

Phytochemical And Medicinal Values Of Marigold (*Tagetes erecta* L.)

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Introduction

Natural plant products have been used throughout human history for various purposes. Many of these natural products have biological activity that can involve in drug discovery and drug design. The Indian system of medicine known as “Ayurveda” uses mainly plant-based drugs or formulations to treat various ailments, including cancer. Herbal drugs have great growth potential in the global market. Research work on the chemistry of natural products, pharmacognosy, pharmaceuticals, pharmacology and clinical therapeutics have been carried out on herbal drugs and most of the leading Pharmaceutical corporations have revised their strategies in favour of natural products. Many herbal remedies individually or in combination have been recommended in various medical treatises for the cure of different diseases. The therapeutic value of *Tagetes erecta*, commonly known as Marigold, has been recognized in different systems of traditional medicine for the treatment of different human ailments. *Tagetes* is a genus (family Compositae/Asteraceae) containing about 50 species of annual or perennial herbaceous plant. The plant *Tagetes erecta* L. (Fig. 1) is locally known as Genda Phool (Marigold). Marigold is a spice native to India. Historically, marigold has been used all over India, China and Indonesia as a spice and medicinal agent. Marigold is a spice that enhances the flavour of foods and is the base of most Indian curries. Marigold is used in curries goes back more than 5000 years. It is stout, branching herb, native to Mexico and other warmer parts of America and naturalized elsewhere in the tropics and subtropics including India and Bangladesh. These are rapid growing annual flowering plants in height ranging from dwarfs of 6-8 inch, to medium and taller and erect-growing plants with heights from 10 into 3ft, bearing large pompon-like double flower up to 5 in across and has a shorter flowering period from midsummer to frost. It is very popular as a garden plant and yields a

strongly aromatic essential oil (*Tagetes* oil), which is mainly used for the compounding of high-grade perfumes. It is very popular as a garden plant and yields a strongly aromatic essential oil (*Tagetes* oil), which is mainly used for the compounding of high-grade perfumes. Different parts of this plant including flowers are used in folk medicine to cure various diseases. Leaves are used as antiseptic and in kidney troubles, muscular pain, piles and applied to boils and carbuncles. The flower is useful in fevers, epileptic fits (Ayurveda), astringent, carminative, stomachic, scabies and liver complaints and is also employed in diseases of the eyes.



Fig. 1. Blooming flowers field of marigold (*Tagetes erecta*) Fig.-2 Single marigold (*Tagetes erecta*) plant with flowers

Taxonomic classification:-

Tagetes erecta is stout, branching herb, native to Mexico and other warmer parts of America and naturalized elsewhere in the tropics and subtropics including India and Bangladesh.

Kingdom	Plantae
Sub-kingdom	Tracheobionta
Super-division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Asteridae
Order	Asterales
Family	Asteraceae
Genus	<i>Tagetes</i> L.
Species	<i>Erecta</i> L.

Vernacular names

Language	Name	Language	Name
Marathi	Zendu	Sanskrit	Sandu
Hindi	Genda	Punjabi	Tangla
Bengali	Genda	Malayalam	Chendumalli
Gujarati	Guliharo	Telugu	Bantichettu
Manipuri	Sanarei	Urdu	Genda
Konkani	Gondiphool	Kannada	Chenna mallige

Cultivation and economic value

Tagetes erecta is also known as “Marigold” flower. Flowers are edible and also used as colouring agent and condiment. A yellow dye obtained from the flower can be used as a saffron substitute for colouring and flavouring foods. This probably refers to the use of the flowers as an edible dye. Marigold is a hardy annual herb native to Southern Europe, which can also be found growing in most temperate regions of the world. They grow up to 50-80 cm in height, the leaves mid-green, lanceolate and between 5 and 17 cm in length. The leaves and stems are covered with small hairs; the edges of the leaf can be sparsely toothed or wavy. The plant grows to a height of one to five feet and is cultivated extensively in Asia, India, China, and other countries with a tropical climate. The marigold plant needs temperatures between 20°C and 30°C and a considerable amount of annual winter and rainfall to thrive. The world production of marigold stands at around 600000 tones, of which India has a share of approximately 75-80%. India consumes about 80% of its own Production. Indian marigold is considered the best in the world. India exports marigold flower to discerning countries like Japan, Sri Lanka, Iran, North African countries, US and UK. The production of marigold is concentrated in the southern part of the country, mainly in the peninsula area. Andhra Pradesh, Utter Pradesh is the leading marigold producing state in India followed by Tamil Nadu. Andhra Pradesh also has the highest area under marigold cultivation. Maximum area under marigold is in Andhra Pradesh followed by Maharashtra, Tamil Nadu, Orissa, Karnataka, U.P and Kerala. The genus *Tagetes* contains many taxes which are economically important as food, condiment and as colouring, medicinal and ornamental materials. The highest diversity is concentrated in India and Thailand, with at least 50 species in each area, followed by French, Africa, Mexico, Myanmar, Bangladesh, Indonesia and India. *Tagetes erecta* is the main species of commerce and distributed its flower in India, China and also in Shri Lanka, Indonesia, Jamaica and Peru. Erode, a city in the South Indian state of Tamil Nadu is India’s largest producer and the most important trading centre for marigold. The optimum time for cultivation and harvesting of marigold is given in below table.

