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A REVIEW ON PHYTOCOMPOUNDS AND PHARMACOLOGICAL ACTIVITIES REPORTED FOR *TAGETES ERECTA*

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ABSTRACT

The use of medicinal plants, their derivatives, and their defined secondary metabolites is increasing worldwide as a natural substitute for synthetically generated chemicals in both Traditional and Allopathic systems of medicine. *Tagetes erecta*, also referred to as Genda Phul (marigold) shows several therapeutic benefits. The plant's various parts are beneficial for fevers, astringent, stomachic, scabies and liver issues, ocular conditions, purify the liver, carminative, colds, rheumatism, bleeding piles, bronchitis. *Tagetes erecta* is a plant includes several significant phytochemical components such as carotenoids, flavonoids, terpenoids from various parts of the plant. It demonstrates a variety of pharmacological effects, including anti-nociceptive, anti-inflammatory, antioxidant, insecticidal, larvicidal, hepatoprotective, antipyretic, wound healing, antifungal, antibacterial, and antiepileptic.

Keywords: *Tagetes erecta*, Astringent, Carotenoids, Hepatoprotective, Antibacterial, Antiepileptic

INTRODUCTION-

Traditional societies around the world make extensive use of medicinal plants and their derivatives, and modern society is starting to catch on as well alternatives to manufactured chemicals that are natural **[1]**. Over the past few decades, there has been an exponential increase in herbal medicine discipline. It is becoming more well-known in due to its natural resources, both developing and developed countries

minor side effects and their genesis **[2]**. In the current situation, the cost of modern conventional healthcare is extremely high, issues with hazardous medications, persistent illnesses, resistance infections, autoimmune conditions, and degenerative conditions age-related illnesses, despite significant scientific progress. More than 70% of India's 1.1 billion populations still use these non-allopathic systems of medicine **[3]**. There are 50 species of annual or perennial herbaceous plants in the genus Tagetes, which belongs to the family Asteraceae. *Tagetes erecta* L. **(Figure 1)** is referred as Genda Phool (Marigold) locally. In the past, India has used marigolds extensively, China and Indonesia as sources of medicinal and spice agent. Marigold is used as spice to make food taste better. Marigold has been utilised in curries for more than 5000 years **[4]**. It is an annual or perennial herbaceous plant that grows to a height of 30 to 110 cm. The flowers' primary distinguishing feature is their arrangement in small heads or solitary inflorescences, on peduncles up to 15 cm long, and their ligulas, which range in colour from yellow to red. It shows various pharmacological effects, including anti-nociceptive, anti-inflammatory, antioxidant, insecticidal, larvicidal, hepatoprotective, antipyretic, and wound healing healing, antifungal, antibacterial, antimicrobial, and antiepileptic **[5, 6]**.

Taxonomical Classification-

Kingdom	**Plantae**
Order	**Asterales**
Family	**Asteraceae**
Subfamily	**Asteroideae**
Class	**Magnoliopsida**
Division	**Magnoliophyta**
Genus	**Tagetes**
Species	**Erecta**

Figure 1: Flowers of *Tagetes Erecta*

PHYTOCHEMISTRY-

T. erecta flowers have been found to include phytoconstituents such tannins, phenolic compounds, flavonoids, sterols, triterpinoids, saponins, and alkaloids, according to preliminary analysis **[5, 6]**. Quercetagetin, syringic acid, methyl-3, 5 dihydroxy-4- methoxy benzoate, quercetin, vinyl, and ethyl gallate have all been found to be present in the plant *T. erecta* **[7]**. Lutein is an oxycarotenoid, or xanthophyll that has the fundamental C-40 isoprenoid structure found in all carotenoids as well as two cyclic end groups (one beta and one alpha ionone ring). It is the primary pigment and one of the key component of *Tagetes erecta* **[18]**. Tetra decanoic Acid, 2,6,10-Trimethyl 14-Ethylene-Pentadecme, N-Hexadecanmic Acid, 15-Hydroxy pentadecanoic Acid, and Stigmasterol are the main bioactive compounds present. About 31 phytochemicals were identified from methanol extract of flowers, the major are Hexadecanoic acid, 7-Tetra decenal (z), Vitamin E and Norolean –12 – Ene **[19, 20]**. The fatty acids present in flower are linoleic acid, palmitic acid and oleinic acid. By using GCMS analysis, the steam-distilled volatile oil from dried plant material revealed 47 chemicals, including the major components piperitone (11.52%), piperitenone (12.74%), limonene (14.48%), and terpinolene (15.48%) **[21]**. Syringic acid and several other substances like ethyl gallate and methyl-3,5-dihydroxy-4-methoxy benzoate, were found in the dried flowers of *Tagetes erecta* **[22]**.

