



## CANNA INDICA (L.): A PLANT WITH POTENTIAL HEALING POWERS: A REVIEW

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### ABSTRACT

The use of plants as medicines predates written human history. Ethnobotany (the study of traditional human uses of plants) is recognized as an effective way to discover future medicines. In 2001, researchers identified 122 compounds used in modern medicine which were derived from "ethnomedical" plant sources; 80% of these have had an ethnomedical use identical or related to the current use of the active elements of the plant. The plant is a biosynthetic laboratory, not only for chemical compounds, but also a multitude of compounds like glycosides, alkaloids etc. These exert physiological and therapeutic effect. Plants can provide biologically active molecules and lead structures for the development of modified derivatives with enhanced activity and reduced toxicity. The small fraction of flowering plants that have so far been investigated have yielded about 120 therapeutic agents of known structure from about 90 species of plants. According to one estimate only 20% of the plant flora have been studied and 60% of synthetic medicines owe their origin to plants. The medicinal values of many plants have been established and published, but most of them are waiting to be explored till date. Therefore, there is every need to find their uses and to conduct pharmacological studies to discover their medicinal properties. *Canna Indica* (L.) is a spreading annual herb found throughout India but unfortunately it is one of the neglected plants. Hence, the present review aims to open new avenues for the improvement of medicinal use of *Canna Indica* for various ailments and to bring the anti-diabetic Medicinal plant to the scientists' notice, and raise awareness and add value to the resource. This review attempts to highlight the available literature on *Canna Indica* (L.) with respect to ethno botany, chemical constituents and summary of various pharmacologic activities.

**KEY WORDS:** CANNA INDICA (L.), Medicinal plant, Weed, Pharmacology

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## INTRODUCTION

Indian medicinal plants are the essence of Ayurveda and Ayurvedic treatments. When used judiciously and clocking with the basic principles they produce miraculous effects. Their role cannot be confined to mere curative of disease but they also used being of human body. Hence, Ayurvedic drugs are rightly called the elixirs of life. Ayurvedic Herbs played important role in Ayurvedic treatment, from ancient time to this most modern time. Medicinal plants have been identified and used throughout human history. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions, and to defend against attack from predators such as insects, fungi and herbivorous mammals.

*Canna indica* L. (also known as saka siri, Indian shot) is a species of the *Canna* genus, belonging to the family Cannaceae. Indian shot or canna represents an important floral material of all urban areas. It is often planted in large areas, such as squares, areas along roads, parks and green spaces in front of representative buildings in order to get strong effects. *Canna indica* L. (Cannaceae) is commonly known as an Indian shot or Canna lily. Several varieties are common all over India and are grown in gardens. A medium sized species; green foliage, oblong shaped, spreading habit; triangular flower stems, coloured green; spikes of flowers are erect, self-coloured red, staminodes are long and narrow, edges regular, petals red, partial self-cleaning; fertile both ways, self-pollinating and also true to type, capsules globose; rhizomes are thick, up to 3 cm in diameter, coloured purple; tillering is prolific. It is an upright perennial rhizomatous herb up to 5 feet high, whose leaves are fleshy with thinner margins, usually not more than 1 foot long and half as broad, lanceolate to sub-orbicular. The flowers

are red or yellow and showy. It encloses a variable number of round, shiny black seeds. In folkloric medicine, root decoction is used for the treatment of fever, dropsy, and dyspepsia. Seed juice is used to relieve ear aches. The flowers are said to cure eye diseases<sup>1,2</sup>. The leaves of *C. indica* showed a significant analgesic activity and the rhizomes showed a good anthelmintic activity against *Pheritima posthuma*<sup>3</sup>. *Canna indica* sps. Can be used for the treatment of industrial waste waters through constructed wetlands. It is effective for the removal of high organic load, color and chlorinated organic compounds from paper mill wastewater.<sup>4, 5</sup> Archaeological evidence suggests that *Canna indica* L. was one of the first plants to be cultivated during incipient civilization of Peru and Argentina<sup>6</sup>. Today, it is used in medicine, and its starchy rhizome is used in nutrition. Paper is made from the fibers of its leaves and stems. The seed is used in jewelry making, and it used to be used instead of rifle bullets. Purple color is obtained from the seeds. Young seeds and young shoots can be used in nutrition<sup>7</sup>. The fibers obtained from stems are used as a substitute for jute. This plant has a large biomass production and in some countries is used for thermal energy production i.e. as biofuel<sup>8</sup>. It can produce high biomass in different soils and especially in the aquatic environment. In addition to its exceptional decorativeness and wide application, *Canna indica* L. is also very important for phytoremediation because it can successfully remove heavy metals and other pollutants from soil and water. By deposition of various pollutants from the air (dioxins, polycyclic aromatic hydrocarbons and polychlorinated biphenyls) on leaves with large surface areas *canna indica* L. can remove this serious pollutants from the atmosphere<sup>9</sup>.



