LINK NATURAL DIGEST

Volume.9, Issue 1, 2013

LINK NATURAL PRODUCTS (PVT) LTD

PAPAYA
IS MORE THAN A TASTY DESSERT FRUIT

LINK NATURAL DIGEST

Volume 9, Issue 1, 2013 ISSN : 1391-8869

IN THE PAGES THAT FOLLOW.....

Registered Office
C. I. C. House,
199, Kew Road,
Colombo 02, Sri Lanka.

Factory & Office
P. O. Box : 02,
Malinda, Kapugoda,
Sri Lanka.

Tel.: +94 11 2409294
Fax: +94 11 2409293

e.mail :
info@linknaturalproducts.com

web :
www.linknaturalproducts.com

Editor in Chief
R.O.B. Wijesekera

Editor
Dilmani Warnasuriya

Editorial Consultants
M. B. Wijesekera
Gamani Samarasekera

Editorial Assistance
Natasha Jayamanne

Layout & Production
Sisira Wijetunga

Printing
Samayawardana

Comunication / Distribution
The Library & Information Centre
Link Natural Products
library@linknaturalproducts.com

EDITORIAL

"The longstanding successful use of herbal drug combinations in traditional medicine makes it necessary to find a rationale for the pharmacological and therapeutic superiority of many of them in comparison to isolated single constituents."

This statement prefaces the paper by the European researchers, Hildeberte Wagner and Ulrich-Merzenich entitled Synergy Research. Approaching a New generation of Phytopharmaceuticals.*

Both in research attention, as well as in the actual therapeutic use, herbal medicines are now enjoying a world-wide resurgence. For example the annual global sales of herbal products as medicines exceed the hundred billion mark in terms of their US dollar value. In Sri Lanka where the herbal products are seeing a renewal in terms of scientific attention to process technology as well as packaging into more accessible forms, the benefit of the availability of personnel with experience in their clinical use as well as possessing documents and knowledge in their use in medicine, add an attractive lure for potential researchers in this field.

In a recent editorial **, on the very subject Professor Colvin Goonaratna, onetime Chairman of the State Pharmaceutical Corporation of Sri Lanka states: " Physicians clinically experienced in the prescription of herbal medicines are available for consultation by people who are willing to seek their advice. Many of them have vast collections of hitherto chronicled ola manuscripts describing herbs, herbal products and their clinical indications." Adds Professor Goonaratna, "The consumption of herbal medicines and other herbal products is expanding in exponential fashion. This has major implications for public health policy, clinical care of peoples' life and health, health politics and macroeconomics, and the roles of regulatory bodies such as review committees for research ethics, Medical Councils, and medical science journals. Hence clinical research with traditional medicines, unrestricted by inflexible hierarchical distinctions affords vast opportunities. Medical journals and researchers looking for research material ought to welcome it."

Indeed from the standpoint of modern health management, globally, and even within a little island such as Sri Lanka, recourse to herbal products justifies itself from every standpoint ranging from the socio- economic to the medical. A vast drive towards trans sectorial research in the field must precede this and the resources spent will bring boundless rewards.

References:

* Phytomedicine. 16 (2009) 97-110

** Ceylon Medical Journal (2013), 58, 1=5

If you wish to receive a copy of the Link Digest, Please e-mail your request to info@linknaturalproducts.com

PAPAYA IS MORE THAN A TASTY DESSERT FRUIT

By Dilmani Warnasuriya

Introduction

Carica papaya, commonly known as Papaw or Papaya, or Paw paw in Australia and New Zealand, is immensely popular in Sri Lanka as a dessert fruit. It is an oblong shaped, normally greenish yellow, yellow or orange coloured fruit borne on a large tree plant, reaching up to around 2.5 kg in weight.

It has a bitter taste when raw, and sweet when mature, and grows in tropical countries with higher humidity. It is native to Southern Mexico, and now cultivated in Brazil and countries of Central America, Hawaii, South Africa, Thailand, Indonesia, Vietnam, Sri Lanka and other countries of Asia and grows well in Australia.

The plant has been hailed by traditional medicine men as a source of powerful medicine. Other than the fruit, the Papaw tree, like the coconut tree, has multiple uses from different parts of the plant and with increasing research, more public awareness is now being raised on the health benefits of Papaya. Papaw is not a seasonal fruit, being available throughout the year in the country, in large cultivations, as well as in home gardens. In some countries, fermented papaya, herbal teas or even tablets are available, bearing testimony to the beneficial effects of the fruit. In Sri Lanka, it is mainly used as a fresh fruit or juice. Although its basic effects on health due to the presence of vitamins and dietary fibres could be termed common knowledge, many other more potent and powerful effects of the fruit and other parts of the plant are less well known.

Composition

Papaya fruit is an excellent source of dietary fibre, folate, high amounts of vitamin A, C , and vitamin E. It also contains small amounts of calcium, iron, riboflavin, thiamine and niacin, and is rich in antioxidant nutrients flavonoids and carotenes, and low in calories and sodium.

The presence of the enzyme Papain, mainly in the skinny peel of the fruit, is being made use of widely, for softening of meat. Papain and chymopapain which is also present, have the capacity to break down the proteins from foods such as meat, and convert them into amino acids, which are easily digestible.

Papaya also contains fibrin, another useful compound not readily found in the plant kingdom. Fibrin reduces the risk of blood clots and improves the quality of blood cells, increasing the ability of blood to flow through the circulatory system, and also preventing strokes. Papaya leaves boast large doses of important nutrients that support the immune system, including vitamins A, C, and E, and most importantly, vitamin B17. Papaya leaves also contain over fifty active ingredients which account for many of the beneficial health effects attributed to the plant.

Heath Benefits

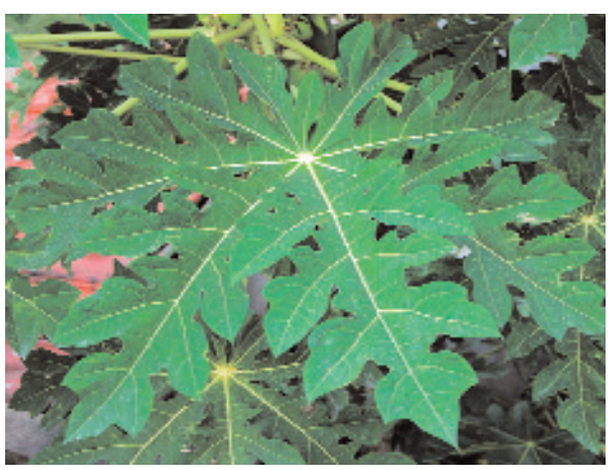
Digestion

Papaya facilitates better digestion, prevents bloating and chronic indigestion. This is due to the ability of papaya enzymes to break down proteins into amino acids, making papaya an ideal dessert after meals - the culinary pleasures experienced being an additional bonus. As we age, less and less of digestive enzymes are produced in our stomach and pancreas, and this leads to ineffective digestion of proteins. This results in an excess amount of undigested protein, and not enough of amino acids to perform all important chemical reactions. Amino acids play a major role in metabolic activities in the body, the chemical reactions contributing significantly to both mental and physical health.

Papaya enzymes are also helpful after antibiotic use to replenish friendly intestinal bacteria that were destroyed along with the unwanted bacteria. When the intestinal tract is well populated with friendly bacteria, the immune system is strengthened, and can better protect against flu and other disease. To rid the body of intestinal parasites, a home remedy of half a cup of papaya juice alternated each hour for twelve consecutive hours with the same amount of cucumber or green bean juice has been effectively used.

Cancer

Some of the first documented anecdotes of the effect of papaya on cancer was in Gold Coast, Australia where papaya leaf juice was claimed to have reversed cancer in many people living in the area. Papaya leaves have been known for their cancer fighting properties and have been used as an alternative cancer treatment option for many years, although there has been no scientific evidence to give veracity to this. However, researchers from Japan and US have now shown this claim to have much credibility, having conducted extensive studies on it. They conclude that a dried extract of papaya leaves have dramatic cancer fighting properties against a broad range of tumors, including those of the cervix, breast, liver, lung, and pancreas. According to their studies, higher the dose of papaya leaf extract, the more it impacted the tumor. It is reported that components in papaya tea extracts actually kill cancer cells directly. An added plus, is that papaya leaves are not known to have toxic effects and their consumption does not have side effects. In light of this discovery, doctors are beginning to recommend papaya leaf tea as part of a well balanced traditional chemo treatment, while others go so far as to say that this treatment could replace the harmful procedures of chemotherapy and radiation.



The cancer fighting properties of papaya leaves are partly attributed to increased production of key anti-tumor molecules called Th1-type cytokines, which are regulators of the immune system. The ability of papaya leaves to stimulate these Th1-type cytokines, which in turn strengthens the ability of the immune system to destroy cancerous cells, is the key to its potency. Proteolytic enzymes are able to digest and destroy the defense shields of viruses, tumors, allergens, yeasts, and various forms of fungus. Once the shield is destroyed, tumors and invading organisms are extremely vulnerable and easily taken care of by the immune system.

As mentioned, papaya leaves contain several vitamins, including B 17 which in concentrated form is already

used as part of traditional chemotherapy treatments. A recent study by Purdue University on over 3500 plants, showed that Papaya Leaf Tea consisted of over 50 biologically active ingredients found to kill fungi, worms, parasites, bacteria, and many forms of cancer cells. They identified Acetogenins as the medically effective ingredients of this plant. They compared this with conventional chemotherapy agents, and found that they worked comparably in cell culture and animal studies, but at far lower concentrations and with almost no toxicity to host animals. They postulated that papaya was effective against any type of abnormality which involved faster than normal growth and could be used as a support during Chemotherapy and radiation.

Studies have also shown that the fruit is a store-house of carotenoids, of which beta carotene and lycopene are found in abundance. The intense orange to pink colour is one indication of the presence of carotenoids. Lycopene is highly reactive towards oxygen and free radicals, and scientists think that this antioxidant activity makes it an effective cancer fighting agent. In addition to antioxidant activity, other experiments have indicated that lycopene induces cancer cell death and anti-metastatic activity in addition to other beneficial effects. This has been shown to be so by epidemiological studies on prostrate cancer in Australia, where they found that men who consumed the most lycopene rich fruits and vegetables such as papaya, were 82% less likely to have prostate cancer.

Papaya also contain Isothiocyanates which are organo – sulphur compounds. Animal studies have shown that isothiocynates are effective against some type of cancers as well as leukemia, and have postulated that they have the potential to prevent cancer in humans as well. Researchers have identified the isothiocyanate in papaya as BITC (Benzyl isothiocyanate) , and have established that BITC exerted cancer cell killing effects that were greater in proliferating cells than in quiescent cells. So it seems that papaya uses a multi pronged approach to fight the dreaded disease, rather than depending on one type of compound.

Papain is also being studied for relief of cancer therapy side effects, especially relieving effects such as difficulty in swallowing and mouth sores after radiation and chemotherapy, in addition to boosting up the immune system and helping the body to fight the cancer. This has created the trend of large scale cultivation of organically grown papaya, to produce fermented papaya enzymes, and these are available on a commercial scale.

It would be interesting to study and analyse the recipe given by those who traditionally used this plant for cancer treatment. This is as follows:

Wash and partly dry several medium-size papaya leaves. Cut them up like cabbage and place them in a saucepan with 2 quarts/ litres of water. Bring the water and leaves to the boil and simmer without a lid until the water is reduced by half. Strain the liquid and bottle in glass containers.

The concentrate will keep in the refrigerator for three to four days. If it becomes cloudy, it should be discarded.

The recommended dosage in the original recipe is 3 Table-spoons/ 50ml three times a day.

Dengue

In Sri Lanka, Dengue is now becoming a severe health hazard, almost assuming epidemic proportions. It is transmitted by mosquitoes and can be fatal. Common symptoms include fever with headache, severe muscle pain, joint pain and rashes on the body. There is no effective medicine for dengue.

However, in traditional medicine, the juice of papaya leaf has been found to be effective in the treatment of dengue fever, and following upon this knowledge, studies have been carried out to substantiate these claims. A recent study done by the Indian Institute of Forest Management on five dengue patients given papaya leaf juice, has shown some interesting observations. The number of platelets increased in all five patients within 24 hours of drinking the juice, with all patients reporting significant improvement in their health. It seems that this bitter green juice is promising without posing any serious ill-effects. As a result, pharmaceutical and nutraceutical companies are already formulating papaya leaf extract preparations. The extract of raw papaya leaf helps boost platelets, also known as thrombocytes. In Sri Lanka too, undocumented evidence have displayed the efficacy of using papaw leaf juice on dengue patients, and is now frequently

used on them. As a home remedy, the juice is extracted by crushing fresh leaves of papaya - one leaf of papaya giving about one tablespoon of juice. Two tablespoons of papaya leaf juice given to dengue patient three times a day has shown amazing results according to unpublished reports.

Interestingly, papaya leaf has also been found to possess powerful anti-malarial effects apart from its anti-cancer properties and the extract has been used in some parts of the world as a prophylactic to prevent malaria in endemic regions.

Other effects

Because of its anti-inflammatory properties papaya is also said to relieve the severity of rheumatoid arthritis and osteoarthritis. Its high antioxidant content can prevent cholesterol oxidation and can be used as a preventative treatment against atherosclerosis, strokes, heart attacks and diabetic heart disease. It can also lower the inflammation in the body, alleviate the pain and edema caused by sport injuries.

Also, home applications of leaf and bark papaya extract is used to deal with mouth gums and toothaches which is being effectively practised in many cultures around the world. It is also traditionally used to treat various skin disorders, including wounds and burns, especially in developing countries.

However one point to be aware is that the unripened papaya (still green papaya) contains far more of the proteolytic enzymes papain and chymopapain than ripened papaya which we commonly eat. You can also juice the leaves and stems but be prepared for the most objectionable taste of it …. you wont naturally like its taste but then nor does the cancer cells. So why not try it?

References

1. Indian Express Sat Oct 27 2012
2. International Journal of Oncology, October, 2008)
3. International Journal of Food Science and Nutrition, May 2010
4. Cancer Letter, October 8, 2008)
5. Asia Pacific Journal of Clinical Nutrition, 2007
6. Forum of Nutrition, 2009
7. http://www.naturalnews.com/026372_cancer_papaya_protein.html
8. www.rochway.com.au
9. www.ncbi.nlm.nih.gov/pubmed/
10. Indian Express Sat Oct 27 2012,
11. Journal of Ethnopharmacology 127 (2010) 760–767
12. Journal of Ethnopharmacology 121 (2009) 338–341
13. Harold W. Tietze in his book Papaya The Medicine Tree Harald Tietze Publishing , Jun 1, 2003
14. Gold Coast Bulletin 1978
15. Link Digest Vol.4, No 1 Page 29

Transfer of Traditional knowledge and the extinction of languages

A language dies every fourteen days. The disappearance of a language deprives us of knowledge no less valuable than some future miracle drug that may be lost when a species goes extinct. Small languages more than large ones provide keys to unlock the secrets of nature because their speakers tend to live in proximity to animals and plants around them and their talk reflects the distinctions they observe. When small communities abandon their languages and switch to English or Spanish there is a massive disruption in the transfer of traditional knowledge across generations - about medicinal plants, food cultivation, irrigation techniques, navigation systems, seasonal calendars etc…

Russ Reymer : in "Vanishing Voices" in National Geographic vol 222 No.1 July 2012 p 78.

