



IJPPR

INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH  
An official Publication of Human Journals

ISSN 2349-7203



Human Journals

Review Article

January 2021 Vol.:20, Issue:2

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## *Tagetes erecta*: A Revolution in Ayurveda



**IJPPR**  
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH  
An official Publication of Human Journals

ISSN 2349-7203



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**Submitted:** 05 December 2020  
**Revised:** 26 December 2020  
**Accepted:** 16 January 2021

**Keywords:** *Tagetes erecta*, phytoconstituents, marigold, carotenoids, phenolic

### ABSTRACT

*Tagetes erecta* is a species of flowering plant it belongs to the family Asteraceae. It is called commonly marigold all over the world. It is one of the most common flowering plants and can be found all over India. In other tropical countries like Sri Lanka, Mexico, African countries, etc. the marigold can be seen. It can be found in over 30 varieties and each has a significant medicinal use mentioned in Ayurvedic literature. Marigold maybe a common plant but has quite significant uses varying from cosmetics to medicine. It is a heavy blooming plant. It does not have any high maintenance concerning soil, climate, altitude, etc. It has proven its medicinal significance in various aspects like anti-bacterial, anti-viral, anti-cancer, anti-diabetic, etc. It consists of various phytoconstituents like carotenoids, phenolic compounds, flavonoids, thiophenes, etc. The objective of this article is to provide the essential knowledge about this plant and to develop a piece of basic knowledge.



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## INTRODUCTION:

History is rich with stories and fable about herbs. The uses of the medicinal plant have been used of thousands and thousands of years by a human. More than 70% of India's of 1.1billions population will use a non-allopathic system of medicine <sup>[1]</sup>. About 30% of the currently used therapeutic is of natural origin and source of many potent and powerful drugs <sup>[2]</sup>. The reason for choosing herb as the anti-bacterial source is the development of drug resistance in human pathogens against commonly used antibiotics <sup>[3]</sup>. Medicinal plants and derived medicines are widely used in traditional cultures all over the world. Often 56 species of marigold are found in the World. Mainly two are commonly found species of marigold "Calendula" and "Tagetes" genus.

There are about 33 species of genus 'Tagetes'. *Tagetes erecta*, commonly known as Marigold. Marigold plants are pretty humble and well-known flower. *T. erecta* belongs to the family Asteraceae (Compositae), most common plant all over the world. Marigold is a species native to India, locally known as 'Gendaphool' (gendu). *T. erecta*, native to Mexican known as 'Mexican Marigold' or 'Azetac marigold'<sup>[4]</sup>. *T. erecta* are widely called as 'African marigold'. The plants reach a height of between 20 and 110 cm. *T. erecta* are plant grown in wild as well as cultivating it for medicinal, ceremonial, decorative purpose. *Tagetes* species are colored, pungent odor, strong plants and also have great importance in the formulations aspects.

Different parts of these plants include flowers are used in folk medicine to cure various diseases. The leaves are reported to be effective against piles, kidney troubles, muscular pain, ulcers, and wounds. 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 <sup>[5][6]</sup>. It shows different pharmacological activities like Anti-bacterial activity, Anti-microbial activity, hepatoprotective activity, Insecticidal activity, mosquitocidal activity, nematocidal activity, Wound healing activity, Antioxidant and Analgesic activity<sup>[7][8][9]</sup>. Marigold is sometimes called for "flor de muerto", flower of death and represent pain and grief.

## TAXONOMICAL CLASSIFICATIONS:

- **Scientific name:** *Tagetes erecta*
- **Higher classification:** Marigold

- **Kingdom:** Plantae
- **Subkingdom:** Tracheobionta
- **Division:** Magnoliophyta
- **Class:** Magnoliopsida
- **Subclass:** Asteridae
- **Family:** Asteraceae
- **Order:** Asteroles
- **Genus:** Tagetes
- **Species:** erecta

**Common Names:**

- Commonly known as: African marigold, American marigold, Aztec marigold, Mexican marigold
- Assamese: narjiphula
- Bengali: genda
- Gujarati: galgoto
- Hindi: genda
- Kannada: chenduhuvu
- Kashmiri: sadbargi
- Malayalam: centumalli
- Manipuri: sanarei
- Marathi: jhenduphul
- Mizo: der-ken
- Nepali: genda
- Oriya: genduphula
- Persian: sad barg
- Punjabi: gainda
- Tamil: kancappucceti, tulukkaccevvanti
- Telugu: chendumalle
- Urdu: genda, gul-e-ashrafi.