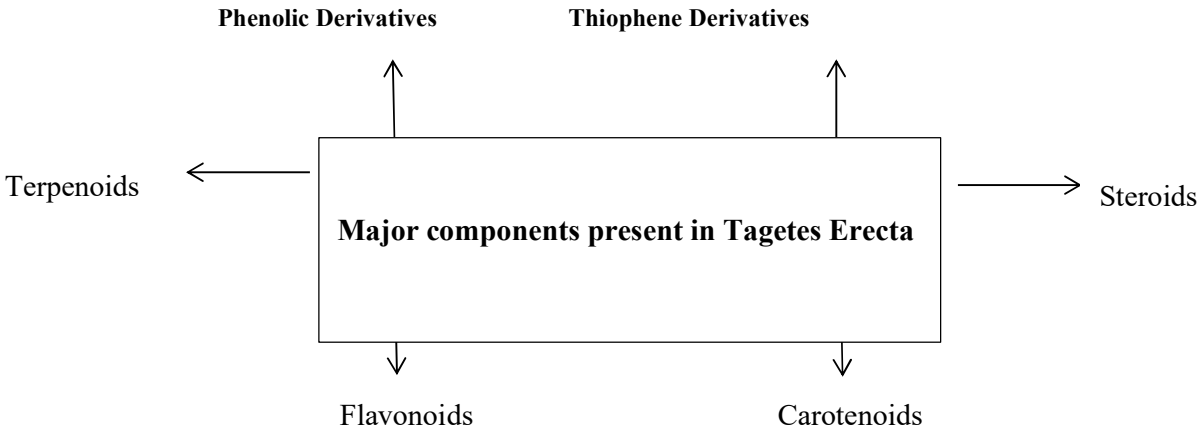
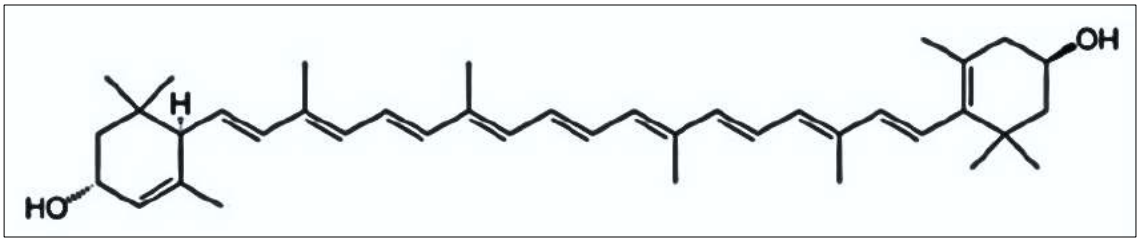
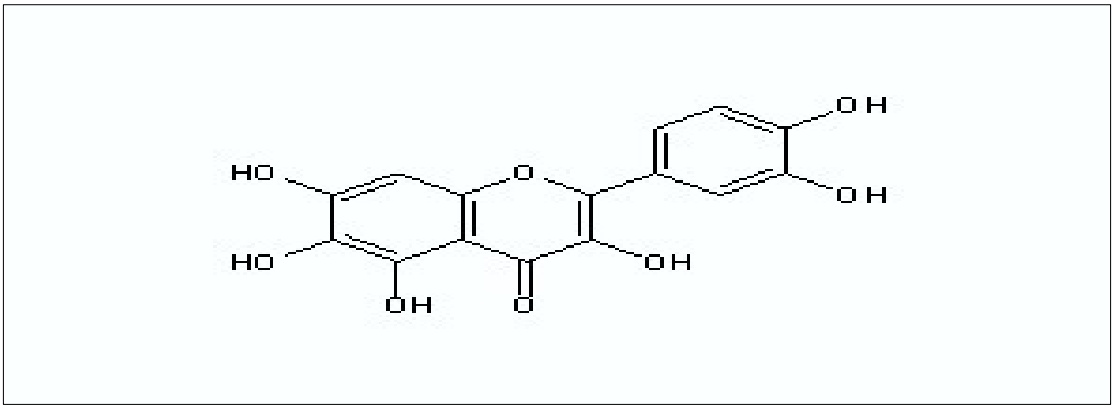


Figure 2: Chemical constituents from *Tagetes Erecta*



Structure of Lutein



Structure of Quercetagetin

PHARMACOLOGICAL PROFILE-

Anti-bacterial activity-

The antibacterial activity of different solvents of *Tagetes erecta* flowers against *Alcaligens 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 **[8]**. The leaf extract showed maximum activity against for *Acinetobacter baumannii* and minimum for *Streptococcus pneumonia*. The ethanolic extract of the root exhibits minimal inhibitory zones against the test organism, while the flower extract exhibits significant antibacterial activity against *S. lutea, E. coli*, and *B. circulence*. The leaf extract is shown to be most sensitive to *S. lutea, B. circulence*, and *B. subtilis*, whereas the ethanolic extract is least sensitive to *E. coli* and *S. aureus* **[22]**.

