an anti-inflammatory agent. The traditional methodology reached out to even modern times when in the poorer sections of Europe, the regions that had known and suffered from the ravages of war were accustomed to treating conditions such as wounds, ulcers, eczemas, skin ailments of every kind, rheumatic pains, neuralgias, and the like with solutions of chamomile. Its gentle effectiveness extended even after the anti-biotic era to the treatment of mild hemorrhoids, where the inflammatory condition as well as the infection was treated with admirable success with chamomile. Indeed the traditional uses of this plant has been extensive to cover ailments of the eyes, the digestive tract, infections of the ears, nose, mouth, and use as a sedative to calm nerves and to reduce anxiety. It's effectiveness was also known as a treatment for gastrointestinal disorders, and as a uterine tonic. It has also been used in the treatment of arthritic pains and lumbar pains, and so it could qualify to be regarded as a traditional cure for a number of common symptoms. In the context of modern scientific research the metabolic constituents of the plant gives rise to much interest in view of the number of physical ailments it has over the ages been known to address. Chamomile, in the mode

of health care had been traditionally used in several forms. The dried powdered flowers are normally kept in storage and even used as such for specific ailments for which it may be deemed to be suitable. Extracts of the dried flowers made with water, alcohol, or methanol are also medicinally used.

Chamomile Production

Hungary, Rumania and the countries of Eastern Europe have been regarded as the home of the chamomile plant and Germany and the Austro-Hungarian region, has always been a major producer, and also a major consumer of the plant.

Chamomile was cultivated in the US by German settlers and soon became an important medicine used by 19th century physicians who used it primarily for treating pregnant women and young children. The herb enjoys relatively widespread use and considerable cultural acceptance in the German speaking regions of



Harvesting of Chamomile flowers

Europe. In addition to its German name Kamilienbluten, it is known by the appellative alles zutraut, which means capable of anything. Prior to the World War II the demand in Germany was of the order of a 1000 metric tonnes of flowers which were mostly collected from the wild flora. At the time only around six hectares were known to be cultivated. Even as of 1955 Germany was its main supply source with imports from Hungary, the Czech Republic and Russia. Although the main source was at the time from wild collections, soon competition from cultivated sources from Egypt and Argentina came to be a reckonable factor.

Formal Usage Authorization

In 1984 the German Commission E formally approved the use of preparations of Chamomile flowers as internal non-prescriptive medicines for gastrointestinal spasms and inflammatory diseases of the intestinal tract, as well as external medicines for skin and mucous membrane inflammations, bacterial skin diseases including the oral cavity and gums, and irritation and inflammation of the respiratory tract, the rectum, and anus and urogenital tract.

Besides, the various European Pharmacopoeias specify the methodologies for the harvesting and the preparation of pharmaceutical products derived from the flowers of the varieties of chamomile.

The British Herbal Compendium had already listed chamomile flowers for external use for spasms and inflammatory conditions of the gastrointestinal tract, peptic ulcers; sleep disorders, and various eczemas and skin conditions. The flowers, Chamomile flos is the basis of a WHO compendium on Medicinal Plants, and the products from it are included in many formal publications as Over-the-counter or OTC herbal Pharmaceutical Products.

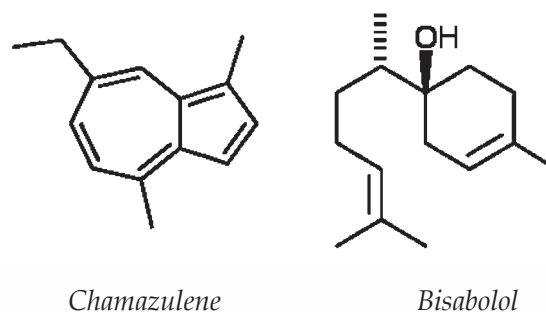
The chemical Constituents of Chamomile

Given the numerous therapeutic application, the variety of chemical metabolic

constituents of the plant chamomile would indeed be revealing, since today modern science has been able to assign activity responses to many chemical entities. The characteristic odour of the plant is due to its essential oil which like any other essential oil can be separated from the plant material by the process of steam distillation. The steam-volatile oil ranges from 0.25-1.9% depending on the freshness of the material and the botanical variety of the material. The oil ranges in colour from a bright blue at first when the azulene component mainly chamazulene distils over, and then it goes into a deep green as the other components of the composite oil gets accumulated. On storage for a period of time the oil is a deep yellow. The principal constituents of the oil are the terpenoids alpha-bisabolol, and the azulenes.

The chemical constituents of the oils are as follows:

Alpha-bisabolol, bisabolol oxides, chamazulenes, and flavanoids



Some Recent Scientific Studies.

Anti-inflammatory effects.

The anti-inflammatory effects are pre-eminently addressed in the traditional treatments. Studies on human volunteers have established that the essential oil from the flowers of chamomile, as well as the flavonoids from the extract from the flowers could penetrate from the surface of the skin into deeper layers, and this is important from the anti-inflammatory aspect of the effectiveness. The in-vivo skin penetration studies carried out by Merfort and co-workers support this.

Anti-cancer activity.

Apigenin is a major constituent of Chamomile and many studies reacting to antitumour activity are centred around this constituent. Promising growth inhibitory effects have been noted in pre-clinical models of skin, prostate, breast, and ovarian cancers. Srivastava and coworkers have shown that chamomile extracts displayed minimal growth inhibitory effects on normal cells but showed significant reduction in cell viability in several human cancer cell lines.

Hemorrhoids.

The treatment of hemorrhoids with chamomile has been a common and successful practice in Europe for many decades and there is clinical evidence of its efficacy in primary cases. Nowadays preparations such as chamomile ointments are employed. Tinctures of chamomile are also used in the format of a sitz bath. Tinctures of Roman chamomile are recorded as having reduced inflammation in hemorrhoids.

Eczemas & Skin conditions.

Ointments and creams incorporating extracts of Chamomile are now employed in the treatment of mild eczemas and skin irritations. Clinical trials have shown the efficacy of the chamomile incorporated creams as well as their comparative safety.

