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Review Article

Tagetes erecta plant: Review with significant pharmacological activities

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ABSTRACT

The beneficial medicinal effects of the plants materials typically result from the combination of secondary products present in the plant. Plants produce secondary metabolites as defenses against animals, parasites, bacteria and viruses and so rely on these chemical and other deterrents for their survival. These secondary metabolites constitute the medicinal value of a drug plant, which produces a definite physiological action on human body. Tagetes erecta is a annual growing to 1 m (3ft 3in) by 0.4 m (1ft 4in) at a medium rate. It is in flower in July. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Insects.The whole herb is anthelmintic, aromatic, digestive, diuretic, emmenagogue, sedative and stomachic. It is used internally in the treatment of indigestion, colic, severe constipation, coughs and dysentery. Externally, it is used to treat sores, ulcers, eczema. Sore eyes and rheumatism. The leaves are harvested as required for immediate use during the growing season, whilst the flowering plant can be dried and stored for later use. A paste of the leaves is applied externally to treat boils, carbuncles and earaches. The flowers are carminitive, diuretic and vermifuge. A decoction is used to treat colds, and mumps. It is applied externally to trea skin diseases, conjunctivitis and sore eyes. The root is laxative.

Keywords: *Tagetes erecta* Linn. , Hepatotoxicity, Hepatoprotective, Carbon tetrachloride

INTRODUCTION

Tagetes is a genus (family Asteraceae) containing about 50 species of annual or perennial herbaceous plant. The plant *Tagetes erecta* Linn. locally known as Genda Phul (Marigold). It is stout, branching herb, native to Mexico and other warmer parts of America and neutralized 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 in to 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 [1].

BOTANICAL CLASSIFICATION [2]

Kingdom : Plantae
Order : Asterales
Family : Asteraceae
Genus : *Tagetes*
Species : *Tagetes erecta*

Phytochemical Constituents: Studies of its different parts have resulted in the isolation of various chemical constituents such as thiophenes, flavonoids, carotenoids and triterpenoids. The plant *Tagetes erecta* has been shown to contain quercetagetin, a glucoside of quercetagetin, phenolics,syringic acid, methyl-3,5-dihydroxy-4-methoxy benzoate, quercetin, thienyl 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* [2,3,4].

Botanical Description: Marigold is a common garden plant which is rather coarse, erect, branched and grows to about 1 meter high. However there is short or dwarf varieties as well. The leaves are very deeply incised and sharply toothed. Flower heads are solitary, long stalked and thickening upward. The flowers are bright yellow, brownish-yellow or crange [5,6].

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TRADITIONAL USES

Different parts of this plants including flower are used in folk medicine to cure various diseases. The leaves are reported to be effective against piles, kidney troubles, muscular pain, ulcers, wounds and earache. The pounded leaves are used as an external application to boils and carbuncles. It is reported to have antioxidant, antimycotic, analgesic activity and 18 active compounds are identified by GC-MS, many of them are terpenoids. The flower is useful in fevers; epileptic fits, astringent, carminative, stomachic, scabies, liver complaints, and also employed in diseases of the eyes. They are said to purify blood and flower juice is given as a remedy for bleeding piles and also used in rheumatism, cold and bronchitis.leaves are used as an external application to boils and carbuncles [7, 8, 9].

PHARMACOLOGICAL ACTIVITY

Antibacterial activity: Kiranmai et al., (2012) carried out investigation of **antibacterial** effect of different extracts of leaves and flowers of *Tagetes erecta* Linn. After performing preliminary Phytochemical screening and thin layer chromatography, antibacterial study was evaluated according to the agar diffusion method by using gram positive *B. cereus*, *S. aureus* and gram negative *E.coli*, *P. aeruginosa*. Study was showed that petroleum ether extract of leaves and ethyl acetate extract of flower of *Tagetes erecta* significantly inhibited the growth of bacteria dose dependently (2).

Rhama and Madhavan reported the **anti-bacterial activity** of different solvents of *Tagetes erecta* flowers against *Alcaligens faecalis, Bacillus cereus, Campylobacter coli, Escherchia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus vulgaris, Streptococcus mutans* and *Streptococcus pyogenes.* The flavonoid possesses anti-bacterial activity against all the tested strains and shows maximum zone of inhibition for *Klebsiella pneumoniae* (29.50 mm). The flavonoid-Patulitrin is one of the potential elements for its anti-bacterial activity [10].