Editorial Note: The disappearance of the indigenous language of the veddah community in Sri Lanka is such a case of Wisdom Lost. The Veddas were semi-nomadic hunters and their lifestyle was linked to the characteristics of plants and animals in their natural habitat.

DRAGON'S BLOOD – THE MYSTERY OF A TRADITIONAL HERBAL PRODUCT

By R.O.B. Wijesekera

Preamble

Dragon's Blood is the name applied to a range of resinous materials that originate from a number of botanical species. The deep red exudate resin has been used as a remedy for several human ailments, as well as artistic applications, throughout the ages by diverse cultures. Several red resins used in traditional medicine are described as such in the medical literature through the ages. The species from which these resins have been gathered are diverse in nature and are found in different geographical regions. The original species is believed to have come from the Indian Ocean island of Socotra, now a part of Yemen. There are several other sources from which dragon's Blood is believed to come from such as: Canary Islands, Madeira, from South East Asia, East and West Africa, and Southern America. In one version of the story of Ancient Greece, Landon the hundred headed dragon, guardian of the Garden of Hesperides, was killed by Atlas as punishment or by Hercules, and while bringing back three golden apples from the garden Landon's dark red blood was spilt upon the land wherefrom there grew the trees which spilt blood from the trunks. These were known thereafter as "Dragon Trees". In the first century A.D. a Greek sailor was said to have written of an island by the name of Dioscorida where the trees yielded drops of "cinnabar". According to another story the struggle between a dragon and an elephant resulted in the spilling and mixing of the blood of both which yielded a magic substance with medicinal properties.

Tapping of Dragon's Blood and the dried ommodity in Socotra Islands

Sources of Dragon's Blood

The Vermillion red exudate of the Tree *Dracaena cinnabari,* was used as a medicine and a dye in the Mediterranean region in ancient times and was very highly valued.

However Dragon's Blood was a name applied to the red exudate from several other sources such as :

- East Indian Dragon's Blood – from the fruit of *Daemonorops draco* (Wild) (Blume)
- Socotran or Zanzibar Dragon's Blood, - the exudate from *Dracaena cinnabari* Balf.
- Canary Dragon's Blood – exudates from incisions on the trunk of *Dracaena draco* (L).
- West Indian Dragon's Blood from exudates of *Pterocarpus draco* L.
- Mexican Dragon's Blood from the resin of *Croton lechleri Mull.* Arg,
- Venezuelan Dragon's blood from the resin of *Croton gossipifolium* Vahl.

It is now believed that although Dragon's blood was originally produced from *Dracaena cinnabari,* later from *Dracaena draco,* and more recently from Dracaemonorops spp., the term Dragon's blood is generally used for all kinds of resins and saps obtained from four distinct plant genera namely: Croton (Euphorbiaceae), Dracaena (Dracaenaceae), Daemonorops (Palmaceae) and Pterocarpus (Fabaceae).

A species identified as *Pterocarpus marsupium* Roxb., is recorded in The Sinhalese Materia Medica by John Attygalle, and is described as not having been known to the Ancient Hindus as a medicine. Attygalle notes that the gum which this tree yields is of blood red colour, and that it had been collected from this source and exported to Europe as Indian Kino. In the Sinhala language it is known as "Gammalu" and is used by Ayurvedic physicians in the country, possibly drawing from the local Deshiya practices. The Pterocarpus spp. includes the species *Pterocarpus santalinus*, which is popularly known as Red Sandalwood and extensively used in the Ayurvedic pharmacopoeia.. In Sinhala it is called Rath Handun, although it bears no resemblance to sandalwood itself.

Historical aspects

The multiple uses of Dragon's blood through ancient times to this day provide ample evidence of its versatility. From the beginning it was prized as a dye as well as a medicine. It provided a dense and spectacular colouring matter for paints and varnishes and was even used in toothpastes, tinctures, and plasters. When substances such as horn were dyed with devils blood they could simulate the appearance of tortoise shell and was used for this purpose in ancient times. People in the island of Socotra had used the resin from *D. cinnabari* for dying of wool, pottery and it is believed to have been used as a form of lipstick.

In conformity with the belief that the resin was the blood of a mythical animal, it found use as a substance employed in magic rituals as well as in alchemy. In India too, the resin from both Dracaena and Daemonorops were used in religious rituals. The resin from the Daemonorops was used in ancient China as a popular varnish for wooden furniture. They were used to colour the surface of paper for banners and posters used for important special occasions such as the Chinese New Year. These red resins also found use in enhancing the colour of precious stones, staining glass, marble, and for varnishing the wood of violins, which r eputedly enhanced the instrument's tone.

Varnished violins

Stained Glass

The Spanish explorer Bernabe Cobo recorded that the sap of the Croton spp. was used widely by the indigenous people of South America in the 1600's as a medicine and for paints varnishes and spiritual occasions. In the African folk magic or voo doo the resin is used as an incense to cleanse a space which has been polluted by negative influences. In neo pagan witchcraft it is used to enhance the potency of spells for protection, love, and sexuality.

Traditional Uses in Medicine.

The ancient Greeks, Romans and the Arabs employed the resin for a variety of medicinal purposes. Dioscorides as well as other Greek healers wrote of its wide powers as a medicine. Dragon's blood was used in the treatment of dysentery, diarrhea, and hemorrhage, in excessive bleeding in menses and in external ulcers. Perhaps its resemblance to blood itself made it a candidate treatment for bleeding conditions in accordance with the celebrated " doctrinaire of signatures", where like was seen as the logical remedy for like."

In Chinese Traditional Medicine, Dragon's Blood derived from the species Daemonorops, is used to stimulate the circulation of blood. It is also reputed to promote the regeneration of tissue, and aid the healing of fractures, ulcers and control bleeding and pains and inflammations. In the South American region the sap of the species *Croton lechleri*, is used in the treatment of fractures, leucorrhea, piles and hemorrhoids, and to speed up internal healing following an abortion. The resin exudes as a sap from mature trees and is harnessed by tapping.

Tapping the exudate - Traditional

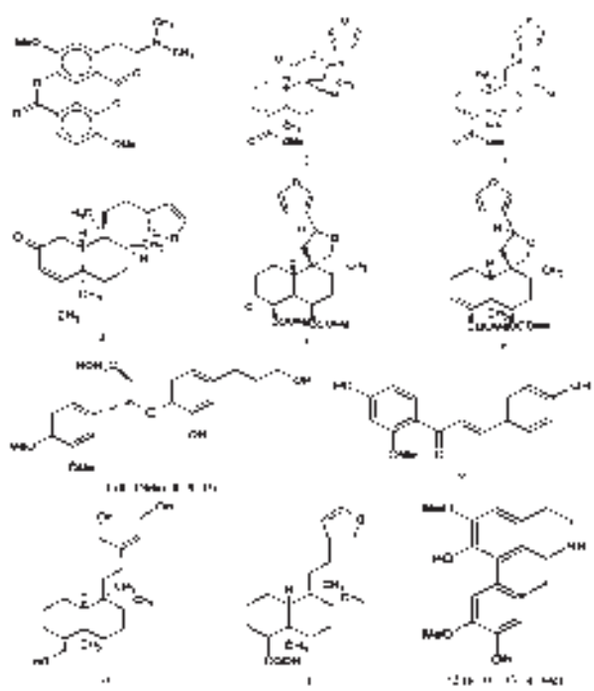
Gammalu Tree (Sri Lanka)

Chemical composition

The chemistry of Dragon's Blood is a complex array of compounds rendered even more varied by the fact that the sources of the resin are also many.

The chemical constituents have been recently studied with the ethnomedically revealed activity in view ie. Reverse pharmacology. Antibacterial properties are attributed to the presence of such phenolic compounds as 2,4,6,-trimethoxy benzene,1,3,5,-trimethoxybenzene, chrolechinic acid, and korberins A and B. The sap on Croton spp has been extensively studied chemically and antiviral, antifungal properties have been attributed to it.

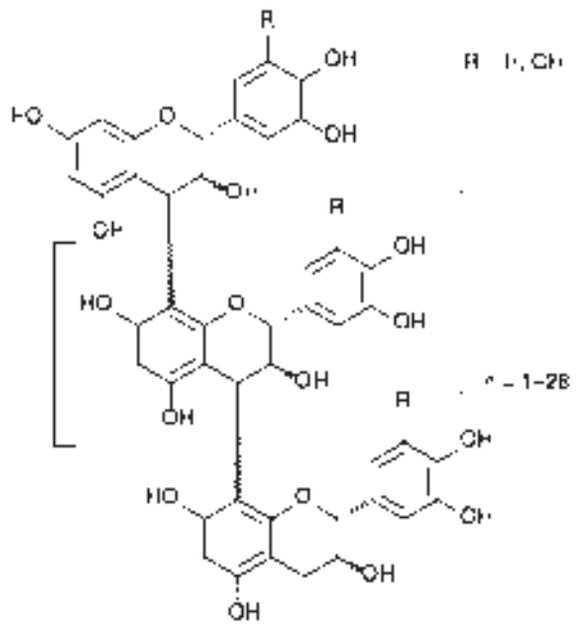
Taspine an alkaloid isolated from the Croton spp has been shown to contain cytotoxic activity and it has cicacitrant or wound healing properties as well. Immunomodulatory, antioxidative, antiproliferative, and mutagenic effects of dragon's blood as well as some of its constituents have received attention from scientific researchers.. Extracts have also been proven to combat Diarrhea although the effect is not attributed to any one constituent. Over forty different compounds have been isolated from various forms of Dragon's Blood and chemically characterized, during the period of the 1990's and tested in cellular as well as animal experiments. Many of the medicinal properties have given credible evidence in animal models, which makes Dragon's Blood appear a goldmine of compounds with a variety of bioactivities awaiting further research.



Varieties of structures representing some of the compounds isolated from Dragon's Blood

An interesting case is that of the constituent Crofelemer- a complex polyphenolic compound which under the trade name of Fulyzac is a drug which underwent development for the treatment of Diarrheas associated with anti-HIV drugs such as nucleoside analogue reverse transcriptase inhibitors and protease inhibitors. It has been approved in 2012 by the US Food and Drug Administration.

Chemical Structure of Crofelemer



It is the second botanical drug approved by the FDA. The first was green tea extract called Veregen in 2006.

As could be expected the different species such as the Croton spp., the Dracaenia spp., the Dracaenorops spp., and the Pterocarpus spp., each may have differing arrays of chemical compounds and as such will possess somewhat different biological activities. Commercial samples of Dragon's blood may undoubtedly be mixtures.

The Sri Lankan variety *Pterocarpus marsupium,* is relatively rare and its use is not documented in texts other than the cited instance of Atttygalle's Material Medica. The medicinal uses cited in Plant Families includes the leaves as an application for skin ailments, the flowers as a febrifuge. The heartwood is used as a decoction for a wide variety of ailments. And the gum is deemed useful in gastralgia, and "vitiated conditions of Pitta", including diarrheas, psoriasis, and ulcers.

Now that the FDA have "approved Crofelemer, for symptomatic relief of non-infectious diarrhea in patients with HIV-AIDS on retroviral therapy", it will make the Sri Lankan variety an interesting research study for comparison with others in respect of its chemical constituents and local use.

Quality in Products. and Resource conservation

Dragon's Blood as a name has been applied to red coloured resins drawn from a variety of sources and from a wide range of geographical regions.. Accordingly there is a need to find methods to identify and classify the commercial products with respect to sources, composition and purity. The resins of commerce differ widely from one another in purity and even in appearance. The early methods were based on solubility in several solvents but recently Edwards and collaborators have devised a method based on Fourier transform Raman Spectroscopy. Edwards' group regard the product derived from the Socotra island as the parent variety. They have devised a method to identify "fake" varieties from genuine exudates derived from the accepted sources.

Another factor that looms large is the result of overexploitation of the sources and this has raised serious concerns with international agencies taking steps to stem the certain loss of most of these endangered species and safeguard the sources with measures for conservation.

For Additional Information

1. Attygalle J. Sinhalese Materia Medica p 60
2. Gupta, D.., Bleakley B., & Gupta R.,(2008) Dragon's Blood: Botany, Chemistry & Therapeutic uses. J.Ethnopharmacol., 361, 80
3. Grieve M., A Modern Herbal
4. Alexander D., & Miller A., (1995): Socotra's Misty Future. New Scientist. 142, 32
5. http ://cms.herbalgram.org/press/2013/FDA_ approves_crofelemer:html
6. Arnone et al. (1997) Constituents of Dragons Blood. J. Nat. Prod., 60, 971-975.
7. Edwards, H.G.M. et al: (1997) Characterisation of ancient resin …J.Raman Spectroscopy. 28, 243-249. Also (2004) Analyst: 129, 134-138.
8. Plant Family: http://www.agri.ruh.ac.lk/medicinalplants/ medicinal_plants/families/leguminasae/plants/ga…

You cannot do anything at all without knowing that one word courage.

Sadie Mintz, 105 year old American author.

NEPENTHES - THE MARVELOUS HERB

By N.M.M. Jayamanne

Sarracenia spp.

Heliamphora spp.

Darlingtonia californica

Carnivorous plants exhibit one of nature's wonderful adaptations for living in harsh environments. They have specialized mechanisms to obtain some or most of their nutrients by trapping vertebrates or invertebrates. Currently there are 630 carnivorous plants and over 300 photo-carnivorous plants. (plants which trap prey but do not have an ability to digest).

Carnivorous plants display various trapping mechanisms in capturing prey such as: Pitfall traps (Pitchers which trap prey in a leaf cup containing digestive enzymes), Flypaper traps (contains sticky mucilage), Snap traps (captures prey with rapid leaf movements), Bladder traps (sucks prey using a bladder like organ that creates a vacuum) and Lobster-pot traps (forces prey to move towards the digestive organ).

Pitcher plants are one of the common groups of carnivorous plants that use pitfall traps in capturing prey. They belong to Family Nepenthaceae (Tropical pitchers or monkey cups) and Sarraceniaceae with three genera *Sarracenia* spp. (North Americal pitchers or Trumpet pitchers), *Heliamphora* spp. (Sun pitchers) and *Darlingtonia californica* (California pitcher).

Among them Nepenthes is the most common group of carnivorous plants

Genus Nepenthes; Monkey cups

Nepenthes commonly known as monkey cups or pitcher plants are a genus of carnivorous plants in the family Nepenthaceae. It comprise of 140 species consisting of natural and cultivated hybrids. The name monkey cups originated due to the fact that monkeys have been observed drinking rainwater from the flower.

The earliest record of Nepenthes dates back to the 17th century. In 1658 French colonial governor Etienne de Flacourt described the plant Amramatico that later became *N. madagascariensis*. This was followed by *N. distillatoria,* endemic pitcher to Sri Lanka, in 1677. One of the earliest illustrations of the Nepenthes appeared in Leonard Plukenet's Almagestum Botanicum in1696.The name Nepenthes was first published in 1737 in Hortus Cliffortianus by Carolus Linnaeus.

Interest on Nepenthes grew throughout the 19thcentury and the 1880s are considered to be the "Golden age of Nepenthes" where most of the plants species were identified. However the popularity of the plants came down with World War II in the 20th century. In the 1960s the interest on cultivation and study on Nepenthes grew with the experiments of Japanese botanist Shigeo Kurata.

The Plant

Nepenthes is a liana-forming plant with a shallow root system. The stem is several meters long and from the stems arise alternate, sword-shaped leaves with entire leaf margins ending in an apical tendril. At the end of the tendril the pitcher forms. Flowers occur in racemes or rarely in panicles. The plants are unisexual.