Gastrointestinal Balance

Chamomile has been used traditionally with evident success to maintain a gastrointestinal balance particularly in post-middle age populations. Numerous gastrointestinal conditions are believed to have been successfully addressed by its use. These include digestive spasms, or colic, flatulence, ulcers and gastrointestinal irritation.

Now Chamomile has been shown to be helpful in dispelling gas in the stomach and intestines, soothing the stomach and relaxing the

muscles in the tract that moves the food along. Several preparations containing largely extracts of Chamomile are now available that are seen to have a similar beneficial effect on the stomach and intestinal tract. Inflammation is also associated with many gastrointestinal disorders such as oesophageal reflux, and diverticular disease. Studies in preclinical models suggest that Chamomile or its extract is able to inhibit bacteria such as *Helicobacter pylori*, the bacteria that can initiate stomach ulcers. Chamomile or its extracts have been shown to also be able to reduce smooth muscle spasms associated with a variety of gastrointestinal inflammatory conditions.

Calming and sedation.

This is yet another significant traditional usage that has now been scientifically established. Chamomile teas and essential oil has over the years been used to effect a calmness and sense of tranquillity. Chamomile is widely regarded as a mild tranquiliser and a sleep inducer. The sedative effects noted for it is considered as being due to Apigenin a major flavonoid constituent. Apigenin binds to the benzodiazepine receptors in the brain. Studies in preclinical models have indicated anticonvulsant and CNS depressant effects as well. There are no clinical trials to confirm these.

In summary, the pharmacological animal studies so far conducted on extracts of chamomile, and constituents, have revealed the following properties:

- Anti-anxiety and stress relieving.
- Anti-cancer, anti-mutagenic and anti-inflammatory
- Anti-peptic, antispasmodic, anti-staphylococcal, anti-ulcerative
- Hepato-protective, neuroprotective, skin metabolizing, anti-dermic
- Fungicidal and wound healing,
- Bactericidal, fungicidal.

Further, controlled clinical trials conducted on pharmaceutical preparations derived from chamomile such as Kamilosan cream, proved to be as effective as dihydrocortisone, and superior to other tested products in the treatment of neuro-dermatitis.

In 2009 a randomized, double-blind, placebo-controlled study investigated the efficacy of chamomile extract on Generalized Anxiety Disorder (GAD), and a statistically significant improvement of symptoms were seen as compared with a placebo. Extension of this study also revealed an anti-depressive effect of the chamomile extract.

A similar randomized pre-post study conducted in 2009-2010 to assess the efficacy of chamomile in Irritable Bowel Syndrome (IBS), revealed significant beneficial effects.

Extracts of chamomile proved effective in the treatment of stomatitis, a painful oral inflammatory ailment, even more than the allopathic treatments of mouth washers.

Studies also revealed that chamomile extract mouthwash proved more effective in the treatment of Recurrent Aphthous Stomatitis (RAS), than the available allopathic treatment.

Concluding Observations

Research especially in Europe has blossomed following the emergence of chamomile as a mild and effective treatment for a wide range of diseases. Also the chamomile flower remains one of the most in-demand medicinal plants in global trade. Predictable the annual demand for it will continue to grow, as the collections from the wild sources continue to decrease and be replaced by those from planned cultivations. Cultivations have scaled up in countries such as Egypt, and Argentina, where the costs of production are lower than in the celebrated cultivation regions in Europe such as Germany and the Balkan regions. While Egypt is the world's top producer, Germany remains the world's top importer, as it is a most popular

herbal tea in the country. The herbal tea is a popular drink due to its multiple health benefits.

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"The problem with history," the late ethnobotanist Richard E Schultes, frequently used to say in his 'Plants and human affairs' course, "is that it is written by historians who often know little or nothing about botany or ethnobotany. Much of our history can and should be written in terms of plants and their effects on human affairs"

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The most exciting phrase to hear in science, the one that heralds the most discoveries, is not "Eureka!" (I found it!) but "That's funny..."

~Isaac Asimov

NEERAMULLI – A WEED USED IN DISEASE THERAPY

By MI Thabrew*



Introduction

Hygrophila auriculata (family **Acanthaceae**) is a spiny, stout, annual herb that grows in marshy places. In Sri Lanka it is commonly referred to as Katu-ikiriya or

Neeramulliya by the Sinhalese and Neeramulli or Nirmalli by the Tamils. In Hindi it is known by many names including Gokulakanta and Talmakhana. It is a popular leaf vegetable and also used in Ayurveda for medicinal purposes.

Synonyms of *Hygrophila auriculata* are : *Asteracantha auriculata*, *Asteracantha longifolia*, *Asteracantha macracantha*, *Barleria auriculata*, *Barleria cornigera*, *Barleria glabrata*, *Barleria herecantha*, *Barleria longifolia*, *Barleria macracantha*, *Barleria spinosa*, *Hygrophila longifolia* and *Hygrophila spinosa*.

In Ayurvedic literature, *Hygrophila auriculata* is described as Ikshura, Ikshugandha and Kokilasha - "having eyes like Kokila or Indian cuckoo". In Ayurvedic treatise such as 'Sushruta Samhita' and "Charak Samhita" this plant is considered to be useful as a Rasayan or rejuvenator. According to these ancient texts, it is also used as a constituent of the Ayurveda formulation "Strirativalabhupugpak" and "Rativardhanayog" that is used to improve sexual behaviour and as a general tonic (Vaidya, 1970).

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Geographical sources

The plant is widely distributed throughout India, Sri Lanka, Burma, Malaysia and Nepal. In Sri Lanka, it is commonly found in the dry zone and in the low country in ditches and moist places such as banks of tanks, ditches and paddy fields (Jayaweera, 1981; Ediriweera, 2007).

Phytochemical composition

Phytochemical investigations have revealed that the whole plant contains tannins, sterols, terpenoids, flavonoids, carbohydrates, and phytosterols.