## **DESCRIPTION:**

There are about 33 species of 'Tagetes' genus. *T. erecta* (African Marigold) is a frequently cultivated tender, herbaceous, annual herb or perennials or houseplant. Plant is hardy, aromatic, erect and branched and spread in a 1-3feet. The arrangements, of the leaf are opposite or sub-opposite. The types of leaves are odd-pinnately. The leaves blades are 30-120 mm overall, peduncles 30-100(150) mm; lamina yellow to orange sometimes, red-yellow. The margin of leafs are Dentate and leaf shape is oblongata. The growth rate of *T. erecta*, were moderate. The color of flower are yellow, Orange, or bicolor <sup>[10]</sup>. Flowers are single to fully double and large-sized with globular heads. For cultivation, the requirement of light comes through the Sun and water requirement is medium. The soils like clay; sandy loam are used for growth.

## **DISTRIBUTION:**

*T. erecta* is an important species found in India. The production of marigold is concentrated in the peninsula area. Andhra Pradesh, Uttar Pradesh is the best marigold cultivating state in India followed by Tamil Nadu. In India, the highest area of cultivation of *T. erecta* is in Andhra Pradesh. The maximum cultivating area of marigold is in Andhra Pradesh followed by Maharashtra, Karnataka, Uttar Pradesh, Kerala, Orissa and Tamil Nadu. The higher diversity of *T. erecta* is concerned in India and Thailand with, at least 50 species are found in each area followed by Africa, Mexico, Bangladesh, French, Myanmar, Indonesia and India.

## **CULTIVATION AND COLLECTION:**

Marigold is one of the most commonly grown plants, because of easy cultivation and wide adaptability.

### **Soil Requirements:**

Marigold can be successfully cultivated on a wide range of soils. The soil should be fertile, well-aerated, good water holding capacity, friable, and neutral soil reaction. An ideal soil for cultivation is sandy loam. Soil are rich well-drained and moist soil having PH 6.5-7.5 are best suitable for marigold cultivation. Acidic and saline soils are not suitable for cultivation.

**Climate:**

Marigold requires mild climate for luxuriant and profuse flowering. Flowers thrive best in hot and dry as well as humid weather conditions. They grow good throughout the year under both tropical and subtropical conditions. The ideal temperature for optimal growth is 15-29 degree Celsius. A very hot climate may infect the flowering growth.

**Preparation of soil:**

Land should be well prepared by plowing the field, till fine tilth of the soil is achieved for planting. Beds of convenient size are made to facilitate irrigation.

**Planting:**

There are two common methods of propagation of marigold.

- a) By seeds,
- b) By cuttings.

Crop raised from seeds is tall, vigorous and heavy bloomer, thus it is preferred over cuttings.

**Seed rate and Nursery rising:**

Seeds of wide range of common species, *T. erecta* are easily available and germinate quickly. The seeds are black in color and remain viable for about 1-2years for rising of seedlings, seeds should be sowed in pots, seeds boxes or raised nursery beds. Nursery beds are prepared by digging area and incorporating well rotten FYM. About 8 to 10 such bed are needed to raise the seedlings for one hectare. Before sowing the seeds, the soils are dusted outside of nursery beds, to avoid the removal of seeds by ants.

Seeds can be sown preferably in lines or by the broadcast method. Seeds should be sown thinly 6-8cm row to row. Care should be taken for proper distribution of seeds so to have a healthy seedling. Seeds to be covered with light soil or sieved leaf mold and watering should be done with rose can. The nursery beds should be remained moist during entire period, but not wet so watered accordingly. The quantity of seeds required depends upon the purity and germination rate.

**Sowing time:**

The seeds germinate 4-5 days after sowing and seed become ready for transplanting after 3-4 weeks for sowing. Depending on the environment Marigold crop can be raised three seasons. i.e. rainy, winter, and summer. These sowed seeds beds should be water frequently, after a 1 month of sowing.

The seasons of sowing and transplanting of seedling for obtaining plants at different seasons of a year are as under:

**Table 1. Seasons of seed sowing and transplanting of seedlings.**

Flowering seasons	Sowing time	Transplanting time
Rainy	Mid- June	Mid- July
Winter	Mid September	Mid of October
Summer	January- February	February to March

**Transplanting of seedlings:**

Marigold seedlings are easily transplanted and established in the field without much mortality. At the time of transplanting, the seedling normally of about one month old stocky and bear a 3-5 true leaves. Very old seedlings are not desirable because they have lost their juvenile phase in the nursery itself. Transplanting should be done in well-prepared land and soil is pressed around root zone to avoid the air space for better growth. After transplanting, a light irrigation is required. On light sandy soil irrigation is done a day before the transplanting is beneficial for better growth of seedlings.