The seed is a four sided capsule with 50-500 wind distributed seeds, a central embryo and two wings.

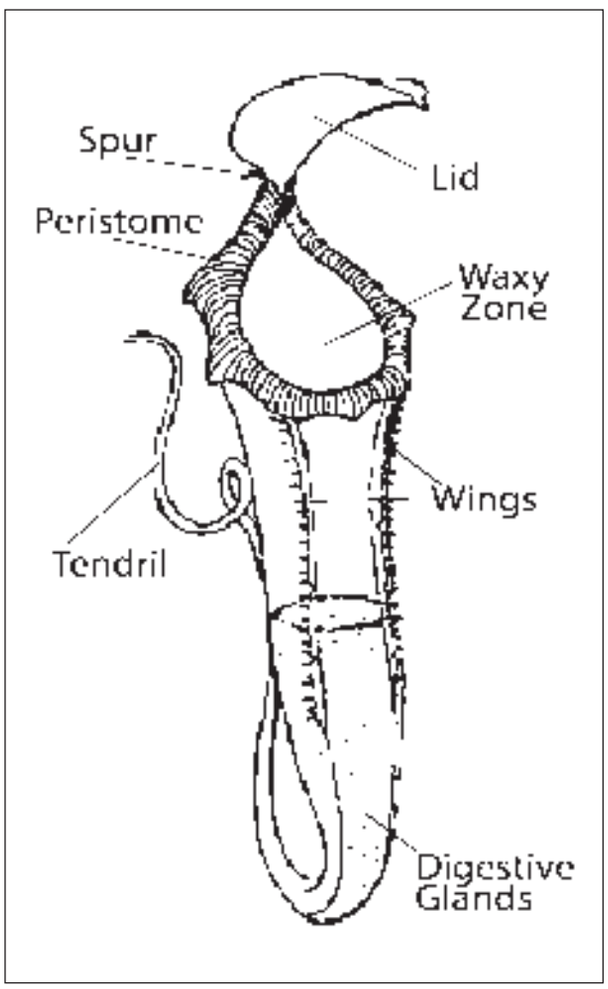
Classification

Kingdom: Plantae
Order: Caryophyllales
Family: Nepenthaceae
Genus Nepenthes

The Deadly Trap

The pitcher starts as a small bud in the beginning which then expands to form a tube or globe shaped trap.

The Peristome, which is a lip like structure surrounding the entrance area is slippery and often colourful, attracting prey to the trap. The lid, or operculum contains nectar glands underneath, being another attractant to prey. The upper inside part of the trap has a waxy coating that prevents prey from escaping and the bottom inside part contains glands which absorb nutrients from the captured prey.



The trap is of two types (dimorphic). Pitchers at the base of the plant are large and low and sit on the ground whereas the pitchers in the upper part are smaller and differently coloured from the base pitchers. This factor makes identification of species difficult.

In a recent study Ulrike Bauer et.al., found that the capture efficiency of the pitchers varies with the peristome wetness which is dependent on rain, condensation and nectar secreted from peristome nectarines. Further it was found through studies, that capturing of the prey is most efficient during the evening, night and early morning and is highly ineffective when the nectarines are removed. The trapping efficiency of the plant remains high although it is diluted by the rain.

A B

Nepenthes distillatoria
a) Aerial / upper pitcher & b) rosette bottom pitcher
(www.joachim-nerz.de/distillatoria1.htm)

The Fluid

The picher contains a watery or syrupy fluid that is produced by the plant. Proteases are the major group of enzymes found in the pitcher fluid. According to Fraizer[8] the first enzyme in the pitcher fluid was studied by Steckelberg et al followed by Nakayama[7] who identified 'Nepenthesin,' the first protease. Later Athauda et al[2] purified Nepenthesin I and II from *N. distillatoria*. Hatano et al[9] identified seven proteases; β-D-xylosidase, chitinase, β-1,3-glucanase, thaumatin-like protein, Nepenthesin I and II in *Nepenthes alata*.

Different Napthoquinones including plumbagin[11,13,14,] 5-O-methyl droserone[11,] 2-methylnapthazarin[11,] droserone[11,14,] octadecyl caffeate[11,14,] isoshinanolone[11,14,] etc that possess antimicrobial properties were also identified.

Apart from the protease activity, lipase activity was recorded in *N. distillatoria*[4] and *N. macferlanei*[10] and alkaline phosphatase, phosphoamidase, esterase C4 and C8 activities were recorded in *N. hybrida*[9].

Nepenthes distillatoria

This is the only pitcher species found in Sri Lanka and the plant is endemic to Sri Lanka. This plant was described as *Miranda herba* (marvelous herb) in 1677 by Bartholinus as the second pitcher identified. It is described as *Bandura zingalensium* by Dutch Merchant Jacob Breyne in 1680 and in 1737 Linnaeus named this plant genus as Nepenthes. In 1683 it was again described by H.N. Grimm and that was the first illustration of the tropical pitcher plant.

According to the recent studies on *Nepenthes distillatoria* it was found that the pitcher fluid was composed of viscoelastic biopolymers including proteinases (Nepenthesin I, Nepenthesin II)[2,] DNases (DNase1, DNase2, DNase3, DNase4)[3,] lipases[4,] glycosidases[5] and phosphatases[6.]

Prey and Inhabitants

Prey of pitchers usually consists of insects, but some pitchers like *N. rajah* have recorded the capture of large prey such as rats, lizards and small birds.

There are over 100 species recorded as inhabiting the Nepenthes species of plants and these are classified as

- Nepenthebionts: Organisms specialized to live inside and are dependent on them at least during some stage of their lives.
- Nepenthephiles: Organisms that are frequently found but not dependent on pitchers.
- Nepenthexenes: Organisms that are occasionally encountered in pitchers.

Distribution and Habitat

These plants are inhabited mostly in old world tropics ranging from South China to Madagascar. The greatest diversity is found in Borneo and Sumathra, with many endemic species.

Depending on the area they occupy Nepenthes are graded into Lowland and Highland species.

Figure 1: Distribution of Genus Nepenthes

Lowland *Nepenthes* require continuous warm climates with little variation between day and night whereas highland species need warm days and cooler nights. Many of the Nepenthes spp are lowland species and most of them prefer areas with high humidity and precipitation and moderate to high light levels. They are often found in soils that are acidic and low in nutrients such as peat, white sand, sandstone and volcanic soils. Some of them are also found at soils with high heavy metal content *(N. rajah*), sandy beaches, sea spray zone *(N. Albomarginata)*, inselbergs and as lithophytes and epiphytes *(N. inermis)*.

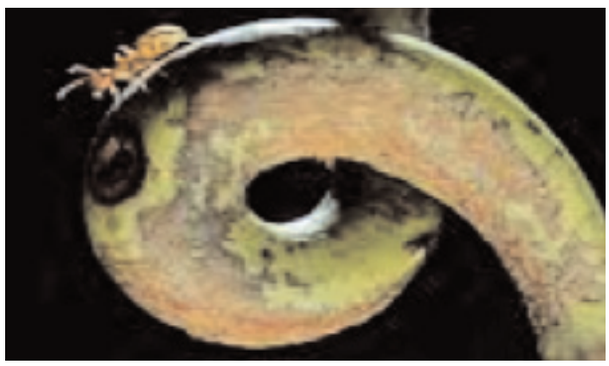
Uses of Nepenthes

• Ecological Value:

Nepenthes play an important role in its niche. It builds symbiotic relationships with many fauna such as providing tendrils for Carpenter ants to build nests. Carpenter ants consume large prey of the pitcher benefiting the pitcher by reducing the harmful nitrogenous waste load. It also provides niche for insect fauna of various types including spiders, mites, ants, etc.

• Medicinal Value

Prey of Nepenthes provides a good source of food for the plant as well as for other macro and microorganisms. To prevent insects from decomposing due to fungal activity before the plant is able to digest them,secondary metabolites are produced by the plant. These are used for the development of novel drugs for microorganisms.



Jessica et al[11] reported that *N. khasiana,* produces pure antifungal compounds (napthoquinones) which are able to kill *Candida albicans.* Napthoquinones also demonstrate antiviral, anticancer, anti-allergic, anti-inflammatory and anti-bacterial properties.

Likhitwitayawuid[12] has isolated 5 secondary metabolites from *N. thorelii:* isoshinanolone, plumbagin, octadecylcaffeate, 2-methylnaphthazarin, and droserone that demonstrate anti-malarial potential.

In his study Shin[13] has reported that plumbagin, one of the Napthoquinone that can be isolated from *N. rafflesiana, N. thorelii, N. gracilis and N. insignis,* exhibit insect antifeedant, cardiotonic, anticancer, antimicrobial and antimalaria activities.

It is known that in the traditional treatment of whooping cough in Sri Lanka the contents of the cup in Nepenthes has been popularly used.

• Ethno-cultural Value:

Nepenthes spp. is being used over centuries by the tribal people in many areas of the world for various cultural activities. Tribes in Philippines use it as a container, whereas Indonesian tribes use Nepenthes for making ropes. Papua New Guinian tribes use Nepenthes as a cultural accessory to garments worn at their festivals[15].

• Economic Value:

Propagation for the ornamental plant trade for Nepenthes is a new trend in many areas where they grow.

• Other Uses:

Nepenthes are used for horticultural purposes, as a garden plant and as a tourist attractant in many countries (eg: Sabah, Malaysia).

Pitchers under Threat

One of the major issues of concern is that all the carnivorous species including Pitchers are under increasing threats of extinction. Some of the pitchers (eg: *N. khasiana*) are included in the endangered list of IUCN Red list and CITES Appendices 1 & 2. The threat is mainly due to the collection of specimens and habitat destruction. Thus it is our responsibility to avoid over exploitation of these marvelous plants and conserve them to maintain the ecological balance of nature.

References

1. Bauer, Ulrike et al (2008) Harmless nectar source or deadly trap; Nepenthes pitchers are activated by rain, condensation and nectar, Proc. R. Soc. 275; 259-65
2. Athauda, SBP et al (2004) Enzymatic and structural characterization of nepenthesin, a unique member of a novel subfamily of aspartic proteinases, Biomedical journal 381:295-306
3. Wijesinghe, Piumal et al (2008) Partial purification and characterization of deoxyribonucleases from *Nepenthes distillatoria*, SLAAS 64th Annual Sessions
4. Koswatte, Indika et al (2008) Occurrence of lipase activity in the pitcher juice of *Nepenthes distillatoria,* SLAAS 64th Annual Sessions
5. Madugalle, Vinodini (2008) Detection and preliminary characterization of glycosidases from *Nepenthes distillatoria,* SLAAS 64th Annual Sessions
6. Jinasena, Dilini (2008) Preliminary characterization of phosphatase activity in the crude pitcher fluid of *Nepenthes distillatoria,* SLAAS 64th Annual Sessions
7. Amagase, S et al (1969) Acid Protease in Nepenthes II. Study on the Specificity of Nepenthesin,J Biochem66 (4): 431-439.
8. Frazier, Christopher K. (2000) The enduring controversies concerning the process of protein digestion in Nepenthes (Nepenthaceae). Carniv. Pl. Newslett. 29(2):56-61
9. Hatno, Naoyaet al (2008) Proteome analysis of pitcher fluid of the carnivorous plant *Nepenthes alata*, The Journel of Proteome Research 7: 809-816
10. Tökés, Z.A et al (1974) Digestive enzymes secreted by the carnivorous plant *Nepenthes macferlanei* L. Planta 119: 39–46
11. Brown, Jassica (2013) The Tropical Pitcher Plant – a Possible Treatment for Fungal Infections retrieved from http://www.predatoryplants.com/Articles.asp?ID=261
12. Likhitwitayawuid K, et al (1998) Antimalarial naphthoquinones from *Nepenthes thorelii* Planta medica 64(3): 237-41
13. Shin, Kwang-soo et al (2007) Antifungal activity of Plumbagin purified from leaves of *Nepenthes ventricosa* maxima against phytopathogenic fungi. Plant.Pathol.J. 23 (3): 113-115
14. Raj, G et al (2011) Distribution of Napthoquinones, plumbagin, droserone and 5-O-methyl droserone in chitin induces and uninduced *Nepenthes khasiana:* molecular events in prey capture Journal of Experimental Botany 62(15): 5429-36
15. Rice, Barry et al (2005) The Carnivorous plant FAQ retrieved from http://www.sarraceinia.com/faq/faq1720.html
16. *Osuthuru wisithuru* (1994) Department of Ayurveda 4; 143

A Dilemma

Nitrogen is one of the most abundant elements of nature. It is the key to modern agriculture. Without this element the machinery of photosynthesis cannot function and no protein can form and no plant can grow. The crops, on which the bulk of humanity depends for survival, Rice, Wheat, and corn are among the most nitrogen hungry of all crops. They demand more than nature alone can provide. Modern chemical technology comes to our aid trapping nitrogen from the atmosphere to produce the nitrogen fertiliser which is abundantly used to sustain modern agricultural production. More than a hundred million tons applied worldwide every year fuels bountiful harvest of grain. Our planets' soil could not without the aid of artificial fertiliser provide sufficient food crops to feed seven billion of us. Yet this modern miracle exacts a price. Runaway nitrogen is suffocating wildlife in lakes and estuaries, contaminating ground water and even warming the globe's climate. As the world looks to feed the oncoming billions of more mouths, the question arises how much clean water and clean air will survive the demand for fertile fields. This is the Nitrogen dilemma.

AYURVEDA'S STIMULUS TO MODERN THERAPY

By VIKRAMA

Col. Sir Ram Nath Chopra,
pioneer scientific researcher on Ayurveda

Preamble

During the early decades of the twentieth century the renowned pharmacologist of India, Col. Sir Ram Nath Chopra, working at the Calcutta School of Tropical Medicine pioneered a research movement making a scientific study of the properties of medicinal plants which were in use in the Ayurvedic system of medicine. Sir Ram Nath commenced a tradition that came down the ages where Ayurvedic therapeutic agents were researched by many chemists and pharmacologists in the sub-continent, in Britain, and even elsewhere. The research tradition he established bore results that are evident today clearly ensconced in the therapies of modern medicine. Fortunately, the Chopra Archives are now lodged safely at the Regional Research Laboratory in Jammu-Kashmir. The Chopra tradition influenced research on medicinal plants throughout Asia and mostly within the British Commonwealth. In modern times this tradition had even influenced the direction of drug research in Europe and the United States, and particularly in Germany.

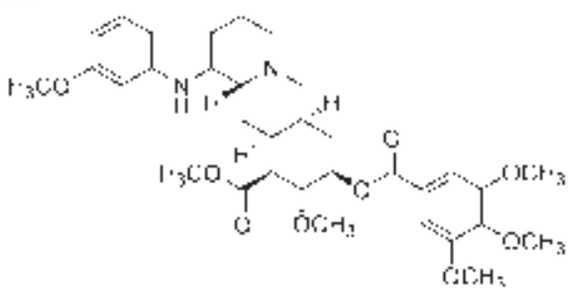
Natural Product chemists and pharmacologists, trained in western countries at first commenced evaluating the chemical constituents of plants used in Ayurvedic therapy and brought into the limelight of scientific evaluation a host of new chemical entities with remarkable biological activity. Many came to be fully developed as therapeutic agents now employed in modern therapy.

Some illustrative examples of scientific research into Ayurveda, from a host of such that has benefitted modern medical therapy, will now be discussed.

