

***Rosa sinensis* (Hibiscus) -a versatile Indian origin plant**

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ABSTRACT

Plants have been a source of medicinal compounds since ancient times and have been used to treat various diseases in humans as well as animals. Many of the modern clinical drugs are of natural origin. *Hibiscus Rosa sinensis* is one of the miraculous medicinal herbs that is found to have powerful antimicrobial properties. This review focuses on the structural aspects of this plant along with its ecology, composition, bioactivity and some of its major applications in the scientific field.

KEY WORDS: Hibiscus, *Rosa sinensis*, Medicinal plant.

1. INTRODUCTION

Medicinal plants have been beneficial to mankind since the Vedic era in India. Due to their exceptional biological and pharmacological applications, they are being continuously exploited by man for his well being. *Hibiscus Rosa sinensis* is one such plant and belongs to the family Malvaceae. It is a species of tropical Hibiscus in the Hibisceae tribe. It is considered native to East Asia (Vyas, 2012). Although the plant is not related to the true roses, the term '*Rosa sinensis*' literally means 'rose of China' in Latin. It was first named by Carolus Linnaeus (Oguntoye, 2014). It is abundant in the sub-tropical and tropical regions and is cultivated extensively as an ornamental plant. This plant bears large flowers on the bushy hedges. The flowers are dark red in colour and are not usually fragrant (Kumar, 2012). They are grown in different regions of the Asian continent and are colloquially known as Chinese hibiscus, China rose, Hawaiian hibiscus and shoeblack plant (Vyas, 2012). The plant exhibits the genetic characteristic of polyploidy. Here, the plant bears more than two complete sets of chromosomes. The side effect of this genetic characteristic is a condition in which the phenotype of the offspring may be quite different from the parent, or any other ancestor, allowing possible random expression of all or any of the previous generations (Munirajappa, 1980; Rani, 2012). This plant has a wide range of applications. Parts of the flower are used to make a popular drink in Egypt and are also used to formulate medicines. Various parts of the plant are also used in the preparation of jams, spices, soups, and sauces (Baranova, 2011). In addition to the above, it is used for treating loss of appetite, colds, heart and nerve diseases, upper respiratory tract pain and inflammation, stomach irritation, fluid retention and also some disorders of circulation. In foods and beverages, hibiscus is used as a flavouring agent. It is also used improve the odour, flavour, or appearance of tea mixtures (Baranova, 2011; Ali, 2015). Hibiscus oil is extracted from the hibiscus plant and is considered as an essential oil. It has a wide variety of practical applications, ranging from aromatherapy to skin and hair care. The fragrance of this oil is found to be pleasant, relaxing and calming. It is thus suitable to be used in homemade beauty products like soaps and lotions. This oil is an excellent moisturizer and is known for its skin healing properties. It is also added in shampoos due to the rich nutrient content and in general, for the moisturizing properties of the hibiscus plant. It finds application in aromatherapy due to its calming and relaxing properties. Hibiscus oil can be used as a perfume on its own, adding to its versatility. There are many other benefits of using hibiscus oil on the skin. It acts as an excellent moisturizer for dry skin, and it also helps to heal lesions caused by skin infections such as psoriasis or eczema (Aldouri, 2000). This oil is also found to preserve the flexibility and elastic nature of the skin and reduces the effect of aging when used on a regular basis. It also has anti inflammatory (Yazan, 2011) and astringent properties. One of the most popular applications of hibiscus oil is in the field of hair care. The leaves and flowers of this plant have been used in the treatment of scalp conditions such as dandruff since ancient times (Vyjayanthi, 2004). Hibiscus oil is obtained from its flowers, and may be used alone or added to various hair care products such as shampoos and conditioners, to improve the overall condition of the hair.

Description and ecology of hibiscus: The genus 'Hibiscus' includes both annual and perennial herbaceous plants, woody shrubs and small trees. The leaves are generally simple, ovate to lanceolate, having a lobed or toothed margin. The flowers are generally big, conspicuous and trumpet shaped having five or more petals. They are coloured flowers ranging from white to purple, red, pink and sometimes yellow. The petals are very broad ranging from 4 to 15cm. Flowers have nectarines, that are composed of several tightly packed glandular hairs, and are generally positioned at the sepals. The fruit is a capsule made up of dry five-lobes. It contains numerous seeds in each of its lobes, which then are released at the time of maturation, when the capsule splits open (Alarcon, 2007; Ames, 2013). Hibiscus plants are a source of beneficial ecological, aesthetic, culinary and medicinal values. Ecologically, the large flowers give nectar to large pollinators such as hummingbirds. Many insects use these flowers as a source of food. It is also well known for its aesthetic values. There are a wide range of varieties of this plant. They can be of many colours such as orange, red, white and pink having a single or double set of petals. Being large and trumpet shaped, the hibiscus is often used as a garden plant as well as a potted plant. They

are more popular among Hawaiian women who traditionally wear a single flower. This plant is also used in the preparation of commercial teas. Hence, this plant, while advancing its own individual functions such as reproduction and survival, also advances a larger function for the ecosystem as well as for humans (Vitullo, 2009; Ames, 2013).