The aerial parts have been reported to contain a seed oil containing linoleic acid, palmitic acid and stearic acid, the alkaloids asterol I-IV, asteracanthine and asteracanthinine 1, Lupeol, betulin and β -sitosterol (0.031%). Lupeol has also been reported from the roots. The leaves show the presence of the alkaloid hentriacontane while oil in seeds of the plant have been shown to contain many fatty acids such as linoleic acid, oleic acid, stearic acid, palmitic and myristic acids. Apigenin-7-O-glucuronide and apigenin-7-glucoside have been demonstrated to be present in the flowers. Flame photometric and atomic absorption spectrophotometric analysis has also revealed the presence of the minerals Mn, Mg, Zn, Ca, Fe, Ni, Cr, Na, K, Al and Sr in this plant (Balraj and Nagarajan, 1982; Mazumdar et al., 1999; Sondhi and Agarwal., 1999; Patra et al., 2009; Nigam et al., 2015).

Traditional uses

In traditional systems of medicine, the whole plant, roots, seeds and ashes of the plant are extensively used for the treatment of a variety of disease conditions. The tincture of the whole plant is considered to be useful for alleviation of urinary infections, dysuria and painful micturition. In the Muslim system of Ayurveda, the Neeramulli plant is used externally as a poultice or embrocation for rheumatism. The oil

extracted from plant is used as an antibacterial agent. A decoction of the root is considered to be a diuretic and is administered to patients with stones in the kidney. It is also used to treat hepatic disorders, rheumatism, gonorrhoea, and as an antidysentric. The burnt ashes of the plant mixed with cow's urine is used to treat oedema and dropsy. The seeds are used to treat gonorrhoea, biliousness, jaundice, anasarca, spermatorrhea and fever, and also used as an aphrodisiac. The leaves are believed to have aphrodisiac and hypnotic properties and considered to be useful as a diuretic, spasmolytic and hypotensive. In India, this plant is also traditionally used to treat cancer, inflammation, diabetes, pain and fever (Jayaweera, 1981; Chopra et al., 1986; Ediriweera, 2007).

Pharmacological properties

During the past few years, a number of in vivo and in vitro studies have been conducted to scientifically validate the ethnopharmacological uses of different varieties of this plant as well as to discover hitherto unreported pharmacological properties that could be further exploited for the benefit of human patients. Findings of these studies conducted by various investigators are briefly described below.

Hypoglycaemic activity

Studies carried out by Fernando et al., (1989) have demonstrated that an aqueous extract of the fresh, whole plant of *H. longifolia* (at a therapeutic dose equivalent to 5 g/kg of the starting material) can, in a non-toxic manner, significantly reduce the fasting blood glucose concentration and improve the glucose tolerance in rats. From investigations on extrapancreatic effects of this plant extract, Fernando et al. (1998) concluded that the plant extract probably exerts hypoglycaemic effects via mechanisms similar to those utilized by sulphonylureas that have been in the allopathic system of medicine for the control of diabetes mellitus. Thus, administration of the plant extract could significantly increase (a) the glycogen content in liver and muscle and (b) triacylglycerol content in the adipose tissue

although it had no effect on gluconeogenic activity of the kidney or intestinal glucose absorption and insulinase activity in rats when administered prior to glucose loading.

A study carried out by Vijayakumar et al. (2006) has also shown that an ethanolic extract of the aerial parts of this plant can mediate significant antidiabetic effects and also exert significant antioxidant effects in diabetic rat models.

Results of investigations carried out by Fernando et al. (1991) with 20 each of normoglycaemic humans and insulin independent diabetic patients confirmed the ability of the aqueous extract of *H. longifolia* to reduce the fasting blood glucose concentration and improve the glucose tolerance in humans also.

Anti-inflammatory and Anti-pyretic activity

Investigations carried out by Patra et al (2009), have demonstrated that chloroform and alcoholic extracts of *H. spinosa* can mediate anti-inflammatory and antipyretic effects in carrageenan induced inflammatory rat model as well as in chronic inflammation rat models. Cotton pellet-induced granuloma and Freund's adjuvant-induced arthritis in rats were used to assess effects in chronic inflammatory conditions. Antipyretic effects were evaluated by monitoring effects on Brewer's yeast -induced pyrexia in rats. Overall results of these studies provided supportive evidence for the traditional use of Hygrophylla extracts to treat rheumatism.

Hepatoprotective activity

The hepatoprotective activity of aqueous extracts of the stems and roots of *H. auriculata* and *H. spinosa*. have been investigated by evaluating effects of these extracts on carbon tetrachloride and paracetamol induced liver toxicity in rats. Effects of the extracts on serum marker enzymes aspartate transaminase, alanine transaminase, alkaline phosphate and γ -glutamyl transferase, as well as total protein and total bilirubin

indicated that the above plant extracts could offer significant hepatoprotection against carbon tetrachloride induced liver damage in rats. Histopathological studies also provided evidence to support results obtained in the liver function tests (Shanmugasundaram and Venkataraman, 2006; Hewawasam et al., 2003; Usha et al., 2007; Kshirsagar and Ashok, 2008)

A methanolic extract of the seeds has also been reported to offer protection against paracetamol and thioacetamide induced liver damage in rats (Singh and Handa,1995). All these studies support the traditional use of Hygrophila for hepatoprotection.

Analgesic activity

By use of the hot plate and tail flick thermal methods and the chemical method acetic acid-induced writhing test, Patra et al. (2008) have been able to demonstrate that petroleum ether, chloroform, alcohol, and aqueous extracts of leaves *H. spinosa* leaves can exert significant analgesic activity in rats. These extracts significantly enhanced the pain threshold of mice towards the thermal source in a dose dependent manner and also inhibited the abdominal constriction produced by the acetic acid. Similar results have been reported in a previous study with *H. auriculata* (Shanmugasundaram and S. Venkataraman, 2005). The activity exhibited by the extracts was comparable to that of the standard drug aspirin (100 mg/kg/p.o). These results reveal that the Hygrophila plant extracts are able to mediate analgesic activity by central as well as peripheral mechanisms.