The Case of Rauwolfia

The case of *Rauwolfia serpentine* Benth., is a saga on its own. The roots of this plant, known locally as Sarpaganda., had been used in Ayurveda for the treatment of insanity for several millennia. In olden days certain symptoms now recognized as severe hypertension, came to be regarded as a type of insanity, for which allopathic medicine of the day had no remedy. Ayurveda at the time, this is even during the decades between the two world wars, did have the ability to respond satisfactorily to this form of malady by way of decoctions of the root of sarpaganda.

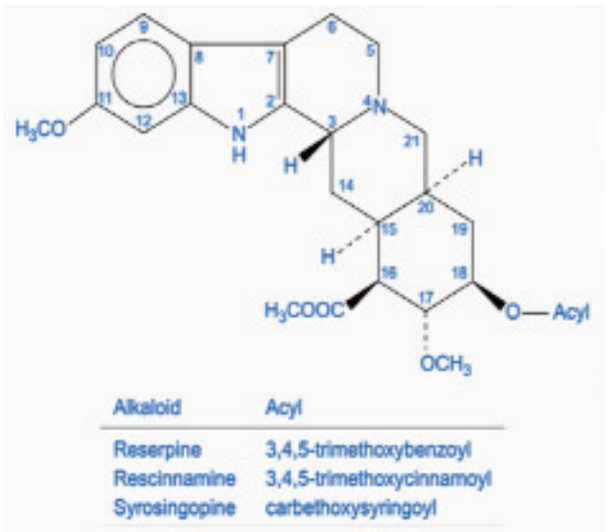
Rauwolfia serpentina became in the decade of the 1950's, the wonder drug of the time- as far as western medicine was concerned. For types of hypertension where the symptoms were akin to mental disease western medicine had little to offer. The plant was first scientifically investigated in pre-partition India, by the celebrated Pakistani chemist Salimuzzuddin Siddiqui. Dr. Siddiqui isolated the main alkaloids and then collaborated with the Swiss chemists led by Emil Schlittler, to elucidate the structures of Reserpine and Ajmalicine. Reserpine and the accompanying array of alkaloids were thereafter used in modern medicine as a treatment for acute hypertension, until superseded recently, by more suitable synthetics based on the main reserpine structure. However the side effects noted with reserpine, to counter for which the improved synthetic structures were modeled, were not evident in the total extract of the plant itself



Reserpine

In Ayurveda the water extracts known as: "Sarpaganda gnanavati", is even used to this day in the treatment of symptoms akin to hypertension. This prompts the issue that the pharmacodynamics of the extract warrants study to make a more suitable delivery form for modern use. There are many instances where the plant extract itself is found to be more efficacious than any of its isolated chemical constituents.

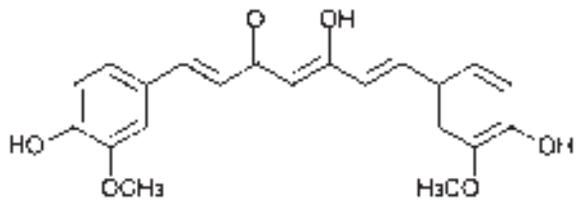
Rauwolfia sepentina



Alkaloid	Acyl
Reserpine	3,4,5-trimethoxybenzoyl
Rescinnamine	3,4,5-trimethoxycinnamoyl
Syrosingopine	carbethoxysyringoyl

The chemical scaffolding of the reserpine alkaloids have been used to synthetically modify them to generate the drugs that are used today.

The multiple benefits from Curcuma



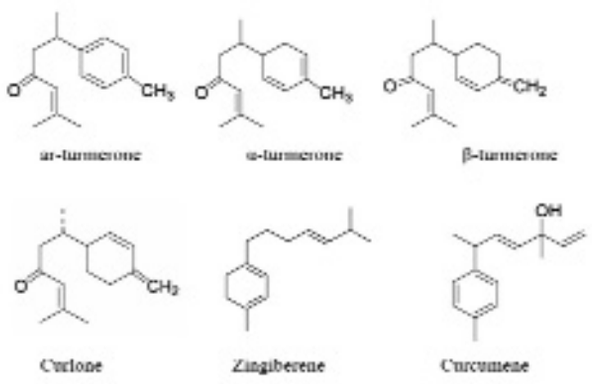
Curcumin

Curcuma longa of the family Zingiberaceae whose rhizomes are commonly known as an important spice ingredient is extensively used in Asian foods. In the early work of Ram Nath Chopra and others, the medicinal properties of Curcuma were amply illustrated. Known commonly as Kaha (Sinhala), Haldi or Haridra (Hindi), and Manchal (Tamil), the plant which belongs to the Ginger family, is one which is widely used in Ayurvedic medicine. Its value in wound-healing, as an anti-inflammatory agent, used in the characteristic preparations such as the Ayurvedic "Paththus", as well as its carminative effects, were well known in Ayurveda. Modern scientific research has demonstrated convincingly it's wound-healing, anti-inflammatory, and anti-mutagenic activities, and extracts and substances isolated from it, such as curcumin and turmerone, as well as the essential oil distilled from it, curcuma oil, are now utilized in modern pharmaceutical preparations. Modern research also shows that it has significantly beneficial effects in certain pre-cancerous conditions. Curcumin has also been shown to reduce plaques in Alzheimer's disease in animal experiments, and this is reckoned a significant lead in the search for a therapy for Alzheimer's syndrome.

The significantly lower incidence of Alzheimer's disease in populations that have curcuma in their food is reckoned as an epidemiological indicator of the role of curcuma in countering this dreaded disease.

The anti-oxidant properties of the curcuma extracts too are being now demonstrated in several laboratories worldwide. Researchers at the MD Anderson Cancer Center have attributed a diverse array of beneficial properties to Curcumin and conclude that it is one of the most powerful chemical preventive and anti-cancer agents.

Besides curcumin, several other chemical constituents of curcuma too have been associated with health benefits and this accentuates what epidemiological evidence has unequivocally demonstrated that people who incorporate the spice in their diet can reap the rewards such as a lower incidence of such diseases as cancer, Alzheimer's disease, rheumatoid arthritis, and myocardial infarction.



Some constituents of Curcuma

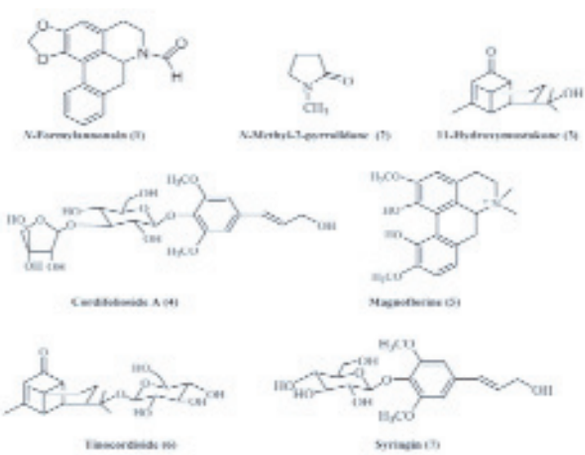
***Tinospora cordifolia Hook* – a sheet anchor of Ayurvedic therapy**

Tinospora cordifolia vine

Tinospora stems used in therapy

This plant known locally as Rasakinda (Sinhala), Chintil (Tamil) and Guduchi (Hindi) is generally used in Ayurvedic therapy to treat fevers of various origins and counts beneficial experiences. The plant belongs to the Menispermaceae family, and is a climbing vine. In regard to its perceived action it is important to comprehend the Ayurvedic concepts of anti-fever, and the mechanisms of countering it as a disease entity and not as a mere symptom. The concept of stimulating the body's own immune system emerges from this, and the drug is representative of the class now identified in modern medical terms as an immune-stimulant.

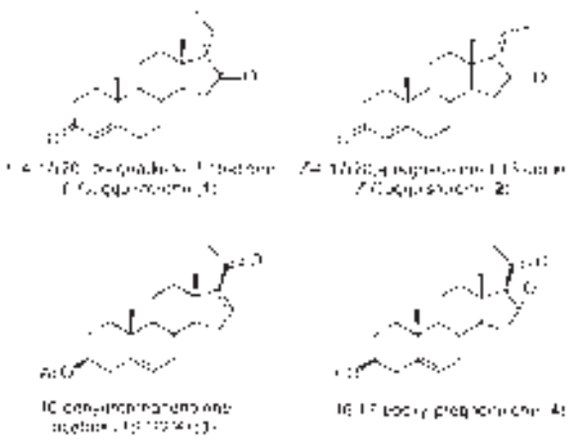
Researchers led by the late Pharmacologist, Mme S.A.Dahanukar and her team in India have carried out considerable pharmacological work on this drug and established its effectiveness as an immune-stimulating agent. A polysaccharide fraction isolated from this plant has displayed immunological activity, and a mitogenic effect on beta-lymphocytes of the spleen. A standardized herbal formulation from Tinospora administered before and after cancer chemotherapy has led to the reduction in the incidence of nausea, and vomiting.



A variety of chemical entities have been isolated from the plant but the bioactivity of the plant extract itself cannot be completely attributed to any one of them. The immune-stimulating activity could be due to some of the soluble polysaccharides also found in the plant together with the other compounds. Research on this activity is far from conclusive save the fact that the whole plant in the form of modern preparations such as capsules finds ready acceptance. It has also been studied as a potent source of antioxidants.

The Resin of the Guggul Tree

Guggul is the brownish yellow gum exudate from the tree *Comnifora mukul,* a plant indigenous to the Indian sub- continent. The plant has been used in the Ayurvedic system for many years for the treatment of a wide variety of ailments including obesity as well as arthritic conditions and even reputed to be an agent for lowering the level of cholesterol in the blood. The latter effect has been researched with positive results and the effects on rheumatoid arthritis conditions have been sustained. Nithya Anand and Nithyanand an Indian husband and wife team of researchers in Lucknow developed a drug which has been successfully used in modern therapy for rheumatoid arthritis. The chemical agents are a group of steroids collectively known as Guggulsterones.



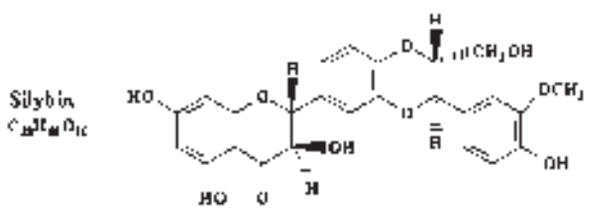
These are well characterized, and are now a developed treatment option for rheumatoid arthritis conditions.

Extracts of the resin were found to lower LDL (low density lipoprotein) cholesterol levels and triglyceride levels in humans." Guggulsterones", the dominant constituents, represent a highly efficacious antagonist of the farnisoid X receptor, FXR, a nuclear hormone receptor that is activated by bile acids. Inhibition of FXR activation is considered the basis for the cholesterol lowering activity of guggulsterone.

Silimarin - a liver protective agent from Milk Thistle

Milk Thistle –Silibum marianum and seeds

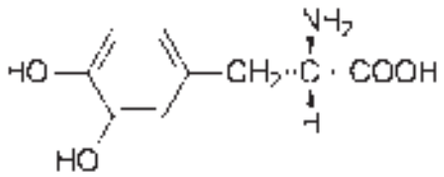
Silybum marianum, commonly known as Milk thistle, is a plant growing in temperate zones. It has been long used in both Mediterranean and Indian cultures for the treatment of liver diseases. Its seeds contain the active ingredients dominantly silybin.



The seed extract is used as hepato-protective agent, that is to combat disorders of the liver. The composition of the extract is a complex of chemical entities related to silibin., and is known by the collective name of silimarin.

The Velvet Bean - *Mukuna pruriens,* for Parkinsonism

The seed powder of the leguminous plant *Mucuna pruriens* has found use in Ayurveda for the treatment of a variety of conditions including what is recognized as Parkinson's disease.



Chemical structure of 3-(3,4-dihydroxyphenyl)-L-alanine (L-DOPA)

Velvet bean is an annual climbing vine indigenous to the tropical regions of Asia, Africa, and the West Indies. The seed pods are covered with reddish brown hairs that can cause intense irritation to the skin hence the Latin name pruriens which means itching. The seeds contain 7-10% of a compound called L-Dopa, and they have been used for a long time in Ayurvedic medicine. It has been considered as an aphrodisiac, a menstrual promoter, a uterine stimulant, and a nerve tonic, for disorders of the nervous system. It is now used in the treatment of Parkinsonian syndrome, an age-related neurodegenerative disorder that is known to affect over four million people worldwide. It is associated with progressive degeneration of the dopaminergic neurons in specific areas of the brain. While dopamine is unable to cross the blood brain barrier, and thus cannot be used directly for treatment, L Dopa is able to do so and gain access to the brain where it is converted to dopamine to address the shortcoming.

Clinical studies in India have validated the claims that the seeds indeed have aphrodisiac activity. In 2002 a US patent was filed on the use of velvet bean to promote anabolic and growth hormone stimulant properties in humans. Research cited in the patent indicated that the high levels of L Dopa in the bean were converted to Dopamine which acted as a stimulant for the release of the growth hormone by the pituitary gland. Research has also confirmed the effect of improved erection and duration of coitus in human males following oral administration. With its documented ability to increase testosterone and stimulate growth hormone, standardized extracts of velvet beans are finding enhanced demand in sports medicine, body building, and in formulas for weight loss.

A Change of Research Paradigm

The impact on research methodology that has been brought about by success in seeking leads from Ayurveda, as indeed from Traditional Chinese Medicine too, and in general from phytotherapy in Europe, is the new paradigm that now governs Natural Product research. No longer is the time-worn symbol of former research, namely the search for the single "active principle" valid. In its place the new paradigm for research that seeks the collective activity of multiple entities, together with perceived synergistic and de-toxicant effects of the multiple components of a plant or many plants of poly-prescriptions as long known in the Ayurvedic system as well as in the Traditional Chinese systems. In the diseases too there is no longer a single target approach to address the singular symptoms. This has been replaced by the multi-target approach and has been termed Synergy Research. It has been established as a new key research activity in recent years and is primarily aimed at research to find a rational for the superiority of several Ayurvedic and other herbal drug extracts as compared to single constituents thereof. The efficacy of these herbal extracts, have been established in several clinical trials. Modern allopathic medicine is slowly moving towards the new goals within this new paradigm, in a gradual transition, from the longstanding use of mono-drug therapy. There is now the supreme advantage in the availability of a staggering range of powerful physical, chemical, analytical and instrumental aids, to assist in research and diagnosis. The growth of detective methods will continue to be phenomenal. The fundamental researches on the genome will bring new and spectacular insights on the nature of disease. It is here that Ayurveda has still to make an even greater contribution. Ayurvedic theory is in terms of modern science an unexplored area. Like in the case of Ayurvedic therapy, exploration of the theories of Ayurveda too, given the powerful tools of modern science, will bring into focus a new paradigm of research in relation to health. Medical science will take on a paradigm shift in a new direction.

