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A brief review on medicinal plant *Tagetes erecta* Linn

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ABSTRACT

Medicinal plants, its derivatives and characterized secondary metabolites are widely used for medicinal purposes, are becoming popular all over the world as a natural alternative to synthetically produced chemicals both in Traditional and Allopathic system of medicine. The beneficial effect of herbal medicine typically result from the combination of secondary metabolites produced in the herbs such as glycosides, alkaloids, flavonoids, tannins, gums etc. There is a need for the documentation of research work carried out on these herbs, hence forth timely review on the herb *Tagetes erecta* Linn. Methodology used in the review is based on the published original research articles through exhaustive search through scientific databases; Saudi Digital Library, Pubmed, and Science Direct etc. Reviewed parameters are ethonomedicinal uses chemical constituents and pharmacological and non Pharmacological studies on medicinal plant *Tagetes erecta* Linn.

INTRODUCTION

Medicinal plants, its derivatives and characterized secondary metabolites are widely used for medicinal purposes, are becoming popular all over the world as a natural alternative to synthetically produced chemicals both in traditional and allopathic system of medicine. The beneficial effect of herbal medicine typically result from the combination of secondary metabolites produced in the herbs such as glycosides, alkaloids, flavonoids, tannins, gums etc (Nadakarni 1954; Ben and Michael, 2009; Ahito 2015).

There is a need for the documentation of research work carried out on these medicinal plants, hence on time review on *Tagetes erecta* Linn. Tagetes is a genus of annual or perennial, mostly herbaceous plants in the sunflower family (Asteraceae). It was described as a genus by Linnaeus in 1753. The name *Tagetes* is originated from the name of the Etruscan Tages. The most commonly cultivated varieties of *Tagetes* are known variously as African marigold, taxonomically known as *Tagetes erecta* L.

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METHODOLOGY

Methodology used in the review is based on the published original research articles through exhaustive search through scientific databases; *Saudi Digital Library*, *Pubmed*, and *Science Direct* etc using different key words. Reviewed parameters are ethonomedicinal uses chemical constituents and pharmacological and non Pharmacological studies on medicinal plant *Tagetes erecta* Linn.

DESCRIPTION OF THE PLANT

Plant types

There are two basic types of marigold; *T. erecta* Linn and *T. patula* Linn. *T. erecta* is also known as American marigold contains larger flowers, *T. patula* also known as French marigold contains smaller flowers. Yellow, orange, golden or bicolored flowers are held either well above the fine textured dark green foliage or tucked in with the foliage. The plant grows to the height of 1 -3 feet and spreads to 0.5 feet. Leaves are arranged in opposite/subopposite pattern and leaf types are of odd pinnately compound. The margin is dentate and shape is oblong. The leaf blade length is less than 2 inches and colour of leaf is green. Colour of the flower is orange; yellow; golden; bicolored. Characteristic of flower is showy (Edward and Teresa, 1999).

Fig. 1: Flowers of *T. erecta*

Taxonomic Classification

Scientific classification of *T. erecta* L as follows
Kingdom: *Plantae*,
Order: *Asterales*
Family: *Asteraceae*
Genus: *Tagetes*
Species: *T. erecta*
Binomial name: *T. erecta* L. (George, 2010)

Common Names

Common names of *T. erecta* Linn used worldwide in different territories. African marigold; American marigold; Aztec marigold; big marigold; marigold or saffron marigold – English, wan shou ju –Chinese, tagète rose d'Inde – French, hohe Studentenblume – German, Studentenblume – German, senju-giku – Japanese, cheonsugug- Korean, maravilha – Portuguese, barchatcy prjamostojajcie –Russian, flor de muerto – Spanish, stor tagetes – Swedish, Gainda – Hindi (USDA, National Genetic Resource Programme)

Pharmacognostic, phytochemical and physicochemical parameters

Pharmacognostic, phytochemical and physicochemical parameters of Flowers of *T. erecta* as follows,

Macroscopic Characteristics

T. erecta flower has bright colour, an aromatic odour and distinctly bitter taste. It has the length of 2 -3 cm and of thickness 3 – 5.5 mm. Corolla is bright orange and calyx of dark green ovate type (Kadam *et al.*, 2013).

Phytoconstituents

Preliminary evaluation revealed that *T. erecta* flowers contain phytoconstituents such as tannins, phenolic compounds, Flavonoids, sterols, triterpinoids, saponins and alkaloids (George, 1865; Kadam *et al.*, 2013).

Physicochemical Parameters

Loss on drying 7.46 % w/w, Total ash 4.95 % w/w, Acid insoluble ash, 0.2 % w/w, Water soluble ash, 1.65 % w/w, Sulphated ash 1.3 % w/w, Water soluble extractive value 72% w/w Alcohol soluble extractive value 16.8 % w/w (Kadam *et al.*, 2013).