**Spacing:**

Proper spacing between plants is for best growth, development and good flower production. For spacing of *T. erecta* should be 40cm ×30cm.

**Manures and fertilizers:**

Marigold is fast growing plant it requires an optimum dose of nitrogen and phosphorus and potash for better root development and quality of flower. The nitrogen from 0 to 40g/sq m, the number of flowers per plant and flower yield increased, with the increase in dose. The response of phosphorus was inconsistent on growth and flower production. The full dose of

phosphorus and potash should be given before transplanting while nitrogen is given in two intervals (30 and 60 days) after transplantation.

### **Weeding and Hoeing:**

Weeds are the measure problem in cultivating especially in rainy season after transplanting of marigold seedling in the field weeds grow faster than marigold in initial phase and cover large area in a few days. If the weeds are not removed on time a great loss take place in terms of growth and productivity of marigold. Normally 3 to 4 times weeding and hoeing are required to check during entire growth period and keep the field clean.

### **Irrigation:**

Marigold is an herbaceous plant. In lighter soil more frequent irrigation required than in the heavy soil. Season of planting determines the frequency of irrigation. Irrigate the crop in 7 to 8 days of interval but the quantity of water depends upon the soil and season.

### **Pinching:**

Pinching (removal of the terminal portion) is done as breaking of apical dominance mechanically to promote laterals and increasing the number of flowers. In African marigold, pinching is done after 30 to 35 days of transplanting enabled the plant to yields more flower.

### **Harvesting and packaging of marigold:**

Marigold flower should be plucked at proper stage is important during harvesting to keep the flower fresh for long time. The flower should be plucked when they bloom. Plucking is done by hand because flower stock is hollow structure that breaks easily when twisted between thumb and finger. Plucking of flower should be done in cool hours of the day either morning or evening. The productivity of plant is increased by regular plucking of flower. The flower yield of African marigold ranges from 200-225q/ha during rainy season, 150-175q/ha in winter, 100-120q/ha in summer can be obtained. Flower plucked should be cover with moist gunny bags if keep over night before taking in market.

### **Methods of plant extraction:**

The plant material was cleaned by dusting, sifting, and blowing to remove contaminants. The flower heads were separate in layers over a clean polythene sheet in cool climate conditions and facilitate drying and avoid microbial contaminations. After drying, flowers were cut into

small pieces and extract were prepared by maceration with a soxhlet apparatus using 60% ethanol at a temperature 80°C and 85°C for 4 hours. The solvent was removed with a rotary evaporator. A deep reddish-brown viscous residue obtained having a characteristic odour and extract are stored in dark place.

## **CHEMICAL CONSTITUENTS:**

### **PHYTOCHEMICAL CONSTITUENTS**

Phytochemical studies of various plants result in different chemical constituents, such as essential oils, carotenoids, flavonoids, thiophenes, and phenolic compound.

#### **Essential oil:**

The steam distillation of fresh leaf or flowers offers in essential oil with a strong, sweet, lasting odor. The essential oil of the leaves of *T. erecta* show the presence of d-limonene,  $\alpha$ -pinene,  $\beta$ -pinene, dipentene, ocimene,  $\beta$ -phellandrene, linalool, geraniol, methanol, tagetone, nonanal and linalyl acetate<sup>[11]</sup>. The essential oil of *T. erecta* further reported to contain camphene, sabinene, myrcene, (z)- $\beta$ -ocimene, (E)- $\beta$ -ocimene,  $\gamma$ -terpinene, terpinolene.

The essential oil of the flower of *T. erecta* showed the presence of d-limonene, ocimene, l-linalyl acetate, l-linalooltagetone, n-nonyl aldehyde, lutein<sup>[12]</sup>, further studies reported the presence of aromadendrene, phenylethyl alcohol, salicylaldehyde, phenylacetaldehyde.

#### **Carotenoids:**

The extract of *T. erecta* was mainly contains Lutein (64-80%) and small amount of antheraxanthin, zeaxanthin, cryptoxanthin,  $\beta$ -carotene. Lutein is a xanthophylls containing two 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 *T. erecta* flower extract was reported for 93% utilizable pigments, consisting of all trans and cis-isomers of Zeaxanthin(5%) all trans and cis-isomers of lutein, and lutein esters(88%)<sup>[13]</sup>.