Figure 1. *Canna indica* plant



Figure 2. *Canna indica* Flowers

### CLASSIFICATION

<b>Kingdom:</b>	Plantae – Plants
<b>Subkingdom:</b>	Tracheobionta – Vascular plants
<b>Super division:</b>	Spermatophyta – Seed plants
<b>Division:</b>	Magnoliophyta – Flowering plants
<b>Class:</b>	Liliopsida – Monocotyledons
<b>Subclass:</b>	Zingiberidae
<b>Order:</b>	Zingiberales
<b>Family:</b>	Cannaceae – Canna family
<b>Genus:</b>	<i>Canna</i> L. – canna
<b>Species:</b>	<i>Canna indica</i> L. – Indian shot

### VERNACULAR NAMES

Region (language)	Vernacular names
Common name:	Indian Shot, Wild canna
English	African arrowroot, Canna lily, Indian shot
Kannada:	Kalahu
Telugu	Krishna Tamara
Tamil	Puvalai kalvalai
Bengali:	Sarbajaya
Spanish	Chupa flor
French	Balisier comestible
Hindi:	Sarvajaya
Marathi	Kardal
Manipuri:	Laphoorit
Sanskrit	Vankelee, Devakuli
Konkani:	Kele Phool
Bengali	Sarbajaya, Kalaboti

**DISTRIBUTION**

A native of the southeastern United States (Florida, Texas, Louisiana, South Carolina), Mexico, Central America, the West Indies and much of South America. It is also reportedly naturalized in Austria, Portugal, Spain, Azores, Canary Islands, Cape Verde, Madeira, most of tropical Africa, Ascension Island, St. Helena, Madagascar, China, Japan, Taiwan, the Bonin Islands, India, Nepal, Sri Lanka, the Andaman Islands, Cambodia, Laos, Thailand, Vietnam, Burma, Java, Malaysia, the Philippines, Christmas Island, the Bismarck Archipelago, Norfolk Island, New South Wales, Queensland, Fiji, Tonga, Vanuatu, Kiribati, the Cook Islands, the Society Islands, the Caroline Islands and Hawaii<sup>10</sup>.

**CULTURE**

**Light:** Grow *Canna indica* in full sun to partial shade. It will benefit from some midday shade in hot climates.

**Moisture:** Indian shot grows best in a moisture retentive soil. Water freely when in bloom.

**Hardiness:** Where not hardy, Indian shot can be lifted and brought indoors for winter. When the leaves become blackened from the first good frost, cut off the stems and leaves and dig up the rhizomes for winter storage in damp peat or sawdust.

**Propagation**

Propagation of *Canna* can be done by seeds or root cuttings. The seeds are small, globular, black pellets, hard and heavy enough to sink in water. They resemble shotgun pellets giving rise to the plant's common name of Indian shot. Allow seedheads to dry on plants then remove them and collect the seeds. Cannas are grown in borders and beds, and are among the most popular flowers in tropical and subtropical gardens. Where not hardy, rhizomes can be planted out in spring for summer blooming, then dug in autumn for winter storage. Indian shot also can be grown in containers. To propagate plants by seeds, pre-soak them for 24 hours in warm water and sow them in late winter to early spring, in a warm greenhouse or indoors at 20 Celsius degrees (68 F). Sow seeds 2-5 cm deep in individual pots. Scarifying the seeds can

speed germination, especially if the seeds have not swollen after being soaked. The seeds usually germinate in 3-9 weeks. Grow the plants on in a greenhouse for at least their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. To propagate *Canna* by root cuttings, divide root clump as the plant comes into growth in the spring. Each portion must have at least one growing point. Pot up the divisions and grow them on in the greenhouse until they are well established and then plant them out in the summer in their permanent position. Avoid planting out young plants until all risk of frost has passed as the frost may damage the new growths. Water regularly during the growing season, avoid letting them dry out between watering and apply a phosphorus-rich liquid fertilizer each month for optimum results.

