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A REVIEW ON CROSSANDRA INFUNDIBULIFORMIS

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ABSTRACT

Crossandra infundibuliformis is a well-known plant in India for its medicinal properties. It belongs to the family acanthaceae, which is a tropical flower also called "Firecracker" because its seed pods explode in high humid environments. This herb has various therapeutic benefits as it contains several secondary metabolites as well as other compounds like tannins, saponins, alkaloids, flavonoids, steroids, glycosides, terpenoids, and carbohydrates. The article elaborates on the plants's various activities, such as antimicrobial, woundhealing, hepatoprotective, anticancer properties, etc. This article also discusses various research investigations, like pharmacognistic, pharmacological, microbiological, and chemical investigations.

KEYWORDS: *Crossandra Infundibuliformis*, Cultivation, Uses.

INTRODUCTION

The field of herbal medicine has grown rapidly in the past few years, and due to their natural origins and low side effects, these medications are becoming more and more popular in developing as well as developed nations. Many of the conventional medications currently in use are made from organic materials, minerals and medicinal plants.

Medicinal plants hold significant economic value in the Indian subcontinent. Herbal medicine is the primary source of healthcare for around 75-80% of the population, particularly in

underdeveloped nations, because to its cultural acceptability and compatibility with the body. About 80% of the people on the planet utilize herbal medicine for primary healthcare, mostly underdeveloped nations. Their safety, effectiveness, cultural acceptability, and few side effects have made them enduring. They are thought to be more suited to human bodies since the chemical components they contain are involved in the physiological process of live flora. Herbal remedies for age-related illnesses like memory loss, osteoporosis, diabetic wounds, Immune system and liver problems etc, for which there is either no current treatment or just palliative care available, are also mentioned in ancient literature. These medications will benefit the masses economically by producing raw materials from renewable resources using environmentally friendly methods.[1]

Crossandra is a flowering plant in the Acanthaceae family with tetraploid (2n=40) and triploid (2n=30) chromosomes. This tiny, evergreen shrub can reach a height of 1 meter (3 feet) and blooms throughout the year. It comes in a variety of colors, including orange, pink, red, yellow and double colored blue, with a white throat. The leaves are shiny, oval-shaped, erect, and deep green in hue. The blooms have a peculiar shape, with 3 to 5 asymmetrical petals. The inflorescence is hairy, and the florets emerge from four-sided stalked spikes bearing conspicuous bracts. The corolla is cylindrical and curved, with four pairs of fringed stamens.[2]

Crossandra infundibuliformis (Acanthaceae) is valuable plant in horticulture.[2] It is commonly found in tropical regions like south India and Sri Lanka. The blossoms of *Crossandra infundibuliformis*, commonly known as 'Tropical Flame' or 'fire cracker', have been utilized as hairstyle by Puliyar tribal women. Leaf extracts of *Crossandra infundibuliformis* have aphrodisiac, anti-inflammatory and analgesic effect. The leaf extracts shown wound healing, antibacterial, antioxidant, antisolar, and larvicidal properties. This plant's therapeutic properties make it useful for treating a variety of diseases. Phytochemical analysis of solvent extracts of *Crossandra infundibuliformis* flower found carbohydrates, flavaniods, alkaloids, saponins, tannins, steroids, and terpenoids.[3]

Geographical source

The plant is native to South India, Malaysia and Sri Lanka. It is commonly found in Southern India, specifically in Malenadu and Kerala. *Crossandra* agriculture in Tamil Nadu covers approximately 1317 hectares, yielding 2634 tonnes annually at a productivity of 2.00 tonnes

per hectare. The crop is predominantly grown in South India, specifically in the districts of Coimbatore, Madurai, Villupuram, Cuddalore, Pondicherry, Trichy and Thiruvannamalai.[2]

Figure: *Crossandra infundibuliformis.*

Botanical information[2]

Common name: Crossandra, firecracker flower

Plant type: Evergreen Perennial flower

Mature size: 1 to 3 feet tall and 1 to 2 feet tall

Soil type: Rich, loamy, well-draining

Sun expose: Part Shade

Soil PH: 5.8 to 6.8

Bloom time: April to October

Flower color: Orange, apricot, salmon pink, red

Hardiness zones: 10 to 11

Native: Southern

Area: India and Sri Lanka

Vernacular names

Hindi	Krosendra
Tamil	Kanakamparam
Telugu	Krassandra
Marathi	aboli
Gujarati	Krossandra
Bengali	Krasandra

