

Medicinal values of plants that are habitat to coastal areas of Sri Lanka: A literary study.

T.A.N.R. Gunaratna, D.K. Samarathunga and Janitha A. Liyanage

Abstract

Herbs cover the complete range of growth habits and sizes of plants. As a tropical country there are several plants available in Sri Lanka's coastal areas that are habitat in large scale. *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea* are the plants and creeping vines which are available in large range. They are rich in pharmacodynamics, mentioned in Ayurveda authentic books and as well as in the details of Sri Lankan oral tradition. But none of that information is famous among Sri Lankans.

This literary study was conducted to identify the medicinal values *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea* which are habitat to the coastal part of Sri Lanka for conservation, sustainable development of natural medicines and share the benefits of their medicinal value.

Study was based on the Ayurveda and Sri Lankan traditional authentic books and findings related to the plants were considered and analyzed. According to the results obtained, parts of whole plant's parts such as flowers, leaves, bark, roots and fruits have medicinal values and they are used for medicines. Every plant has pharmacodynamic actions which are related to Nerve system, Gastro intestinal system, Respiratory system, Blood circulatory system, Urinary system, Reproductive system and Immune system.

Results emphasize the medicinal utility of *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea* and it is essential to bring it up to the Sri Lankan society for the enhancement of natural medicine through the natural resources.

Keywords: *Ayurveda, Coastal area, Plants, Sri Lanka*

Introduction

Ayurveda is a 5,000-year-old system of natural healing that has its origins in the Vedic culture of India. Although suppressed during years of foreign occupation, Ayurveda has been enjoying a major resurgence in both its native land and throughout the world. Recognizing that human beings are part of nature, Ayurveda describes medicines which are related to the environment.

Sri Lanka is a country with a very old civilization and Ayurveda has been a widely practiced medical system throughout the ages. *Deshiya Chikitsa* was the earliest system of medicine that existed in Sri Lanka before the advent of Ayurveda. It was handed down from generation to generation and in the course of time *Deshiya Chikitsa* became fused with Ayurveda.

Herb is a plant or plant part valued for its medicinal, aromatic or savory qualities. Herb plants produce and contain a variety of chemical substances that act upon the body. *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea* are the plants and creeping vines which are habitat to coastal area and available in large range. They are rich in pharmacodynamics or medicinal values, mentioned in Ayurveda authentic books, traditional books and as well as in the details of Sri Lankan oral tradition.

Screening and exploring the use of herbal plants that are habitat to coastal area and evaluating of their therapeutic value are the main objective of this study.

Materials and Method

Sri Lankan Ayurveda pharmacopeia volume 1, 2 and 3 and other Ayurveda and traditional authentic books were used as the sources for the study. *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea* were identified as widely used herbal plants, which are habitat to the coastal part of Sri Lanka. For the completion of the study use of Plants were summarized using the information given in the books. Then the results were summarized and information was presented.

Results and Discussion

According to the Ayurveda authentic books and Sri Lankan traditional books, they are emphasis following details related to *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea*.

Borassus flabellifer

Borassus flabellifera is a member of the *Arecaceae* family. It is a solitary, large, erect palm with rough and black stem. The tree can reach up to 30 m tall with a trunk circumference of 1.7 m at the base. The petiole is measuring about 60–120cm long, robust and grooved. The edges are semiterete and armed with irregular spines. The Leaf blade is 60–20cm long, palmately fanned shaped with 60–80, linear-lanceolate, induplicate segments, 0.6–1.2m long with marginal spiny segments. The male inflorescence is 90–150cm long, much branched with primary and secondary branches; subsessile, with narrowly cuneate sepals and truncated inflexed tips, obovate-spatulate, shorter petals with large anthers. The female flowers have fleshy, large reniform sepals, smaller petals, subtrigonous ovary, recurved and sessile stigmas. The fruits are broadly ovoid, 15–20cm across with a fibrous and fleshy mesocarp and with a tightly adhering persistent large calyx at the base. The pyrenemes are usually three and are obcordate, 6–7mm broad and black. Within the mature seed is a solid white kernel while in the very young fruit, this kernel is hollow, soft and translucent like jelly, and is accompanied by a watery sweetish liquid.