**MORPHOLOGICAL FEATURES**

Height: Rhizome short, tuberous, 2.5–3.5 cm diameter. It is a stout herbaceous plant with a tuberous rootstock. Whole plant is green and smooth, growing 1.5 meters height. Leaves are lanceolate or ovate, 10 to 30 centimeters long, 10 to 20 centimeters wide. Sheaths sometimes lanuginose or glaucous; lamina sometimes pluriplicate, (narrowly) ovate to (narrowly) elliptic, 20–35(–50) by (7–)15–25 cm, base obtuse to narrowly cuneate, apex acute and shortly acuminate. Inflorescence often branched, with (1- or) 2-flowered cincinni; pedicels up to 1 cm long, to 1.5 cm in fruit; primary bracts 7–15 cm long, acute; branch bracts 3–6 cm long, obtuse to acute; floral bracts (broadly) obovate-elliptic, 0.8–2.5 cm long, obtuse to irregularly truncate, persistent; bracteoles narrowly (ovate-) triangular, (0.5–)1.2–1.5(–2) cm long, acute; bracts, bracteoles, and sepals generally glaucous. Flowers deep red to yellow, erect, 3.5–6.5(–7.5) cm long; sepals whitish green to red or purple, narrowly ovate-triangular, 0.8–2 by 0.3–0.5 cm, acute; corolla red to yellow, (3–)4–5.5(–6.5) cm long, petals erect, narrowly triangular, 2.5–4.5(–5) by 0.3–0.7 cm, acute; staminodes 3 or 4, red to yellow, 4.5–5.5(–7.5) cm long, free part narrowly obovate to narrowly triangular, 2.5–4.5(–5) by 0.3–0.8(–1) cm, erect, 1 recurved and sometimes dotted or striped; stamen red to yellow, free part narrowly elliptic, 1.5–2.5(–4) by 0.2–0.6 cm,

theca 0.5–1.2 cm long; style red to yellow, free part linear to club-shaped, 1.5–4.5 by 0.1–0.3 cm. Fruit bright green, covered by green to purple tubercles, ellipsoid to subglobose or obovoid, 1.5–4(–5.5) by 1.5–2(–3.5) cm. Fruits are capsules, green oblong-ovoid, soft, echinate (spiny), and 2 to 2.5 centimeters long. Seeds are about the size of a pea, somewhat spherical, with shining, black seed-coat. Seeds subglobose, 4–8 mm diameter. The dark, shiny seeds can be drilled and used as beads in seed jewellery or strung into leis. The seeds are also used in hula rattles.

### **ECOLOGY AND POLLINATION BIOLOGY**

*Cannas* are found scattered in transitional habitats, both natural and artificial. In the wild they grow along the edges of marshes and forest margins, often in water up to 10 cm deep. They also thrive in spoil banks, roadside ditches and refuse sites given adequate moisture and seasonal drought. Seeds germinate and produce reproductive shoots in a single growing season (less than 4 months), generally flowering mid to late rainy season. Some studies indicate these flowers might be pollinated by hawk moths. However, pollen is shed before the flowers open, resulting in self-pollination. Indeed, greenhouse grown plants set seed readily, even in the absence of any likely pollinator. The coloration and floral tube of some (*C. jaegeriana*, *C. paniculata*, and *C. tuerkheimii*) suggest hummingbird pollination. A variety of insects including bees, moths and butterflies, as well as hummingbirds, have been observed visiting *Canna* flowers, presumably to collect the nectar which accumulates at the base of the floral tube. Seed dispersal is likely unassisted due to the large seed size and lack of reward for potential animal dispersal agents. (Kubitzki, 1998).

### **PARTS USED**

A type of starch is made from the rhizomes that is very similar to, and a good substitute for, arrowroot starch which is derived from an unrelated plant, *Maranta arundinacea*. The young rhizomes of Indian shot are sometimes eaten; they are sweet, but woody and fibrous. The seeds are perfectly round and very hard and reportedly were used as shot for flintlock muskets when lead shot was not available. Nowadays the seeds are commonly used as

beads in natural seed jewellery for necklaces and especially rosaries. The most common use of the *Canna* by Europeans and North Americans is as an ornament. The seeds are used as beads in some countries, or in gourds to form rattles. The rhizomes are used to make a form of arrowroot. The particular starch made from the roots of *Canna indica* is known as "tous-les-mois" in the West Indies, and as the Queensland Arrowroot in Australia. The rhizomes have also been used in India as a diaphoretic, diuretic, in fevers and dropsy, and as a demulcent, stimulant. Indians have used stalks cut into pieces and boiled with rice water and pepper given to cattle as antidote for effects produced by eating poisonous grasses. Rhizome may be collected during any time of the year. Ethanol (50%) extract of the aerial parts is hypotensive; tuber exhibited enterokinase activity. Unsaponifiable matter of the plant is molluscidal (Asolkar *et al.*, 1992).