Antitumor activity

Investigations carried out by Mazumdar et al. (1997) have shown that the petroleum ether extract of *H. longifolia* can inhibit tumour development in Ehrlich ascites carcinoma (EAC) and sarcoma-180 (S-180) bearing mice. At the end of three weeks, it was observed that the tumour fluid volume was significantly suppressed and the life span of EAC/S-180 mice increased, in a day-dependent manner, in animals treated with

the extract. The rapid increase in body weight of the tumour bearing mice was also inhibited. After the extract treatment, the red blood cell and white blood cell counts as well as the haemoglobin content of tumour bearing mice also increased significantly.

A methanol extract of the seeds has been demonstrated to inhibit hepatocarcinogenesis in Wistar rats (Ahmed et al., 2001). Hydro-alcoholic extract of *H. spinosa* has also been shown to prevent or delay the development of breast cancer in rats (Pattanayak and Sunita, 2008). The above findings help to rationalize the traditional uses of *Hygrophila* extracts to treat cancer and blood disorders.

Antimicrobial activity

A study carried out by Sami (2005) has revealed that *H. longifolia* has the potential to inhibit the growth of *Burkholderia pseudomallei* strain. The antibacterial activity of sequential extracts of *H. spinosa* leaves were evaluated using the disc diffusion method by Patra et al in 2008. Results demonstrated that the alcoholic and chloroform extracts could exert much higher antibacterial activity against *E. coli*, *Staphylococcus aureus*, *Bacillus subtilis* and *Pseudomonas aeruginosa*, when compared to the other extracts. The findings support the traditional uses of *Hygrophila* extracts to treat bacterial infections.

Diuretic activity

Male Wistar rats were divided into three groups. First group was treated with normal saline(control group), the second with the positive control Frusemide and the third with the *H. auriculata* extract. At the end of 5h, the total urine volume and concentrations of Na⁺, K⁺ and Cl⁻ determined. A significant increase in the total urine volume and concentrations of Na⁺, K⁺ and Cl⁻ in urine, were observed in the group of rats receiving a 200 mg/kg dose of the alcoholic extract of *H. auriculata* thus supporting the traditional use of this plant as a diuretic (Ahmed et al., 2009)..

Haematopoietic activity

According to Mazumdar et al (1996), a petroleum ether extract of *H. longifolia* root can significantly increase the WBC count in rats. An ethanolic extract of *H. spinosa* aerial parts has also been reported to mediate significant increases in the haemoglobin, haematocrit, RBC and total WBC in normal and anaemic rats as compared to their concentrations in vehicle treated control rats (Gomes et al., 2001).

Pawar et al.,(2006) have demonstrated that chloroform extract of the leaves of *H. spinosa* for 7 days can mediate significant improvements in RBC and haemoglobin counts in rats induced with anemia using cyclophosphamide. Significant improvements in cyclophosphamide induced bone marrow suppression as well as bone marrow cellularity were apparent after 21 days of treatment.

Antioxidant activity

A majority of the present day diseases are reported to be due to the shift in the balance of the pro-oxidant and the antioxidant homeostatic phenomenon in the body. In conditions where there is increased generation of the free radicals caused by excessive oxidative stress of the present day life, or poor scavenging/quenching in the body caused by depletion of the dietary antioxidants, there will be an enhanced prooxidant status that can promote the development and progression of various degenerative diseases in humans. Extracts of different parts of *H. longifolia* and *H. spinosa* have been reported to show the presence of many compounds with antioxidant activity such as phenols, flavonoids and tannins, that can lower the incidence and lower the mortality rate of such degenerative diseases (Dasgupta and De, 2007; Usha et al., 2007).

Aphrodisiac activity

Investigations carried out by Chauhan et al., (2009) have shown that an ethanolic extract of *H. longifolia* seeds has androgenic properties and

also can improve the sexual behaviour of rats in a dose dependent manner. This extract can also improve the histo-architecture of the testis and enhance the sperm count in epididymis and the testosterone level in these animals.

Antimotility activity

The traditional use of *Hygrophila* species in the treatment of diarrhoea and dysentery has been supported by results of a study carried out with *H. spinosa* by Patra et al., (2008). The petroleum ether, chloroform alcoholic and aqueous leaf extracts of this plant have been demonstrated to mediate a dose dependent decrease in the distance travelled by charcoal meal through the gastrointestinal tract in mice.

Conclusion

Hygrophila auriculata and other close relatives of this plant have been traditionally used to treat many different disease conditions. Scientifically controlled investigations carried out during the past few years have provided evidence that validates their traditional uses and also have led to the discovery of some unreported properties such as ability to mediate antioxidant and analgesic effects. The pharmacological studies so far have mostly been performed in vitro and in vivo with animal models. However, clinical studies are urgently needed in order to confirm traditional applications using rational phytotherapy.

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To such an extent does nature delight and abound in variety that among her trees there is not one plant to be found which is exactly like another; and not only among the plants, but among the boughs, the leaves and the fruits, you will not find one which is exactly similar to another.

- Leonardo da Vinci

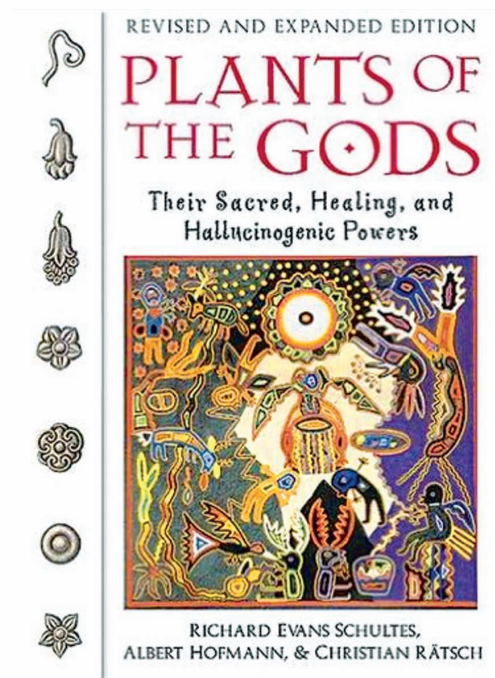
RICHARD EVANS SCHULTES (1915-2011) PIONEER ETHNOBOTANIST, – SUPREME AUTHORITY ON THE SCIENCE OF NATIVE CULTURES AND THEIR USE OF PLANTS

By R.O.B.Wijesekera



Richard Evans Schultes was a scientist unlike any other. He was a Harvard Professor, an explorer of the Amazonian rain forests, an authority of the botany of hallucinogenic plant species, and one who without doubt influenced the likes of Aldous Huxley who considered hallucinogens as perhaps a gateway to paradise.

