IJP (2021), Vol. 8, Issue 10 **(Review Article)**

Received on 16 July 2021; received in revised form, 25 October 2021; accepted, 27 October 2021; published 31 October 2021

FORMULATION & EVALUATION OF HERBAL SUNSCREEN CREAM ENRICHED WITH ANTIOXIDANT FROM *CANNA INDICA*: A REVIEW

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Keywords:

Canna indica, Cannaceae Antioxidant activity, Anthocyanin's, Formulation, sun screening activity

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ABSTRACT: Medicinal herbs have been used for healing since the dawn of time. *Canna indica* is an erect perennial herb in the family *Cannaceae*. This plant is widely cultivated throughout India for its beautiful foliage and flowers. *Canna indica* is also known as Indian shot or Canna lily. South America, Colombia, West Indies, Central America, Brazil & Venezuela are their native habitats. *Canna indica* contains phytochemical constituents like alkaloid Glycosides, Flavonoids, Phenol, Proteins, Saponins, tannins, carbohydrates, phytosterols, fixed oil, of ethanolic solvent extract of *canna indica.* It's an Antioxidant & Antibiotic. The plant is said to have molluscidal, anti-fungal, hepatoprotective, haemostatic, AIDs inhibition Property, antidiabetic & anticancer activities. Anthocyanin pigments are abundant in the flowers of *Canna indica*. It includes phenol, flavonoids and six different forms of anthocyanin, all of which have antioxidant properties. Antioxidants protect our skin from UV radiation by inactivating highly reactive molecules like free radicals and reactive oxygen species produced when exposed to the sun. The purpose of this study is to develop herbal sunscreen cream rich with antioxidants derived from *canna indica* flowers and assess *in-vitro* sun protection activity. Antioxidantactivity is investigated using a variety of techniques. Antioxidant activity is studied in different methods.

INTRODUCTION: Indian therapeutic plants are the elixir of Ayurveda and Ayurvedic treatments. Healing with medicinal plants is as old as mankind itself. When used wisely and clocking with the basic principles, they produce miraculous effects in Recent years, ethnobotanicals & traditional application of natural compounds, principally of plant origin established much attention AS they are well tested for their effectiveness & generally believed to be non-toxic for human use. In the last three decades of the 20th century, Canna species have been categorized by two different taxonomists, Paulus Johannes Maria Maas from the Netherlands and Nobuyuki Tanaka from Japan.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.IJP.8(10).412-22

The article can be accessed online on www.ijpjournal.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.8 (10). 412-22

Maasregards *C. coccinea*, *C. compacta*, *C. discolor*, *C. patens*, and *C. speciosa* as synonyms or varieties of *Canna indica*, while Tanaka recognizes several additional varieties of *Canna indica* A medium-sized species; green foliage, oblong-shaped, spreading habit; triangular flower stems, coloured green; spikes of flowers are erect,

self-colored 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 was introduced by Linnaeus and is now cultivated pantropically and in other warmer regions of the world.

In many regions, including South-East Asia and the Pacific, it has also become naturalized. It is widespread and invasive on Pacific islands (PIER, 2008), is invasive in Queensland (Batianoff and Butler, 2002) and South Africa (Henderson, 2001). Protected over winter, it will also be found in many temperate countries as a garden ornamental. Even though it can tolerate light frosts, it cannot survive persistent cold temperatures and could not naturalize in such climates [4].

FIG. 1: *CANNA INDICA* PLANT

Synonyms: Indian shot, African arrowroot, kardal, Edible *canna, Canna Lily, Purple arrowroot, Sierra Leon*e arrowroot [1].

Biological Source & Family: *Canna indica* or *Canna lily* is the only genus of flowering plants in the Family *Cannaceae*.

Vernacular Name:

English	:	Indian shot
Marathi	:	Kardal
Hindi:	:	Sarvajjaya
Bengali	:	Sarbjaya
Telgu	:	mettatamar
Kokani	:	kelephool

Taxonomical Nomenclature

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta-Vascular plan
Division	:	Magnoliophyta –flowering plant
Class	:	Liliopsida - Monocotyledons
Subclass	:	Zingiberidae
Order	:	Zingiberals
Genus	:	Canna L - canna
Species	:	*Canna Indica*
Clade	:	Tracheophytes1

Geographical Source:

- South America
- Colombia
- Venezuela
- Peru
- Brazil
- Argentina
- West Indies
- Central America
- India
- Europe 2

Chemical Constituents:

Root: The chemical ingredient cannagenins are found in Root. Triacontanal, enzymes and a combination of stigmasterol, sitosterol, campesterol and lectin are found in the rootstock.

Rhizomes: Alkaloids, flavonoids, phenols, sterols, saponins, gum, fat, and starch are all found in it. Unsaponifiable matter includes 5, 8 Henicosdiene, 7 Henicosyne, 3, 15 Dihydroxy-2-octadecene, 6-Hydroxy eicosane, Tricosane, Tetracosane, and rhizome essential oils.