### **PROPERTIES**

Sweet-tasting, slightly cooling-natured, antipyretic, relieves gastrointestinal disorders. Rhizomes considered demulcent, diaphoretic, diuretic, antipyretic. Seeds considered cordial and vulnerary. Roots considered acrid and a stimulant.

### **CHEMICAL CONSTITUENTS**

Rootstock contains enzymes, triacontanol and mixture of stigmaterol,  $\beta$ -sitosterol, campesterol and  $\beta$ -lectin and traces of alkaloids (Asolkar *et al.* 1992; Ghani, 2003). From the red flowers of *Canna indica* (Cannaceae) four anthocyanin pigments have been isolated apart from quercetin and lycopene. They are Cyanidin-3-O-(6"-O- $\alpha$ -rhamnopyranosyl)- $\beta$ -glucopyranoside<sup>(11)</sup>, Cyanidin-3-O-(6"-O- $\alpha$ -rhamnopyranosyl)- $\beta$ -galactopyranosid<sup>12</sup>, Cyanidin-3-O- $\beta$ -glucopyranoside<sup>13</sup> and Cyanidin-O- $\beta$ -galactopyranoside<sup>14</sup>. These compounds were isolated by using HPLC and their structures were subsequently determined on the basis of spectroscopic analyses, i.e., (11)H NMR, C NMR, HMQC, HMBC, ESI-MS, FTIR, UV-Visible etc. The isolated compounds showed good antioxidant activity thus makes it suitable for use in food coloration and as a nutraceutical. Thus it is a promising pigment source for food applications. *Canna indica* was found to contain terpenes, paraffin

hydrocarbons and a toxic red oil termed cannabinol as the major chemical constituents<sup>15</sup>. The flowers of *Canna indica* are brightly red. The appearance of red color is due to the presence of flavonoids, phenols and anthocyanins<sup>16</sup>. The biological activities of flavonoids have been extensively reviewed. Some of them have been found to possess anti-ischemic, anti-platelet, anti-inflammatory and anti-lipoperoxidant activities. Flavonoids have also been found to inhibit a wide range of enzymes involved in oxidation systems such as lipoxygenase, cyclooxygenase, monooxygenase, or xanthine oxidase. These biological activities are related to their antioxidative effects<sup>17</sup>. As flavonoids, anthocyanins are present in flowers of *Canna indica* and are pH sensitive<sup>18</sup>.

### **PHARMACOLOGICAL ACTIVITY**

*Canna indica* sps. can be used for the treatment of industrial waste waters through constructed wetlands. It is effective for the removal of high organic load, color and chlorinated organic compounds from paper mill wastewater. The plant is used in traditional medicine and the rhizome is used in traditional foods.

### **Folkloric**

In Bangladesh, paste of plant used for tonsillitis. In Thailand, rhizome has been used with other herbs for cancer treatment. In southwest Nigeria, leaves used for malaria. Principally used in the treatment of acute jaundice type of hepatitis. Use 15 to 30 gms dried material or 60 to 90 gms fresh rhizome material in decoction. Commonly, recovery from jaunditic symptoms may be observed after one week of administration. In the Philippines, decoction of rhizome used as diuretic. Also, when macerated in water, used to alleviate nosebleeds. In Costa Rica infusion of leaves used as diuretic; rhizomes used as emollient. Decoction of rhizomes used in fevers, dropsy and dyspepsia. Flowers may be used for external wound bleeding use 10 to 15 gm dried material in decoction. In folkloric medicine, root decoction is used for the treatment of fever, dropsy, and dyspepsia. Seed juice is used to relieve earaches. Root is diuretic, diaphoretic, stimulant and demulcent; decoction is used in