Schultes researched for decades the relationship in the Amazonian region between native cultures and their use of plants, in particular medicinal plants.



Tall, well-built and strong and yet so gentle in temperament Richard Schultes is known to have hiked and paddled through Amazonia for long periods of time. He spent the wartime years exploring the rain forests in the Columbian Amazon and documented and collected innumerable plant specimens for detailed study.

He was a pioneering conservationist who raised alarms in the 1960's long before

environmentalism became a global theme that the rain forests and their native population were in danger of being sacrificial to the modern tendencies of development and also destruction.

Schultes resented the reference to the native Indians of the Amazon as "hostile". He is reported to have said that "all that is required to bring out their gentlemanliness is reciprocal gentlemanliness".

The author first met Richard Schultes in 1975 when he came to Sri Lanka as a member of the team sent by the National Academy of Sciences of the US for a joint US-Sri Lanka Workshop on Natural Products. The Workshop was held in Colombo, and the author with Carl Djerassi were the respective team leaders. Dick Schultes was a very supportive and helpful colleague and was quite sympathetic towards our country's struggle in developing a capability towards natural products.

From his presentations one got the impression what a delightfully entertaining teacher he would have been at Harvard. Dr Schultes would have contributed his knowledge to the psychedelic era with his unique ethnobotanical research but to him these were the sacred plants that belonged to the Indians that should be studied for their medicinal value. In scientific terms he crisscrossed many disciplines such as botany and natural product chemistry.

Dr Schultes may have taught by vivid personal example. The story is told how he presented a slide at a lecture of masked dancers under the influence of a hallucinogenic potion, and referring to himself in the picture he remarked that the last one has a Harvard degree. Schultes recalls that he took to botany influenced by what was read to him by his parents mostly "Notes of a botanist on the Amazon and the Andes" – a travel diary of the British Naturalist Richard Spruce.

Following a graduate career at Harvard on scholarship, and then completing a doctoral thesis on the plants used by the Indians of Oaxaca, in Mexico. He encountered a species of morning glory whose seeds contained a natural

form of LSD. It was in 1941 that Schultes travelled to the Colombian Amazon where he was to spend most of his field research. It was also an area that Richard Spruce had studied. He focused attention on plants that contained the curare. This was the substance used by the Indians as arrow poisons because the poisons were fast dissipating. The Indians had used the substance for hunting. This substance later proved to be vital as a muscle relaxant in major surgery. Schultes identified more than 70 plant species from which the Indians had obtained curare.

Dr Schultes was deep in the Colombian Amazon when news reached him of the Japanese Pearl Harbor attack and the commencement of the US-Japanese sector of the World War II. He reported promptly to the US authorities who eventually felt that he could be a greater asset as a botanist researching on natural species of rubber. Soon Schultes was to become a leading authority on natural species of Hevea, and as a consequence he was to live the next decade amidst the Amazonian rain forests with only brief visits to the US. He was proficient in the use of a canoe to guide him through the many waterways and apart from cans of Boston beans and tinned food he was accustomed to the food given him by his Indian friends mainly manioc, fish, wild game, insect grubs, fruits and a fermented fruit drink. Schultes learnt of the properties of important plants seeking information from his Indian colleagues. Many plants now bear his name and Indian Shamans were eager to share their knowledge.

Schultes returned to the US in 1953, as Professor of Botany and Curator at Harvard. He retired from Harvard in 1985. Dr Schultes was awarded the Gold Medal of the Linnaean Society, the highest award in Botany. He indeed was the foremost botanist of his time and certainly the most colorful of all.

"The problem with history, " the late ethnobotanist Richard E Schultes, frequently used to say in his 'Plants and human affairs' course, "is that it is written by historians who often know little or nothing about botany or ethnobotany. Much of our history can and should be written in terms of plants and their effects on human affairs" Herbalgram No.101 Feb-Apr 2014.

PRODUCTS FROM LINK NATURAL

SP BALM – THE NEW GENERATION PAIN RELIEVER

By Madhavi Watson and Yoga Chandran

Link Samahan SP Balm is the latest addition to Link Natural Product portfolio. This world class product was developed after extensive laboratory research conducted by Link Natural R &D team together with consumer insights by the brand team.

As the leading herbal health care company with well over 30 years of experience in ayurvedic pharmaceuticals and herbal health care business, SP Balm is introduced as an unique herbal balm that provides quick and safe relief from all aches, pains and common cold.

SP Balm is made of unique formula consisting of effective herbal extracts and essential oils. The synergistic effect of the ingredients is responsible for its efficacy as a pain reliever and other effects. The SP balm provides quick relief for joint pains, muscle pains, sprains, bruises, abrasions, inflammations and other aches and pains and is also effective for insect bites including mosquitos.

SP Balm has a pleasant aroma and good spreadability. It is available in 4 sizes, namely 3g, 7g, 20g & 50g for the convenience of the consumer. The product is expected to be distributed to the grass root level in the country through the company's extensive distribution network.

Balm is a product category which has penetrated almost equally in rural and urban sectors, and is used by consumers of all walks of life, despite provide demographic differences. Hence the product is positioned to provide some relief to those who follow busy life styles, and who do not have time to spare to cater to their day- to-day aches and pains.

A grand Launch was held on the 2nd May, 2016 at Palm Village, Uswatakiyiwa, gathering the entire sales force and respective staff of Link Natural Products. In addition to above-the-line advertising campaigns the company is focusing on below-the-line activations at most appropriate consumer touch points in the country, Sri Pada, Katharagama, Wedihiti kanda to name a few.