Other species of crossandra infundibuliformis

- *Crossandra greenstock ii*
- *Crossanadra pungens*
- *Crossandra flava*

- *Crossandra guineensis*
- *Crossandra nilotica*
- *Crossandra undulaefolia*

Taxonamical classification

Kingdom	Plantae
Order	Lamiales
Family	Acanthaceae
Genus	*Crossandra*
Species	*infundibuliformis*

Cultivation and Collection[4]

Soil type

Crossandra is quite vulnerable to nematodes. As a result, a field chosen for 47 *Crossandra* growth should be evaluated for nematode population and appropriate *Crossandra* remedial measures implemented prior to transplanting. *Crossandra* may be grown in a variety of soils. *Crossandra* grows best in fertile, red loamy soils with a pH range of 6 to 7.5 and high organic matter content. Alkaline or saline soils are unsuitable because they cause chlorosis.

Water

During the growing season, irrigate the soil frequently and never let it dry out. *Crossandra* plants are particularly sensitive to drought and like some what moist but not soggy soil at all times. Reduce the quantity of water you see in winter, even if you're growing *Crossandra* in a container inside.

Light

These plants perform best in bright, indirect sunshine. In the summer, do not expose them to direct sunlight. However, in the winter, use as much light as possible. If you do not have a sunny window, your plant can thrive indoors with bright artificial light.

Temperature and Humidity

Crossandra is very heat-tolerant and cold sensitive, as one would expect from a tropical plant. If the temperature drops below 55 degrees Fahrenheit, the plant's leaves and top growth may be damaged. *Crossandra* also prefers high humidity. In drier locations, misting your *Crossandra* regularly during the growing season may be important to maintain adequate humidity. Indoor plants can be humidified by laying them on a tray of pebbles filled with water, as long as the water does not reach the pot's bottom.

Fertilizer

Throughout the growing season, apply a little liquid to your *Crossandra* once every two weeks. Reduce the fertilizer use to once a month in the winter.

Season

Planting *Crossandra* is best done in june and july, although it can be done as late as September or October.

Propagation

It can be reproduced using either seeds or stem cutting. For optimal plant population, use a seed rate of 5kg/hectare. From July to October, fresh seeds are put in raised beds spaced 15cm apart. Watering should be done daily. Seedlings are ready for transplantation after 60 days, when the have 4 pairs of leaves. Seeds are used for propagation, as well as stem cutting. *Crossandra* easily roots from cutting. To achieve the best results, take cutting early in the spring, when the growing season begins. use a rooting hormone and place the cutting in the seed starting soil. Provide bottom heat and plenty of humidity until new growth appears, then relocate your young plants to their permanent home. Young plants develop quickly and will probably need to be repotted within.

Irrigation, Weeding and Hoeing

Adequate irrigation promotes rapid plant development and a consistent flower supply. The crop must be irrigated twice a week when it is first planted, and then every 7-10 days thereafter, Depending on the environment and soil condition for initial growth. Throughout the dry season, irrigation should be provided at shorter intervals, as well as throughout the blossoming stage, which results in more flowers and promotes greater plant development.

Method of harvesting

Crossandra flowers within 2 to 3 months of planting and continue to produce flowers throughout the years, with lesser production during rainy season. Flowers have to be gathered early in the morning by pulling the corolla from the calyx. Flowers will be available for harvesting for six month for per year. Flowers are harvested on alternate days.

Stages of harvesting

Flowers open sequentially from the spike's base. Two diagonally opposed flowers on the spike open at the same time. The bloom take two days to completely open. Flowering on spike takes approximately 15-25 days.

Potting and Repotting

Although *Crossandra* plants are perennial shrubs in their native habitat, gardeners frequently treat them as annuals, maintaining them only until their blooms fade and their leaves begin to drop before discarding them. If you do overwinter your plant, repot it in the spring in a little larger container filled with fresh soil. Provide plenty of indirect, strong light to the transplant to aid in its adjustment.