Transverse Section of Flower

The transverse section of calyx contains cortical portions and fibro vascular bundles. In the cortical portion the cells are rectangular and compactly arranged. The transverse section of the corolla contains epidermis, veins and vein reaches through the semen portion (Kadam *et al.*, 2013).

ETHNOMEDICINAL USES

Flowers of *Tagetes erecta* Linn used traditionally from ancient times. Different parts of this plant including flower are used in folk medicine to cure various types of diseases. Leaves are used as an antiseptic agent and also used in kidney troubles, muscular pain, piles, and applied to boils. The flower are used to cure fever, epileptic fits according to Ayurveda, astringent, carminative and stomachic, scabies and liver complaints and is 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 is also used in colds, rheumatism and bronchitis (Nadakarni 1954; Kadam *et al.*, 2013). The Cherokee used it as skin wash and for yellow dye (Nadakarni 1954; Kadam *et al.*, 2013; Ahito, 2015). In India juices of flowers occasionally used as blood purifier and remedy for piles. In Brazil flower and leaf infusion used as vermifuge. Mexicans used decoctions of flowers and leaves as diuretics and carminative. Aztecs used marigold for eye infections. In Brazil and Mexico, marigold used for joint pain and for muscular spasm. Other folklore uses of Tagetes include its use in anaemia, irregular menstruation, abdominal pain, muscular and bone pain. Internally Tagetes used for indigestion, colic, cough and dysentery. Externally used for ulcers, eczema, sore eyes and rheumatism (Shetty *et al.*, 2009; Manisha *et al.*, 2013; Ahito, 2015).

CHEMICAL CONSTITUENTS

Phytochemical constituents

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 *Tagetes erecta* plant as 4'-methoxy-eupatolitin-3-O-glucoside, kaempferitrin, rutin, beta-sitosterol, daucosterol and gallic acid (Zang and Zhang, 2010). About 19 phytochemicals were identified from methanol extract sample of leaves of *Tagetes erecta*. The major bioactive compound present are Tetra decanoic Acid, 2,6,10- Trimethyl 14 – ethylene – 14 – Pemtadecme, N – Hexadecanmic acid, 15-Hydroxy penta decanoic acid and Stigmasterol. About 31 phytochemicals were identified from methanol extract sample of flowers, the major are Hexadecanoic acid, 7-Tetra decenal (z), Vitamin E and Norolean – 12 – Ene (Devika and Justin, 2014). The major biocomponent of flowers of *Tagetes erecta* is carotenoid; includes all trans and cis isomers of zeaxanthines (5%), all trans and cis isomers of lutein, and lutein esters (88%) (Leigh *et al.,* 1999).

Volatile Constituents

Thirty-three components in leaf and stem oil and 34 components in flower oil were identified through GC and GC/MS analysis. The main characterized phytoconstituents were *β*-caryophyllene, terpinolene, (E)-ocimenone, (Z)-*β*-ocimene piperitenone, (Z)-ocimenone and limonene in leaf and stem and flower oils respectively (Sefidkon *et al.,* 2004). Piperitone (50.7%), piperitenone (13.2%) and (E)-β-ocimene (6.7%) were the predominant components in the leaf oil of *T. erecta* collected from Nigeria. The flower oil was characterized by the presence of 1, 8-cineole, α-pinene, α-terpineol, piperitone and sabinene as the major compounds (Isiaka, 2006).

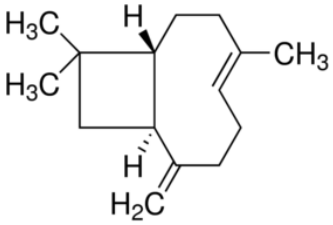

Fig. 2: β-*caryophyllene.*

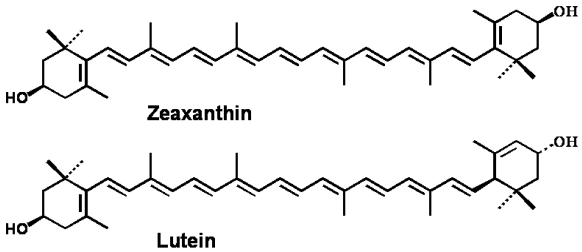

Fig. 3: Zeaxanthine & Lutein.

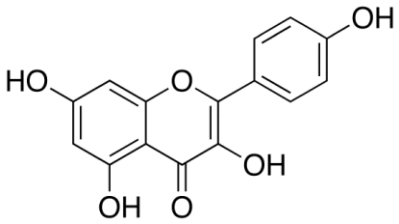

Fig. 4: kaempferol.