The optimum time for cultivation and harvesting of marigold

Season	Sowing time	Transplanting time	Harvesting time
Rainy	June-July	July- Aug.	Sep.-Oct.
Winter	Sep.-Oct.	Oct.-Nov.	Nov.-Dec.

Chemical constituents

Phytochemical studies of its different parts have resulted in the isolation of various chemical constituents such as thiophenes, flavonoids, carotenoids and triterpenoids. The plant *T. erecta* has been shown to contain quercetagetin, a glucoside of quercetagetin, phenolics, syringic acid, methyl-3, 5-dihydroxy-4- methoxy benzoate, quercetin, vinyl and ethyl gallate. Lutein is an oxycarotenoid, or xanthophyll, containing 2 cyclic end groups (one beta and one alpha-ionone ring) and the basic C-40 isoprenoid structure common to all carotenoids. It is one of the major constituents and the main pigment of *Tagetes erecta*. The flower consists of carotenoids consisting of lutein, zeaxanthin, neoxanthin plus violaxanthin, β carotene, lycopene, α -Cryptoxanthin, phytoene and phytofluene. Thorough phytochemical study on 22 compounds from the flowers of *T. erecta* by isolation of various fractions of the ethanol extract by silica gel column chromatography. They were β -sitosterol, daucosterol, 7 β -hydroxysitosterol, erythrodiol-3- palmitate, lupeol, erythrodiol, 1-[5-(1-propyn-1-yl)- [2, 2-bithiophen]-5-yl]-ethanone, α -terthienyl, quercetagetin, quercetagetin-7-methylether, quercetagetin-7-O-glucoside, kaempferol, syringic acid, gallic acid, 3- α -galactosyl disyringic acid, 3- β galactosyl disyringic acid, 6-ethoxy-2, 4- dimethylquinoline, oplodiol, (3S, 6R, 7E)-hydroxy4,7-megastigmadien-9-one, palmitin, ethylene glycollinoleate, and n-hexadecane. The chemical structures of lutein, quercetagetin and syringic acid.

Pharmacological activities

Tagetes erecta shows diverse pharmacological activities which are shown below in the following heads-

Antibacterial activity

The antibacterial activity of different solvents of *Tagetes erecta* flowers against *Alcaligenes faecalis*, *Bacillus cereus*, *Campylobacter coli*, *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *Streptococcus mutans* and *Streptococcus pyogenes*. The flavonoid possesses antibacterial activity against all the tested strains and shows a maximum zone of inhibition for *Klebsiella pneumoniae* (29.50 mm). Flavonoid-patulitrin is one of the potential elements for its anti-bacterial activity. The flower parts showed maximum inhibitory action against *Neisseria gonorrhoeae* strain.

Antinociceptive and anti-inflammatory activity

Antinociceptive and anti-inflammatory activity of chloroform, methanol and ether fraction of *Tagetes erecta* reported by using acetic acid-induced writhing in mice and carrageenan-induced paw oedema in the rat. Antinociceptive and anti-inflammatory activity of hydroalcoholic extract of leaves of *Tagetes erecta* reported by using acetic acid-induced writhing and hot plate method in mice and carrageenan-induced paw oedema in the rat.

Anti-oxidant activity

The ethanolic extract of *Tagetes erecta* flowers showed anti-oxidant activity by three different assays like DPPH, reducing power and superoxide radical scavenging activity at different concentrations were used. In all the three assays, *Tagetes erecta* showed better reducing power than the standard (*i.e.* ascorbic acid), and superoxide anion scavenging activity and DPPH antioxidant activity showed less than standard. The essential oil of flowers of *Tagetes erecta* produced anti-oxidant activity by using DPPH, thiocyanate, β -carotene bleaching, free radical scavenging activity and oxidation of deoxyribose assay.

Hepatoprotective activity

Ethyl acetate fraction of *T. erecta* at the dose of 400 mg/kg orally significantly decreased the elevated serum ALT, AST, ALP and level of bilirubin almost to the normal level compared to CCl₄-intoxicated group. Histological changes in the liver of rats treated with 400 mg/kg of the extract and CCl₄ showed a significant recovery except for cytoplasmic vascular degenerations around portal tracts, mild inflammation and foci of lobular inflammation.

Anti-cancer activity

Marigold has long been used as a medicinal herb for a number of therapeutic activities. The cytotoxic activity of ethanol and ethyl acetate extracts of marigold flowers and their inhibitory effects on elastase and tyrosinase enzymes were investigated. An assay was performed to measure the cytotoxicity of these two extracts on the H460 lung cancer and the CaCO₂ colon cancer cell lines.