USES

The leaf extracts of *Crossandra infundibuliformis* have hepatoprotective, antibacterial, antifungal, and anticandidal properties. It also discovered that *Crossandra infundibuliformis* have excellent anti-corrosive capabilities.

Antimicrobial activity

The medicinally active compounds were recovered from the leaves of *Crossandra infundibuliformis* using soxhlet extractor and identified using phytochemical testing. consequently *Crossandra infundibuliformis* shown potential antibacterial activity against some selected strains.[5]

Wound healing activity

Crossandra infundibuliformis floral extract shown remarkable wound healing potential. It is used variety of disease, including fever, headache and discomfort. The document anti-oxidant effectiveness of *Crossandra infundibuliformis* was the primary proof and catalyst for commencing this endeavor.[6]

Hepatoprotective activity

The hepatoprotective activity of *Crossandra infundibuliformis*. Hepatotoxicity was caused by a petroleum ether extract of dried leaves.[2]

Aphrodisiac activity

Crossandra infundibuliformis has been used to treat male sexual issues since ancient times. The early phytochemical screening of a petroleum ether extract of *crossandra*

infundibuliformis leaves revealed the presence of alkaloids and saponins. It suggested that saponins, a plant component, could enhance aphrodisiac quality by boosting testosterone levels.[7]

Antioxidant activity

Methanol and chloroform extract of *Crossandra infundibuliformis* shows substantial antioxidant activity in the majority of method examined. The antioxidant activity of methanol and chloroform extract of *Crossandra infundibuliformis* was ideal when total phenol and flavonol levels were taken to account. The results of the investigation shows that methanol and chloroform extract of *Crossandra infundibuliformis* could serve as a source of natural antioxidants.[3]

Antibacterial activity

The ethanol extract of *Crossandra infundibuliformis* shown antibacterial activity against all six pathogenic micro organism.[3]

Antisolar activity

The aqueous extract of fresh and dried leaves have the ability to create UV radiation. As a result, the plant's anti-solar activity has been proven, demonstrating its relevance and preventive utility in anti-solar compositions.[8]

Insecticidal activity

Crossandra infundibuliformis leaf extract is a promising option for creating insecticides to manage sitophilus oryzae due to its natural insecticidal properties. It is active at extremely tolerable levels, biodegradable, and does not leave hazardous residues, where as regularly used phosphorus and chlorinated pesticides pollute the environment. *Crossandra infundibuliformis* insecticidal action may be attributed to the presence of flavonoids and saponins.[9]

Anticancer activity

The ethanolic extract of the leaves of *crossandra infundibuliformis* was studied, and phyto-constituent such as triterpenes, flavonoids, and tannins were found to be physiologically active against many bacterial strains and many human cancer cells. The presence of the phyto constituents may account for *Crossandra infundibuliformis* anticancer properties.[9]

Antidiabetic and Anthelmintic activity

The ethanolic extract of *Crossandra infundibuliformis* significantly inhibited α amylase and Endrullus enguinae. *Crossandra infundibuliformis* antidiabetic and anthelmintic properties lend to credence to its usage in traditional Indian medicine for a variety of diseases.[10]

Antiarthritic activity

The in vitro experiments on the petroleum ether extract *of Crossandra infundibuliformis* leaves revealed substantial anti-arthritic efficacy. flavonoids which contain active components such as terpenoids and cardiac glycosides, may be responsible for this activity.[8]

Antihyperlipidemic activity

The ethanolic extract of *Crossandra infundibuliformis* has hypolipidemic action.[2]

Research investigations

Pharmacognostical investigation[11]

- **Macromorphology**

Erect shrub, 60-90 cm tall, with terete stems, pubescent tops, and four whorls of leaves. The plant is ovate-oblong, measuring 3-12 ×1.5.5cm, narrower at the base and decurrent on petioles, whole and undulate, acute or sub-obtuse, glabrous above and sparsely pubescent beneath. Petioles are 1-3 cm long and blossom in terminal peduncles. The spikes are erect, 4 sided, and 10 – 15 cm long. The peduncles are thinly pubescent and 4 – 10 cm long. The bracts are ovate- oblong, 1 – 1.5 cm long, sharp, and keeled. The bracteoles are shorter and thinner, and the calyx is profoundly 4-partie, with uneven sepals. lmbricate 6 to 10 mm length. The corolla is brightly arranged with a paler yellow throat tube. It is densely pubescent above the expanded base and slender, measuring 1.5 -2.5 cm length.