Generally roots, flowers, kern, leaves, sprout, tegument, toddy and sweet toddy are used as medicines. They are used as an individual medicine such as root extract, leaf extract and root decoction and as a component of a poly herbal medicine. Apart from that palmyra treacle, jaggery, sugar, candy, palmyra sago and ash of palmyra are the secondary products which are used as medicines. Kottakilangu or cultivated plamyra sprout is a main ingredient in traditional Sri Lankan Modaka (semi solid medicinal preparation). According to the above details all parts are used as medicines in Ayurveda and traditional Sri Lankan medicine. Some parts are used as food items in rural areas of Sri Lanka.

Chemical composition of *Borassus flabellifer*

borassosides A-F; dioscin is the main chemical ingredient in *Borassus flabellifer*.

Pharmacological, Therapeutic properties and indications of *Borassus flabellifer*

Ayurveda authentic books emphasis that *Borassus flabellifer* also has therapeutic properties which are related to all systems in the human body. It also has the curetting power externally as

well as internally in human. Externally palmyra has anti inflammatory, wound healing, refrigerant, clotting, scrapping and skin problems alleviating properties. According to the above actions, leaf extract is applied for inflammations, wounds, bleeding, burning sensations in body and skin diseases. Fruit medulla is used externally for alleviate skin problems. Ash of flower stem is used for scrape or reduces unwanted skin nodules and other skin abnormalities.

Internally it acts as a brain stimulator in the nerve system and therefore leaf extract is used for mental retarded problems, faint and unconsciousness. In the gastro intestinal system, *Borassus flabellifer* has mild purgative, moistening, gastro stimulating, intestinal air flow regulating, severe purgative attributes. Thus palmyra fruit is applied for mild constipation and dryness. Palmyra toddy is used in the conditions of indigestion and flatulence. Ash of palpyra is applied for severe constipation due to its severe purgative property. *Borassus flabellifer* has cardiac stimulating, blood cleansing and blood clotting properties in the blood circulating system. So fruit is used for cardiac weakness and leaf extract is used for internal bleeding conditions and impurities removing conditions. Leaf extract and root extract have the expectorant power in the respiratory system and for that reason it is applied for cough, asthmatic conditions and bronchitis. In the reproductive system fruit acts as an aphrodisiac and the flower stem acts as menstrual stimulator. Apart from those properties, *Borassus flabellifer* has antipyretic, refrigerant and immune promoting properties.

Cocus nucifera

The coconut palm (also, cocoanut), *Cocos nucifera*, is a member of the family Areaceae (palm family). It is the only accepted species in the genus *Cocos*.

Cocos nucifera is a large palm, growing up to 30 m (98 ft) tall, with pinnate leaves 4–6 m (13–20 ft) long, and pinnae 60–90 cm long; old leaves break away cleanly, leaving the trunk smooth. Coconuts are generally classified into two general types: tall and dwarf. On very fertile land, a tall coconut palm tree can yield up to 75 fruits per year, but more often yields less than 30, mainly due to poor cultural practices. In recent years, improvements in cultivation practices and breeding have produced coconut trees that can yield more. Botanically, the coconut fruit is a drupe, not a true nut. Like other fruits, it has three layers: the exocarp, mesocarp, and endocarp. The exocarp and mesocarp make up the "husk" of the coconut. The mesocarp is composed of a fiber, called coir, which has many traditional and commercial uses. The shell has three germination pores (stoma) or "eyes" that are clearly visible on its outside surface once the husk is removed. A full-sized coconut weighs about 1.44 kg (3.2 lb). It takes around 6,000 full-grown coconuts to produce a tonne of copra. Roots, leaflet, tegument of pinnate leaf, coconut water, inflorescence, drupe, kern, shell and tender husk of coconut are used for medicinal applications. Coconut has several stages which are useful in medicine such as tender coconut, immature coconut, mature coconut, dry coconut and copra. There are some secondary products which are also used in medicinal applications. Sweet toddy, toddy, coconut treacle, jaggery, coconut oil, vinegar and coconut alcohol are those products. Medicinal application parts of *Cocony nucifera* can be used as a mono herbal or a poly herbal component. This is used as a traditional indigenous remedy in Sri Lanka and other tropical countries.

