

A REVIEW ON THE MEDICINAL VALUES OF THE PLANT *Hibiscus sabdariffa* Linn.**Dr. Debaprotim Dasgupta*, Prerona Choudhury, Dhritilata Pegu**

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ABSTRACT

Roselle plant (*Hibiscus sabdariffa*) of Malvaceae family is an annual herbaceous shrub belonging to the family Malvaceae. Sudan is considered as the country in which Roselle originated, particularly in the Kordofan and Darfur areas. Roselle is known as karkade in the Sudan and other Arab countries. It is mainly grown for its fleshy calyx (sepals), which is the commercially valuable part of the plant. The color of the calyx plays an important role in determining the quality of karkade. This plant finds its mention in folk medicine of North East India for its use in various ailments. In the present day studies, the proximate value and nutritional quality, antioxidant activity, antimicrobial properties, anti-proliferative activity and apoptosis-inducing capacity of roselle found in North East India. Nutritional evaluation of the calyx establishes it as a good source of dietary antioxidants and ascorbic acid.

KEYWORDS: *Hibiscus sabdariffa*, cancer cells, antioxidant, antimicrobial activity, anti-proliferative activity, apoptosis.

1. INTRODUCTION

The roselle plant, with an attractive flower believed to be native to Africa, is cultivated in Sudan, India, Malaysia and Taiwan. It is also one of the signature food ingredients of indigenous delicacies such as Masortenga in Assam, Jingtahjajewsaw in Meghalaya, Gakroghapha in Nagaland, Siloksougri Mapan Metpa in Manipur etc. The flowers are also used as a dye by virtue of its bright red colour. In addition to their use in food, various parts of the roselle plant have been used in traditional medicine for the prevention of diseases. It has been used in herbal tea to treat hypertension, pyrexia and liver damage although the pharmaceutical components are poorly defined.^[1] Various workers reported the roselle calyx possesses various beneficial effects in human health as mediated through its antioxidant property.^[2,3] The calyces are also rich in vitamins, especially ascorbic acid. Ascorbic acid is an essential dietary component.^[4] The antimicrobial activity, antibacterial and cytotoxicity studies in dose-dependent manner have also been studied.^[5,6] Antioxidative activity of the extract was also reported in cancerous cell lines while the antioxidant potential in the form of scavenging free radical and inhibitory effect on XO activity has been evaluated. The effects of roselle-anthocyanins (HA) on human cancer cells (HL-60) showed apoptosis of cells in a dose and time-dependent manner.^[7]

SYNONYMS

Abelmoschus cruentus, Furcariasabdariffa, Hibiscus acetosus, Hibiscus cruentus, Hibiscus fraternus, Hibiscus

gossypifolius, Hibiscus palmatilobus, Hibiscus sanguineus, Sabdariffa rubra, Florida cranberry

TAXONOMIC CLASSIFICATION

Domain: Eukaryota
Kingdom: Plantae
Phylum: Spermatophyta
Subphylum: Angiospermae
Class: Dicotyledonae
Order: Malvales
Family: Malvaceae
Genus: Hibiscus
Species: Hibiscus sabdariffa



Fig. 1: Morphology of Roselle plant. (A) Leaves; (B) pink or yellow flower; (C) Red fresh calyces; (D) Fruit; (E) Dark brown seeds.

Source; (E).^[7]

DESCRIPTION

Plant description- It is an erect, annual or perennial bushy or herbaceous woody-based subshrub, growing to 2–2.5 m (7–8 ft) tall.

Stems- Smooth or nearly smooth, cylindrical stems red in colour.

Leaves- Leaves are dark green to red, alternate, glabrous, long petiolate, palmately divided into 3-7 lobes, with serrate margins.

Lamina- Five-pointed leaves three palm deeply concave or flat.

Floral description- The flowers are 8–10 cm (3–4 in) in diameter, white to pale yellow with a dark red spot at the base of each petals, and have a stout fleshy calyx at the base, 1–2 cm (0.39–0.79 in) wide, enlarging to 3–3.5 cm (1.2–1.4 in), fleshy and bright red as the fruit matures.

Fruit- Five-pointed thick red succulent calyces. These are also known as roselle petals or flower petals.

Seeds- 30-35 seeds are covered by a kidney shaped capsule, 2.5cm and are pale green when young, turns into brown colour when it matures.