Stems: Ash value: 3.14 ± 0.01 g 100/g, nitrogen free extractives: 80.43 g 100/g, calorific value: 1611.54 kJ 100 g-1, crude fiber: 5.78 ± 0.08 g 100/g, crude lipid: 4.31 ± 0.11 g 100/g, crude protein: 6.34 ± 0.21 g 100/g

Leaves: Sucrose, amino acids, organic acids, citric, malic, glyceric, succinic and lactic acids, and the aspartic, glutamic, glutamine and alanine are present. Leaves also contain lignin, furfural and hemicelluloses.

Seed: Flavonoids (4.76 µg/g) and total polyphenols (13.79 µg/g) are present in seeds.

Flowers: Flavonoids, phenols, lutein, ß-carotene, violaxanthin, lutein, Zeaxanthin, β-Cryptoxanthin, terpenes, paraffin hydrocarbons are present and also contain a toxic red oil known as cannabinolasa major chemical constituent. Six Anthocyanins are as follows, malvidin 3-O-(6-O-acetyl-b-Dglucopyr anoside) -5-O-b-D-glucopyranoside [1], malvidin 3,5-O-b D-diglucopyr anoside [2], cyanidin-3-O-(600-O-a-rhamnopyranosyl b-glucopyranoside [3], cyanidin-3-O-(600-O-a-rhamnopyranosyl)- b-galactopyr anoside [4], cyanidin-3-O-b-glucopyranoside [5] and cyanidin-O-b-galactopyranoside [1, 2, 6].

Cultivation and Collection of Crude Drug: It's a moist tropics plant that can be found at elevations of up to 2,000 meters. It may be grown in both subtropical and warm temperature climates. It thrives in climates with yearly daily temperatures ranging from 12 to 32 degrees Celsius. Even light frosts can damage top growth, while the rootstock can withstand several degrees of frost. It prefers 1,000 - 4,500 mm of yearly rainfall but will withstand 500 - 5,000 mm. Requires a deep, rich, well-drained soil in a sunny location, with a pH of 5.5 - 7.5 preferred but tolerating [5, 8]. The plant has big leaves that are prone to be ripped to shreds by strong winds. The plant is widely grown as ornamental, and selected forms are cultivated for their edible roots. Plants are fast-growing and can produce a flowering shoot in their first year of growth from seed.

Harvesting: Planting rhizome cuttings results in harvestable plants in 6 to 8 months. Plants produced from rhizome tips can be harvested four months after planting, but picking after eight months produces more since the rhizomes have swelled to their maximum size. Rhizomes should not be permitted to grow over ten months because they become harsh and unfit for food or starch production. When the triangular split in the outer scale leaf of the rhizome turns purple, it is considered mature. Rhizome yields range from 23 tonnes per hectare after 4 months, 45-50 tonnes after 8 months and 85 tonnes after a year. Starch yields range from 4 to 10 tonnes, with exceptional yields of 17.5 to 20 tonnesper hectare.

Plants grown for ornamental purposes start flowering a few months after planting in tropical regions, and flowers continue to appear as long as the plant lives. In cooler regions, where frost can be expected, the rhizomes should be lifted and overwintered at about 7 °C. Slugs love the young growth in spring and can cause serious damage to plants

Propagation: Seed - Because the several species in this genus frequently hybridize, seed cannot be trusted to breed true. If starting from seed, immerse the seeds in warm water for 24 h before planting. 2-5 cm deep in individual pots at 20 °C in light shade**.** Scarifying the seed by carefully removing a little portion of the outer shell (without harming the seed itself) to allow it to absorb water can expedite germination, especially if the seed has not expanded after being soaked. In most cases, the seed germinates in 3 to 9 weeks. Continue to grow the plant until it is large enough to plant out. AS the plant grows, the root clump will be divided. At least one growth point must be present in each part. Make the divides, put them in a pot, grow them on until they are well established, and then plant them out of root cuttings.

Fertilization: To produce a strong harvest, *Canna indica* requires fertilizer. Seedling fertilizer should be applied during the initial tillage and disseminated according to seedling circumstances in the early stages.

A ternary compound fertilizer (N, P, K) of up to 750 kg/ha can be applied. Direct contact with the base and leaves should be avoided when applying fertilizer. To encourage the growth of underground stems and roots, the second tillage can be paired with the second fertilizer treatment before flowering. Applying fertilizer evenly on both sides of the roots aids in water absorption and uniform growth

Yield: The yield is affected by the cultivation region and the climate and soil conditions. *Canna indica* has a higher yield than other starchy crops like cassava and arrowroot in some areas. The average rhizome yield is estimated to be between 22 and 50 tonnes per hectare, while the starch yield is estimated to be between 2 and 5 tonnes per hectare, with the potential to reach 10 tonnes per

hectare. Observations demonstrate that the largest rhizome yield does not always equal the maximum starch yield [3].

Morphology and Macroscopy:

Flowers: Flowers are red, solitary, or in a pair, the diameter of the flower 4-6 cm, with bract about 1.3 cm in length. Sepals are whitish-green to red or purple & 1-1.5 cm in length. Corolla tube about 1 cm long and red or reddish 2.5-3 cm long. The staminodes are bright red in colour. Flowers are hermaphrodite.