Chemical composition of *Cocus nucifera*

Table 1: A -Coconut-inner edible solid part, B –Coconut water

| | |
|---|---|
| A - Nutritional value per 100 g (3.5 oz) | B - Nutritional value per 100 g (3.5 oz) |
|---|---|

| | | | |
|------------------------------------|----------------|-----------------------------------|---------------|
| Carbohydrates | 24.23 | Carbohydrates | 3.71 |
| - Sugars | 6.23 | - Sugars | 2.61 |
| - Dietary fiber | 9 | - Dietary fiber | 1.1 |
| Fat | 33.49 | Fat | 0.2 |
| Protein | 3.33 g | Protein | 0.72 |
| Water | 47 | Water | 95 |
| Thiamine (vit. B ₁) | 0.066 mg (6%) | Thiamine (vit. B ₁) | 0.03 mg (3%) |
| Riboflavin (vit. B ₂) | 0.02 mg (2%) | Riboflavin (vit. B ₂) | 0.057 mg (5%) |
| Niacin (vit. B ₃) | 0.54 mg (4%) | Niacin (vit. B ₃) | 0.08 mg (1%) |
| Pantothenic acid (B ₅) | 1.014 mg (20%) | Vitamin B ₆ | 0.032 mg (2%) |
| Vitamin B ₆ | 0.05 mg (4%) | Vitamin C | 2.4 mg (3%) |
| Vitamin C | 3.3 mg (4%) | Calcium | 24 mg (2%) |
| Calcium | 14 mg (1%) | Iron | 0.29 mg (2%) |
| Iron | 2.43 mg (19%) | Magnesium | 25 mg (7%) |
| Magnesium | 32 mg (9%) | Phosphorus | 20 mg (3%) |
| Phosphorus | 113 mg (16%) | Potassium | 250 mg (5%) |
| Potassium | 356 mg (8%) | Zinc | 0.1 mg (1%) |
| Zinc | 1.1 mg (12%) | | |

Pharmacological, Therapeutic properties and indications of *Cocos nucifera*

Ayurveda authentic books mentioned that *Cocos nucifera* has therapeutic properties which are related to all systems in the human body. Also it has the curetting power externally as well as internally in human. Externally coconut has fairness, refrigerant, hair promoting, wound healing and skin problems alleviating properties. According to the above actions, coconut water is applied for hair fallings, wounds, and burning sensations in body and skin diseases. Especially it is good for measles and chicken pox conditions as a refrigerant reliever and fairness promoter. Coconut oil is also used as a wound healer and hair grow promoter. The tegument of coconut is used for wound due to its wound cleansing and wound healing properties. In some rural areas of Sri Lanka, ash of coconut trunk is used as a tooth powder due to its antiseptic properties.

Internally it has therapeutic properties related gastro intestinal system, blood circulating system, respiratory system, urinary system and reproductive system. In the gastro intestinal system, it has analgesic, anti colic, appetizing, intestinal air flow regulating, refrigerant, anthelmintic, stool binding and antacid properties. Therefore immature coconut water is applied for thirst, burning sensation of body, de-worm, flatulence, gastritis and kern is also applied for gastritis and severe constipation. Coconut water, inflorescence and kern of immature fruit have blood cleanser properties. Due to that, those parts are used for blood disorders of blood circulating system. According to the respiratory system of human body, *Cocos nucifera* has anti hiccough and sputum decreasing properties. Therefore coconut water is given to patients as a hiccough reliever and oil for decrease sputum in cough. In the urinary system authentic books mentioned that the immature coconut water and roots have the power of urine discolouration, diuretic and cleanser. Thus it is applied for disuria, burning sensation of urine, urinary calculi and colour abnormalities. On the other hand, inflorescence has the power of decreasing urine volume. It is applied for polyuric conditions. Mature kern has the properties related to aphrodisiac and

