WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 15, 346-354. Review Article ISSN 2277– 7105

TAGETES ERECTA (MARIGOLD) - A REVIEW ON ITS PHYTOCHEMICAL AND MEDICINAL PROPERTIES

L. Shiju, Prajwal K.*, Anjana Sajeev O., Dayananda H. S. and Meghana H. C.

Department of Pharmacognosy, Bharathi College of Pharmacy, Rajiv Gandhi University of Health Sciences, Bharathi nagara, maddur-571422, Mandya, Karnataka, India.

Article Received on
08 September 2022,
Revised on 29 Sept. 2022,
Accepted on 19 Oct. 2022
DOI: 10.20959/wjpr202215-26014

***Corresponding Author**
Prajwal K.
Department of Pharmacognosy, Bharathi College of Pharmacy, Rajiv Gandhi University of Health Sciences, Bharathi nagara, maddur-571422, Mandya, Karnataka, India.

ABSTRACT

Medicinal plants have been of great importance to the health care needs of individuals and their communities. This article discusses the medicinal values of *Tagetes erecta* (Compositae), also known as Genda Phul (marigold), reported during the period between 2006 and 2014. Different parts of the plant are useful in fevers, astringent, carminative, stomachic, scabies and liver complaints, diseases of the eyes, purify the blood, bleeding piles, rheumatism, colds and bronchitis. The plant *Tagetes erecta* contains various important phytochemical constituents from the different part of the plant. It shows different pharmacological activities like anti- inflammatory, nematicidal, antioxidant, insecticidal, hepatoprotective, antipyretic, wound healing, antibacterial, antimicrobial, antiepileptic and antifungal. This review discusses the investigation made by various workers related to chemical constituents, pharmacological action and toxicological studies, traditional and non-pharmacological uses of this plant for years.

KEYWORDS: Tagetes erecta, Genda, Marigold, Traditional medicine.

INTRODUCTION

Medicinal plants and derived medicine are widely used in traditional cultures all over the world and they are becoming popular in modern society as natural alternatives to synthetic chemicals.[1] Many of these natural products have biological activity that can involve in drug discovery and drug design. The Indian system of medicine is known as “Ayurveda” uses mainly plant-based drugs or formulations to treat various ailments, including cancer. 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.[2] India possesses almost 8% of the estimated biodiversity of the world with around 0.126% million species.[3] Many herbal remedies individually or in combination have been recommended in various medical treaties for the cure of different variety of diseases. Tagetes is a genus of annual or perennial, mostly herbaceous plants in the sunflower family (Asteraceae). The pant Tagetes erecta L (Fig.1) is known as Genda Phool or Marigold. Marigold is a spice native to India. Historically, marigold used as a spice all over India, China and Indonesia. These are rapid-growing annual flowering plants in height ranging from dwarfs of 6-8inch, to medium and taller and erect- growing plants with heights from 10 into 3ft. Different parts of the plants used to cure various diseases. Leaves are used in piles, muscular pain and kidney troubles.[4]

Fig.1: Whole plant of Tagetes erecta.

BOTANICAL STUDY

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

Species : Erecta

CULTIVATION

Tagetes erecta is also known as "Marigold Flowers". Flowers are used as colouring agent and condiment. Marigold is a hardly annual herb native to southern Europe, which can also be found growing in most temperature regions of the world. They grow upto 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 leaf can be sparsely toothed or wavy. The plant grows to height of one to five feet and is cultivated extensively in Asia, India, China and other countries with a tropical climate. 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 flowers to different countries like Japan, Sri Lanka, Iran, North African countries, US and UK. The genus Tagetes contains many taxes which are economically important as food, condiment and as colouring, medicinal and ornamental materials. The optimum time for cultivation for cultivation and harvesting of marigold is given in Table.1

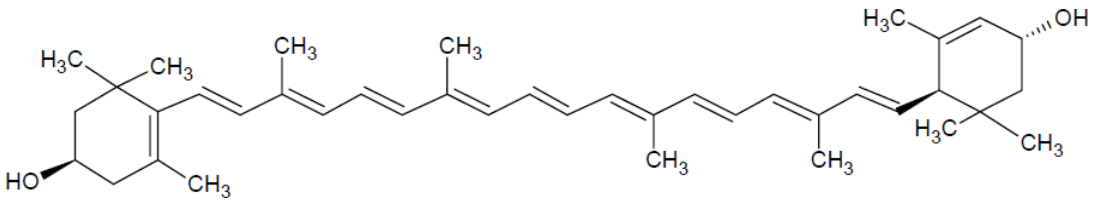
Table 1: The optimum time for cultivation and harvesting of marigold.

Season	Sowing time	Transplanting time	Harvesting time
Rainy	June-July	July-Aug	September-October, even up to December
Winter	September-October	October-November	November-December
Summer	January	February	March-April

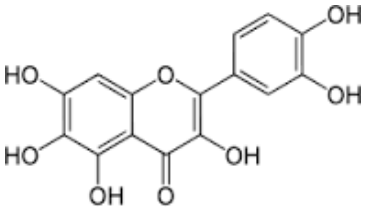
CHEMICAL CONSTITUENTS

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 constiturents and the main pigment of Tagetes Erecta. The flower consists of carotenoids consisting of lutein, zeaxanthin, neoxanthin plus violaxanthin, β-carotene, lycopene, α-cryptoxanthin, phyotene and phytofluene. Twenty two naturally occurring phytoconstituents were isolated from the various fractions of ethanolic extract of flower. They were β – sitosterol (Kojima *et al.,* 1990), β- daucosterol (Zhou *et al.,* 2007), 7-hydroxysitosterol (Greca *et al.,* 1990), lupeol (Liu and Kong, 2005; Xue *et al.,* 2008), erythrodiol (Antonio *et al.,* 1981), erythrodiol-3-palmitate (Shaheen and Aneela, 2004), 1-[5-(1-propyn-1-yl)-[2,2-bithiophen]-5-yl]- ethanone (Tsumotu *et al.,* 1986; Wei *et al.,* 1997; Hai and Yue, 2008), α- terthienyl (Coogan and Horn, 1965), quercetagetin (Huang, 2006),