#### **Flavonoids:**

The flowers of *T. erecta* show the presence of 6-hydroxykaempferol-7-O- $\beta$ -D alloside. The aqueous methanolic extract of the defatted of flower heads and leaves of *T. erecta* show



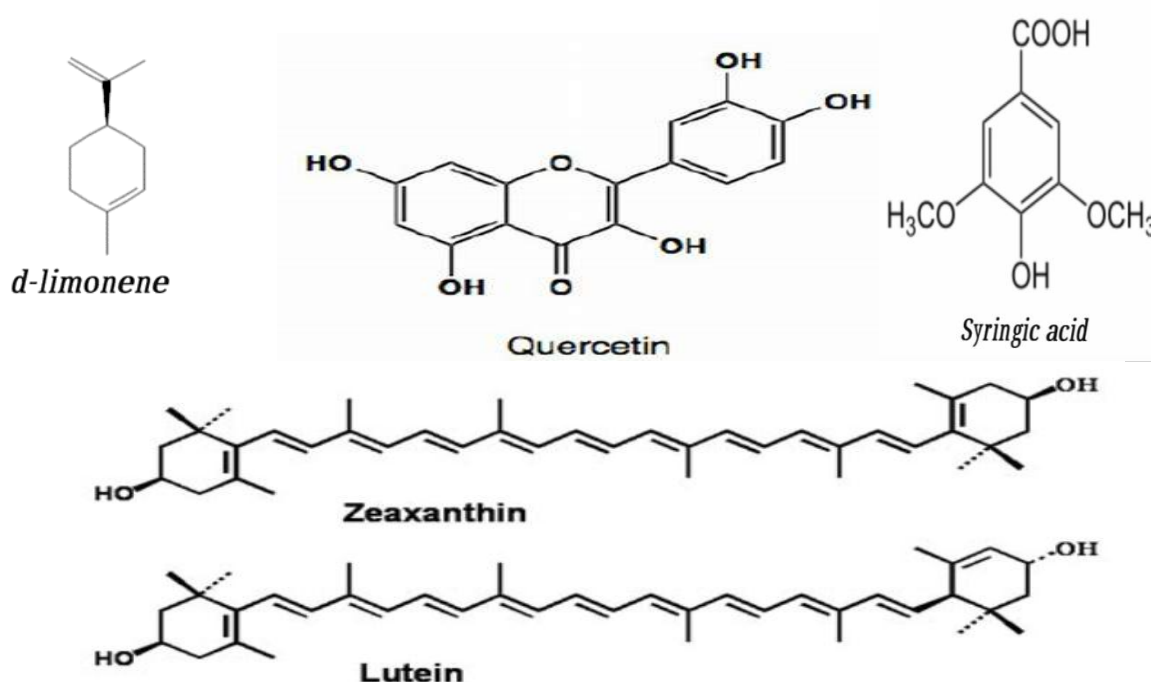
quercetagenin(0.4%) , quercetagenin and 6-hydroxykaempferol-7-O-rhamnoside and kaempferitrin and later quercetin was also reported from the dried flowers of *T. erecta*<sup>[14]</sup>.

### Thiophenes:

Thiophenes are also been isolated from the hairy roots culture of *T. erecta* (Flores, 1992) 5-(but-1-ol-3-ynyl)-2,2'-bithienyl. Furthermore, a new bithienyl derivative viz. 2-hydroxymethyl-non-3-ynoic acid 2-[2,2']-bithiophenyl-5-ethyl ester was isolated from the ethyl acetate fraction of the roots of *T. erecta*<sup>[15]</sup>.

### Phenolic compound:

The dried flower of *T. erecta* revealed the presence of phenolic compound such as syringic acid (Tripathy and Gupta, 1991) in addition to various other components such as ethyl gallate and methyl-3,5-dihydroxy-4-methoxy benzoate<sup>[16]</sup>.



### PHARMACOLOGICAL ACTIVITY:

*T. erecta* reported various pharmacological activities which are shown below:

#### Anti-oxidant Activity:

*In-vivo*, ethanolic extract of *T. erecta* flowers shows activity by three different assays like DPPH, reducing power and superoxide radical scavenging activity at different concentrations.

In all three assay, *T. 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 ethanolic extract of *T. erecta* demonstrated antioxidant property in all the *in vitro* models. The essential oil of flowers of *T. erecta* produced antioxidant activity by using DHPP, thiocyanate,  $\beta$ -carotene and oxidation of deoxyribose assay <sup>[17]</sup>. The antioxidant activity of the extracts and the composition of antioxidant compounds in the extracts were investigated. Carotenoids such as lutein extract from marigold (*T. erecta*) showed the antioxidant activity as whereby they reported as scavenge superoxide radical also observed.