menstrual stimulating. So it is used in the reproductive system for sexual problems and dysmenorrhoea. According to the Sri Lankan indigenous medicine, sweet toddy is given to a pregnant mother thrice a week for the fairness of infant. Also kern of coconut is a good immune stimulant and antipyretic.

Apart from above therapeutic properties, immature coconut water and king coconut water is used as a substitute for saline water. On the other hand coconut oil which is prepared from coconut milk (*Ath tel*) is given to patient as a substitute for codliver oil. Coconut milk is used to prepare *Tel kira*, which is applied for orthopedic problems.

Ipomoea pes-caprae

Ipomoea pes-caprae is a seaside trailing herb or creeping vine. The stems are long sometimes twining reaching up to 30 m long. The roots are thick taproot found at the nodes. The leaves are simple, ovate, quadrangular, rounded or sometimes reniform; measuring 2.5 cm by 10 cm, with slender petioles that could be as long as 17 cm. There are two abaxial glands at base of the midrib, base broadly cuneate, truncate, or shallowly cordate, margins entire, apex emarginated or deeply 2-lobed, mucronulate. The inflorescence 1 to several flowered. The peduncle stout measures 3-16 cm long. The bracts are early caduceus, broadly triangular, measure 3-3.5 mm long. The pedicel measures 1-7 cm long. The 5 sepals are unequal, somewhat leathery, glabrous, apex obtuse, mucronulate, 2 outer ones nearly circular and concave, measure 7-13 mm long. The corolla is funnel-shaped measuring 3 – 6.5 cm long, purple to reddish-purple in colour, with darker inside centre. The filaments measure is 7-12 mm long, hairy at base. The plant bears dehiscent capsules measuring 1.2 cm containing hairy seeds that break up easily. Seeds contained 4 in numbers, trigonous-globose in shape, measure 6-10 mm long, black, densely brownish tomentose.

Chemical composition of *Ipomoea pes-caprae*

β -damascenone; antistine; behenic acid; E-phytol; jalapinolic acid; melissic acid; murucoidin vi; myristic acid; pescaproside A & B , pescapreins I-XX; stoloniferin iii, ix, x, 2-hydroxy-4,4,7-trimethyl-1(4H)-naphthalenone (1), (-)-mellein (2), eugenol (3), and 4-vinyl-guaiacol, glochidone, betulinic acid, alpha- and beta-amyrin acetate, isoquercitrin.

Pharmacological, Therapeutic properties and indications of *Ipomoea pes-caprae*

All parts of *Ipomoea pes-caprae* are used for Ayurveda medicines. Occasionally roots and leaves are used separately as medicine. Externally it is applied (leaf extract, root extract or whole plant extract / paste) for inflammation, skin diseases, joint pains due to its analgesic and anti inflammatory properties.

Internally it has anti inflammatory, analgesic, purgative properties related to gastro intestinal system and nerve system. Therefore it is given to patients who suffered from rheumatoid arthritis, abdominal colic. Due to the blood cleanser property, it is applied for blood circulating system's disorders. In the urinary system, it acts as a diuretic. Thus it is applied for urinary problems as well as inflammatory conditions.