Roselle is locally known as ‘Mesta’ or ‘Meshta’ on the Indian Subcontinent. Roselle is locally known by different names in different countries (Table 1).^[8,9]

Table 1: Names of Roselle in different regions.

| Regions | Vernacular names | Source |
|--------------------------------|-----------------------|--------|
| Caribbean | Sorrel | [5] |
| Egypt, Saudi Arabia, and Sudan | Karkade | [10] |
| Florida | Cranberry | [5] |
| Gambia | Wonjo | [11] |
| Indian Subcontinent | Mesta, Meshta | [5, 8] |
| Indonesia | Rosela | [5] |
| Latin America | Jamaica | [5] |
| Malaysia | Assam paya, Asamsusur | [5,12] |
| Mali | Dah, Dah bleni | [11] |
| Myanmar | Chin baung | [11] |
| Namibia | Omutete | [5] |
| Nigeria | Zoborodo | [11] |
| Panama | Saril | [5] |
| Senegal, Congo and France | Bissap | [11] |
| Thailand | Krajeab | [11] |

ORIGIN

Roselle, which originated from Africa, was planted in Sudan about 6000 years ago. Sudan is currently the major producer of Roselle as a source of Sudanese tea. It was introduced to India and South America as a vegetable in the 17th century and was domesticated in Asia for use in fibre production. There were reports of its cultivation, in India, Sri Lanka, Thailand, Malaysia and Indonesia at the beginning of the 20th century.

The warm and humid tropical climate is suitable for Roselle plants as it is exceptionally susceptible to frost and mist.^[10,11] The temperature range within which Roselle thrives is between 18 and 35°C, with an optimum of 25°C. Growth of the plant ceases at 14°C. In tropical and subtropical regions, an altitude 3000 ft. (900 m) above sea level is suitable for growing this plant. Annual rainfall between 400 and 500 mm is necessary throughout the Roselle growing season. Roselle is a short-day plant that is very sensitive to the photoperiod.^[12,13]

PROPAGATION

Roselle is commonly propagated by seeds, but it is also readily grown from cuttings. Sowing is at the beginning of the rainy season in India. There are two approaches for sowing: sowing directly in the field and sowing in seed beds.^[12,13]

HARVESTING AND POST-HARVEST HANDLING

The fruits should be gathered sufficiently early before any woody matter forms in the pods, or in the calyxes. Harvested stems are steeped in water for two weeks, followed by stripping of the bark and subsequently the stems are beaten to discrete their fibres. The beaten stems are washed, dried and sorted according to length, colour and stiffness to produce fibre. The seed capsules are removed from the calyxes by round and sharpened metal tubes.^[12,13]

2. PHYTOCHEMISTRY

2.1 Nutritional value

The nutritional composition of fresh cHs varies between studies, probably due to different varieties, genetic, environmental, ecology and harvest conditions of the plant. Early studies reported that cHs contains protein (1.9 g/100 g), fat (0.1 g/100 g), carbohydrates (12.3 g/100 g) and fibre (2.3 g/100 g). They are rich in vitamin C (14 mg/100 g), b-carotene (300 lg/100 g), calcium (1.72 mg/100 g) and iron (57 mg/100 g).

The leaves contain protein (3.3 g/100 g), fat (0.3 g/100 g), carbohydrate (9.2 g/100 g), minerals (phosphorus (214 mg/100 g), iron (4.8 mg/100 g) thiamine (0.45 mg/100 g), b-carotene (4135 lg/100 g), riboflavin (0.45 mg/100 g) and ascorbic acid (54 mg/100 g).^[15]

The seeds contained crude fatty oil (21.85%), crude protein (27.78%), carbohydrate (21.25%), crude fibre (16.44%) and ash (6.2%). In terms of minerals, the most

prevalent is potassium (1329 ± 1.47 mg/100 g), followed by sodium (659 ± 1.58 mg/100 g), calcium (647 ± 1.21 mg/100 g), phosphorus (510 ± 1.58 mg/100 g) and magnesium (442.8 ± 1.80 mg/100 g). The major saturated fatty acids identified in the seed oil are palmitic (20.84%) and stearic (5.88%) acids and the main unsaturated fatty acids are linoleic (39.31%) and oleic acid (32.06%).^[16]

2.2 Organic acids

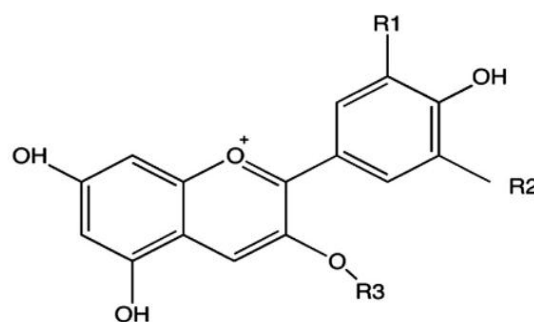
Hs extracts contain a high percentage of organic acids, including citric acid, hydroxycitric acid, hibiscus acid, malic and tartaric acids as major compounds, and oxalic and ascorbic acid as minor compounds. Based on previous studies, the percentage of organic acids in ‘hibisci flos’ varies; hibiscus acid accounts for 13–24%, citric acid 12–20%, malic acid 2–9%, tartaric acid 8% and 0.02–0.05% of ascorbic acid (vitamin C).^[17]