- **Micromorphology**

T. S. of root

The root of *Crossandra infundibuliformis* has a thick protective covering of cork at the top. The cork measures about 30- 40 µm. The cork is followed by cells from the epidermis or hypodermis. The epidermal cells were compactly organized and were around 30-35 × 35-40 µm. Cortex comes after the epidermis. The cortex is further divided into outer, middle, and inner cortex. The cortex is made up of elongated parallel organized cells. The outer cortical cells are approximately 25-30 × 40-55 µm. The cortex comes first, followed by the middle

cortex. The intermediate cortex cell measures 30-35 × 35-40 µm. The cortical zone is followed by a centrally positioned stele.

T. S. of stem

The T.S. Stem of *Crossandra infundibuliformis* reveals the circular outline, and the outermost is thick. Walls barrel shaped, compactly placed epidermis (Cuticle exists). The epidermal cells Trichomes disrupted the epidermal cells. The measurements were around 20-25 ×25-30 µm. There is no collenchyma in stem. The epidermis is followed by cortex. The epidermis is followed by a cortex. The cortex comes in two types. I.e., outer and inner cortex. The outer cortex is made up of small, compactly packed parenchymas, whereas the inner cortex is made up of somewhat bigger inner parenchymatous cells than the outer cortex. The outer cortical cells sized around 10-15 × 15-20 µm. The cortical cells are approximately 30-35 × 35-40 µm. Stele comes after the cortex. The Setle consists of vascular strands. The dictyostele is present in the stem. The vascular strand has a ring-like appearance in T.S. The ring-like pattern of phloem parenchyma is disrupted by xylem components. The phloem parenchyma and xylem elements were measured at 15-16 × 16-20 µm. The xylem components have thicker cells than the phloem parenchyma. The vascular tissue is followed by a centrally positioned pith.

T. S. of leaf

Crossandra infundibuliformis leaves have both upper and bottom epidermis, as seen in the dorsiventral lamina. The upper epidermis is the top layer of the skin, characterized by barrel-shaped cells with thick walls and densely packed cells. Trichomes interrupt the upper epidermis, and a cuticle is present around it. Upper epidermal cells were quantified at 30-40 × 45-50 µm. The top epidermis is followed by one layer of palisade cells. The palisade cells sized around 15-17 × 50-70 µm. Palisade cells are followed by spongy parenchyma that is loosely organized. The spongy parenchyma was approximately 15-20 × 20-25 µm. The palisade cells and spongy parenchyma had much chlorophyll. The leafs T.S reveals a single globular vascular strand in its center. Bundle sheath cells form the boundary between vascular tissue. Bundle sheath cells are compact and form a ring around the vascular strand. The bundle sheath cells sized approximately 12-13 × 13-14 µm. The bundle sheath cells lead to phloem parenchyma. Phloem parenchyma cells are disrupted by xylem patches. The phloem parenchyma measured around 25-30 µm. The xylem element has a dimension of around 25-25 × 30-35 µm. The T.S reveals that the lower epidermis layer is covered with

cuticle. The lower epidermis is compactly organized, with significantly thinner and smaller cells than the upper epidermis.

Chemical research study[12]

- **Determination of total phenol content**

The total phenol content of the extracts was determined using the Folin-Ciocalteau technique with slight modifications. The extracts (0.1 ml) were combined with 2.5 ml of Folin-Ciocalteau reagent (Previously diluted with distilled water 1:10 v/v) and 2 ml of sodium carbonate (7.5%). After 30 minutes of incubation at 40^{o}C, the absorbance of the reaction mixture was measured at 760 nm using a Shimadzu UV-160 spectrophotometer. The extracts total phenol content was measured in milligram gallic acid equivalents (mg GAE) per gram, with gallic acid serving as the standard. All determinants were performed in triplicate.