### **Antibacterial activity:**

The anti- bacterial activity of different solvents of *T. erecta* flowers show the actions against *Alcaligenes faecalis*, *Bacillus cereus*, *Campylobacter coli*, *Escherichia coli*, *Klebsiella pneumoniae*, *Streptococcus pyogenes*. The flavanoidspetulitrin is one of the potential elements for its anti-bacterial activity <sup>[18]</sup>.

Nutrient agar medium was used for antibacterial assay and the inoculums was prepared by inoculating 0.2ml of overnight cultures of each organism into 20ml of sterile nutrient broth and incubated at 37°C for 3-5 hrs to standardize the culture to produce 10<sup>6</sup> cfu/ml. Antibacterial activity of the flavonoids (10 mg/100ml) was tested by diffusion assay. Antibacterial activity of the flavonoids (10 mg/100ml) was higher for all the tested strains than that of the antibiotic tetracycline. Inhibition is maximum for *Klebsiella pneumoniae*(29.50 mm) and minimum for *Pseudomonas aeruginosa*(21.00 mm) <sup>[19]</sup>. The flower parts showed maximum inhibitory action against *Neisseria gonorrhoeae* strain.

### **Antimicrobial Activity:**

The essential oil of the leaves and stems of *T. erecta* showed antimicrobial activity against four gram positive and fifteen gram negative pathogenic bacteria viz. (*Staphylococcus aureus*, *Bacillus mycoides*, *Bacillus pumilus*, *Bacillus subtilis*, *Salmonella paratyphi A*, *Salmonella paratyphi B*, *Salmonella paratyphi C*, *Salmonella typhi H*, *Salmonella enteritides*, *Salmonella flexneri*, *Salmonella typhimurium*, *Escherichia coli*, *Klebsiella pneumoniae*, *Shigella sonnei*, *Shigella schimizzii*, *Shigella shigae*, *Vibrio cholerae Inawa*, *Vibrio cholerae Ogawa*, *Vibrio cholera Eltor* and *Xanthomonas campestris*) strains with minimum inhibitory concentration (MIC) for the extract ranging between 12.5-100  $\mu$ g/mL. The tincture prepared from its leaves and flower and its n-hexane, ethanol and aqueous extract were tested for

inhibitory effect against *Vibrio cholera* whereby it was reported that the best antimicrobial activity [20].

Traditionally, the antimicrobial activity for cutaneous infections was against screened against *Neisseria gonorrhoeae* (NG) by disc susceptible 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 flower parts *sT. erecta* showed maximum inhibitory action against NG strain [21].

### **Hepatoprotective activity:**

The hepatoprotective activity of flowers of regards by car *T. erecta* carbon tetrachloride induced hepatopathy model was determined. The CCl<sub>4</sub> treated showed an increase in serum ALT, AST, ALP and bilirubin levels. Ethyl acetate fraction of *T. erecta* (EATE) at the dose of 400 mg/kg orally decreased the elevated serum marker enzymes and level of bilirubin almost to the normal level compared to the CCl<sub>4</sub>-intoxicated group. Historical changes in the liver of rats treated with 400 mg/kg of (EATE) extract and CCl<sub>4</sub> showed a significant recovery except for cytoplasmic vascular degenerations around portal tracts, mild inflammation and foci of lobular inflammation. Phytoconstituents such as flavonoids, terpenoids and steroids are responsible for the observed hepatoprotective activity [22].

### **Wound healing activity:**

The activities of the marigold extract on the wound healing of albino Wister 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 extract *T. erecta* increased platelet count, white blood cell count ( $p > 0.05$ ) and shortened the bleeding and clotting times.

The treatment with hydroalcoholic extract of *T. erecta* have beneficial influence the various phase of wound healing fibroplasias, collagen synthesis and wound contraction result in faster healing The crude extract of *T. erecta* significantly stimulated wound contraction, breaking strength of the incision wound and increased in the dry granulation weight in the treated group compared with extract of *T. erecta* [23].

*T. erecta* extract (250 and 500 mg/kg) showed significantly increased wound breaking strength in incision wound model and wet and dry granulation tissue weights, breaking strength in a dead space wound model [24].

#### **Insecticidal Activity:**

The aqueous and methanolic extract of leaves, stem and buds of *T. erecta* reported for insecticidal activity against the second stage larvae of *Tylenchulus semipenetrans*. *T. erecta* flowers against a stored product insect pest, *Tribolium castaneum* (Herbst)<sup>[25]</sup>. The chloroform fraction showed highest toxicity against both the larvae and adults of *Tribolium castaneum* followed by petroleum ether fraction and ethanol extract. Thus the flower of *T. erecta* might be pesticide against *Tribolium castaneum*.