Fruits: Fruits are bright green capsules covered by green to purple tubercles, green oblong or aid, softly echinate (spiny) and 2-2.5 cm in length. Capsules are about 40 × 25 mm, outer tepals (sepals) are persistent at the apex.

Seeds: Seeds are about the size of a pea and thus are white when young, turning black with chestnut brown markings as they age. A smooth coat protects them. On the outside, young rhizomes are yellowish-white or pinkish, with a yellowish-white inside. They turn brownish on the outside as they mature due to a thick outer covering.

Leaves: Leaves are lanceolate or ovate 10-30 cm long, 10-20 cm wide having large laminae up to 60 cm long. An inflorescence is a waxy-glucose erect peduncle about 30 cm long with 2-flowered Cincinnati. Leaves are dark green with colorless margins and veins.

They are carline, simple, alternate, and spiral. The oblong leaves have their petioles spreading downward to form a sheathing base around the stem. The lamina is pinnately, parallel-veined. Leaf margins appear smooth and wavy with an acute apex. The leaves are large and foliaceous, reaching up to 65-70 cm in length and 30-35 cm in width.

Rhizomes: On the outside, young rhizomes are yellowish-white or pinkish, with a yellowish-white inside. They turn brownish on the outside as they mature due to a thick outer covering. It is sympodial with Y-shaped axes, tuberous, and abundant roots growing both adaxial and abaxial from the nodes.

Stem: Stem is a pseudostem & upto reaches up to 1.5-2 m in height. It is glabrous, erect, herbaceous, sturdy, and cylindrical, enveloped by the sheathing leaf bases that are light green in colour.

Roots: The roots are thick, tubular, and creamy white. About 2-5 mm in diameter with numerous root hairs. Thinner primary and secondary lateral roots are also present [1, 2].

Physiochemical Properties:

- Taste -Sweet tasting
- Nature -slightly cooling-natured
- PH value (ethanol, methanol, and water)- 8.0, 4.0 and 6.0%, respectively
- Loss of weight on drying - 4.1%
- Total ash - 17.98%
- Acid-insoluble ash - 69.2%
- Water-insoluble ash - 48%
- Alcohol soluble extractive value - 3.86%
- Water-soluble extractive - 6.31% [1].

Microscopy:

Leaves: The leaves are amphistomatic. Stomatal density is about 2 mm. Sclerenchyma patches can appear on either side of the vascular bundle, with a single-layered epidermis made up of rectangular cells and a few layers of parenchyma cells followed by a few layers of chlorenchyma.

Seeds: The epidermis is made up of a palisade layer of Malphigian cells, which are long and narrow cells with thickened walls. The micropyle is surrounded by integumentary tissue, and the inner integument forms the micropyle. The integumentary seed coat is mainly composed of 4 layers: The epidermal layer, subepidermal, vascularized, and taniniferous layer.

Stem: An undifferentiated ground tissue follows the uniseriate epidermis. Below the epidermis, there are two to three layers of parenchyma cells that are arranged in a regular pattern. Then, two to three layers of chlorenchymatous tissue create a band. An occurrence of a few U-shaped sclerenchymatous patches at regular intermissions is below and in contact with the chlorenchymatous zone. The vascular tissue system comprises various vascular bundles scattered all over the ground

tissue. Each vascular bundle is conjoint, collateral, end arch, and closed.

Rhizomes" Cutinization of the epidermal cell walls is sparse. A three-layered hypodermis lies beneath the epidermis, with cells that have a sub polygonal outline and thick walls.

Between the hypodermis and the endodermis, there is a thin zone called the cortex. Parenchymatous tissue, starch granules and calcium oxalate crystals make up most of it [1].

Flowers: Flower anatomy and ontogeny of *Canna indica*.