Antiepileptic activity

The ethanolic extract *Tagetes erecta* was evaluated using the in vivo models such as pentobarbitone induced sleeping time, MES and PTZ induced convulsions, potentiation of PTZ induced convulsion, spontaneous locomotor activity, forced swim test and learned

helplessness test model. The ethanolic extract *Tagetes erecta* showed antiepileptic activity. The findings suggested that ethanolic extract may reduce the seizure threshold in epileptic patients, chances of seizure precipitation is more, thus usage in epilepsy is cautious.

Anti-diabetic activity

Hydro-alcoholic extract of *Tagetes erecta* was studied for its anti-diabetic activity. Diabetes was induced by a single intraperitoneal injection of streptozotocin (60 mg/kg b.w). Treatment with standard drug glibenclamide, blood glucose raised at 30 min followed by subsequent fall up to 120 min. It was observed that the administration of *Tagetes erecta* extracts increased the glucose levels were seen after 30 min and the hypoglycemic effect was observed only after 120 min.

Anti-depressant activity

Tagetes erecta, the marigold, showed some anti-depressant activity. Some study was carried out to elucidate the antidepressant effect of hydromethanolic flower extract of *T. erecta*. The extract was evaluated for antidepressant effect using a forced swim test in mice. *T. erecta* significantly inhibited the immobility period in forced swim test in mice.

Wound healing activity

The activities of the marigold extract on the wound healing of albino Wistar rats have been evaluated. Thirty-six male and female rats weighing 150-200g were randomly selected and divided into 4 groups (A, B, C, and D). The test rats were fed normal rat feed and water ad libitum in addition to oral administration of 1.0ml of the petal extract of marigold. Blood samples were obtained by cardiac puncture of the animals into EDTA bottles for analysis. The initial blood picture of the animals was taken before administration of the extracts to the test rats. Results showed that *Tagetes erecta* extract increased platelet count, white blood cell count ($p > 0.05$) and shortened the bleeding and clotting times. To screen the wound healing activity of carbopol gels prepared from hydroalcoholic extracts of *Gymnema sylvestere* and *Tagetes erecta* in excision wound model and burn wound models in albino mice. Formulations of the extracts were done in the form of gels of carbopol individually and also in combination in equal ratio. In excision and burn wound models, the so treated animals showed a significant reduction in the period of epithelization and wound contraction and combined gel showed accelerated wound healing activity may be because of synergism.

Mosquitocidal activity

Mosquitocidal effects of ethanolic extract of flowers of *Tagetes erecta* and its chloroform and petroleum ether soluble fractions against the larvae of *Culex quinquefasciatus* have been investigated. The larvicidal effect of ethanol extract and their solvent fractions were determined by the standard procedure of WHO against different instars of *C. quinquefasciatus*.

Anti-fungal activity

Fungitoxic activity of the essential oil of leaves of *Tagetes erecta* exhibited complete inhibition of the growth *Pythium aphanidermatum*, the dampingoff pathogen, at a concentration of 2000 ppm.

Non-pharmacological importance

Tagetes erecta exhibited insecticidal larvicidal mosquitocidal and nematocidal activity. *Tagetes erecta* flower extract was found to contain biologically useful lutein compounds and studied for use as a nutritional supplement and as poultry food colourant. The flower petals yield a natural dye, the colourants consisting mainly of carotenoid-lutein and flavonoid-patuletin, with crude extracts used for dyeing textiles. The study describes an innovative dyeing process with a net enhancement of dye uptake due to metal mordanting. Results suggest a potential for industrial application.

Traditional uses

Different parts of *Tagetes erecta* plant including flower are used as a traditional medicine to cure various diseases. Leaves of this plant are used as antiseptic, in kidney troubles, muscular pain, piles and applied to boils and carbuncles. The flower petals are useful in fevers, epileptic fits (Ayurveda), astringent, carminative, stomachic, scabies and liver complaints and is also employed in diseases of the eyes. They are said to purify the blood and flower juice is given as a remedy for bleeding piles and also used in rheumatism, colds and bronchitis. Different species of *Tagetes* have been found to possess antimicrobial, anti-inflammatory, hepatoprotective, wound healing, insecticidal, analgesic activities. The pharmacological activity of *Tagetes erecta* is related to the content of several secondary metabolites and the most important compounds are terpenes, essential oils, flavonoids, carotenoids and polyphenols .

Conclusion

The literature survey represented that the *Tagetes erecta* is an important medicinal plant with the diverse pharmacological spectrum and medicinally important phytoconstituents. *Tagetes erecta* shows the presence of many chemical constituents which are responsible for various medicinal properties, which can be used for the welfare of mankind. There are many other traditional uses of *Tagetes erecta* species in different traditional systems, which serves as the basis for further studies. This review will definitely help the researchers to explore its different properties and interactions of *Tagetes erecta* plant.