#### **Mosquitocidal activity:**

The Mosquitocidal activity in Ethanolic, chloroform and petroleum ether extracts of *T. erecta* flower against different strains of *Culex quinquefasciatus*. Among the tested samples the chloroform soluble fraction showed the highest toxicity and consistently the LC50 values (14.14µg/mL, 1.706µg/mL, 36.88µg/mL and 75 µg/mL) and for all instars larvae of *Cx. quinquefasciatus*. The larvae showed comparative tolerance in the course of increasing age and time. From this they concluded that the flower of *T. erecta* having good mosquitocidal activity<sup>[26]</sup>.

#### **Nematocidal Activity:**

Nematicidal efficacy of four medicinal plants viz. *Azadirachta indica*, *Calotropis procera*, *Datura stramonium* and *T. erecta* were 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 [27].

#### **Larvicidal Activity:**

The larvicidal activity of essential oil from *T. erecta* establish against 3rd instars of *Aedes aegypti*, the oil obtained by steam distillation and analyzed by gas chromatography or mass spectrometry showed 14 compounds. The main compounds are piperitone (45.72%), d-limonene (9.67%) and Piperitenone (5.89%).The essential oil was active larvae of *Aedes aegypti*, with LC50 of 79.78 µg/ml and LC90 of 100.84µg/ml. The larvicidal thiophenes contents were higher in the roots and flowers as demonstrated by high-performance liquid

chromatography analysis. Thus, *T. erecta* constituents a good source of varied compounds showing larvicidal activity against *Aedes aegypti*<sup>[28]</sup>.

#### **Anti-hyperlipedemic Activity:**

The antihyperlipidemic activity of hydro alcoholic extract of *T. erecta* in hyperlipidemic rats at a dose of 200 and 400 mg/kg. Hyperlipidemic was induced by cholesterol 25 kg/day. Lovastatin (10mg/kg/day) was used as standard. Blood samples were collected from rats in all groups on 30th day and estimated for their serum cholesterol, serum triglyceride, serum HDL and LDL levels using standards procedures. From the study it was observed that administration of *T. erecta* extracts significantly decreased all the hyperlipidemic parameters in rats<sup>[29]</sup>.

#### **Anti-diabeticActivity:**

Hydroalcoholic extract of *T. erecta* was studied for its anti diabetic activity by inducing diabetes using single intraperitoneal 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. The administration of *T. erecta* extracts showed increase in glucose levels after 30 min and hypoglycemia effect was observed only after 120 min<sup>[30]</sup>.

#### **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<sup>[31]</sup>.

#### **Anti-epileptic Activity:**

**The ethanolic extract extract of *T. erecta* showed antiepileptic activity.**

EtE of flowers of the *T. erecta* is considered to be effective in the treatment of epilepsy as in Ayurveda, but the phytoconstituents in EtE devoid of anti-epileptic activity, but they found with phytoconstituents which decreases seizures threshold such menthol, indole alkaloids and verbenone. Menthol is already providing to be proconvulsant in nature, indole alkaloids are CNS stimulants thus may reduce seizures threshold and verbenone is found to be antidepressant.

*T. erecta* may have CNS stimulant property; may be due to the presence of indole as one of the major phytoconstituents. Due to the CNS stimulants and antidepressant property of the EtE; may decrease the seizures thresholds, it may be cautious if used in epileptic patients [32].

#### **Anti-fungal activity**

Fungitoxic activity of the essential oil of leaves of *T. erecta* exhibited complete inhibition of the growth *Pythium aphanidermatum*, the damping-off pathogen, at a concentration of 2000 ppm<sup>[33]</sup>.

#### **Anti-depressant activity**

*T. erecta*, the marigold, showed some anti-depressant activity. Some study was carried out to elucidate the antidepressant effect of hydroethanolic 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 [34].

#### **Ovicidal and repellent activity:**

The ethyl acetate, acetone and methanol extract of *T. erecta* leaves for oviposition- deterrent, Ovicidal and repellent activity against malaria vector, *Anopheles subpictusgrassi* and emphasized on mosquito control facing a threat due to the emergence of resistance to synthetic insecticides and potential insecticides of plants origin which may serve as suitable alternative bicontrol techniques in the future<sup>[35]</sup>.

#### ***Medicinal Properties of Marigold as per Ayurveda***

- **Rasa** (Taste) - Tikta (Bitter), Kashya(Astringent)
- **Guna**(Qualities) - Laghu(Light for digestion), Ruksha(Dry in nature)
- **Veerya** (potency) – Sheeta (cold)
- **Vipaka**(After digestion taste conversion) – Katu (Undergoes pungent taste after digestion)
- **Karma** (Actions) – KaphapittaShamaka (Reduced vitiated Kapha and Pitta dosha).