- **Determination of total flavonol content**

The total flavonol content of extracts was measured using the aluminium chloride technique, with certain modification. The extracts (0.5 ml) were combined with 1.5 ml aluminium chloride (10%) and 0.1 ml potassium acetate (1M). After 30 minutes of incubation at room temperature, 2.8 milliliters of distilled water were added. The absorbance of the reaction mixtures was measured at 415 nm. The total flavonol content was reported as milligrams of rutin eqivalents per gram of extracts. All determinations were carried out in triplicate.

Microbiological research study[13]

- **In vitro antibacterial activity**

The extracts of petroleum ether, ethyl acetate, and methanol were tested for antibacterial efficacy against harmful bacteria. The agar diffusion procedure was carried out using Muller-Hinton agar (Hi-Media) medium. Microorganism suspensions were put to plates containing serially diluted substance (DMSO, solvent control) and incubated at 37˚c for 20 hours. The substances were evaluated at doses of 0.015 to 0.007 g/mL. Rifampacin was employed as the reference standard. Bacterial strains used included B. brevis (Ia), B. circulans (Ib), B. firmus (Ic), B. coagulants (Id), B. formis (Ie), B.megaterium (If), B.sterothermophilus (Ig), C. autobotylicum (Ih), K.pneumoniae (Ij), B.pumilus (Ik), B.substilis (Ii), E. aerogenes (Im), and E.coli.

- **In vitro Antifungal and Anticandidal activity**

The extracts were tested for antifungal and anticandidal activity against pathogenic fungi using the diffusion method on Saburoud's dextrose agar (Hi-Media). Suspension of each fungus were produced and evaluated on agar plates using serially diluted chemicals. The substances were evaluated at doses ranging from 0.015 to 0.0078 g/mL. Amphotericin B was employed as the reference standards. Plates were incubated at 26˚C for 72 hours and MIC was measured. The study included the fungal strains A. niger (IIa), A.flavus. (IIb), A.fumigatus (IIc), p.chrysogenum (IId), C.kruseii (IIIa), and C.gullirmondi (IIIb).

Pharmacological research study[9][14]

- **Anti-cancer activity**

MCF-7 cell lines were obtained from the National Centre for Cell Science (NCCS), pune, india. Stock cells were grown in DMEM and MEM with 10% inactivated Fetal Bovine serum (FBS), penicillin (100 IU/ml), streptomycin (100 µg/ml), and amphotericin B (5 µg/ml) in a humidified environment of 5% CO2 at 37˚C until confluent. The cells were dissociate using TPVG solution (0.2% trypsin, 0.02% EDTA, and 0.05% glucose in PBS). Stock cultures were produced in 25 cm2 culture flasks, and tests were conducted on 96 microtitre plates (Tarsons India Pvt. Ltd., Kolkata, India). To conduct anticancer studies, Weighed test drugs were dissolved in distilled DMSO and mixed with DMEM and MEM supplemented with 2% inactivated FBS to create a stock solution of 1 mg/ml concentration. The solution was then sterilized through filtration (Francis[4] et al). For anticancer research, serial two-fold dilution were created. The monolayer cell culture was trypsinized and adjusted to 1.0µ × 105 cells/ml using DMEM and MEM, both with 10% FBS. Each well of the 96-well microtitre plate received 0.1 mL of the diluted cell solution (about 10,000 cells). After 24 hours, a partial monolayer was produced. The supernatant was removed, the monolayer was washed with media, and 100µl of various test drug concentrations were put to it in microtitre plates. The plates were then incubated at 37˚C for 3 days in a 5% CO2 environment, with microscopic examination and observation taken every 24 hours. After 72 hours, the drug solution were removed, and 50µl of MTT in PBS was added to each well.

- **Anti-inflammatory activity**

Fresh leaves of *Crossandra infundibuliformis* are collected, dried, powdered, and extracted with methanol and petroleum ether using a Soxhlet apparatus. The extacts undergo preliminary phytochemical screening to detect to various phytoconstituents like flavonoids,

terpenoids, tannins, and other. Egg white is diluted, treated with ammonium sulfate, and centrifuged to prepare egg albumin for the test. The anti-arthritic activity is assessed by the inhibition of protein denaturation using the Egg-Albumin method, comparing the percentage inhibition of protein denaturation by the extracts to that of the standard drug diclofenac sodium.