GLEANINGS FROM THE LITERATURE

MORE ON NUTRACEUTICALS

by Dilmani Warnasuriya

Nutraceuticals, seems to have taken the health conscious consumer by storm. On visiting any supermarket or pharmacy, there will be a range of herbal products adducing reversal of aging, digestive support, protection (or even treatment) of cancer, increased energy, toxin removal, weight loss, weight gain, and several other health benefits. In fact it would be difficult to find a health condition that is not treatable by a herbal product. The problem we have today, how do you separate the wheat from the chaff, so is to speak?

The philosophy behind nutraceuticals is to focus on prevention, according to the saying by a Greek physician Hippocrates (known as the father of medicine) who said "let food be your medicine". Over the years nutraceuticals have attracted considerable interest due to their potential nutritional safety and therapeutic effects. They could have a role in a plethora of biological processes, including antioxidant defenses, cell proliferation, gene expression, and safeguarding of mitochondrial integrity.

Therefore nutraceuticals may be used to improve health, prevent chronic diseases, postpone the aging process (and in turn increase life expectancy), or just support the functions and integrity of the body. They are considered to be

healthy sources for prevention of life threatening diseases such as diabetes, renal and gastrointestinal disorders, as well as different infections.

A wide range of nutraceuticals have been shown to impose crucial roles in immune status and susceptibility to certain disease states. They also exhibit diseases modifying indications related to oxidative stress including allergies, Alzheimer's disease, cardiovascular diseases, cancer, eye conditions, Parkinson's diseases and obesity.

When one talks of herbal products of medicinal value, distinction must be made between Pharmaceutical products which are based on substances obtained from plants, bacteria and fungi, which have undergone rigorous laboratory and clinical testing and Herbal supplements or Nutraceuticals which are alleged to have great medicinal value of a rather broad nature but they are not supported by any hard evidence. The first category includes aspirin, quinine, and penicillin which have their origins in willow bark, cinchona bark, (see Link Digest Vol. 12. No.1) and *Penicillium chrysogenum* fungus, respectively. These products are accepted as being in the mainstream of medicines. Nutraceuticals on the other hand

are not bound by this burden of proof, and this makes it difficult to determine which claims are valid, and which are based on assumptions, stories, anecdotes, or the glib blah of the medical salesman.

Of course this does not imply that any manufacturer can introduce a product to the market as a nutraceutical. The U.S. Food and Drug Administration requires that any dietary supplement be safe, either by limiting its ingredients to those “generally recognized as safe” or by proving that any New Dietary Ingredient is not toxic at the dose supplied. Natural product suppliers must register with the FDA and abide by Good Manufacturing Practices (GMP), which include requirements for consistency in manufacture, record-keeping, and sterility. However, no proof of efficacy is required; and any claims made regarding such products must bear the following disclaimer: “This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent any disease”. It is up to the consumer to determine if a product is effective.

The cost of making nutraceuticals is obviously far less than traditional pharmaceuticals which involves laboratory studies, clinical trials, toxicity studies etc. to prove its efficacy. The danger thus of nutraceuticals is that with social media and internet being so widely used, it is possible for disinformation of the product to be disseminated without the onus of proof. This, coupled with the difference in cost can influence the consumer to resort to the indiscriminate use of nutraceuticals. The consumer needs to be more educated and indeed this is happening with science education being taught even at primary school level. So the younger consumers are less gullible to the lures of manufacturers than the older generation who actually need nutraceuticals for maintaining their health. A nutraceutical company thus needs to provide some kind of authenticated data to support their claims if they wished to create and maintain a market for their products. In the expanding market, empirical evidence will

definitely go a long way in encouraging sales and counter misinformation and unethical advertising of pseudo medicinal products.

Nutraceuticals is thus a broad umbrella term that is used to describe any product derived from food sources with extra health benefits in addition to the basic nutritional value found in foods. They can be considered non-specific biological therapies used to promote general well-being, control symptoms and prevent malignant processes.

Nutraceuticals can be classified in different ways, one being in terms of their natural sources, pharmaceutical conditions and chemical constitution of the products. Most often they are grouped in the following categories: dietary supplements, functional food, medicinal food, farmaceuticals.

A dietary supplement applies to a product that contains nutrients derived from food products, and is often concentrated in liquid, capsule, powder or pill form. They are regulated by the FDA as foods as a different category.

According to their generally accepted definition, functional food is a category which includes whole foods and fortified, enriched or enhanced dietary components that may reduce the risk of chronic disease and provide a health-benefit beyond the traditional nutrients it contains.

Medical food is formulated to be consumed or administered internally, under the supervision of a qualified physician. Its intended use is a specific dietary management of a disease or condition for which distinctive nutritional requirements are established by the medical evaluation (on the basis of recognized scientific principle).

Farmaceuticals are medically valuable components produced from modified agricultural crops or animals. The term is a

combining of the words “farm” and “pharmaceuticals”.

Potential health benefits

The term “nutraceutical” combines two words – “nutrient” (a nourishing food component) and “pharmaceutical” (a medical drug). The name was coined in 1989 by Stephen DeFelice, founder and chairman of the Foundation for Innovation in Medicine, an American organization located in Cranford, New Jersey.

Their role in human nutrition is one of the most important areas of investigation, with wide-ranging implications for consumers, health-care providers, regulators, food producers and distributors.

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1. <http://www.wasatchscientific.com/legitimizing-nutraceuticals/v>
2. <http://www.news-medical.net/health/What-are-Nutraceuticals.aspx>
3. Blog Feed on June 25, 2015 by Cory L. Grand, PhD, PMP.

Until man duplicates a blade of grass, nature can laugh at his so-called scientific knowledge. Remedies from chemicals will never stand in favorable comparison with the products of nature, the living cell of the plant, the final result of the rays of the sun, the mother of all life.

- Thomas Alva Edison

“She was the catalyst for the modern environmental movement, and in that sense we are all children of Carson”. This was said about Rachael Carson the author of *Silent Spring*. John Briley.