Hydroxycitric acid

Has an additional hydroxyl group at the second carbon of citric acid. This acid has four stereoisomers, (2S, 3S), (2R, 3R), (2S,3R) and (2R, 3S), and their lactone forms. The principal organic acid found in the cHs is the (2S, 3R)-hydroxycitric acid. It is the principal organic acid found in the calyxes of Hs.^[18]

2.3. Anthocyanins

The anthocyanins are a group of flavonoid derivatives and natural pigments present in the dried flowers of Hs and their colour varies with pH. Delphinidin and cyanidin-based anthocynins, include delphinidin- 3-sambubioside (hibiscin), cyanidin-3-sambubioside (gossypicyanin), cyanidin-3,5-diglucoside, delphinidin (anthocyanidin) and others.^[19]



Cyanidin-3-sambubioside (R1= OH; R2= H; R3= Sambubioside)
Delphinidin-3-sambubioside (R1= OH; R2= OH; R3= Sambubioside)
Cyanidin-3-glucoside (R1= OH; R2= H; R3= Glucose)
Delphinidin-3-glucoside (R1= OH; R2= OH; R3= Glucose)

Fig. 2: Chemical structures of main anthocyanins.

2.4. Flavonoids

Hs contain polyphenols of the flavonol and flavanol type in simple or polymerised form. The following flavonoids have been described in Hs extracts: hibiscitrin (hibiscetin-3-glucoside), sabdaritrin, gossypitrin, gossytrin and other gossypetin glucosides, quercetin and

luteolin; as well as chlorogenic acid, protocatechuic acid, pelargonidic acid, eugenol, quercetin, luteolin and the sterols β -sitosterol and ergosterol.^[20]

2.5. Mucilage, pectin and carbohydrates (polysaccharides)

Polysaccharides are another key group of compounds present in large quantities in the cHs WE. In one study, the ethanolprecipitated water extract yielded 10% of reddish polysaccharides. The following compounds were identified in two different fractions, arabinose, galactose, glucose, rhamnose and smaller amounts of galacturonic acid, glucuronic acid, manose and xylose.^[21]

The mucilage content was determined in the calyces of five strains of *Hs* var. *sabdariffa*, reaching 24–28% in strains from Central America and Egypt but only 15% in an Indian strain. This amount was only reached at a later stage of development in the strains from Senegal and Thailand. The pectin content only accounted for 2–4% while the sugars reached a maximum of 3–5% in these five strains. Mucilage and pectin consisted of 60–80% anhydrouronic acid.^[22]

The petals of *Hs* yielded 65% of dry weight of mucilage, which on hydrolysis produced galactose, galacturonic acid and rhamnose, while the leaves only yield 10%.^[23]

3. Medicinal properties

The plant *H.sabdariffa* is also known as Roselle or Rosella. It is reported to be **antihypertensive, antiseptic, sedative, diuretic, digestive, purgative, emollient, demulcent and astringent**. The calyces are used to treat **heart ailments, hypertension and leukemia**. They are also reported to have **diuretic, aphrodisiac, antiseptic, astringent, cholagogue, sedative, laxative, and antimicrobial activity**. They are also used as remedy for **pyrexia and abscesses**. The flowers and fruits are used for treatment of cough and bronchitis. Anthocyanins present in Roselle are dephinidin 3-sambubioside, cyanidin 3-sambubioside, delphinidin 3-glucoside and cyanidin 3-glucoside. They contribute benefit for health as a good source of **antioxidants** as well as a **natural food colourant**.

Ethno botanical information of Roselle plant revealed diuretic, diaphoretic, uricosuric, antibacterial, antifungal agent, mild laxative, sedative, antihypertensive, antitussive, gastrointestinal disorder treatment, hypercholesterolemia treatment, kidney stone treatment, liver damage treatment, agent for decreasing the viscosity of the blood, and agent for treating the after effects of drunkenness.

This plant has been found to show good larvicidal activity. Leaves of *Hibiscus sabdariffa* shows larvicidal activities on mosquito larva as per research.^[24]

DISCUSSION

The roselle plant has been found to show many medicinal values like diuretic, antihypertensive, anticancer, antioxidant, antifungal, antiseptic etc. This plant also serves as good larvicidal agent on mosquito larva. *Hibiscus sabdariffa* belong to the family malvaceae. The macroscopical evaluation i.e; colour, size, shape, taste of the plant was performed by identification. Extraction of the fruit part of the plant was performed by using soxhlet extraction apparatus by using petroleum ether and ethanol as solvents. The petroleum ether as well as ethanolic extract was analyzed by using coloured reactions based on chemical tests for identification of alkaloids, flavonoids, glycosides, saponins, tannins, phenols.

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CONCLUSION

The current results support the medicinal use of *Hibiscus sabdariffa* as an antimicrobial, antioxidant agent, antihypertensive, anticancer, diuretic property etc. Also, from a research it is found that the leaf parts of the plant *Hibiscus sabdariffa* are reported to show good larvicidal activity on mosquito larvae.

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