Pandanus tectorius

Pandanus tectorius is a member of the Panadanaceae family. It is a stout, branching and often multi-stemmed large shrub or small tree than can reach up to 18 m high. They have numerous aerial and prop roots and thick forking spiny trunk. The leaves are variable in leaf shape and

size. They are spirally-arranged in three rows and clustered at branch apices, dark green in colour, 1-3 m long by 11-16 cm wide, V- to Y-shaped in section with spiny or prickly margins and midribs. Marginal prickles measure 0.8-2.5 mm long. The plant is dioecious with separate male and female plants. The flowers are borne in heads at the shoot apex. The male flowers are fragrant, tiny, white in colour, pendant, arranged in racemes or branched in clusters, with large white showy bracts. Male flowers only last for about a day, with the inflorescence decaying within 3 to 4 days. Female flowers are pineapple like. The fruit head may be ovoid in shape, ellipsoid, subglobose or globose with overall dimensions of 8-30 cm long by 4-20 cm diameter. The fruit head is made up of tightly bunched, wedge-shaped fleshy phalanges or drupes. Individual phalanges are narrowly oblong to ovoid in shape measuring 2.5-11 cm long by 1.5-6.7 cm wide. The seeds are ovoid, ellipsoid or oblong in shape measuring 6-20 mm long, red-brown and whitish/gelatinous inside in colour.

Chemical composition of *Pandanus tectorius*

2-phenyl ethyl alcohol; 2-phenyl ethyl methyl ether; terpinen-4-ol; 3-hydroxy-2-isopropenyl-dihydrobenzofuran-5-carboxylic acid methyl ester; 3-methyl-3-buten-1-yl acetate; 3-methyl-3-buten-1-yl cinnamate; 3-methyl-2-buten-1-yl acetate; 3-methyl-2-buten-1-yl cinnamate; 3,4-bis(4-hydroxy-3-methoxybenzyl) tetrahydrofuran; 4-hydroxy-3-(2',3'-dihydroxy-3'-methylbutyl)-benzoic acid methyl ester; 24,24-dimethyl-5 beta-tirucall-9; 25-dien-3-one; α -terpineol; β -carotene; beta-sitosterol; benzyl benzoate; pinosresinol; germacrene B; stigmaterol; viridine; vitamin C.

Pharmacological, Therapeutic properties and indications of *Pandanus tectorius*

Roots, supporting roots, stalk, flowers, fruits and seeds are the commonly using for Ayurveda pharmaceuticals. It is used as a mono herb such as powder, paste and ash or ingredient of a poly herb. Externally it has fairness, analgesic, anti convulsion, odour controlling, hair fall controlling and wound healing properties. Therefore *Pandanus tectorius* is used for wounds, skin disorders, body odour, pains and hair falling problems.

Internally it has therapeutic properties which are related to nerve system, gastro intestinal system, blood circulating system, urinary system reproductive system and immune system. According to that *Pandanus tectorius* has brain stimulating properties and due to that it is used for mental retarded problems. Digesting, appetizing and intestinal air flow regulating properties are help to enhance the digestion power, protect from abdominal colic, relief from flatulence. Related to the blood circulating system, it has blood cleanser, cardiac stimulant and blood developing properties. Therefore it is used for cardiac problems and blood disorders. *Pandanus tectorius* also has properties related to reproductive system. Flowers have aphrodisiac power and it helps to reduce abnormalities related to the system. Roots and supporting roots have power to control abortions. This plant also has anti pyretic, immune promoting properties. Due to that it helps to decrease the number of measles and chicken pox pustules.

Calotropis gigantea

Calotropis gigantea is a medium sized shrub or small tree that grows up to 4m high with a generally waxy appearance and copious milky sap. The stem is ash in colour, smooth, branching sometime almost from the base. The leaves are grey-green, opposite, alternating, waxy, thick and rounded-ovate. They measure 5–15cm x 4–10cm with a short pointed tip and a heart-shaped base partly clasping the stem; a stiff brush of hairs occur at the base of the mid vein. The flowers are white with deep purple blotch at the base of each lobe and deep purple scales between the petals and the stamens; more or less tubular, 5-lobed, 2–3cm across, devoid of milky sap. They

are grouped in umbels in which the outer flowers open first while the inner do not develop fully. The fruit is a grey-green bladderly pod, 8–12 cm long, rounded at the base but shortly pointed at the tip and containing numerous seeds. The seeds are brown, flattened, with a tuft of long white hair at one end.