**Table 2; Physiochemical parameters of *T. erecta***

Parameter studied	Flower powder (values obtained on dry weight basis w/w)
Loss on drying (moisture content)	7.46% w/w
Total ash	4.95% w/w
Acid insoluble ash	0.2% w/w
Water soluble ash	1.65% w/w
Water soluble extractive value	72% w/w
Alcohol soluble	16.8% w/w

***Traditional uses:***

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 carminative, diuretic and vermifuge. A decoction is used to treat colds and mumps. It is applied externally to treat skin diseases, conjunctivitis and sore eyes. The root is laxative.

***Toxicity studies***

Nikkon et al reported the sub-acute toxicity studies in chloroform fraction from ethanol extract of *T. erecta* flower by solvent-solvent partitioning method. The subacute toxicity of chloroform fraction was evaluated on Long Evan's rats at 200 and 400 mg/kg doses and the results obtained from chloroform fraction treated rats were compared with untreated controls. Treatment of chloroform fraction at 200 and 400 mg/kg doses did not make any significant alterations on the hematological and biochemical parameters of rats when data were compared with that of untreated controls. Histopathological examination also showed no detectable changes in liver, kidney, heart and lung of chloroform fraction treated rats. This study revealed that the chloroform fraction of *T. erecta* had no toxic effects [36].



## REFERENCES:

1. Thomas paul, A Devasagayam, Radiation Biology and Health sciences Division, Bhabha Atomic Research centre, Mumbai 2006.
2. Research guidelines for evaluating the safety and Efficacy of Herbal medicines, world health organization, Regional office for the western pacific, Manila 1993, 1-2.
3. Erdogru OT. Antibacterial activities of some plants extracts used in folk medicine. *Pharmaceutical Biology*, 2002; 40: 269-273.
4. *T. erecta* Natural resources conversation service Plants database. USDA. Retrieved 7Dec.2015
5. Kirtikar KR, Basu BD. *Indian Medicinal plants*, Lalit mohan Basu, Allahabad, India 1987, pp 1385-1386.
6. Gha Edward FG, Teresea H. 1999 *T. erecta*. Factsheet Eps-569, Institute of Food and agriculture, University of Florida.
7. ni A. *Medicinal plants of Bangladesh. Chemical constituents and uses*, 2<sup>nd</sup> ed., Asiatic society of Bangladesh, Dhaka, 1998; pp 301-302.
8. Rhama S, Madhavan S. Antibacterial activity of the flavonoid, patulitrin isolated from flowers of *T. erecta* L. *Int J PharmTHech Res* 2011; 3:1407-9.
9. Kiranmai M, Ibrahim M. Antibacterial potential of different extracts of *T. erecta* Linn. *Int J pharm* 2012; 2: 90-6.
10. Gopi G, Elumalai A, jayasri P. A concise review on *T. erecta*. *Int J phytopharmacy Res* 2012; 3:16-19.
11. Baslas, R.K. and Singh, A.K., (1980). Chromatographic Separation of *T. erecta*, 24, pp. 163-165.
12. Sharma, M.L., Nigam, M.C., Handa, K.L and Chopra (1962). Essential oil of *T. erecta*, perf. *Essential oil Rec.*, 52, pp. 561-562.
13. Hadden, W.L., Watkins, R.H., Levy, L.W., Ragalado, E., Rivadeneira, D.M., Van Breemen, R.B. and Schwartz, S.J., (1999). Carotenoid composition of marigold (*T. erecta*) flower extract used as nutritional supplement, *J. Agric. Food Chem.*, 47, pp. 4189-4194.
14. Tripathy, A.K. and Gupta, K.R., (1991). Plant Phenolics of *T. erecta*, *Fitoterapia*, 62, pp. 91-92
15. Vasudeva, N., Gupta, P. and Sharma, S.K., (2007). A new bithienyl constituent from *T. erecta* Linn. *Roots, Indian J. Heterocy. Ch.*, 16, pp. 303-304
16. Tripathi, A.K., Khan, S.A., Vaishnava, M.M. and Gupta, K.R., (1992). Compounds of taxonomic significance in *Tagetes*, *Fitoterapia*, 63, p. 85.
17. Martha R, Gutierrez P, Luna HH, et al. Antioxidant activity of *T. erecta* essential oil. *J Chilean Chem Soc* 2006; 51:883-6
18. S. Rhama and S. Madhavan. Antibacterial Activity of the Flavonoid-patulitrin isolated from the flowers of *T. erecta* L. *International Journal of Pharm Tech Research*, 3(3), 2011, 1407-1409.
19. Bauer A.W. Kirby M.D.K. Sherris J.C. and Trick M., (1966); Antibiotic susceptibility testing by standard single disc diffusion method; *American J. Clin. Pathol*; 45(4); 493-696
20. Gupta, P. and Vasudeva. N., (2010); In vitro Antiplasmodial and antimicrobial potential of *T. erecta* roots; *Pharma Biol*; 48(11); 1218-23
21. Patrick RS, Marijo C, Sandra R (2011). Antimicrobial Activity of flavonoids from *Piper lanceaefolium* and other Colombian medicinal plants against antibiotics susceptible, 38, 88
22. Giri RK, Anindya Bose and Subrat Kumar Mishra., (2011); Hepatoprotective Activity of *T. erecta* against carbon tetrachloride- induced hepatic damage in rats; *Acta Poloniae Pharmaceutica n Drug Research*; 68.
23. Chatterjee S., Prakash T, Kotrsha D, Rao RN, Goli D., (2011); Comparative Efficacy of *T. erecta* and *Centella asiatica* Extracts on Wound Healing in Albino Rats; *Scientific Research*; 2(4); 138-1); 999-1003.
24. Alam M.M., S. A. Islam., Y. Mohammed., N. S. Juyenaand., M. A. Hashim., (2005); Comparative Efficacy of Two Medicinal Plant Extracts and an Antibiotic on Wound Healing; *Pakistan Journal of Biological Sciences*; 8(5); 740-743.
25. Farjana Nikkon M, Rowshanul Habib M, Ezaul Karim and Zennat Ferdousi. Insecticidal activity of flower of *T. erecta* against *Tribolium castaneum* (Herbst). *Research Journal of Agriculture and Biological Sciences*, 5(5), 2009, 748-753.
26. Rahman M, Ekramul Haque M., (2009); *T. erecta* Linn and its Mosquitocidal Potency against *Culex quinquefasciatus*; *Asian pacific Journal of Tropical Biomedicine*; 1(3); 186-8.