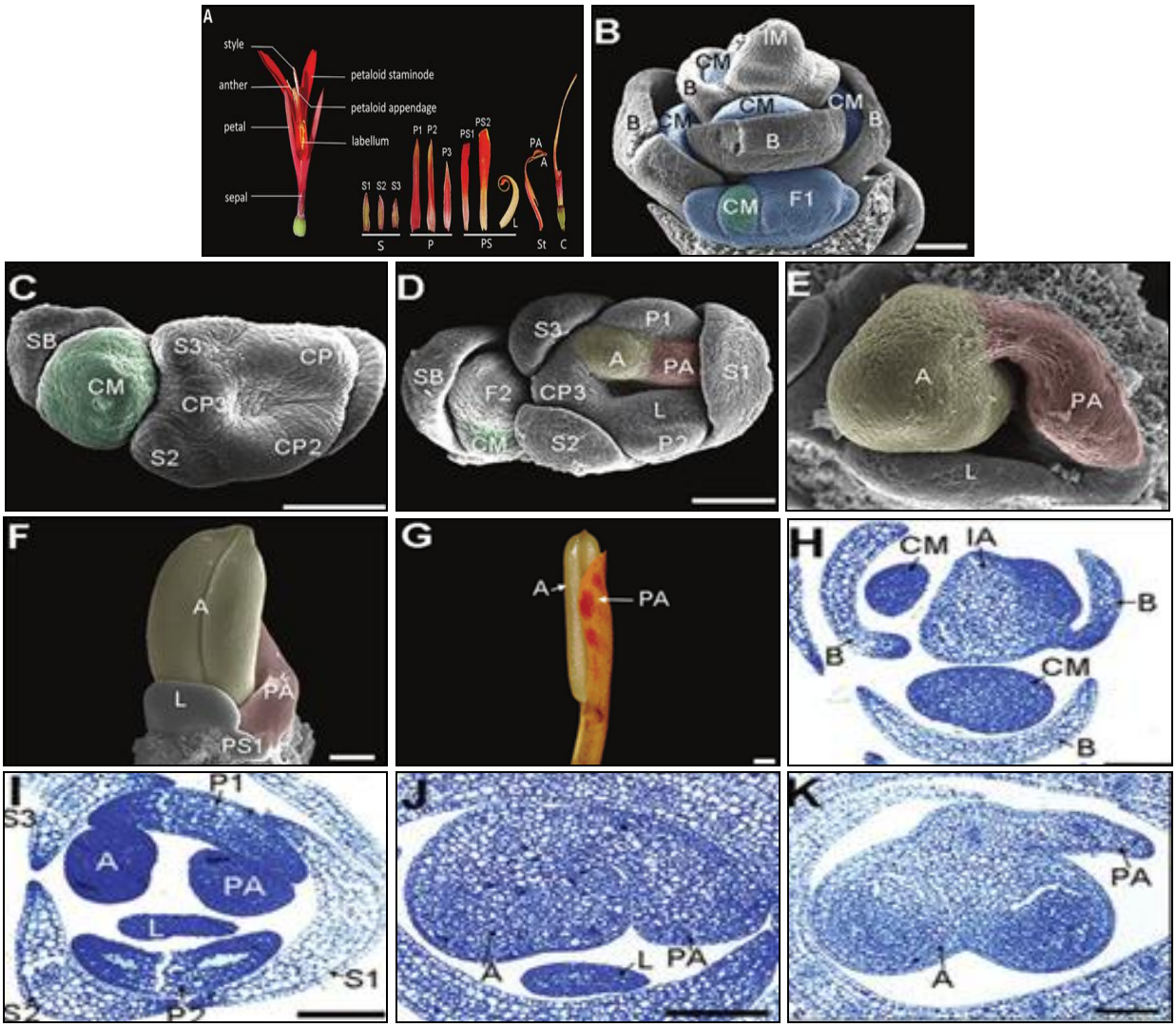

FIG. A: FLOWER DISSECTION SHOWING IN ABOVE THE FLORAL STRUCTURE. (B-F) FLOWER ORGANOGENESIS WAS OBSERVED UNDER A SCANNING ELECTRONIC MICROSCOPY. FIG. B: LATERAL VIEW OF A YOUNG INFLORESCENCE WITH DEVELOPING CINCINNI MERISTEMS SUBTENDED BY THE PRIMARY BRACTS. FIG. C: TOP VIEW OF A CINCINNI. CONTAINS THREE SEPAL PRIMORDIA AND THREE PETAL-STAMEN COMMON PRIMORDIA HAVE ALREADY FORMED IN THE PRIMARY FLOWER. FIG. D. THE CINCINNI'S EVOLUTION CONTINUES. THE INITIAL PETAL AND THE ADAXIAL STAMEN SPLIT FROM THE CP1 (PETAL-STAMEN COMMON PRIMORDIUM), WITH THE LATTER DEVELOPING INTO AN ANTHER PRIMORDIUM ON THE LEFT SIDE AND A PETALOID APPENDAGE PRIMORDIUM ON THE RIGHT. THE SECOND PETAL AND THE LABELLUM PRIMORDIUM ARE SEPARATED BY CP2. THE CINCINNUS MERISTEM SHIFTS TO THE ABAXIAL SIDE OF THE SECONDARY FLOWER AS THE SECOND FLORAL MERISTEM FORMS. FIG. E: CLOSE-UP OF THE ASYMMETRIC PATTERN OF THE ADAXIAL STAMEN PRESENT IN THE PRIMARY FLOWER. THE ANTHER PRIMORDIUM IS GROWING FASTLY THE PETALOID APPENDAGE SLOWS DOWN ITS GROWTH. FIG. F: FRONT VIEW OF A FULLY DEVELOPED ANTHER &THE PETALOID APPENDAGE CONTINUES TO DEVELOP IN A PETALOID WAY TOGETHER WITH OTHER PETALOID STAMINODES (PETALOID STAMINODES IS NOT SHOWN IN THIS FIGURE). FIG. G: BEFORE MATURATION, A FERTILE STAMEN. (H-K) TOLUIDINE BLUE-STAINED SEMI-THIN SLICES EXHIBITING THE SAME DEVELOPMENTAL PHASES AS (B, D, E, AND F), RESPECTIVELY 16

FIG. 2: FLOWER ANATOMY &ONTOGENY

Screening Electron Microscopy: Floral buds were dissected in 70% ethanol and subsequently dehydrated to 100% ethanol using an ethanol series. The sample was then critical-point dried with a JFD-310 lyophilization device, mounted onto SEM stubs with double-sided adhesive tape, and coated with platinum with a JFC-1600 coater. An SEM JSM-6360 cold field emission at 20 kV was used to examine the dried material [15].