Chemical composition of *Calotropis gigantea*

Leaves and Stalk – Calotropin and Calotropagenin, Latex – uscharin (0.45%); Calotoxin (0.15%) and Calactin (0.15%), Roots – Calotropin, Calactin, Uscharidin and Frugoside

Pharmacological, Therapeutic properties and indications *Calotropis gigantea*

Generally root, flower, leaf, latex, resin, sprout and cotton are the parts which are used for medicinal purposes. Ayurveda authentic books mentioned that the old shrubs are the best for medicinal applications due to their high percentage of tannins. They also mentioned that latex should be collected to a coconut early in the morning and the coconut helps to latex stay as a liquid. Externally *Calotropis gigantea* has anti inflammatory, analgesic, wound healing, wound cleansing and clotting, shrinking actions. Therefore it can be used in wounds to prevent bleeding, cleanse the wound and heal. Especially the dried latex powder and powder of leaves is used for wounds. *Calotropis gigantea* leaves have broncho dilating effect and thus it is applied as an inhaler for bronchitis and asthma. Ash of *Calotropis gigantea* root is applied for severe sinusitis as an analgesic. Ash is also used shrink the hemorrhoids and to remove it and other unwanted parts from the body. *Calotropis gigantea* cotton dressing is applied on the chest as a cover during the bronchitis conditions. It is also used to prevent bleeding.

On the absence of latex, Ayurveda prescribed extract of mature leaves as a substitute. Dried *Calotropis gigantea* root bark is used as a substitute for *Ipomoea radix* for the dysentery conditions.

Conclusion

Plants have been used as mono or poly herbal preparation to overcome the health problems of human being since last 5000 years. These formulas have been used to treat various types of diseases that are mentioned in Ayurveda system of medicine. Whole plant's parts such as flowers, leaves, bark, roots and fruits of *Borassus flabellifer*, *Cocos nucifera*, *Ipomoea pes-caprae*, *Pandanus tectorius* and *Calotropis gigantea* are habitat to coastal area of Sri Lanka have therapeutic values, pharmacodynamic actions which are related to Nerve system, Gastro intestinal system, Respiratory system, Blood circulatory system, Urinary system, Reproductive system and Immune system. Therefore results revealed that the need of experimental research to develop value added natural products using these plants.

References

- Abesekara, S.A.C. (2006). *Traditional Medicine in Sri Lanka and other Neighboring Countries*, Dharshana Printers, Sri Lanka.
- Ambikadatta Shasthri, (1996). *Susrutha Samhitha*, Chowkhamba Press, Varanasi.
- Buddhadasa, R. (1962). *CharakaSamhitha Sinhala Anuvada*, Colombo, Official Language Department.
- Buddhadasa, R. (1966). *SusruthaSamhitha Sinhala Anuvada*, Colombo, Official Language Department.
- Department of Ayurveda. Colombo. (1979). *Ayurveda Pharmacopoeia*, vol. 1 part 2.
- Department of Ayurveda. Colombo. (1985). *Ayurveda Pharmacopoeia*, vol. 1 part 3.

- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 1.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 2.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 3.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 4.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 5.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 6.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 7.
- Department of Ayurveda. Colombo. (1992). *Talpate Piliyam*, part 8.
- Department of Ayurveda. Colombo. (1976). *Ayurveda Pharmacopoeia*, vol. 1 part 1.
- Jadavji Trikamaji Acarya, (1994). *Charaka Samhitha*, Chowkhamba Sanskrit Samsthan, Varanasi.
- Somasiri, G. (1964) *Sharangadarasamhita Sinhala Anuvada*, Colombo, Official Language Department.
- Srikanth Murthy, K. R. (1998). *Bhavaprakasa of Bhavamisra*, Volume 1, Chowkhamba Press, Varanasi.
- Warrier, P. K., Nambir, V. P. K., Rmankutty, C. (1994). *Indian Medicinal Plants*, Volume 1, Orient Longman Private Ltd., India.