Composition: Various parts of the plant contain a number of chemical constituents, that are of major pharmacological importance. The stem and leaves contain stigmaterol, β -sitosterol, taraxeryl acetate and three other cyclopropane compounds along with their derivatives. Flowers are composed of flavonoids, diglucoside, and vitamins like thiamine, riboflavin, ascorbic acid and niacin (Ghani, 2003). Quercetin-3-diglucoside, 3, 7-diglucoside, cyanidin-3-sophoroside-5-glucoside and cyaniding-3,5-glucoside have been isolated from the bright yellow flowers of this plant. Along with these compounds, kaemferol-3-xylosyl glucoside has been isolated from white ovary flowers (Kumar, 2012). Five new phyto constituents have been isolated from the flowers of hibiscus *Rosa sinensis*. These were found to be n-Docosane, n-entacos-4-en-3-one-18, 23-diol and hencos-11-ene-8-one, stigmast-5-ene-3 β , 4a- diol, stigmast-5-ene-3 β -benzyloxy-12 β -ol (Kasture, 2000; Siddiqui, 2006). The total anthocyanin composition was reported to be 165 mg/kg with about 6% reduction due to fermentation. Tannin content is reported as 11.8g/kg. Ascorbic acid and total polyphenol composition is established as 478 mg /kg and 14.4 mg/g, respectively. The phytochemical screening reveals the presence of alkaloids and saponins. The antioxidant activity of the extract is significantly lower ($EC_{50} = 43.9 \mu\text{g/mL}$) compared to ascorbic acid ($E_{50} = 3.3 \mu\text{g/mL}$) (Mak, 2013). Total phenolic content in hibiscus *Rosa sinensis* was reported to be $48.4 \pm 1.03 \text{mg catechol equivalent/g}$ and the total flavonoid content was established as $24.26 \pm 1.1 \text{mg catechol equivalent/g}$ (Shirwaikar, 2005).

Bioactivity of hibiscus components: Hibiscus is one of the medicinal plants that generally find applications in treating diseases such as oxidative stress like hypertension and cancer. This is because they are made up of strong antioxidants like alkaloids and flavonoids / anthocyanins. Anthocyanins are useful in therapy against cardiovascular diseases and cancer (Trevisanto, 2000) and age related conditions such as dementia or Alzheimer's disease (Commenges, 2000; Milugo, 2013). Flavonoids have the ability to induce human protective enzyme systems. They have also been found to have protective effects against many infectious bacterial and viral diseases including degenerative diseases such as cardiovascular diseases, cancers, and other age-related disorders (Cook, 1996; Kumar, 2013; Filippo, 2014). Flavonoids also have antibacterial, antiviral (Critchfield, 1996; Cushnie, 2005), anticancer and anti-inflammatory properties. Flowers of the plant contain ascorbic acid whose biological role is to act as a reducing agent by donating electrons in several enzymatic reactions and a few non-enzymatic ones. The one-and two-electron oxidized forms of vitamin C that is, semi hydro ascorbic acid and dehydro ascorbic acid, respectively, can be reduced in the body by glutathione and NADH- dependent enzymatic mechanisms (Meister, 1994; Ewadh 2014). The leaves and stem contain cyclopropane compounds that are inactive at the GABA and glycine receptors. They instead act as an NMDA- receptor antagonist (Hemmings, 2006; Hudson, 2011). It inhibits the AMPA receptor and nicotinic acetylcholine receptors, and activates certain K channels (Hudson, 2011; Borghese, 2012)

Applications of hibiscus:

Traditional uses: Hibiscus *Rosa sinensis* has been used in Siddha medicine, a traditional Tamil system from South India, for many centuries. Hibiscus extracts have been used for ages in Ayurveda to cure many ailments. The plants have the natural health benefit that can be used to cure diseases naturally. They are used to cure ailments such as cough cold, hair loss and hair greying also. The flowers and leaves of this plant play a major role in hair treatment. These are ground into a fine paste with water and this is generally used as a shampoo plus conditioner. The plant also helps to improve the overall texture and health of hair. Hibiscus is a sweet sour herb and is used in the preparation of herbal teas. It acts as an antioxidant and also helps in the reduction of cholesterol levels (Esa, 2010). It has also been used in the traditional medicine for treating colds, loss of appetite, disorders of the respiratory tract. The plant is beneficial as a mild laxative, expectorant and diuretic. The hibiscus *Rosa sinensis* has been found to have emmenagogue effects which can stimulate menstruation and in some women, cause an abortion (Ernst, 2002; Ali, 2005; de Boer, 2014).