The 1962 classic *Silent Spring* focussed on the detrimental effects of the pesticide DDT on wild life and its longevity in the food chain. The dramatic decline of bald eagles was attributed to the consumption of DDT laden prey which in turn led to some bird species producing ultra fragile eggs. This was allegedly the reason for EPA to ban the pesticide DDT in 1972. Although Carson who died in 1964, didn’t specifically advocate this ban or lay down any stringent policies, she urged the cautious use of pesticides. This prompted more research in this area which resulted in major policy shifts in time, and in 1972 there was an overhaul of regulations on the sale and use of pesticides. It is also interesting to note that the EPA, the US Environmental Protection Agency was set up in 1970, and this was possibly due to the concerns raised by Rachael Carson in her book, *Silent Spring*.

National Geographic,
September 2012

"LINKING" WITH PEOPLE AND SOCIETY

LINK SAMAHAN RELIEF ZONE AT SRI PADA

Sri Pada or 'The Samanthakoota' could be said to be as one of the most sacred and venerated places of worship among the people of all faiths: Buddhists, Hindus and Muslims, in Sri Lanka. This sacred precincts is subjected to continuous veneration of both local and foreign tourists for a period of 6 months starting from Unduwap poya in December every year.

There are a number of legends associated with the pilgrimage to Sri Pada. According to some popular legends it is a practice that dates back to the reign of King Nissankamalla.

People of all ages join this arduous journey driven by the overwhelming faith in them. The journey to the mountain peak is a challenging one with a winding narrow trek with steep slopes often under harsh climatic and weather conditions.

Link Natural Products being a leading Sri Lankan company involved in the manufacture of traditional medicinal products, have close links with the people of the country, and are only too aware of the arduous journey undertaken by the pilgrims annually. It is in such a backdrop that the company came forward with its CSR programme under the banner 'Samahan Relief Zone' to lend a helping hand to the weary pilgrims during the entire season of the pilgrimage.

The Samahan Relief Zone is located at Nallathanni (on the Hatton Nallathanni road):

the most widely used trail to the peak. Arrangements have been made for each pilgrim to receive the benefits of two of its flagship products: Link Samahan health drink and Samahan SP balm.

Each pilgrim is provided with a soothing warm drink of Link Samahan, ensuring that they would not be afflicted by bodily ailments such as the common cold, and thus hamper their journey; this is a certificate of trust the company has maintained for over 21 years.

The Samaha Relief Zone has automatically turned into the most sought after rest in the strenuous 8 km journey; this could probably be due to the hospitality shown by the staff and the attractive outlook displayed in addition to the beneficial effects of the products.

The SP balm which is a combination of 15 valuable herbs, relieves the weary pilgrim from pains in their legs after the strenuous journey. It brings instant relief not only for muscle pains but also for body aches and headaches associated with the long journey.

The company also maintains a sales outlet, and it is a matter of great encouragement that despite the weariness of the pilgrims, they rarely refrain from buying the products at the end of the journey. The Samahan Relief Zone is in operation round the clock with 20 employees at service on shift basis, during the entire season.





Samahan

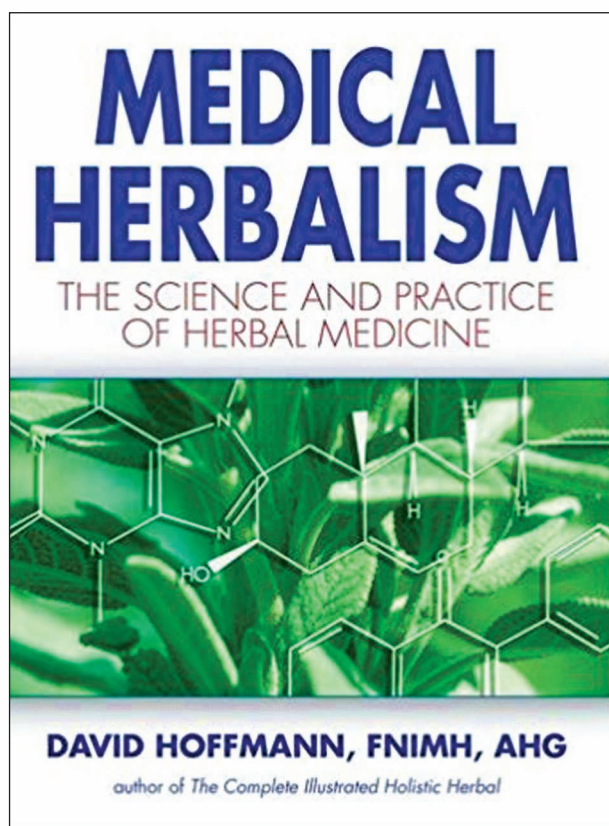
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BOOK REVIEWS

MEDICAL HERBALISM : THE SCIENCE AND PRACTICE OF HERBAL MEDICINE



Publication year: August 30, 2003

Edition: 1st edition

Pages: 666

ISBN: 978-089-281749-8

Herbalism (Herbology or herbal medicine) is the use of plants for medicinal purposes, and the study of botany for such use. Plants have been the basis for medical treatment through much of human history, and such traditional medicine is still widely practiced today. Modern medicine recognizes herbalism as a form of alternative medicine, as the practice of herbalism is not strictly based on evidence gathered using the scientific method. Modern medicine, does, however, make use of many plant-derived compounds as the basis for evidence-tested pharmaceutical drugs. Phytotherapy, and phytochemistry work to apply modern standards of effectiveness testing to herbs and medicines that are derived from natural sources. The scope of herbal medicine is sometimes extended to include fungal and bee products, as well as minerals, shells and certain animal parts.

Medical Herbalism contains comprehensive information concerning the identification and use of medicinal plants by chemical structure and physiological effect, the

Title : Medical Herbalism, The Science and Practice of Herbal Medicine

Author : David Hoffmann, FNIMH, AHG

Publisher : Healing Arts Press,
One Park Street,
Rochester, Vermont

art and science of making herbal medicine, the limitations and potential of viewing herbs chemically, and the challenge to current research paradigms posed by complex plant medicines. It also includes information on toxicology and contraindications, the issues involved in determining dosage and formulation types for an individual, guides to the different measurement systems and conversion tables, and the pros and cons of both industrial and traditional techniques.