A prominent modern German researcher Professor Hildeberte Wagner of Munich, puts it this way: ***"The transition to a new kind of multidrug therapy, through which the interference of drugs with protective, repair, and immune-stimulating mechanisms of the human body, rather than with single disease causing agents, gains more and more importance".***

References for further reading

1. The Rauwolfia story. Edited and published by CIBA Pharmaceutical Products Inc.
2. Byron Richards: (2012), Wellness Resources.com News & Views
3. Thatte & Dahanuka r, (1989),Phytother.Revs.3,4.]
4. Sipahimalani et al. Planta Med..60.596]
5. S.Nithyanand et al. (1989) J. Assoc. Physicians. India, 37, 323.
6. R.B.Singh et al.(1994), Cardiovascular Drugs Ther.8. 659
7. Urizar et al. Science 296,(2002)]
8. Raintree :Tropical Plant Database Velvet bean. http://wwwrain-tree.com/velvet bean.htm

9. Robert E. Svoboda. http:www.//drsvoboda.com/ayurved.Alt.htm
10. Garodia, P. et al (2006). From Ancient Medicine to Modern Medicine; Ayurvedic Concepts of Health and their Role in Inflammation and Cancer. J. Soc. Integrative Oncology vol 5 no 1, 1-13.
11. H.Wagner: (2000). New targets in Phytopharmacology of Plants, in Herbal Medicine: a Concise Overview for Professionals. E.Ernst (ed) Butterworths-Heinemann, Oxford.
12. H.Wagner: (2005) Pure & Appl.Chem. vol 77(1), 1-6,
13. H.Wagner: (1999) - ibid - 71(9), 1649-54
14. H.Wagner & G. Ulrich-Mercenich. (200). Synergy Research and approaching a new generation of phytopharmaceuticals. Phytomed. 16, 97-110.
15. Vaidya A. (2006), J.Pharmacol. 38,311
16. L.Taylor: (2000) Plant-based Drugs and Medicines.// http:www.rain-tree.com/plantdrugs.htm

A story of Sugar and our ancestral apes..

What are even the best theories, if not old stories retold in the language of science? It is said that some twenty two million years ago, Apes filled the canopy of the African Rain Forest. They survived on the fruit of the trees, sweet with natural sugar, which they ate year round – a summer without end. One day perhaps five million years later a cold wind blew through this Eden. Then the seas receded, and the ice caps expanded. A spit of land was then said to have emerged from the tides, which made a bridge that a few adventurous apes followed out of Africa. Nomads and Wanderers as they were, they then settled in the rain forests that blanketed Eurasia. But the cooling winds continued replacing tropical groves of fruit with deciduous forests where the leaves flame in autumn then die. So a time of famine followed and the woods were filled with starving apes. Dr. Richard Johnson, a nephrologist at the University of Colorado, in Aurora,

Denver, explains: "At some point a mutation seemed to have occurred in one of those apes. It made the ape a wildly efficient processor of fructose – the dominant sugar in fruits.. Even small amounts were stored as fat, a huge survival advantage, in months when winter lay upon the land and food was scarce. Then one day that ape with its mutant gene, and a healthy craving for rare precious fruit sugar returned to its home in Africa and begot the apes we see today, including the one that has spread its sugar loving progeny across the globe. The mutation was such a survival factor, that only those animals that had it survived.

As Dr. Johnson summed up: "So today, all apes have that mutation, - including us humans. It got our ancestors through the lean years. But when sugar hit the West in a big way we had a big problem. Our world is flooded with fructose but our bodies have evolved to get by on very very little of it."

Sugar Cane harvest (Jamaica)

sugar cookies

It is a great irony for the very thing that saved us could kill us in the end? For today sugar is regarded as similar to an addictive drug, and the above story perhaps explains our craving for it.

Source: *Rich Cohen in the National Geographic magazine, August 2013.*

RESEARCH/
REVIEWS

AGARWOOD RESIN PRODUCTION FROM WALLA PATTA *(GYRINOPS WALLA)*: THE TREE OF THE FUTURE

*By S.M.C.U.P. Subasinghe**

"Walla patta", scientifically known as *Gyrinops walla*, a tree which had no commercial value a few months back, suddenly came under the spot light in Sri Lanka due to frequent efforts made to smuggle it out of the country. The reason of smuggling was believed to be the resinous tissue of agarwood which is produced inside the stem of this particular tree. The agarwood resin extracted from other species has been used for centuries in the Arab region and in some Asian countries. However, it is the first time that evidence was found on the production of agarwood resin in walla patta. Agarwood resin is a highly fragrant and very valuable resin produced by certain species of the family Thymelaeaceae as a result of a self-defence mechanism. The resin is highly sought after for religious, medical, ceremonial and domestic activities by Asian Buddhists and Moslems. In addition to that, a large demand is seen for agarwood resin in Southeast Asia, Middle East and United States as a perfumery agent. The extreme value of the agarwood resin depends on the oleoresin content of the wood. For instance, first grade agarwood resin is one of the most expensive natural raw materials in the world, with prices in consumer countries ranging from a few dollars per kg for low quality material to more than US$ 30,000 per kg for top quality wood. Agarwood oil fetches similarly high prices. Agarwood resinous substance occurs mainly in the trees of the genus Aquilaria which can be found from the foothills of the Himalayas to the rain forests of Papua New Guinea. In addition, agarwood resin is produced in three other genera, i.e., Gyrinops, Aetoxylon and Gonystylis of the family Thymelaeaceae. The agarwood resin production ability of walla patta was first reported in 2012 by the author.

Irrespective of the species, the presence of agarwood resin is seen in a small percentage of trees which are growing naturally. The process of this production is the tree's response to injury where its first line of defense, formation of phloem callus tissue, is inhibited from forming over the injury. Formation of agarwood resin can mechanically be initiated by the creation of open wounds on the trunk of the tree.

It is a common practice nowadays to apply mechanical injuries on the stem and branches at regular intervals to initiate early infection.

These injuries provide ready infection sites and also pushes the tree to undergo a stress condition, which helps in spreading of the infection. This practice yields better results when there is a microbial population already built up in the soil and also when the climate is warm and humid. These cut injuries further serve as the initial sites of fungal infection.

*Senior Lecturer, Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka Tel: 011 2804685, Email: upul.forestry@gmail.com

Agarwood resin is not a uniform product, but instead possesses different characteristics. Therefore it is classified according to various grading systems that differ according to the product in trade and country in which trading is taking place. The grade (and hence value) of agarwood resin and its derivatives such as oil is determined by a complex set of factors including: country of origin; fragrance strength and longevity; wood density; product purity; resin content; colour; and size of the form traded.

Agarwood resin has been used for medicinal purposes for thousands of years, and continues to be used in Ayurvedic, Tibetan and traditional East Asian medicine. The Sahih Muslim, which dates back to approximately the eighth century, refers to the use of the resin for the treatment of pleurisy and its use is referenced in the Ayurvedic medicinal text the *Susruta Samhita*. It is prescribed in traditional East Asian medicine to promote the flow of *qi,* relieve pain, arrest vomiting by warming the stomach, and to relieve asthma. High-grade agarwood resin powder is prescribed in Chinese medicine and is also used in the production of pharmaceutical tinctures. Furthermore, Malaysians used agarwood resin mixed with coconut oil as a liniment, and also in a boiled concoction to treat rheumatism and other body pain. It is also used as a complex ointment for smallpox and for various abdominal complaints.

The use of agarwood resin for perfumery extends back several thousands of years, and is referenced, for example, in the Old Testament several times using the term 'aloes'. Both agarwood smoke and oil are customarily used as perfume in the Middle East. In addition, the perfumes manufactured using agar oil as a base has become increasingly popular in USA and Europe.

Agarwood incense is burned to produce a pleasant aroma, its use ranging from a general perfume to an element of important religious occasions. Irregular chunks of agarwood, usually a few centimetres long and weighing 10-200 g, may be cut or broken into smaller pieces and then burned, usually in a specially made incense burner. Agarwood powder and dust cannot be burnt directly in incense holders, but can be used to make incense sticks or coils for indoor fragrance, and are used for religious purposes by Muslims, Buddhists and Hindus.

Nine species out of 15 recorded Aquilaria species *i.e., A. beccariana, A. crassna, A. filaria, A. hirta, A. khasiana, A. malaccensis, A. microcarpa, A. rostrata, and A. sinensis produce* agarwood resin. Moreover, resin production has been recorded from *Gyrinops ledermanii* and *G. versteegii* from the recorded eight species of Gyrinops. The author has identified the ability of walla patta *(Gyrinops walla)* for producing agarwood resin for the first time. In addition to that, preliminary studies have proven that the quality of the resin produced by walla patta is similar to that are available in the market produced by Aquilaria species.

Aquilaria trees are native to Asia from northern India to Vietnam and Indonesia. However, none of the species of the Aquilaria genus has been recorded in Sri Lanka. Walla patta is the only member present in Sri Lanka of the genus Gyrinops. According to the floristic records, outside the wet zone of Sri Lanka, "walla patta" had been recorded only in the extreme southwest of India, where it appeared to be very rare. Therefore it can be assumed that, walla patta occurs only in Sri Lanka at present based on the lack of information on finding this species in India.

"Walla patta" is a medium-tall tree which grows up to 15 m in height with a straight, slender trunk and a small, rounded crown. It bears a thin, brownish-grey bark which is smooth and strongly fibrous. Therefore its bark is used as a binding material by the villagers. Twigs are slender and wiry, rather shining and chestnut-brown in colour when young. Leaves are oblong and 3.0-9.0 cm x 1.2-5.0 cm with a short, rather abrupt, bluntish acumen up to 1 cm long. Petiole is short and 1-6 mm in length. Inflorescence is terminal or few flowered with umbel-like heads. Pedicels are 3-4 mm and thinly pilose. Flowers are yellowish-white and the size of the calyx tube is 4-10 mm which is narrow.

During the study carried out in identifying the agarwood resins of walla patta, the presence of those constituents were identified using gas chromatography analysis. In addition, those compounds identified in "walla patta" were compared with the commercially available agarwood resins of Aquilaria species. For that reason, chromatograms and indices obtained from authentic agarwood samples were used for confirmation of published data.

The resin contents of the samples varied from 4.4% to 10.9% with an average of 6.81%. However, since artificial resin induction had not been done and the naturally wounded areas of the selected trees were used for the present study, the pattern of the development of the tissues of the plants was not identified.

The results of the gas chromatography analysis revealed that the agarwood resins of "walla patta" contained several aroma principles commonly found in agarwood. Sesquiterpenes of guaiane and eudesmane skeleton were

also present. These compounds were known to produce a characteristic camphor like aroma with woody and floral notes. In addition, several fatty acids were also found to be common between the authentic and test samples. The following table illustrates the presence and the similarity of six main agarwood resin compounds in the tested *Gyrinops walla* and *Aquilaria crassna* trees.

Compound	Retention Index		Percentage area ± Standard deviation
	G. walla	*A. crassna**	
jinkho-eremol	1641	1643	0.58 ± 0.1
selina--3,11-diene-9-one	1689	1687	2.22 ± 1.89
selina--3,11-diene-14-al	1733	1735	5.35 ± 1.62
9,11-eremophiladien-8-one	1741	1740	1.44 ± 0.74
guaia-(10),11-dien-15-ol	1766	1770	1.76 ± 0.45
oxo-agarospirol	1818	1822	0.98 ± 0.38

Agarwood oils vary in their composition between trees. According to the previous studies, over 57 major compounds have been identified. The main compounds in the resin have been revealed to be sesquiterpenes and chromone derivatives.

Various techniques are used for agarwood oil extraction such as hydro-distillation, solvent extraction, and supercritical fluid extraction. Each technique has advantages and disadvantages. The classical method that is currently used in commerce for the agarwood oil extraction is hydro-distillation. This method consumes 7-10 days and high energy for extraction. The supercritical fluid carbon dioxide extraction is known as non-flammable, non-toxic, chemically stable and a less energy consumption method. It provides some advantages over classical method, since super critical carbon dioxide has low viscosity, high diffusivity, good transport properties and gives faster extraction and high yields.

International demand for agarwood resin is increasing and over the past decade it has resulted in over-exploitation. Poaching increases tree mortality, reduces the growth rate of pre-adults and adults, and decreases the percentage of adults that reproduce. Loss of lowland forest habitats also threatens populations of these species. Agarwood resin producing species are becoming more difficult to find, as reported by collectors, non-infected trees are increasingly being felled and collection is taking place within protected areas.

This over-use of agarwood resin producing species has therefore seriously affected the natural resources of all Aquilaria species capable of producing the resin, thus making these endangered species listed in Appendix II of the Convention on Internal Trade in Endangered Species of Wild Fauna and Flora (CITES) since 2004.

Based on the results of the studies conducted on "walla patta", it can be concluded that the resin formed in "walla patta" is strongly similar to that of the commercially available agarwood resin mainly extracted from Aquilaria species. Due to this finding and the present rate of illegal harvesting, if proper action is not taken by the government, the same fate of Aquilaria can befall the "walla patta" trees naturally growing in Sri Lanka causing its extinction. However, at the same time, it is essential to establish a proper mechanism to grow this tree in homegardens and as plantations so that a new industry can be developed in line with the "green economy" concept which can significantly contribute to the poverty alleviation.

References

1. Anklam E, Berg H, Mathiasson L, Sharman M, Ulberth F. 1998. Supercritical fluid extraction (SFE) in food analysis: A review. Food Additive Contaminants, 15: 729-750
2. Blanchette, R.A. 2003. Deterioration in historic and archaeological woods from terrestrial sites. In Koestler, R.J., Koestler, V.R., Charola, A.E., and Nieto-Fernandez, F.E. (Eds), Art, biology and conservation: Biodeterioration of works of Art. The metropolitan Museum of Art, New York, 328-347pp
3. Burkill, I. 1966. A dictionary of economic products of the Malay Peninsula, I. Government of Malaysia and Singapore. The Ministry of Agricultural and Cooperatives, Kuala Lumpur
4. Chakrabarty, K., Kumar, A., Menon, V. 1994. Trade in agarwood. TRAFFIC India and WWF-India, New Delhi
5. Compton, J.G.S., Zich, F.A. 2002. *Gyrinops ledermannii* (Thymelaeaceae), being an agarwood producing species prompts call for further examination of taxonomic implications in the generic delimitation

between Aquilaria and Gyrinops. Flora Malesiana bulletin 13(1): 61-66
6. Dassanayake, M.D. and Fosberg, F.R. 1981 Flora of Sri Lanka: Vol II. 1981. Oxford and IBH Publishing Company, New Delhi
7. Fratkin, J. 1994. Chinese herbal patent formulas: A practical guide. Shya Publications, Colorado, USA
8. Ishihara, M., Tsuneya, T., Shiga, M., Uneyama, K., 1991. Three sesquiterpenes from agarwood. Phytochemistry 30(2): 563-566
9. Naf, R., Velluz, Thommen, W., Brauchli, R., Sigwart, C., Gaudin, J-M., 1993. New Compounds Identified in Agarwood (*Aquillaria aggalocha* Roxb.) Flavour and Fragrance Journal, 8: 307-313
10. Ng, L.T., Chang, Y.S., Kadir, A.A. (1997). A review on agar (gaharu) producing Aquilaria species. Journal of Tropical Forest Products 2 (2): 272-285
11. Subasinghe, S.M.C.U.P., Hettiarachchi, D.S., Rathnamalala, E. 2012. Agarwood type resin from *Gyrinops walla* Gaertn: A new discovery. Journal of Tropical Forestry and Environment 2(2) 43-48
12. Subasinghe, S.M.C.U.P., Hettiarachchi, D.S. 2013. Agarwood resin production and resin quality of *Gyrinops walla* Gaertn. International Journal of Agricultural Sciences 3(1): 357-362
13. Wetwitayaklung, P., Thavanapong, N., Charoenteeraboon, J., 2009. Chemical Constituents and Antimicrobial Activity of Essential oil and Extracts of Heartwood of *Aquilaria crassna* Obtained from water distillation and supercritical fluid carbon dioxide extraction. Silpakorn University of Science and Technology Journal. 3 (1): 25-33
14. Yaacob, S. (1999). Agarwood: Trade and CITES Implementation in Malaysia. Unpublished report

From Atta-ur-Rahman FRS.