Pharmacological and medical applications: It is found that the leaves and flowers of Hibiscus *Rosa sinensis* have a wide range of pharmacological benefits. The aqueous-ethanolic extract of its aerial parts has been reported for its use in constipation and diarrhoea (Kumar, 2012). It is a blood purifier and also helps in treatment of cystitis, that is, inflammation of the bladder. It is a very good natural source of vitamin C and is used for curing syphilis and gonorrhoea also. Other varieties of hibiscus have also been found to be advantageous in the reduction of blood pressure, similar to captopril (Faraji, 1999; Arellano, 2004).

Effect on hair growth: Petroleum ether extracts of the leaves and flowers of Hibiscus *Rosa-sinensis* have been used to check hair growth potential by both *in vivo* and *in vitro* methods. *In vivo* methods, a 1% extract, made with liquid paraffin, was applied topically over the shaved skin of albino rats and were kept under systematic review for

a period of time. Length of hair and the different cyclic phases of hair follicles, like anagen and telogen phases were monitored at different intervals of time. *In vitro* method, the hair follicles from neonate albino rats were isolated and cultured in DMEM supplemented with 0.01 mg/ml petroleum ether extract of leaves and flowers. It was observed that the leaf extract exhibited higher potency than the flower extract on hair growth (Adhirajan, 2003).

Effect on estrous cycle: The roots of *Hibiscus Rosa sinensis* have been tested for their anti-implantation and also estrogenic properties. Ethanol extract was found to cause the loss of implantation that might be due to antizygotic, blastocytotoxic or anti implantation activity (Dionne, 1979; Vasudeva, 2008). Oral administration of the ethanol extract of roots of *Hibiscus Rosa sinensis* in ovariectomized immature female rats increases the uterine weight and also stimulates uterine growth suggesting estrogenic activity. Hence administration of estrogen may have uterotrophic effects in immature female rats and mice (Jordan, 1985; Gray, 1988; Vasudeva, 2008).

Effect on blood glucose level: Streptozotocin induced diabetic rats have been monitored to determine their blood glucose and total lipid levels after orally administering the ethanol flower extract of *Hibiscus Rosa sinensis*. After a period of 7 and 21 days of oral administration of extract, along with glibenclamide, a hypoglycaemic effect has been observed. After 21 days, maximum diminution in blood glucose, that is 41-46% and insulin level of 14% has been noticed. The extract was also found to lower the total cholesterol and serum triglycerides by 22 and 30% respectively. The hypoglycaemic activity of this extract can be compared to that of glibenclamide, but is not mediated through insulin release (Sachdewa, 2003)

Green synthesis of gold and silver nanoparticles: The leaf extract of *Hibiscus Rosa sinensis* has been used in the biological synthesis of gold and silver nanoparticles by a simple, cost-effective method. The particles are stable for long time. Self-assembly of gold and silver nanoparticles can be attained by carrying out this synthesis at room temperature in an aqueous environment. The shape and size of gold nanoparticles can be modulated by altering the ratio of metal salt and extract in the reaction medium. For the synthesis of gold nanoparticles, 5ml of hibiscus extract and 30 ml aqueous solution of $\text{HAuCl}_4 \cdot 3\text{H}_2\text{O}$ (5×10^{-4} M) have been used. The colloids were found to be stable for two months.

For the synthesis of silver nanoparticles, 20 mL hibiscus extract has been used with 25 mL aqueous solution of AgNO_3 (0.8×10^{-3} M) with stirring for 1 minute. To initialize the reduction of Ag ions, the pH of the solution was been adjusted to be 6.8 using NaOH. These colloids were found to be stable for four months. To ascertain the formation and stability of metal nanoparticles in aqueous solution, UV- visible spectroscopy technique has been used (Philip, 2010).

2. CONCLUSION

Thus *Rosa sinensis* is a powerful medicinal plant that is proven to have many valuable properties. Due to its various applications, hibiscus and its oil have a wide scope for future research especially in the field of pharmacology and as cosmeceuticals.

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