Anti-oxidant activity-

By using three distinct assays, including DPPH, reducing power, and superoxide radical scavenging activity, the ethanolic extract of *Tagetes erecta* flowers demonstrated anti-oxidant activity. In all the three assays, it showed better reducing power than the standard (i.e. ascorbic acid), and superoxide anion scavenging activity

and DPPH antioxidant activity showed less than standard **[9]**. Compared to beta carotene and lycopene, lutein has significantly higher antioxidant activity. The maximum phenolic content and antioxidant activity were reported in ethyl acetate extract of flowers. Its bioassay-guided fractionation resulted in the identification of the flavonoid quercetagetin. Quercetagetin has a substantially greater antioxidant potential than standard quercetin. Caryophyllene, limonene, methyleugenol, (E)-ocimene, piperetone, piperitenone, and terpinolene are other chemicals found in *Tagetes erecta* essential oil that possess antioxidant activity **[22]**.

Anti-cancer activity-

Marigold has a long history of use as a medicinal herb for many therapeutic purposes. Ethanol and ethyl acetate extracts from marigold (*Tagetes erecta L.*) flowers were nontoxic to two human cell lines, lung cancer (H460) and colon cancer (Caco-2). An MTT assay was performed to measure the cytotoxicity of these two extracts on the H460 lung cancer and the Caco-2 colon cancer cell lines **[10]**.

Anti-depressant activity-

T. erecta flower extract possess antidepressant action demonstrated by modulation of nitrergic, serotonergic pathway, and sigma receptors. A study was done to determine the antidepressant effects of hydromethanolic flower extract of *T.erecta*. The extract was evaluated for antidepressant effect using a forced swim test in mice **[11]**.

Insecticidal activity-

The insecticidal activity in *Tagetes erecta* flowers against a stored product insect pest, *Tribolium castaneum* (Herbst) was reported. The chloroform fraction showed highest toxicity against the larvae and adults of *Tribolium castaneum* followed by petroleum ether fraction and ethanol extract. The LC values of chloroform fraction against first, second, third, fourth, fifth and sixth instar larvae were 11.64, 14.23. 19 26, 29.02, 36.66, 59.51 µg/cm2 (72 h.), respectively and for adults the value was 65.93 µg/cm2 (72 h.). No mortality was observed in control. Finally they concluded that the flower of *Tagetes erecta* might be a pesticide against *Tribolium castaneum* **[15]**.

Hepatoprotective activity-

The hepatoprotective action of *Tagetes erecta* flowers was reported by Bose et al using a carbon tetra chloride-induced hepatopathy model. The serum ALT, AST, ALP, and bilirubin levels increased as a result of the ethanolic extract. Histological changes in the liver of rats treated with 400 mg/kg of EATE extract and CCl4 showed a significant recovery except cytoplasmic vascular degenerations around portal tracts, mild inflammation and foci of lobular inflammation. Flavonoids, terpenoids, and steroids are phytoconstituents that are

responsible for the hepatoprotective effect that has been reported **[12]**.

Wound healing activity-

Ibrahim et al reported the wound healing activity of carbopol gels prepared from hydro alcoholic extracts of Gymnema sylvestere (GE) and *Tagetes erecta* Linn. (TE) in excision wound model and burn wound models in albino mice. The animals treated with GE and TE showed significant reduction in the time required for epithelization and wound contraction in excision and burn wound models. The combined gel demonstrated rapid wound healing activity, which may have been caused by synergism **[13, 14]**.

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 reported. For all instar larvae of *Cx.quinquefasciatus*, the LC50 values were 14.14 g/mL, 17.06 g/mL, 36.88 g/mL, and 75.48 g/mL for the chloroform-soluble fractions among the tested samples. In the course of increasing age and time, the larvae showed comparative tolerance. From this they concluded the flowers of *Tagetes erecta* having good mosquitocidal activity **[15, 16]**.

TRADITIONAL USES-

The entire plant is fragrance producing, increase digestion, diuretic and tranquillizing. It is used to treat upset stomach, abdominal cramps, constipation and inflamed and painful eyes. The flowers are useful in fever and convulsions. Leaves of this plant are used as antiseptic, muscular pain, piles, in kidney troubles and to cure for haemorrhoids; their extract is used for earache and sore eyes. Different species of Tagetes have been found to possess hepatoprotective, wound healing, antimicrobial, anti-inflammatory, insecticidal, analgesic activities **[14, 20]**.

CONCLUSION-

The extensive literature survey revealed that, *Tagetes erecta* is a significant medicinal plant with a wide range of pharmacological effects. The plant demonstrates the presence of numerous chemical components that are responsible of diverse therapeutic characteristics that can be applied to benefit mankind. Different species of Tagetes have been found to possess hepatoprotective, wound healing, antimicrobial, anti-inflammatory, insecticidal, analgesic activities.

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