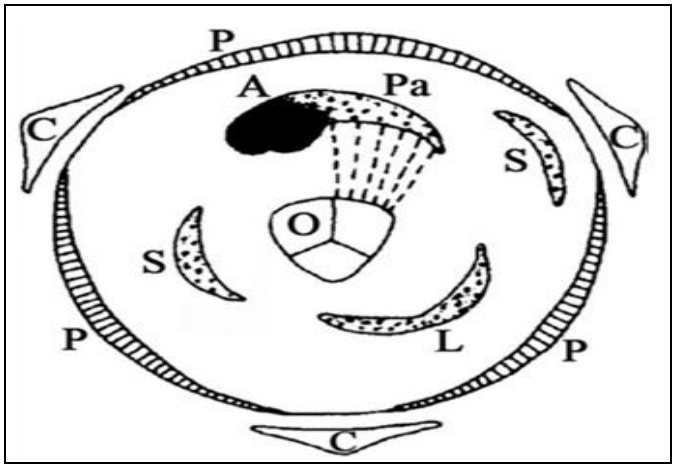

FIG. 3: FLORAL DIAGRAM OF *CANNA INDICA*. C = CALYX, P = PETAL, A = ANTHER, PA = PETALOID APPENDAGE, S = STAMINODE, L = LABELLUM, O = TRI-LOCULAR INFERIOR OVARY

Uses:

- Relief of fever,
- Sedative
- Lowering blood pressure.
- Menstrual or vaginal discharge
- Hepatitis drug
- Natural food colouring
- Natural preservative
- Antidiabetic agent
- Anti-inflammatory,
- Anticancer,
- Antibacterial,
- Antiviral,
- Antithrombotic,
- AS protection from damage caused by UV radiation
- Antioxidants
- Natural indicator 7-10

Commercial Varieties of *Canna Indica*:

***Canna Indica* var. maculata (Hook) Nb. Tanak:** A medium-sized species having green foliage, ovoid shape, branching habit; spikes of flowers are erect, yellow with red spots, staminodes are long and narrow, edges regular, petals green, fully self-cleaning, low bloomer; fertile both ways, self-pollinating and also true to type, capsules globose; rhizomes are thick, up to 3 cm in diameter, coloured white and pink; tillering is average. Introduced by Hook. Many plants previously offered as Canna lutea fall into this subspecies.

***Canna indica* Var Sanctaerosea Kraenzl Nb Tanaka:** A small species having green foliage, oval shape, white margin, branching habit & spikes of flowers are erect, self-colored pink, staminodes are long and narrow, edges regular, labellum is pink, stamen is pink, style is pink, petals red with farina, fully self-cleaning; fertile both ways, self-pollinating and also true to type, capsules ellipsoid; rhizomes are thick, up to 3 cm in diameter, coloured white and pink; tillering is prolific.

***Canna indica* Var warszewiczii A Dietr Nb Tanaka:** This variety is distinguishable from *Cannaindica* var indica by having purple-red-margined leaves, purple-red fruits, and slightly corm-like thickened terrestrial stem at the base. & two staminodes are recurved backward, and the stamen is often strongly reflexed at the apex. These characteristics are fairly stable in this taxon. Sometimes, this variety is confused with C. discolor Lindl, from which it differs in much smaller, deep-red coloured flowers, short and slender rhizomes, and chromosome numbers [4].

Endophytes:

- Endophytes are organisms, often fungi & bacteria, that live between living plant cells.
- Their relationship with the plant varies from symbiotic to bordering on pathogenic of all of the worlds. It seems that only a few grass species have had their complete complement of endophyte studies.

Examples of Endophytes Present in *Canna Indica*: *Mycelia sterila, Curvularia sp., Aspergillus* sp., *Trichoderamasp., Penicillium* sp [14].

MATERIALS AND METHODS:

Extraction Method: The plant *C. indica* L. was identified and collected. Plant material was washed under tap water and allowed to dry in the shade. The dried material was then pulverized to powder. About 50 gm of powder was then extracted with 300 ml of a mixture of ethanol and water (1:1) using the Soxhlet apparatus. After 6 h, the resulting hydro-alcoholic extract (HAE) was filtered and concentrated using a rota evaporator. It was stored in the refrigerator till further use [11].