Wound healing activity: Chatterjee et al., (2011) compared the efficacy of hydroalcoholic extracts of leaves of *Tagetes erecta* (*T. erecta*) and aerial parts of *Centella asiatica* (*C. asiatica*) on excision, incision and dead space **wound** models in albino rats. Extract of *T. erecta* and *C. asiatica* ($P < 0.001$) showed significant increase in rate of wound contraction, epithelization and formation of scar faster in excision wound model compare to control group. *T. erecta* extract (250 and 500 mg/kg) showed significantly increased the wound breaking strength in incision wound model and wet and dry granulation tissue weights, breaking strength in a dead space wound model compare to control and *C. asiatica* treated group ($P < 0.001$) [6].

Kiranmai et al., (2011) carried out the screening of **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, showed significant reduction in period of epithelization and wound contraction and combined gel showed accelerated wound healing activity may be because of synergism. The enhanced wound healing activity of hydro alcoholic extracts may be due to free radical scavenging action and the phytoconstituents (flavonoids) present in it which either due to their individual or additive effect fastened the process of wound healing [11].

Antioxidant activity: Chivde et al., (2011) performed ***in Vitro*** **antioxidant** study on the ethanolic extract of *Tagetes erecta* flowers. During the study preliminary phytochemical analysis were carried out on ethanolic extract of flowers of *Tagetes erecta* and found the presence of alkaloids, flavonoids, proteins, steroids and tannins. For *in Vitro* antioxidant activity three different assays like DPPH, reducing power and super oxide radical scavenging activity at different concentrations were used. In all the three assay, *Tagetes erecta* showed better reducing power than the standard (i.e. ascorbic acid), and super oxide anion scavenging activity and DPPH antioxidant activity showed less than standard. However, ethanolic extract of *Tagetes erecta* demonstrated antioxidant property in all the *in Vitro* models [12].

Anti-Diabetic activity: Raghuveer et al., (2011) carried out studies on hydro alcoholic extract of *Tagetes erecta* its **anti-diabetic** activity by inducing diabetes using single intra-peritoneal injection of streptozotocin (60 mg/kg b.w). Treatment with standard drug Glibenclamide, blood glucose rose at 30 min followed by subsequent fall up to 120 min. From present study, it was observed that administration of *Tagetes erecta e*xtracts showed increase in glucose levels after 30 min and hypoglycaemia effect was observed only after 120 minutes [13].

Anti Hyperlipedemic activity: Raghuveer et al., (2011) investigated the **anti hyperlipedemic activity** of hydro alcoholic extract of *Tagetes erecta* in hyperlipedemic rats at a dose of 200 and 400 mg/kg. Hyperlipidemia was induced by cholesterol 25mg/kg/day. Lovastatin (10mg/kg/day) was used as standard. Blood

samples were collected from rats in all the groups on 30th day and estimated for their serum cholesterol, serum triglyceride, serum HDL and serum LDL levels using standard procedures. From the study it was observed that administration of *Tagetes erecta* extracts significantly decreased all the hyperlipedemic parameters in rats [14].

Hepatoprotctive activity: kumar et al., (2011) giving emphasis on use of many folk remedies from plant origin for their potential antioxidant and **hepatoprotctive** liver damage in experimental animal models, carried out hepatoprotective activity in Carbontetrachloride (CCl_4)-induced hepatotoxicity model using 80% ethanolic soxhlet extract. In the experiment Wistar albino rats (150-250g) of either sex were used for the activity. The ethanolic extract of *Tagetes erecta* was found to show significant increase in serum ALT, AST, ALP and bilirubin levels in carbon tetrachloride intoxicated groups compared to the normal control group. Ethyl acetate fraction of *T. ereta* at the dose of 400mg/kg oraly significantly decreased the elevated serum marker enzymes and level of bilirubin almost to the normal levels compared to carbon tetrachloride intoxicated group [15].