The exciting developments in Science and Technology are transforming the world we live in. The only constant is change. Nations that can ride this change rather than be buried in it are surging forward, leaving others behind. The change is being driven by new scientific discoveries. These are then transformed into technologies. Then through innovation and entrepreneurship they become products of daily use. This is apparent in almost every sphere of our lives: Engineering goods, household appliances communication tools, electronics. Pharmaceuticals and many other fields are evolving with increasing rapidity.

Indigenous knowledge wizardry
Captain Cook's ship the Endeavour

In the winter of 1769 the British explorer Captain James Cook received from a Polynesian priest named Tupaia an astonishing gift, namely a Map showing all the major islands of the south Pacific. Some accounts say that Tupaia sketched the map on paper; others that he described it in words. The map instantly gave Cook a far more complete picture of the South Pacific than any other European possessed. It showed every major island group in an area some 3000 miles across from Marquesas to Fiji. It matched what Cook had already seen and showed much that he had not. Cook then granted Tupaia a berth on his exploration vessel the Endeavour, in Tahiti. Soon the Polynesian priest surprised Cook and his crew by navigating to an island unknown to Cook, some 300 miles south, without ever consulting compass, chart, clock or sextant. In the weeks that followed he helped guide the Endeavour, from one archipelago to another, and amazed the sailors by pointing out on request, at any time day or night, cloudy or clear, precisely toward Tahiti.

David Dobbs in the National Geographic Magazine January 2013.

"Climbing is akin to love. It is hard to explain. We endure pain for the joy that comes with discovering ourselves and the Planet..

Cory Richards, Mountaineer and Photographer,, National Geographic Magazine January 2013.

A PLANT BASED SUNSCREEN PRODUCT

*By Mayoorini Ganesharajah & Lakshmi Arambewela**

Introduction

The harmful effects of solar radiation are caused predominantly by ultra violet region of the electromagnetic spectrum. Sunburns, skin cancers, premature skin aging and suppression of the immune system are linked to exposure of skin to ultraviolet radiation. Solar ultra violet radiations are divided into three categories1.

- UV - A : 320-400 nm
- UV - B : 280-320 m
- UV –C : 200-280 nm

UV-C is the most biologically damaging radiation, but it is filtered out by the ozone layer. UV-B is not completely filtered out and is responsible for the damage due to sun burn. UV-A radiation reaches the deeper layers of the epidermis and provokes premature aging. Ultra violet radiation has been implicated as a causative factor of skin cancer. Due to these facts sunscreen substances are now incorporated in creams, lotions, shampoos and other hair and skin preparations. Regular use of sunscreen products may help to reduce the chance of the harmful effects of ultraviolet radiations.[1-2]

Sunscreen is a topical product that absorbs or reflects some of the solar ultraviolet radiation on the skin exposed to sun light and thus helps to protect against sun burn and other harmful effects of UV radiation. With the thinning of the ozone layer, protection from sun's rays has become more important. There are two kinds of sunscreen one works as a physical block, the other works as a chemical block[3]. The best known physical filters are zinc oxide and titanium oxide, naturally occurring minerals being more effective than some chemical sunscreens[1].

Chemical blocks that are synthesized and used in sunscreen products as active ingredients work by absorbing ultraviolet rays before they reach the skin's surface. It is believed that the rise in skin cancer is linked with increased use of chemical filters[4]. Some of the chemical filters are genotoxic The evaluating studies on sunscreen use and cancer has shown that chemical filters in sunscreen products cause more cancer deaths than they prevent.[5] Some studies suggest that sunscreens interfere with the skin's ability to produce vitamin D and can cause hives and contact sensitivity[2]. As adverse effects are observed in synthetic sunscreen products, there is a need for an alternative product which does not cause adverse reactions. The focus is now on natural plant based sunscreens. Since they are natural, they may not lead to such problems.

The effectiveness of Sunscreen is measured by a factor called Sun Protection Factor. The amount of light that induces redness in sun protected skin divided by the amount of light that induces redness in unprotected skin is known as the Sun Protection Factor. It is denoted as SPF and is mainly a measure of UVB protection. SPF ranges from 1 to 45. Generally evaluation of SPF has been assessed through in vivo methods which have been performed on human volunteers. In this study an in vitro method was employed to calculate the SPF of extracts and the final product.

The in vitro methods are of two types. Methods which involve the measurements of absorption or the transmission of UV radiation through sunscreen product films in quartz plates or bio membrane and methods in which absorption characteristics of the sun screen agents are determined based on spectrophotometric analysis of dilute solutions 6-10. Usually for extracts 0.02% solutions and for oils 0.1% solutions are used in this analysis [10].

Mansur et al.(1986), developed a very simple mathematical equation utilizing UV spectrophotometry[10]. The Equation is given below for the in vitro method. $SPF_{spectrophotometric} = CF \sum_{290}^{320} EE \times I \times Abs$

Where : EE - erythermal effect spectrum; I –solar intensity spectrum; Abs – absorbance of sunscreen product; CF – correlation factor (=10)

The values of EE x I are constants. They were determined by Sayre et al.(1979) and shown in table .1

* *College of Chemical Sciences, Institute of Chemistry Ceylon. 341/22, Kotte Road, Welikada, Rajagiriya.*
mayganesh@gmail.com, lakshmi.arambewela@gmail.com

Table 1 –Normalised product function used in the calculation of SPF (Sayre et al. (1979))

Wave length (nm)	EE x I (normalised)
290	0.0150
295	0.0817
300	0.2874
305	0.3278
310	0.1864
315	0.0839
320	0.0180

Plants which are commonly available in Sri Lanka were selected for the study. In addition to the plant extracts, essential oils were also incorporated to the sun protection gel.

The Sun Protection Factor and Anti- oxidant property of the plant based gel were evaluated in this study.

Piper betle

Centella asiatica

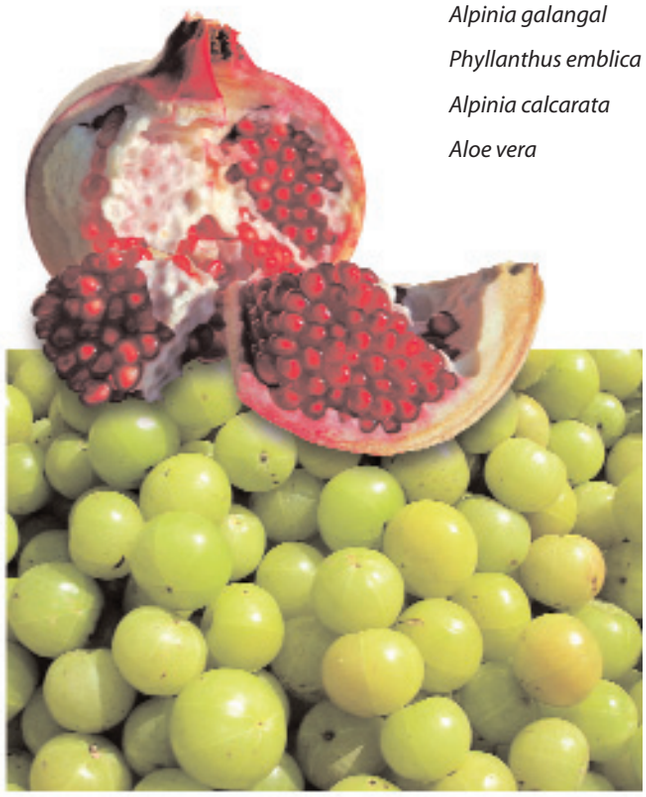
Punica granatum

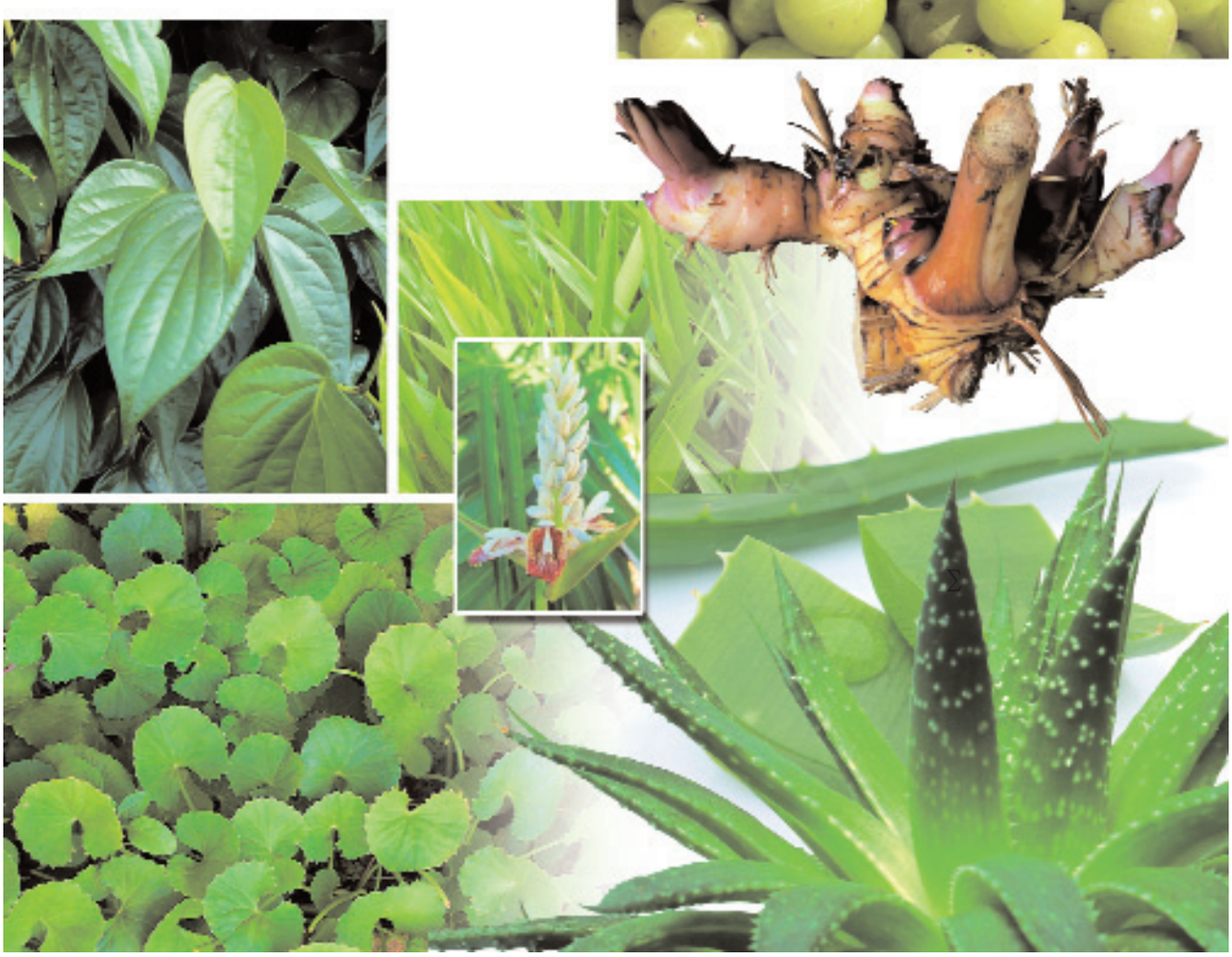
Alpinia galangal

Phyllanthus emblica

Alpinia calcarata

Aloe vera





METHOD

Preparation of plant extracts

Plant materials were cut into small pieces and extracted thrice with the suitable solvent by agitating. The extracts were then concentrated under vacuum using a rotary evaporator. *Piper betle* ethyl acetate extract, *Alpinia galangal* ethanolic extract, Green tea extract, Punica granatum ethanolic extract and juice, *Centella asiatica* ethanolic extract, *Phyllanthus emblica* ethanolic extract, *Alpinia calcarata* ethanolic extract and *Aloe vera* juice were prepared.

Preparation of 0.02% ethanolic solution of plant extracts

The extracts and cream purchased from the market (0.10g) were taken and dissolved in 5 ml of pure ethanol and transferred into 10 ml volumetric flask. By adding more pure ethanol, the solution was made up to the mark. The contents were mixed well and the solution was filtered. First 5 ml solution was discarded and the second 5 ml solution was collected. To prepare 0.02% solution, 1 ml was taken from the initial solution using a 1 ml pipette and transferred into a 50ml volumetric flask. Pure ethanol was added to make the solution up to the mark. Thereafter, absorbance values of each aliquot prepared were determined from 290 to 320 nm, at 5nm intervals, taking pure ethanol as blank, using UV-Visible spectrophotometer (U-2910 spectrophotometer). Standard solution of the sun protection cream purchased from the market was prepared to compare the results with plant extracts as well as the plant based gel developed in the lab.

Preparation of 0.1% ethanolic solution of essential oil

A portion of 0.1ml of sample was taken in a 10 ml volumetric flask, dissolved in 40% ethanolic solution and made up to the mark. From this 0.1% was prepared by taking 1ml and diluting to 10 ml with 40% ethanolic solution. Thereafter, absorbance values of each aliquot prepared was determined as mentioned above.

Preparation of the plant based sunscreen gel

P.betel extract (0.43g), *A.galanga* extract (1.52g), Green tea extract (1.52g), *P.emblica* extract (0.57g), *C.asiatica* extract (0.75g), *P.granatum* extract (15.00g), *A.calcarata* extract (5.00g) 10 ml of Cinnamon bark oil and 5 ml of Citronella oil were taken in a beaker and 10 ml of pure ethanol was also added to dissolve the extracts. Mixture was stirred to get a homogeneous mixture. A portion of 15 ml of Aloe juice was taken in a separate beaker, methyl paraban was added to it and stirred well. After methyl paraban dissolved, mixture was heated up to 50 deg Celsius. Carbopol Ultrez was slowly added to the mixture. This mixture was stirred again and transferred in to the mixture of extracts. Final mixture was stirred well until it started to gel. An ethanolic solution of the gel (0.02%) was prepared for the UV absorbance test as mentioned above.

Testing of radical scavenging activity of the prepared gel employing DPPH method

The antioxidant activity was determined by DPPH. scavenging assay as described by Navarro et al (1993) with some modifications (Ordonez et al., 2006). In this assay, known concentrations (0 - 160 µg/ml) of methanolic solution of gel and butylated hydroxyl toluene (BHT) were placed in different test tubes, and the volumes made up to 1.5 ml by adding methanol. Volume of 3 ml of a methanolic solution of DPPH. (4 mg/100 mL in MeOH) were added to each of these tubes and shaken vigorously. The tubes were allowed to stand at room temperature for 5 min. and the absorbance was measured at λ 517 nm. Control tubes were prepared as above by adding methanol instead of test solution. Butylated hydroxyl toluene(BHT) was used as positive control.

Results and Discussion

Sun protection factor

In vitro sun protection factor values were determined using the method and the equation stated above. Individual SPF values are shown in table 2.1 & 2.2

Table 2.1
SPF of plant extracts

Plant extract	SPF Value
P. betel	5.17
A.galanga	13.96
Green tea	7.83
P.emblica	5.50
C.asiatica	6.51

Table 2.2
SPF of plant extract & Cream

Plant extract	SPF Value
P.granatum	6.76
Cinnamon bark oil	28.40
Citronella oil	20.91
A.calcarata	14.67
A.vera juice	0.19
Purchased Cream	20.48

Calculation of the sun protection factor of the gel

Calculation of the sun protection factor of the plant based gel is given below. Absorbance curve of the gel is also shown figure1.