With additional sections devoted to the principles of green medicine, the history of Western Herbalism, the variety of other medical modalities using medicinal plants, an extensive resource directory, and a discussion of treatments organized by body system, Medical Herbalism is the comprehensive textbook all students and practitioners of clinical herbalism need to develop their healing practices.

What is Deep Ecology?

This is a movement prevalent in the United States where the basic philosophy is that all living things have a right to exist. It goes further to say that humans have no right to determine which animals should live and which should be driven to extinction. It rejects the anthropocentric view that humans lie at the hub of the universe, and is the centre of all that is worthwhile and that all other creatures are valuable only as long as they serve mankind. Deep Ecology says that all living things have an inherent value – be it human, animal, plant, bacteria and

other microbes. Animals are not more important than plants and mammals are no more valuable than even insect. Basically it upholds many of the Eastern religious views that all living things are sacred.

However, it is not easy and not always practical to carry the precepts of Deep ecology when actual human living is concerned. To illustrate, a farmer cannot be told not to burn forest for farmland as trees and wildlife are as valuable as his family and livelihood. This is where deep ecology conflicts with the developing world. However, this is not to say that the farmer does not value the trees and wild life seen in the forests, as he is dependent on them for life's necessities such as food, medicine, utensils, clothing etc. and he totally appreciates the biodiversity of life around him. It is the need for survival that eggs him on to some of the living things around him.

From : E O Wilson,(1988)
Biodiversity; National Academy of Sciences, Smithsonian Institution

www.nap.edu/catalog/989.htm

DIGEST MAIL BOX

Correspondence 1

I am a senior Sri Lankan Ophthalmologist working abroad since 1976. I came across a copy of the Link Natural Digest, which I happened to peruse while on a brief holiday in Sri Lanka, over the holiday season. I am an avowed plant lover, especially related to medicinal products, and found reading a copy of Volume 10, Issue 2, 2014 highly instructive and interesting.

I am a colleague and friend of long standing, of your Editor in Chief, Dr. R.O.B. Wijesekera.

Yours Sincerely

*"Para" R Pararajasegaram
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Alfred House Gardens .
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Sri Lanka*

Response

Many thanks for your kind comments. We shall send you some recent past issues as well, Do we use the Lanka address?

Compliments of the season

R O B Wijesekera

I was thrilled to receive so many volumes of your excellently put together journal. I could not literally take my eyes off for doing anything else.

I am deeply appreciative of your kindness and look forward to conveying my thanks in person early in the New Year.

My best wishes for your health and happiness to you and yours, in the New Year and beyond.

Warmest regards,

Para

Correspondence 2

May I request to be kindly included in the mailing list for the Link Journal?

My mailing address is:-

*Dr. U.Pethiyagoda,
43/88, Purwarama Mawatha,
Kirulapone.
Colombo 5..*

I obtained your address, upon my request from Dr R.O.B.Wijesekera.

*Sincerely,
U.P*

Response

Thank you for your interest on our Magazine. We have added your name and address to our Digest

Readers Mailing List Currently we are issuing the Link Digest Vol.11 Issue 2 and your copy will be mailed to you ASAP.

Best Regards.

Dear Editors

I am pleased to confirm that I have today received the latest copy of the journal.

Even a quick glance impresses me of its excellence.

My congratulations and many thanks.

Dr U.Pethiyagoda.

Dear Dr Upatissa

Thank you very much for your valuable comment.

We will start to distribute LNP Digest Volume 12, Issue 1 within few days and your copy will be mailed to you.

Dear Editors,

I have the pleasure of acknowledging receipt of the latest Link Magazine.

I compliment Link again for a classy publication. The article by ROBW would qualify to be a worthy article in many World class Journals. No praise is good enough for your efforts. Incidentally, you may be interested to know that the Dutch (?) had introduced Cinchona Plantations in the Haputale/Koslanda/Wellawaya area. It went into neglect when Coffee was later introduced, followed by tea. I did a little scouting around to see whether any remnants of the Cinchona plantations still left some stragglers. But not knowing exactly what a Cinchona tree looked like, I had no success! Wonder whether any misguided adventurer would like to try again!

Dr U.Pethiyagoda.

Correspondence 4

I am a retired Professor who was involved in natural product research for some time. I have read some volumes of the Link Digest and found them to be very interesting. I will be extremely grateful if you would send me a copy of the Link Digest magazine to the following address.

Prof C Pathirana

Response

Thank you for your interest in our Magazine. We have added your name and address to our Digest Readers' Mailing List

Correspondence 4

Dear R.O.B.,

It was a fine surprise to read your nice article about me. Grateful thanks for your article and your kind words about me. Mind you my wife's name is Hanife, not Yasmine but never mind. You have given a very nice profile of me. I shall be grateful if you kindly send me a pdf of that article so that I can share it with my colleagues and friends and in my circles.

Husnu

*K. Husnu Can Baser PhD (London) FLS
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Faculty of Pharmacy, Head of the Department of
Pharmacognosy, Lefkoşa (Nicosia) N. Cyprus
Vice-President, International Council for Medicinal
and Aromatic
Plants (ICMAP)*

NOTE TO POTENTIAL CONTRIBUTORS

Link Natural Digest

The DIGEST is a popular publication, albeit a scientific one, dedicated to medicinal plants, herbal healthcare and personal care products, essential oils, aromatherapy, herbal therapy and Ayurveda, and related healthcare systems. It is published bi-annually.

The DIGEST welcomes contributions in English in the category of reviews, brief communications, ethno reports in brief, phytomedical and phytochemical communications, book reviews, and reports on safety and efficacy of phytomedicines.

Potential authors may consult the Editor-in-Chief prior to dispatch of communications, reports and reviews.

Authors may submit manuscripts by email to :

Dr. R. O. B. Wijesekera
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or

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Link Natural Digest
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By post to:

Dr R O B Wijesekera
Dilmani Warnasuriya
Link Natural (Pvt) Ltd
P O Box 02
Kapugoda

Please forward to the editor one original hard copy and a soft copy in the form of a PC compatible diskette (Microsoft Word).

All manuscripts must include the following :

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