27. FarjanaNikkon M, Rowshanul Habib, ZahangirAlam Saud and Rezaul Karim M, (Medicinal Plants: Conservation & Sustainable Use) Efficacy Evaluation OfAzadirachta Indica, Calotropis Procera, Datura Stramonium and *T. erecta* Against Root-Knot Nematodes Meloidogyne Incognita. Pak. J. Bot, 43, 2011, 197-204.
28. Marcia M, Marques M, Selene M, Morais I caro G, Vieira P, Mariano G, Vieira P, Ana Raquel, silva A, Raimudo Rafael De Almeida., (2011)Larvicidal activity of *T. erecta* against Aedes aegypti; Journal of the American Mosquito Control Association; 27(2); 156-158.
29. Raghuvveer R., (2011); Antihyperlipedemic effect of *T. erecta* in cholesterol fed hyperlipedemic rats; Sch Res lib; 3(5); 266-70.
30. Raghuvveer R., (2011); Antidiabetic potential effect of *T. erecta* whole plant in streptozotocin induced diabetic rats; J Pharm Res; 3(3); 1407-
31. Vallisuta O, Nukoolkarn V, Mitrevej A, Sarisuta N, Pimporn L, Phrutivorapongkul P, Sinchaipanid N (2014). In vitro studies on the cytotoxicity, and elastase and tyrosinase inhibitory activities of marigold (*T. erecta* L.) flower extracts. Experimental and Therapeutic Medicine, 7, 246–250
32. James EF, Kathleen P, Anne VP, Sean CS., (1996); Martindale: The extra Pharmacopoeia. London Royal pharmaceutical society; 21; 363-366.
33. Kishore N, Dwivedi RS (2006). Fungi-toxicity of the essential oil of *T. erecta* against Pythium aphanidermatumfitz. the damping of the pathogen. Flavour and Fragrance Journal, 6, 291-294.
34. Khulbe A, Pandey S, Sah PS (2013). Antidepressant like action of the hydromethanolic flower extract of *T. erecta* in mice and its possible mechanism of action. Indian Journal of Pharmacology, 45, 386–3908.
35. Elango G R., (2011); Efficacy of indigenous plant extracts on the malaria vector Anopheles subpictus Grassi (Diptera: Culicidae); Indian J Med Res; 134; 375-83.
36. FarjanaNikkon, Rowshanul Habib M, ZahangirAlam Saud, Rezaul Karim, Apurba Kumar Roy, Shahriar Zaman. Toxicological evaluation of chloroform fraction of flower of *T. erecta* on rats. Int. J. Drug Dev & Res, 1(1), 2009, 161-165.