fevers, dropsy and dyspepsia. Seeds are cordial and vulnerary. Seed juice relieves earaches. Root bark and stalks are used to the cattle suffering from poisoning. Rhizome is used in ringworm in Khagrachari. The rhizomes contain ethereal oils, waxes, and a diuretic (diuresin;). They are used as a febrifuge (diaphoresin;), against dropsy (hydropsia;), against fever, in softening compresses in tand powder, and as a stimulant. A decoction of the rhizome is used to treat gonorrhoea (antiblennorrhagia) and cold of the bladder. A decoction of the stems is used as a drink or bath to regain energy. The leaves are used for wrapping up parcels in Asia (Ridley 1924) as well as in Panama, and to wrap around tamales (pastries made of corn filled with beans, meat, and pepper;), they are fed to animals, and have sometimes been eaten as legume by the poor (Brazil). Smoke of burned leaves can be used as insecticide (Kraenzlin 1912: 15; greenhouse America). Freshly squashed leaves are used in baths against rheumatic pains and arthritis and are applied to ulcers. Juice of leaves is used against mercurial's as a diuretic, and in compresses. Leaf extracts have shown molluscicidal activity (to kill snails, Rogers 1984). The juice of unripe fruit is used against inflammation of the ear. The fruit can be used to treat constipation of children, and they yield a purple dye which is not permanent. The seeds are used as ammunition for blowpipes, in musical rattles as beads for making rosaries (Indonesia, India, West Indies), as beads to make necklaces and bracelets after boiling as toys, as ammunition for children's shotguns or as a substitute for lead in hunting. They also have been used as an ingredient or a substitute for coffee (Brazil, Europe).

### **STUDIES**

- AIDS / HIV1-RT Inhibition: *Canna indica* was one of twenty Thai medicinal plants used to treat AIDS tested for their HIV type 1 reverse transcriptase inhibitory activity. *C. indica* rhizomes showed HIV-1 RT inhibition ratio higher than 90% at 200 bug/ml concentration. Further study of *C. indica* and two proteins isolated showed significant HIV-1 RT inhibition<sup>19</sup>.
- Cannagenin / Molluscicidal: Study yielded cannagenin, which had a highly synergistic with chlorophyll on the mortality of snails<sup>21</sup>.

Study showed *C indica* to have time and dose dependent molluscicidal activity in a dose that was not toxic for the fish *Colisa fasciatus*, which shares the same habitat as the snail *L acuminata*.<sup>21</sup>

- **Hepatoprotective:** Study showed the methanol extract of aerial parts of *Canna indica* has liver protective effect against carbon tetrachloride-induced hepatotoxicity. Study of hydroalcoholic extract showed significant antioxidant and hepatoprotective activity. Results were compared with reference drug Silymarin<sup>22</sup>.

- **Cytotoxicity / Anticancer:** Study yielded two pure compounds, stigmasteril and 6-beta-hydroxystigmasta-4, 22-diene-3-one and two other toxic minor components. They showed cytotoxicity against P388 leukemia cells<sup>23</sup>.

- **Antioxidant:** Study results clearly indicate the aerial parts of *C indica* is effective in scavenging free radicals and has the potential to be a powerful antioxidant<sup>23,26</sup>.

- **Flower Anthocyanins / Antioxidant / Pigment Source:** Study of red flowers of *Canna indica* isolated anthocyanins. Four anthocyanin pigments were isolated from quercetin and lycopene. The compounds showed good antioxidant activity. Results suggest a promising pigment source for food applications<sup>25</sup>.

The plant is used in the treatment of women's complaints<sup>27</sup>.

- A decoction of the root with fermented rice is used in the treatment of gonorrhoea and amenorrhoea<sup>27</sup>.

- The plant is also considered to be demulcent, diaphoretic and diuretic<sup>27</sup>.

USES

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1. The plant yields a fiber - from the stem - it is a jute substitute<sup>28</sup>.

2. A fiber obtained from the leaves is used for making paper<sup>29</sup>. The leaves are harvested in late summer after the plant has flowered, they are scraped to remove the outer skin and are then soaked in water for 2 hours prior to cooking. The fiber are cooked for 24 hours with lye and then beaten in a blender. They make a light tan brown paper<sup>29</sup>.

3. A purple dye is obtained from the seed<sup>28</sup>.

4. Smoke from the burning leaves is said to be insecticidal<sup>30</sup>.

## CONCLUSION

*Canna indica* (L.) is a well known plant with less known scientific data. Each and every part of it is useful having medicinal activity. India is home to a variety of traditional medicinal systems that rely to a very large extent on native plant species for their raw drug material. The folkloric medicinal value imparts tremendous value to this herb. The qualitative analysis revealed the presence of the biomolecules such as flavonoids, phenolic compounds, saponins, steroids, tannins and terpenoids. The studies on plant *Canna indica* (L.), also desire development of novel therapeutic agents from the various types of chemicals with various pharmacologic properties isolated from it. Therefore, there is a wide scope for research in the direction of more medicinal activities of plant and to evaluate the pharmacological actions of the same in coming future.

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