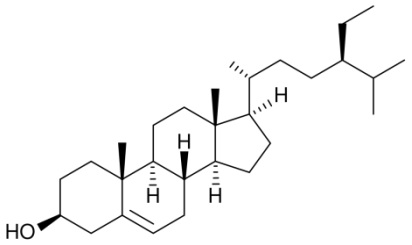

Fig. 5: β – Sitosterol

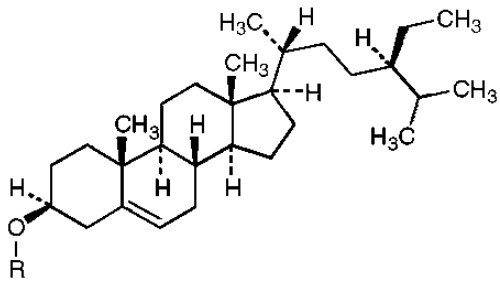

Fig. 6: β- daucosterol

TOXICOLOGICAL DATA

Both aqueous and ethanolic fractions of flowers of *T. erecta* found to be safe during acute toxicity study. The study was in accordance to OECD Guidelines 425, Up and down procedure using albino Wistar rats (Shetty, 2008; Shetty *et al.,* 2009; Manisha *et al.,* 2013). The LD_{50} value for chloroform fraction was found to be 8964.8 mg/kg body weight on Long Evan rats (Farjana *et al.,* 2009). The study carried out according to the *Lork D Method* of acute toxicity study (Lorke, 1983). Chloroform fraction of the drug did not alter biochemical and hematological parameters, no changes detected in histopathological studies during sub acute toxicity study (Farjana *et al.,* 2009). Seed and leaf extract of *T. erecta* shown LD_{50} value 357.43µg/insect against the strain *Tribolium castaneum* (Islam and Talukder, 2005).

PHRMACOLOGICAL DATA

Ethanolic extract of *T. erecta* reported to possess central nervous stimulant and antidepressant property through serotonergic pathway may decrease the seizure threshold if used in epileptic patients. The extract may precipitate seizure, hence use in epileptic patients is contraindicated (Shetty, 2008; Shetty *et al.,* 2009). Extract has significant antipyretic property, revealed that flowers of *T. erecta* may have used to treat febrile epilepsy in *Ayurveda* practice as reported by Nadakarni (Nadakarni, 1954; Shetty *et al.,* 2009). Fractions of chloroform, methanol, hydro alcoholic and ether fraction of *T. erecta* reported to possess analgesic and anti-inflammatory property. All the fractions were significant in acetic acid induced writhing in mice, hot plate method in mice, tail immersion method in mice and in carragenanan induced paw edema method in rats (Ghose *et al.,* 2004; Natarajan *et al.,* 2006; Chatterjee *et al.,* 2009; Charaborthy *et al.,* 2009; Shinde *et al.,* 2009). Hydro alcoholic fractions of leaves were evaluated on adult albino rats. Results shown significant wound healing activity, comparable to the

nitrofurazone control. The study supports the wound healing properties of the leaves as claimed in folkloric literature (Ghose *et al.,* 2004). The wound healing activity may due to free radical scavenging action and the phytoconstituents (flavonoids) present in it which either due to their individual or additive effect on the process of wound healing (Ibrahim, 2011). An ethanolic extract of flowers and volatile oil of plant were studied for antioxidant activity. Results shown antioxidant activity in all *in vitro* assays - DPPH, reducing power, and superoxide radical scavenging activity, with better reducing power than standard ascorbic acid (Rosa *et al.,* 2006; Basavraj, 2011). Ethyl acetate fraction of *T. erecta* shown significant hepatoprotective activity in carbon tetra chloride induced hepatopathy model (Giri *et al.,* 2011). Different fractions of flowers shown significant antibacterial, antimicrobial activity; volatile oil of the plant reported to possess fungitoxic activity (Majia *et al.,* 1997; Patrick *et al.,* 2011; Rhama and Madhavan, 2011). Hydro alcoholic extract of the flower possess antidiabetic and hypolipidemic activity (Rodda, 2011; Raghuveer *et al.,* 2011).

NON- PHARMACOLOGICAL DATA

Studies showed that *T. erecta* plant exhibited insecticidal (Sarin, 2004; Nikkon *et al.,* 2009), larvidical (Marcia *et al.,* 2011), mosquitocidal (Nikkon *et al.,* 2011) and nematicidal activity (Patrick *et al.,* 2011). Flower extract was found to contain biologically useful lutein compounds and studied for use as nutritional supplement and as poultry food colorant (Leigh, 1999). The petals yield a natural dye, the colorants consisting mainly of carotenoid-lutein and flavonoid-patuletin, with crude extracts used for dyeing textiles. The study describes an innovative dyeing process with net enhancement of dye uptake due to metal mordanting. Results suggest a potential for industrial application (Padma *et al.,* 2009).

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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