Isolation: *Cannaindica* is a new source of Anthocyanin's Red flowers of *canna indica* (Cannaceae) were extracted by using sonicator & isolation of anthocyanin has been carried out. Four anthocyanin pigments have been isolated apart from quercetin and lycopene. They are Cyanidin-3-O-(6"-O-α-rhamnopyranosyl)- β-gluco pyranoside [1], Cyanidin-3-O- (6"-O-α-rhamnopyranosyl)- β-galactopyranoside [2], Cyanidin-3-O-β-gluco-pyranoside [3] and Cyanidin-O-β-galactopyranoside [4]. These compounds were isolated by using HPLC, and their structures were subsequently determined on the basis of spectroscopic analyses. It was suitable for use in food Coloration and as a nutraceutical. Thus it is a promising pigment source for food applications [5].

Quantitative Test for Analysis:

Preliminary Screening: Extract was tested for the presence of different secondary metabolites like alkaloids, terpenoids, tannins, flavonoids, sterols. Test specific for each class of secondary metabolites was based on the change in colour or formation of precipitate on the addition of a specific reagent.

TABLE 1: TEST FOR THE PRESENCE OF DIFFERENT SECONDARY METABOLITES

S. no.	Name of the Test	Result
1	Alkaloids	+
2	Amino acids	-
3	Carbohydrates	+
4	Flavonoids	+
5	Glycosides	+
6	Protein	+
7	Steroids, Terpenoids	+

Thin Layer Chromatographic Analysis: HAE was put to a uniform thickness of 0.2 mm precoated silica gel 60 F254 TLC plate (E. Merck). In a twin trough chamber, plates were grown in the mobile phase Toluene: Ethyl acetate (93:07) to a distance of 8 cm, then envisioned by spraying anisaldehyde-sulphuric acid reagent and heating at 105 °C for 5-10 min.

H1-NMR Spectrum Analysis: Sophisticated Analytical Instrument Facility (SAIF) At North-Eastern Hill University (NEHU), Shillong, India, provided the H1-NMR analysis facility. HAE was dissolved in deuterated methanol (CD3OD with a distinctive peak of 3.34), and the H1-NMR spectra were acquired using a Bruker Avance II, 400 MHz instruments.

HR-LC/MS-MS Analysis: To analyze HAE by HR-LC/MS-MS technique, the facility was subcontracted to Sophisticated Analytical Instrument Facility (SAIF) - Indian Institute of Technology, Bombay (IIT Bombay), India. Here, firstly chromatographic separation was achieved using extra densely bonded and double end-capped active silanols as stationary phase packed in Agilent Eclipse XDB-C-18 2.1 × 150 mm, 5 µm column and acetonitrile-water (with 0.1% formic acid) as mobile phase at a flow rate of 0.2 ml/min. Then, LC-ESI-MS analysis of HAE was performed in dual (positive and negative) ion mode using Agilent Jet Stream technology with a hexabore capillary sampling array and dual-stage ion funnel for increased ion sampling and transmission where fragmentation was achieved on collision-induced dissociation (CID) by varying the collision cell voltage. Firstly, a chromatogram was obtained and studied for retention volume and column efficiency [11, 12].

Pharmacological Action of *Canna Indica*: Pharmacological Studies showed that *Canna Indica* plant exerted activities like.

- Antioxidant
- Antiviral
- Anti-inflammatory
- Molluscicidal
- Antibacterial
- Antidiabetic
- Hepatoprotective
- Immunomodulatory

- Antidiarrheal
- Haemostatic
- Anticancer
- AIDs/HIV-RT Inhibition
- Anthelmintic & anticonciceptive [7, 10].

Antioxidant Activity

Skin Oxidation" Oxidation is related to the production of energy associated with the degradation of glucans, lipids, and proteins, to the detoxification of many xenobiotic, and to the immune response through some of the free radicals (FR) generated. Oxygen is associated with the conditions for aerobic life and is the motive force for the maintenance of the metabolism and cellular viability, but, at the same time, it is responsible for the formation of partially reduced mediators with high reactivity, known as reactive oxygen species (ROS). The majority of ROS are FR, that is, active molecular species with a separated electron at a higher energy level, which have paramagnetic properties, providing them with high reactivity. Skin oxidation is occurring, when a compound loses electrons because the level of oxides is increased; this is exactly why when oxygen combines with iron, another case comes when sebum on the surface of the skin (a combination of keratin and oil) clogs pores and is exposed to the air. It results in a blackhead. Unfortunately, blackheads are not the only result of oxidation. Skin oxidation is a massive contributor to photo-aging. AS we get older, our skin is more and more exposed to the elements + UV irradiation causing our skin to lose elasticity, increasing the development of fine lines and wrinkles. Our skin begins to essentially lose the ability to "bounce back [17, 19].