CONCLUSION

Crossandra is a flowering plant in the Acanthaceace family. It underscores its significant pharmacological properties, including antimicrobial, wound healing, hepatoprotective, and aphrodisiac activities. The plants phytochemicals, particularly terpenoids, flavonoids, and carbohydrates, contribute to its therapeutic efficacy. Further clinical studies are warranted to validate these findings and explore the potential of *Crossandra infundibuliformis* in treating various human and animal disease. Conservation and cultivation efforts are essential to meet commercial demands and discover new bioactive compounds, positioning *Crossandra infundibuliformis* as a promising candidate in modern pharmacology.

REFERENCE

1. Shimoyama Y, Hosaka H, Kuribayashi S, Kawamura O, Kusano M. Herbal medicine. Funct Dyspepsia Evidences Pathophysiol Treat, Current science, 2018; 78: 147-52.
2. Chavhan P, Shahare PD, Sheikh MT, Kalambe PS, Nakhate YD, Kondha PK. Crossandra Infundibuliformis: A Review Study On Ethnobotany, Phytochemical Investigation And Pharmacology, International Journal of Creative Research Thoughts (IJCRT), 2023; 11: 564-572.
3. Sharmila N, Gomathi N. Antibactrial, antioxidant activity and phytochemical studies of Crossandra infundibuliformis leaf extracts. International J Phytomedicine, 3: 151-152.
4. Remya SB, P SCM, Aparna P. Review On Cultivation, Propagation And Harvesting of Crossandra Infundibuliformis International Journal of Research Publication and Review, 2022; 3: 972-975.
5. Elamathi R, Deepa T, Kavitha R, Kamalakannan P, Sridhar S, Kumar JS. Phytochemical Screening and antimicrobial activity of leaf extracts of Crossandra infundibuliformis (L)Nees on common bacterial and fungal pathogens. International Journal of Science Research and Review, 2011; 1: 1-5.
6. Gundamaraju R, Verma T. Evaluation Of Wound Healing Activity Of Crossandra, Indian Journal of Pharmaceutical Science and Research, 2012; 3: 1-5.

7. Kumar AS, Sumalatha K, Lakshmi SM.Kumar. Aphrodiasic Activity of Crossandra Infundibuliformis (L) on Ethanol Testicular Toxicity in Male Rats, Pharmacologyonline, 2010; 2: 812-815.
8. Swapna Kandagattla, Meghana Arukala, Sowmya Gujjuala, Greeshma Mandapally, Rohit Choppandand. In- Vitro Evaluation of Anti-Solar Activity of Leaves of Crossandra Infundibuliformis (L) Nees, World Journal of Pharmaceutical Reaserch, 2023; 8: 922-926.
9. Vadivel E, Panwal S V. Invitro Anticancer and Insecticidal activity of Crossandra Infundibuliformis, Journal of chemical and Pharmaceutical Research, 2016; 8: 260-264.
10. Vadivel SN and Devarkar, VD, Nees L. Pharmacognostical studies in Crossandra Infundibuliformis, International Journal of Pharmacy and Technology, 2020; 8: 16508-16514.
11. Sangekar SN and Devarkar, VD, Nees L. Pharmacognostical studies in Crossandra Infundibuliformis, Bioscience Discovery, 2020; 8: 346-351.
12. Patil KG, Jaishree V, Tejaswi HNP. Evaluation of Phenolic Content and Antioxidant Property of Crossandra infundibuliformis leaves Extracts, American Journal of Plant Science, 2014; 5: 1133-8.
13. Madhumitha G, Am S.Preliminary phytochemical analysis, antibacterial, antifungal and anticandidal activities of successive of Crossandra infundibuliformis tropical Medicine, 2011; 4: 192-5.
14. Gaidhani KA, Harwalker M, Bhambere D, Nirgude PS. Invitro Anticancer and Insecticidal Activity of Crossandra infundibuliformis, Journal of chemical and Pharmaceutical Research, 2016; 8: 260-264.