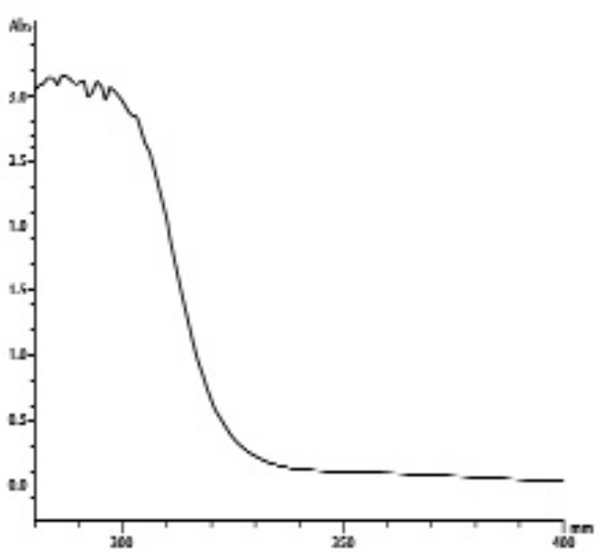
Table 3 Absorbance of the gel in the wave length range of 290-400 nm.

Wave length/ nm	Absorbance	EE x I	Absorbance x EE x I
290	3.1030	0.0150	0.0465
295	3.0373	0.0817	0.2481
300	2.948	0.2847	0.8473
305	2.639	0.3278	0.8651
310	2.023	0.1864	0.3771
315	1.221	0.0839	0.1024
320	0.652	0.0180	0.0117

$SPF_{invitro}$ = CF 290320 EE x I x Abs CF $\sum_{290}^{320}$ EE x I x Abs

$SPF_{invitro}$ = 10 x 2.4983

$SPF_{invitro}$ = 24.98



Wave length

Figure.1 UV absorption curve of the standard solution (0.02%) of the gel with in the wave length range of 290-400nm

Anti oxidant property of the gel

Absorbance values of the aliquots prepared in methanol were recorded at λ517nm.Percentage of radical scavenging activity (RSA) of the gel and BHT were calculated using the general equation shown below.

Percentage of RSA = $[(A_0 - A_s)/ A_0] \times 100$

Where A_0 is the absorbance of the control and As is the absorbance of the sample at λ 517 nm. IC50 values denote the concentration of sample required to scavenge 50% DPPH. Free radicals.

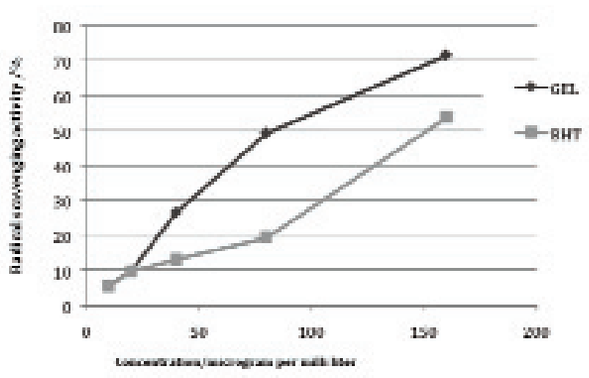


Fig .2 RSA versus concentration curve

IC50 values

IC50 value of gel = 82.44µg/ml

IC50 value of BHT=151.05µg/ml

Conclusion

The gel that was prepared using plant extracts and essential oils as UV absorbers, absorbed mostly the UV B (280- 320 nm) region, which is more harmful than UV A region. By increasing the amount of Alpinia extract which absorb in both regions the gel can be improved further. Sun protection factor of the gel is higher than the value of the sun screen cream which was purchased from the market. Therefore this plant based gel is more effective than the cream. Since the gel contains natural plant extracts, side effects can be less. IC50 value of gel is 82.44µg /ml whereas IC50 value of BHT is 151.05µg/ml. Therefore the gel is more effective in scavenging radicals compared to BHT. As the plant based gel shows higher value for sun protection factor compared to the cream, and has very good antioxidant property, it can be used for topical applications. Since the gel also contains Citronella oil as an active ingredient, it can also act as mosquito repellent during day times. However the performance of this gel has to be assessed through *in vivo* method which is performed on human volunteers

References

1. Nick Serpone , Daniele Dondi and Angelo Albini, Inorganic and organic UV filters: Their role and efficacy in sunscreens and suncare products, In: Inorganica Chimica Acta,360, pp.794–802 Elsevier Sci. Publ (2007)
2. Caroline Kerr, The effects of two UVB radiation-absorbing sunscreens on UV radiation-induced carcinogenesis, suppression of the contact hypersensitivity response and histological changesin the hairless mouse, In: Mutation Res, 422 pp.161–164, Elsevier Sci. Publ,(1998).
3. Sunscreen drug products for over-the-counter human use, Final Monograph, Federal Register 64 27666,US Food and Drug Administration, Rockville, 2000). Available from:http://www.cfsan.fda.gov/~lrd/fr990521.html
4. M.L. Kripke and P. Wolf, J. Natl. Cancer Inst. (1996).
5. T.M. Chiang, R.M. Sayre, J.C. Dowdy, N.K. Wilkin and E.W.Rosenberg, Melanoma Res (2005)
6. Denis Garoli, Maria Guglielmina Pelizzo, Piergiorgio Nicolosi,Andrea Peserico,Elena Tonin and Mauro Alaibac, Effectiveness of different substrate materials for in vitro sunscreen tests,In: Journal of Dermatological Science,56,pp.89–98, Elsevier Sci. Publ(2009)
7. J.S.Mansur, M.N.R.Breder, M.C.A.Mansur and R.D.Azulay, Determinação Do Fator De Proteção Solar Por Espectrofotometria, An Bras Dermatol Rio De Janeiro 61,121-4(1986).
8. E.P.Santos, Z.M.Freitas, K.R. Souza, S.Garcia and A.Vergnanini, in vitro and in vivo determinations of sun protection factors of sunscreen lotions with octylmethoxycinnamate, Int J Cosmet Sci 21,1-5(1999).
9. R.M.Sayre, P.P. Agin, G.J.LeVee and E.Marlowe, Comparison of in vivo and in vitro testing of sunscreening formulas,Photochem Photobio, 29,559-566(1979)
10. C.D.Kaur and S.Saraf. In vitro sun protection factor determination of herbal oils used in cosmetics, Pharmacognosy Research ,2, 22-25(2010)

All intellect and no feeling can be characteristic of the arch criminal and all feeling and no intellect exemplifies the harmless idiot. But when intellect and feeling are perfectly balanced, then we get the superlative actor.

Charlie Chaplin in his autobiography

The Yasuni National Park, Ecuador.

Giant Kapok trees with sprawling buttress roots soar like Roman columns straight into the canopy, their bifurcating branches draped with orchids and bromeliads that sustain entire communities of insects, amphibians birds and mammals. Strangler figs coil around their trunks in a tightening embrace. Thre is so much life here that tiny killifish are wriggling in a shallow puddle created by animal tracks. A turn down a slope and the forest is studded with bizarre looking Socratea trees commonly called walking palms, with four foot high stilt roots that allow the trees to shift location slightly in a quest for light and nutrients. It is one of the untold millions of evolutionary adaptations unfolding all around the rain forest.

Scott Wallace in the National Geographic Magazine January 2013

Friendship is like a river; it flows around rocks; adapts itself to valleys and mountains, occasionally turns into a pool until the hollow in the ground is full and it can continue on its way. Just as the river never forgets that its goal is the sea, so friendship never forgets that its only reason for existing is to love other people.

Paulo Cuelho in: The manuscript found in Accra.

PROMINENT RESEARCHERS NO.9

ASIMA CHATERJEE (1917 – 2006): QUEEN OF NATURAL PRODUCTS RESEARCH

By R. O. B. Wijesekera

Asima Chatterjee was, since the beginning of the second half of the twentieth century a regal icon of Indian science; particularly in the field of research on organic natural products. She was a protégé of one of the pioneer Indian researchers on natural products, Professor Prafulla Chandra Ray, and as was the practice with researchers of the sub-continent in the post war era, she expanded her skills and horizons by doing post graduate studies in the U.S.A. and in Switzerland. She came under the influence of Professor L.Zechmeister, of the California Institute of Technology, while she also spent a sabbatical period at Zurich, with the Nobel Laureate Professor Paul Karrer, and did research work on alkaloids and carotenoids.. She excelled in her own work at Calcutta where she held the prestigious Khaira Chair of Chemistry, - a Chair she held for two decades. She had by then her own team of researchers and become the first Indian woman to be awarded a D.Sc. in chemistry.

Asima Chatterjee did pioneering work on Alkaloids of the Rauwolfia, Alstonia, and Vinca species, the constituents of the Beli fruit, *Aegle marmelos*, and earned a niche as one of the world's most prolific researchers on natural products. During her later years she was the principal author of the monumental six volume Treatise of Indian Medicinal Plants, published by the Publications and Information Directorate of the CSIR, India. Her interest focused onto the desire to enrich phytomedicine, and she was responsible for creating the anti-epileptic drug Ayush 56 from the constituents of the plants *Marsilia munuta* and *Nardostachys jatamansi,* as well as the anti-malarial Ayush-64, a combination of four herbs, both being patented through the Central Council for Research in Ayurveda and Sidda.

The scientific community recognized her contributions to science and the nation through the award of the Shanti Swarup Bhatnagar Award in Chemical Sciences - the first woman scientist to be so honored. She was also the first lady scientist to be elected General President of the Indian Science Congress Association, while in 1975 the Indian Government awarded her the prestigious Padma Bhushan. A popular and respected personality at international scientific forums Asima Chatterjee with her vast knowledge, disarming smile, and her simple self-effacing personality, was a welcome delegate whenever she attended them.

The Series on Prominent Researchers has Featured :-

	Vol / No	Year	Page
1. Finn Sandburg	2/2	2006	09
2. Peter E Magda Telenyi	3/1	2007	05
3. Edgar Lederer	3/2	2007	11
4. Norman R. Farnsworth	4/1	2008	27
5. Nithya Anand	5/1	2009	14
6. Xiao Peigen	6/1	2010	30
7. Atal C.K	6/2	2010	13
8. Wagner H	7/1	2011	27

PRODUCTS FROM LINK NATURAL

MOSQUITO REPELLANTS FROM ESSENTIAL OILS

Mosquitoes

Phylum: Arthropoda
Class: Insecta
Order: Diptera

Although tiny in size mosquitoes are easily identifiable by their sharp irritating bites and annoying and whiny hum of their buzzing wings. Their involvement as disease vectors have been given much publicity in the media as well.. Nearly 3000 species of mosquitoes exist worldwide. They recognize their hosts by exhaling CO2, body odors and body temperature[12].

Life cycle
Eggs-Larvae-Pupae-Adult

Habitat
Mosquitoes spend most of their life cycle in water (Eggs, Larvae & Pupae) and adults are found in terrestrial habitats.

Both male and female mosquitoes feed on nectar and plant sugars. In addition, female mosquitoes have mouthparts for sucking blood

by Kanchana Wanasinghe & N.M.M. Jayamanne

Mosquitoes in Sri Lanka

Being a tropical country, Sri Lanka provides an ideal habitat for different species of mosquitoes. In a recent survey done in the Mahaweli project area, 27 species of male mosquitoes 67 species of female mosquitoes[1] and 49 species of mosquito larvae2 were recorded.

Mosquitoes and vector-borne diseases

Mosquitoes are one of the main vectors responsible for transmitting some of the major vector borne diseases. Mosquito borne diseases such as Malaria, Japanese encephalitis, Filariasis, Dengue (Table 01) cause serious health problems in Sri Lanka, almost reaching epidemic proportions. Studies have revealed that these diseases contribute to major economic and social problems such as 1.8% loss of labour days, US$ 15.56 of annual economic loss per household, 10% lost schooldays in children and adverse impact on the school performance due to malaria.[10]

As far back as 1675, Thomas Willis, a physician and founding member of the U.K. Royal Society, noted that the urine of people afflicted with diabetes “tasted wonderfully sweet as if it were imbued with honey or sugar.”

Rich Cohenin the National Geographis Magazine, Aug 2013.

Disease	Reported pathogens in Sri Lanka	Vector mosquito
Malaria[3]	*Plasmodium vivax* *Plasmodium falciparum* *Plasmodium ovale* *Plasmodium malariae*	*Anopheles culicifacies* *Anopheles subpictus* *Anopheles vagus* *Anopheles peditaeniatus*
Dengue[4]	*DENV-1-4 flavivirus serotypes*	*Aedes aegypti* *Aedes albopictus*
Chikungunya	*Chikungunya virus*	*Aedes aegypti*[9]
Filariasis	*Wuchararia bancroftii* *Brugia malai*	*Culex pipiens fatigans* *Mansonia spp.*
Japanese encephalitis	*Japaneseencephalitis virus (flavivirus)*	*Culex tritaeniorhyncus* *Culex gelidus* *Culex fuscocephala* *Culex whitmorei* *Mansonia uniformis*[6]

Table 01: Major Mosquito borne diseases in Sri Lanka

How to Control mosquitoes[11]

- Source reduction (reduction of breeding sites)
- Use of larvicides such as Methoprens
- Use of adulticides such as Malathion
- Bio-control methods such as introduction of mosquito larvae eaters such as Mosquito fish (*Gambusia affinis*) and Tilapia (*Tilpia mosambica*)
- Oil-drips (dripping of a thin oil layer onto the water)
- Genetic methods such as sterile male technique
- Mosquito traps

Use of repellents is a practical and economical method of preventing mosquito bites. Active components of the most common mosquito repellent formulations available on the market are DEET (N, N-diethyl – 3- methyl benzamide), Diethyl phthalate, Diethyl carbate, etc. DEET has shown excellent efficacy against mosquitoes[13]. However, human toxicity reactions after the application of DEET vary from mild to severe. In addition, the long term use of synthetic insecticides cause a number of ecological and medicinal problems such as the development of resistant insect strains and ecological imbalance. To avoid these adverse effects, natural plants that contain compounds of insecticidal, insect repelling and insect anti-juvenile properties can be used. Therefore the demand for natural mosquito repellants has dramatically increased during the last decade leading search for to mosquito repelling formulations from essential oils.

Essential oils that display mosquito repellant activities

Citronella *(Cymbopogon nardus)*, Eucalyptus *(Eucalyptus globulus)*, Lemongrass *(Cymbopogon citratus)*, Lemon *(Citrus limon)*, Cinnamon *(Cinnamomum verum)*, Basil *(Ocimum bacilicum)*, Cajeput *(Malaleuca leucadendron)*, Rosemary *(Rosmarinus officinalis)*, Listea *(Listea cubeba)*, etc

Many plants produce essential oils that demontrate mosquito repellant activities.

Over 2 billion people, in tropical countries carry a risk from mosquito – borne diseases. However, the search for effective vaccines against mosquito born diseases is still in progress. Therefore mosquito control and personal protection from mosquito bites are currently the most important measures to control these diseases.

A mosquito repellant remedy from Link Natural

Link Natural Products (Pvt) Ltd. has formulated a natural mosquito repellant as a spray and cream. This is expected to be out in the market no sooner the necessary regulatory procedures have been completed.