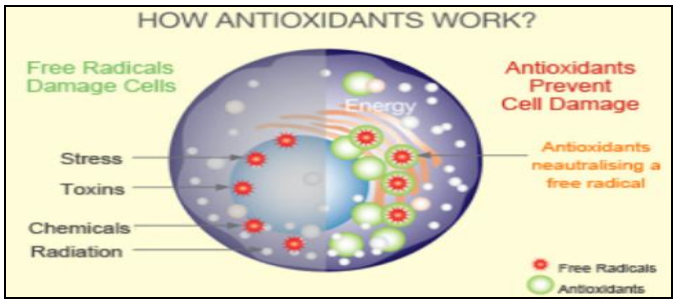

FIG. 4: WORKING OF ANTIOXIDANT

Mechanism of Working of Antioxidants: Antioxidants such as high molecular weight polyphenols, phenolic acids, flavonoids, vitamin C, vitamin E and carotenoids, which are naturally occurring phytochemicals, have been shown to be beneficial as photoprotective agents to protect human skin against harmful effects & and prevent signs of aging, prevent sunburn, help skin repair itself by promoting collagen production, brighten the complexion, and also prevent skin cancer since some have anti-carcinogenic properties. The main reactive oxygen species (ROS) are hydroxyl radicals (HO•) and superoxide (O_2•-), peroxyl and alkoxyl radicals (RO_2• and RO•), the singlet oxygen (O_2), as well as hydrogen peroxide (H_2O_2) and organic peroxides (ROOH). In addition to direct damage to molecules such as lipids, amino acids, and DNA, ROS can activate enzymatic and non-enzymatic cellular responses, with the potential to modify other processes that end up interfering with gene expression. Antioxidants are substances that combine to neutralize reactive oxygen species preventing oxidative damage to cells and tissues. The cutaneous antioxidant system consists of enzymatic and non-enzymatic substances. Among enzymatic antioxidants, glutathione per oxidase (GPx), catalase (CAT) and superoxide dismutase (SOD) can be highlighted. Antioxidants are substances that protect your cells against free radicals. Free radicals are molecules produced when you're exposed to radiation. Non-enzymatic or low molecular weight antioxidants also contribute to the maintenance of cellular redox balance. Here some hormones are grouped, such as estradiol, melatonin &some vitamins, such as E and C. Large number of natural phenol derivatives (polyphenols), Flavonoids have shown both antioxidant and photoprotective activity. *Canna Indica* contains phenol, Flavonoids, & Six types of anthocyanin. Anthocyanin is blue, red, or purple pigments present in flowers & fruits & they consider as one of the flavonoids, although it has a positive charge at the oxygen atom of the C ring of basic Flavonoid structure. The anthocyanin's isolated from the red flowers of C. indica also showed good antioxidant activity. Results suggest a promising pigment source for food applications Anthocyanins reduce MMP production (Wang 2008).

They also protect against UV skin damage by inactivating highly reactive molecules such as free radicals and reactive oxygen species (ROS) formed

during sun exposure, which start a chain reaction that produces significant cell and tissue damage. AS well, they increase levels of Phase II detoxification enzymes (anti-oxidant proteins), including glutathione S-transferase, that help eliminate toxins, and reduce lipid peroxidation (fat damage) and DNA damage that can trigger cancer formation antioxidant activity studied in different methods (1, 1diphenyl-2-picryl hydroxyl [DPPH] radical scavenging assay, NO scavenging assay, hydrogen peroxide assay and hydroxyl radical scavenging assay). Its free radical scavenging activity was estimated for various concentrations 10-100 µg/ml. At 100 µg/ml, DPPH radical scavenging assay, hydroxyl radical scavenging assay, hydrogen peroxide assay, & NO assay showed inhibition of 76.70%, 74.36%, 61.37%, & 62.84%, respectively [20, 21].

Herbal Sunscreen Cream Formulation: Herb & herbal preparations have been used throughout history in medicine, pharmaceutical & cosmetic preparation. Sunscreens are the main components used in lotions and creams to prevent UV-induced skin damage or overcome the harmful effects of sunburns.

Sampling Plant Materials: The fresh flowers of Canna (red) hybrid and Aloe Vera leaves were collected.

Chemicals: Folin-Ciocalteu phenol reagent, Hydrochloric acid, Catechin, Sodium Gallic acid, Methanol, Ethanol, Acetone, Stearic acid, Triethanolamine, Beeswax, Cetyl alcohol, Poly-ethylene glycol, Methylparaben, Rosewater, ED-TA, Araliya oil, Olive oil and all other chemicals

TABLE 2: FORMULA FOR SUNSCREEN PREPARATION F1 FORMULATION 1, F2- FORMULATION-2

Ingredients	F1	F2
Freeze-dried powder of flower extract	0.400	0.400
Steric acid	0.500	1.000
Cetyl alcohol	0.100	0.200
Beeswax	1.500	0.500
Olive oil	2.000	1.000
Polyethylene glycol	0.200	0.200
Triethanolamine	0.135	0.135
Rosewater	2.000	1.000
Moisturizing conditioner aloe	1.500	1.500
Methyl paraben	0.20	0.20
EDTA	0.10	0.10
Aralliya oil (perfume)	Q.S	Q.S
Water	Q.S	Q.S

Preparation of Extracts: The oven-dried flowers were subjected to extraction. The powder of the dried flowers of Canna (red) was steeped in acidified 70% aqueous acetone (AAD), 200 ml in a Scott Duran bottle overnight in the dark conditions at room temperature (28 ± 2 °C).