Ovicidal and Repellent activity: Elango et al., (2011) assessed the ethyl acetate, acetone and methanol extracts of *Andrographis paniculata*, *Eclipta prostrata* and *Tagetes erecta* leaves for oviposition-deterrent, **ovicidal and repellent** activities against malaria vector, *Anopheles subpictus* Grassi (Diptera: Culicidae) and emphasized on Mosquito control facing a threat due to the emergence of resistance to synthetic insecticides and potential Insecticides of plant origin which may serve as suitable alternative biocontrol techniques in the future [16].

Nematocidal activity: Wang et al., (2007) carried out the studies on **nematocidal activity** of marigold. This plant produces number of potentially bioactive compounds, among which α-therthienyl is recognized as one of the most toxic. This sulfur-containing compound is abundant in marigold tissues, including roots. It has nematicidal, insecticidal, fungicidal, antiviral, and cytotoxic activities, and it is believed to be the main compound responsible for the nematicidal activity of marigold. Nematicidal compounds apparently permeate from marigold root tissues into nematodes attached to the root, but they are also believed to kill nematodes found in the rhizosphere, the soil near marigold roots. Thus, marigold is believed to be most effective in suppressing plant-parasitic nematodes [17].

Husain et al., 2011 reported the **nematicidal** efficacy of four medicinal plants viz. *Azadirachta indica*, *Calotropis procera*, *Datura stramonium* and *Tagetes erecta* was ascertained for the control of *M. incognita*. All leaf amendments at different dosages significantly improved the plant growth characteristics of okra and reduced root-knot infections compared with the untreated control [18].

Insecticidal activity: Nikkon et al reported the **insecticidal activity** in *Tagetes erecta* flowers against a stored product insect pest, *Tribolium castaneum* (Herbst). The chloroform fraction showed highest toxicity against both 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* [19].

Anti-oxidant and Analgesic activity: Bashir and Gilani reported the **in vitro anti-oxidant and in vivo analgesic activities** (acetic-acid-induced abdominal writhing) on flower extracts of Tagetes erecta. The results revealed the presence of pronounced antioxidant potential on dose-dependent (100 and 300 mg/kg) and analgesic effect also. The antioxidant and analgesic activities obtained seem to be in good accordance with the medicinal uses of Aztec marigold as an anti-inflammatory and analgesic [20].

Cytotoxic activity: Curcumin and lutein were isolated from rhizomes *of Curcuma longa* and petals of *Tagetes erecta*. The isolated pigments were quantified spectroscopically and separated by thin layer chromatography. The active components of the pigments were further purified and identified by high performance liquid chromatography. *In vitro* cytotoxic activity of both extracts against Hep2 cancer cell lines were evaluated. Furthermore, the activities of both pigments in different concentrations against Hep2 cancer cell line were compared. The test sample showing cell viability of more than 97% at 0.078 mg/ml were considered to be less active at minimum concentration. The maximum viability of Hep2 cell line were 3.27% (curcumin) and 8.88% (lutein), respectively, which are most suitable to perform cytotoxic studies [21].

Antiepileptic Activity: Shetty et al. reported central nervous system (CNS) stimulatory activity of ethanolic extract of flowers of *Tagetes erecta* in rats. The findings suggested that ethanolic extract may reduce the seizure threshold in epileptic patients [1].

Fungitoxic activity: Kishore and Dwivedi reported fungitoxic activity of the essential oil of leaves of *Tagetes erecta* exhibited complete inhibition of the growth *Pythium aphanidermatum* Fitz., the damping-off pathogen, at a concentration of 2000 ppm [1].

Antimutagenic activity: Majia et al. reported antimutagenic activity of xanthophylls extracted from Aztec Marigold (*Tagetes erecta*) on 1-nitropyrene (1-NP) mutagenicity using the *Salmonella typhimurium* tester strain YG1024 in the plate-incorporation test [1].

CONCLUSION

Many Indian herbs are being used in traditional practices to cure various human ailments. *Tagetes erecta* has an important place among such anti-inflammatory medicinal plants, it can also be used in treating wound, cancer, liver disorder and diabetes. Furthermore, in future study, the isolated principles from *Tagetes erecta* needs to be evaluated in scientific manner using various innovative experimental models and clinical trials to understand its mechanism of action, in search of other active constituents, so that its other therapeutic uses can be widely explored.

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