References:

1. Amarasinghe H & Ariyasena TG (1991) Survey of Adult Mosquitoes (Diptera: Culicidae) During Irrigation Development in the Mahaweli project, Sri Lanka, Journal of Medical Entomology. 28 (3); 387-393
2. Amarasinghe H & Ariyasena TG (1990) Larval survey of surface breeding mosquitoes during Irrigation Development in the Mahaweli project, Sri Lanka, Journal of Medical Entomology. 27 (5); 789-802
3 Priyanie H et al (1999) Malaria vectors in a traditional dry zone village in Sri Lanka, Am.J.Trop.Med.Hyg. 60 (3), 421-429
4. Tissera HA et al (2011) New Dengue virusrype 1 Genotype in Colombo, Sri Lanka,Emerg Infect Dis. 17 (11); 2053-2055
5. Japanese Encephalitis – A manual for medical officers of health, Epidemiological Unit, Ministry of Health, Sri Lanka
6. Peiris JS et al (1992) Japanese encephalitis in Sri Lanka – the study of an epidemic : vector incrimination, porcine infection and human disease, Trans R Soc Trop Med Hyg. 86 (3); 307- 313
7. Lambrecht FL (1974) Entomological aspects of Filariasis control in Sri Lanka, Bu World Health Organ. 51 (2)
8. Chikungunya – For service members and their families (2007) extracted from www.deploymenthealthlibrary.fhp.osd.mil
9. Chikungunya (2013) extracted from ww.nt.gov.au/health/cdc
10. Yasuoka J et al (2006)Impact of education on knowledge, Agricultural practices and community actions for mosquito control and mosquito-borne disease prevention in rice ecosystems in Sri Lanka, Am J Med Hyg, 74 (5);1034-1035
11. Mosquito control (2013) retrieved from en.wikipedia.org/wiki/mosquito-control
12. Mosquito (2013) retrieved from animals.nationalgeographic.com/animals/bugs/mosquito

GLEANINGS FROM THE LITERATURE

CINNAMON OIL IS A MOSQUITO KILLER

by Dilmani Warnasuriya

Recent studies have effectively shown that Cinnomon oil is a better mosquito killer than the well known DEET. More accurately cinnamon oil has the ability to kill mosquito larvae, and it is postulated that the oil could be a good mosquito repellent although scientific testing on these lines has not yet been done. The advantage of this is that conventional pesticide application although effective in destroying mosquito larvae, could cause serious environment issues and detrimental health effects. Taking this into cognizance scientists are now turning to natural mosquito repellents to replace the conventional pesticides.

The scientific team has tested 11 compounds in cinnamon leaf oil for their ability to destroy larvae of the yellow fever mosquito *Aedes aegypti*. After 24 hours of testing, four compounds namely cinnamaldehyde, cinnamyl acetate, eugenol and anethole showed the strongest effect against the mosquito larvae. The measurement used was the LC50 value, which is the concentration required to kill 50% of mosquito larvae within the 24 hours. Lower the LC50 value, the more potent the compound, as it takes lesser amount to kill the larvae in the same amount of time. All the compounds tested had a LC50 value of less than 50 ppm (parts per million) with cinnamaldehyde showing a LC50 of 29. It is pertinent to note that the LC50 value of DEET is more than 50 ppm.

The advantage of using cinnamon for this purpose is that it is already used as a food additive and flavouring agent, having established its popularity.

References:

http://www.ecomall.com/greenshopping/cinnamonoil.htm

SPA TREATMENT FOR TRAVELLERS

By Dilmani Warnasuriya

Link Natural Products', 'earth essence' Gallery staff participated in a unique programme in February 2013, whereby spa treatments were provided to passengers on board the Viceroy Special train travelling from Colombo Fort to Matale . The Viceroy Special train was introduced by JF Tours, the pioneer of vintage train tour operation in Sri Lanka, since 1986.

This novel concept was a brainchild of BT Options, who provided this facility to members of the Young Presidents Organization who were on tour to Sri Lanka. YPO is an organization founded by Ray Hickok, in 1950 and it connects successful young chief executives in a global network. Presently, 19,000 business leaders in 110 countries are part of this vast organization.

BT Options also organized a cricket tournament for the members of YPO, and during the matches, arrangements were made with the Gallery to provide spa treatments to over 70° clients on two cricket grounds .

Therapists of the gallery first boarded the train at Dematagoda railway yard. Their main task initially was to simulate the atmosphere of the gallery in a train compartment, with some of the accoutrements being brought in from the gallery. The passengers, boarding from Colombo Fort Railway Station displayed much enthusiasm in receiving the treatment, with requests for foot, hand and head and shoulder massages. Over 50 such treatments were provided during the journey. Earth essence cosmetics were also made available to the passengers. A second such program was organized by JF Tours in March for VIP group of passengers from Australia, numbering over 45. The Viceroy Special has been proved to be the only train that could provide spa treatments on board due its exclusive package and spacious accommodation. The art of train travel combined with the desired spa treatment touched the lives of passengers who were soothed and rejuvenated by the treatment.

With the changing hectic lifestyles of the modern day, soothing massages are becoming increasingly popular, and therapists are much in demand. Earth essence staff are committed to provide these services effectively, having the advantage of having a range of earth essence spa products at their disposal.

LINK NATURAL ACHIEVES GMP STATUS

*By Janitha Mendis**

What is GMP?

Good manufacturing practice (GMP) is a guideline which ensures that the manufacturing process is unfailingly conducted and controlled to the standard operating procedures(SOP)/quality standards as appropriate to their intended use. The set of guidelines have an effect on production, development, production related services and testing.

> "Good manufacturing practice is a guideline which ensures that the manufacturing process is unfailingly conducted and controlled to the standard operating procedures (SOP)/quality standards as appropriate to their intended use."

It also includes concerns on Personnel, Sanitation and Hygiene, Buildings and Facilities, Equipment, Production and Process control and Records and Reports.

GMP along with Standard Operating Procedures (SOP) is a prerequisite to the development of Hazard Analysis & Critical Control points (HACCP)

GMP – What it means to Link Natural

Getting closer to its vision of becoming a world class manufacturer and supplier of Ayurvedic pharmaceuticals and herbal care products, Link Natural was recently able to establish a Good Manufacturing Practices system in its factory and precincts. The certification was given on 3rd April 2013. GMP has a significant impact on the entire production process, and can be used as a management control tool.

There is no doubt that achieving GMP has been a profitable investment and it has become the production enriching avenue at Link Natural.

Personnel

In establishing and maintaining GMP standards at Link Natural, totally reliance has been placed upon the people who are directly involved with the process. In order to minimize the potential contamination associated with all personnel, it is mandatory that employees wear the uniforms, overalls and factory shoes provided by the company, when entering a work station.

All personnel are instructed to have trimmed nails, sans finger nail polish and false finger nails. Chewing betel is strictly forbidden, with lipstick being another taboo.

As per the Link Natural jewelry policy, all jewelry must be removed before entering a production section. The Production supervisor maintains a Personal Hygiene Record Sheet where daily conditions are recorded and updated monthly. Link Natural employees undergo annual health checks and eye examinations prior or during the employment as appropriate. Employees are also given sufficient training on GMP as per the training schedule. Visitors or untrained personnel will not be taken to the manufacturing high risk areas, as a rule, but if the necessity arises, they are provided with prescribed clothing.

Equipment and utensils

Equipment and utensils are located in such a way as to minimize the risk of errors, avoid contamination and ensure sanitation.

> "Surfaces in direct contact with products and equipment have been made with corrosion – resistance, non – absorbent, impervious material, and non-toxic substances as appropriate to the products used."

Surfaces in direct contact with products are made of corrosion – resistance, non – absorbent, impervious material, and non-toxic substances as appropriate to the products used. Fixed pipe lines, gas lines electrical conduits etc. are labeled in compliance with BSI standards, indicating its content and direction of flow. Preventive maintenance schedules are put in place to reduce the risk of breakdown which might cause contamination. A Calibration program for equipment is also effectively conducted twice a year by internal and outside calibration service providers.

* *Assistant Manager, Manufacturing standards & Quality Systems, Link Natural*

Buildings and facilities

Contamination can be significantly reduced through properly designed, well located, and organized buildings and facilities. A well designed ventilation system is in place mainly in the Sudantha, Samahan and essential oil plants to minimize the potential for contamination of products through dirt, sweat and vapour. A properly designed dust collection system is also in place to remove dust emissions in the grinding section in order to reduce the impact on cross contamination of raw materials at a significant level. Humidity has been controlled at an appropriate level in the production areas. Link Natural production floors are marked as personnel flow, material flow and finished goods flow and ceilings are so fitted in all manufacturing work station in order to ensure the safety of the products.

Link Natural operates an efficient waste management system along with an aerobic water treatment plant, incineration process, composting, recycling and reuse. The premises are always free of trash and debris due to proper ground cleaning program. Pest control is regulated through an outside Pest control agency.

Production and process control

Link Natural process manual relating to the ISO 9001 describes the procedures for all the processes from the receiving of raw material to the distribution of final products. In order to maintain a greater product quality and safety assurance, a HACCP plan has been developed for each of the manufacturing processes and there are 12 CCPs in the processes according to HACCP decision tree criteria. Finished products are handled and stored in such a way as to prevent the contamination, packaging damages etc Instructions have been given to the stores keeper relating to storage procedure and inspections. Link Natural has introduced modern management control concept named "Performance Wheel" in each section in the factory focusing on the continuous improvement of quality. Link Natural Key Performance Index will evaluate the process monthly so as to make a snap shot about the process, through three main criteria such as Cost, Quality and Delivery.

Sanitory operations, facilities and control

Link Natural sanitary management system has a significant effect on ensuring that the product is free from contamination of micro-organism and foreign debris.

Food graded cleaning liquids and powders are given for cleaning activities in production areas. Cleaning is done according to the given cleaning schedule and instructions. .Water taken to the factory premises from the municipal supply, portable water suppliers and natural well water is tested twice a year by outside laboratory service providers. Hand washing facilities have been established at the number of entry points including foot operated taps, food graded washing liquid and hand dryer/tissues. "Machine/Equipment Cleaning Tag" will ensure details of the cleaning processes carried out.

Quality control

Link Natural R&D/QA Department is responsible for holding or the release of the product depending on the final quality test report. All raw materials and packaging materials are checked (using standards sampling methods) by the QA officers and depending on the results it can be accepted, rejected or re-worked. All the products undergo through in-process, online and final product testing.

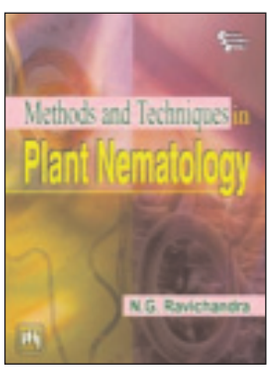
Product recall

The Product recall procedure of Link Natural consists of identification of defective product, recalling the product (includes recall strategy), monitoring the effectiveness, termination of product recall and post recall reporting.

As always, Link Natural strives to deliver quality products to its customers, and achieving GNP status will no doubt be a main player in this.

BOOK REVIEWS

METHODS AND TECHNIQUES IN PLANT NEMATOLOGY

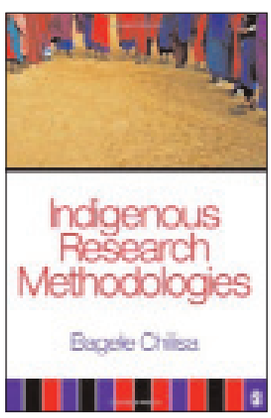


Author : N.G. Ravichandra
ISBN : 978-81-203-4096-1
Publisher :
PHI Learning Private Limited

Nematodes are one of the major concerns in Agriculture and Horticulture. This book covers a wide range of practical methods and techniques used in Plant Nematology. It was specially designed to fulfill the needs of students who are in the Agricultural and Horticultural fields. It includes both basic and applied aspects of Plant Nematology.

It covers nematode sampling and extraction techniques from both soils as well as plant tissues. It provides keys to identify major plant parasitic nematodes and includes techniques of drawing and measuring nematodes, histochemical, biochemical and molecular techniques in addition to important techniques related to Remote Sensing, Electron Microscopy, Microplots, Photomicrography, Culturing, Bioagents, Botanicals, Nematicides, etc.

This book provides tips for better results, important points to remember, and advantages or disadvantages of the different techniques used. Besides students, this book will serve the needs of research scholars and scientists engaged in the field of Plant Nematology, Plant Pathology, Soil Microbiology and Entomology. It will also be useful to the officials/field personnel of the agricultural and horticultural departments and others concerned with plant protection.



Author : Bagele Chilisa
ISBN : 978-1-4129-5882-0 (pbk)
Publisher :
SAGE Publications, USA

The book provides a comprehensive overview and synthesis of of indigenous research methodologies and indigenous feminist methodologies and illustrates their applications through a fascinating array of global case studies. It brings together postcolonial indigenous epistemologies and methodologies from across the globe, creating a platform to discuss them along with other emergent methods and methodologies in the social sciences.

Key features of the book include overview and synthesis of indigenous research methodologies, predominant research paradigms and indigenous paradigms and methodologies, application of postcolonial, indigenous, and critical race theory and guidance on relationships between the researchers and the researched. It provides a variety of learning aids in each chapter that stimulate critical thinking.

This book is recommended to anyone who is working in indigenous communities in health, education, international development or social sciences.

DIGEST MAIL BOX

Letter 1

Dear Editor-in-chief

I have just received the 2nd issue of Volume 8 and found some extremely useful information on Fragrances and saffron.

I have noticed a steady improvement in the scientific contents, illustrations and general get up of the journal under your stewardship.

My congratulations to you and the entire Editorial team as I await future issues.

I am sure the upward trend in quality will be maintained and accelerated.

Best wishes

Prof. B.N. Dhawan
Ex-Director
Central Drug Research Institute (CDRI)
3, Ram Krishna Marg, Faizabad Road
Lucknow - 226 007-01, INDIA

Letter 2

Let me congratulate the editors of the Link Natural Products Digest . It is a very informative publication and I for one have gained much information on Ayurveda, Herbals and allied areas. I have passed the Digest on to several of my friends, who also felt the same upon reading it. I am happy that through my request , I have been able to include them on the mailing list of the Digest.

I am looking forward to the next issue.

Ninette Makalanda
(former Chemist , MSJ Industries Cey Ltd.)

Letter 3

During my brief and most pleasant holiday spent in Sri Lanka, I came across the Link Natural Product Digest in a hotel lobby. I spent an hour or more reading several of the contributions in it. I need to confess that I was not entirely technically equipped to comprehend the articles completely, but they did capture my interest fully. I must say there was much variety ranging from aromatics to therapeutic substances.

May I offer my humble appreciation of a worthwhile and most interesting publication

Yours
Isidore Planetolla
Davis , California,

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 By email to :

Dr. R. O. B. Wijesekera
Editor in Chief
Link Natural Digest
robw@linknaturalproducts.com

or

Dilmani Warnasuriya
Co-Editor
Link Natural Digest
dilmani.warnasuriya@gmail.com

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 :

Title (in brief), author(s), address(es) of affiliated institutions. The authors' names must include initials and/or forenames as required in publication. All papers and submissions are subject to peer review, but the editors reserve the right to regulate the content. No proofs can be sent prior to publication. The decision of the Editor-in-Chief will be final in all matters.

The Digest Mail Bag Welcomes Reader's Views & Ideas.

COLLECTIVE INDEX TO LINK DIGEST FROM INAUGURAL ISSUE TO VOL.8