The extracts were filtered by using four layers of muslin cloth and concentrated on the rotary evaporator (HAHN HS-2005S-N) below 350 under vacuum.

The concentrated filtrate was freeze-dried and stored at -40 °C until further used. The extraction of aloe Vera leaf was performed by soaking fresh aloe gel (50 g) peeled off from the leaf in 70% ethanol (200 mL) for 12 h.

The gel extract was filtered through a muslin cloth and it was stored in the refrigerator (-200 °C) until being used in the herbal cream formulation. Determination of ferric-reducing antioxidant power by FRAP assay Ferric reducing antioxidant power assay or FRAP assay was used to determine the different semisolid emulsion-base oil in water. Formulations were prepared according to the compositions given in the following Table.

Evaluation of Physical Parameters of The Cream: The physical stability test was performed for formulation prepared, to determine the properties like,

pH: 1 gm of the formulation was dispersed in 25 ml of deionized water, & the pH of the cream is determined by using a pH meter. The pH meter was calibrated by using standard buffer solutions.

Appearance: In appearance, the odour, colour, and roughness of cream are evaluated by visual observation.

Homogeneity: Homogeneity of cream is determined by visual appearances & also by touch appearance of the formulation. By pressing a small quantity of cream between the thumb & index finger.

The consistency of the formulations & the presence of coarse particles were used to evaluate the texture & homogeneity. Immediate skin feel (including stiffness, greasiness grittiness) was also evaluated.

Wash Ability: It is determined by washing with tap water for 45 days at room temperature.

Determination of Total Phenol Content and Total Flavonoid Content: The Folin-Ciocalteu assay and the aluminum chloride colorimetric method were used for the 70% acidified aqueous acetone dried flower extract, and the total phenol content (TPC) was expressed as mg Gallic acid equivalent (GAE)/100 g dry weight (DW) of the flowers and total flavonoid content (TFC) was expressed as mg Catechin equivalent (CAE)/100 g DW of the flowers respectively.

Determination of Radical Scavenging Activity of The Cream by DPPH Assay: The radical scavenging activity of the most stable cream formulated was determined by using 2, 2-diphenyl-1picrylhydrazyl (DPPH) assay and expressed as mmol Trolox equivalent (TE)/100 g of the cream. The results were expressed as mmol Trolox equivalents to 100g of the cream.

Determination of Ferric Reducing Antioxidant Power of The Cream by FRAP Assay: FRAP assay is Ferric reducing antioxidant power. It is used to determine the antioxidant power of the most stable cream formulated, and the results were expressed in mmol Fe(II) equivalent/ 100 g of the cream.

Evaluation of *In-vitro* Sun Protective Factor (SPF) of The Cream: The SPF value was calculated using the Mansur mathematical equation and Ultraviolet spectrophotometry. The cream was dissolved in methanol and solutions with the concentrations of 0.5 mg/ml, 1.0 mg/ml and 1.5 mg/ml were produced.

Dermatone was dissolved in methanol (0.1 mg/ml, 0.5 mg/ml, 1.0 mg/ml, and 1.5 mg/ml) to make a series of positive controls. The Mansur equation and the normalized product function were used to determine SPF values.

Mansur Equation 1:

$$SPF = CF \times 32/\ 290\ EE(\gamma) \times (\gamma) \times Abs\ (\gamma)$$

EE (λ) –Erythemal Effect spectrum, CF – Correction Factor (10), I (λ) – Solar Intensity spectrum, Abs (λ) – Absorbance of sunscreen product [6].

CONCLUSION: The objective of the present review is to highlight the chemical constituents of Morphology, Microscopy, the pharmacological &therapeutic effects of *Canna indica*. It contains antibacterial, antiviral, anthelmintic, anticancer, molluscicidal, anti-inflammatory, analgesic, immunomodulatory, hemostatic, hepatoprotective, antioxidant, antidiarrheal, Cytotoxic, and other effects good antioxidant activity. Antioxidants may reduce the risk of many diseases. They scavenge free radicals from the body cells & prevent the damage caused by oxidation. The present study Review on formulation & evaluation of a novel herbal sunscreen cream with promising antioxidant activity enriched with Canna flowers. Sunscreens are used to protect our skin from harmful UV rays. Also, reduce the risk of skin cancer, avoid inflammation & redness, &prevent hyperpigmentation. *Canna indica* and the formulated herbal sunscreen cream have promising sun screening and antioxidant activity; thereby, the formulated cream can be commercialized as a novel herbal sunscreen cream with antioxidant activity. Every part of *canna indica* has valuable properties that can serve humanity, so the whole plant can be broadly studied for further research aspects.

ACKNOWLEDGEMENT: Nil

CONFLICTS OF INTERST: Nil

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How to cite this article:
Samruddhi SN, Chougule PN and Patil SKV: Formulation & evaluation of herbal sunscreen cream enriched with antioxidants from *Canna Indica*: A Review. Int J pharmacognosy 2021; 8(10): 412-22. doi link: http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.8(10). 412-22.

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