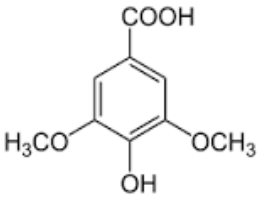
quercetagetin- 7-methyl ether (Vilegas *et al.*, 1999), quercetagetin-7-O-glucoside (Nair *et al.*, 1995), kaempferol (Xio *et al.*, 2006), syringic acid (Yang *et al.*, 2003), gallic acid (Huang, 2007), 3-β-galalctosyl disyringic acid (Huang, 2007), 3 α galalctosyl disyringic acid (Huang, 2007), 6-ethoxy-2,4- dimethylquinoline (Gallagher and Stahr, 1980), oplodiol (Werner and Kinzo, 1983; Takahashi and Takani, 2000), (3S,6R,7E)-hydroxy-4,7-megastigmadien-9-one (Brigida *et al.*, 2004), palmitin (Wu *et al.*, 2005), ethylene glycol linoleate (Wang, 2007), and n-hexadecane (Huang, 2007). Six compounds were identified from the stem as leaves of tagetdes erecta plant for methoxy-eupatolitin-3-O-glucoside, Kaempferitrin, rutin, beta-sitosterol, daucosterol and gallic acid. Twenty two naturally occurring phytoconstituents were isolated from the various fractions of ethanolic extract of flower.



Lutein



Quercetagetin



Syringic acid

Fig.2: Major chemical constituents of Tagetes erecta.

PHARMOCOLOGICAL ACTIVITIES

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

ANTIBACTERIAL ACTIVITY

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.[5]

ANTIMICROBIAL ACTIVITY

Ruddock et al reported the anti microbial activity in 19 plants used in Colombian traditional medicine for cutaneous infections, were screened against Neisseria gonorrhoeae (NG) by disc susceptibility assay. In all, 71% of the crude extracts exhibited antibacterial activity against the antibiotic susceptible NG strain, whereas 10% of the extracts inhibited penicillinase-producing NG strain GC1–182. The *Tagetes erecta* flower parts showed maximum inhibitory action against NG strain.[6]

ANTIOXIDANT 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 (Chivde et al., 2011). The essential oil of flowers of *Tagetes erecta* produced anti-oxidant activity by using DPPH, thiocyanate, ß-carotene bleaching, free radical scavenging activity and oxidation of deoxyribose assay (Pérez Gutierrez RO et al., 2006).[7]

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 CCl_4- intoxicated group. Histological changes in the liver of rats treated with 400 mg/kg of the extract and CCl_4 showed a significant recovery except for cytoplasmic vascular degenerations around portal tracts, mild inflammation and foci of lobular inflammation (Giri et al., 2011).[8]

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. In excision and burn wound models, the GE and TE treated animals 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 fastens the process of wound healing.[9]

NEMATICIDAL ACTIVITY

Husain et al 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.[10]

ANTIDIABETIC 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 e*xtracts increased the glucose levels were seen after 30 min and the hypoglycemic effect was observed only after 120 min (Rodda et al., 2011).[11]

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 helplessnesstest 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 (Shetty et al., 2009).[12]

ANTIFUNGAL ACTIVITY

Fungitoxic activity of the essential oil of leaves of *Tagetes erecta* exhibited complete inhibition of the growth *Pythium aphanidermatum,* the damping- off pathogen, at a concentration of 2000 ppm (Kishore et al., 2006).[13]

LARVICIDAL ACTIVITY

Marques et al reported the larvicidal activity of essential oil from *Tagetes erecta* against 3rd instars of *Aedes aegypti* and to determine the amounts of larvicidal thiophenes in all plant

tissues. The oil obtained by steam distillation and analyzed by gas chromatography/mass spectrometry showed 14 compounds. The main compounds were piperitone (45.72%), d-limonene (9.67%), and piperitenone (5.89%). The essential oil was active against larvae of *Aedes aegypti*, with LC_{50} of 79.78 µg/ml and LC_{90} of 100.84µg/ml. The larvicidal thiophene contents were higher in the roots and flowers as demonstrated by high-performance liquid chromatography analysis. Thus, *Tagetes erecta* constitutes a good source of varied compounds showing larvicidal activity against *Aedes aegypti*.[14]

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 (Shinde et al., 2009). Anti-nociceptive 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 (Chatterjee et al., 2009).[15]

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 (Shetty et al., 2009; Vallisuta et al., 2014). Different species of *Tagetes* have been found to possess antimicrobial, anti-inflammatory, hepatoprotective, wound healing, insecticidal, analgesic activities (Rodda et al., 2011; Ibrahim et al., 2011; Khulbe et al., 2013). 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 (Kishore and Dwivedi, 2006; Nikkon et al., 2011).

CONCLUSION

The literature survey revealed that the plant *T. erecta* is an important source of many pharmacologically and medicinally important phytoconstituents. There is huge scope for research; the plant could be further exploited in future as a source of useful phytochemical

compound for the pharma industry. There are many other traditional uses of *T. erecta* species in different traditional systems, which serves as basis for further studies. This review will definitely help the researchers to explore its different properties and interactions of *T. erecta* plant.

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