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Qualitative phytochemical analysis of *Tagetes erecta* L. flowers and leaves in different solvents

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Abstract

The present study focuses on the qualitative phytochemical analysis of the flower and leaves of *Tagetes erecta* (marigold) from the Asteraceae family, known for its ornamental and medicinal properties. The research aims to identify and compare bioactive compounds in the plant's flower and leaves, contributing to its potential therapeutic applications. Standard phytochemical screening methods were employed to detect the presence of alkaloids, flavonoids, tannins, saponins, phenols, glycosides, terpenoids, and steroids in both the flower and leaves. Fresh plant materials were processed and subjected to different solvent extraction using aqueous, methanol, and chloroform extractions. The extracts underwent qualitative tests for each phytochemical group. Results showed that both flower and leaves of *Tagetes erecta* contain various phytochemicals. Alkaloids, flavonoids and phenols were found in both parts. Tannins were found in significant amounts in flowers. Saponins were identified in methanol and chloroform extracts of both parts. Other bioactive compounds like glycosides, terpenoids and steroids were also detected.

Key words : Phytochemical, *Tagetes erecta*, bioactive compound, alkaloids.

The genus '*Tagetes*' (family Asteraceae) comprises about 50 species of annual or perennial herbaceous plants. *Tagetes erecta* commonly known as marigold or "Genda Phul," is a stout, branching herb native to Mexico and other warm regions of the Americas, now also found in India and Bangladesh. These fast-growing plants range from 6 inches to 3 feet in height, featuring large, double pompon-like flowers up to 5 inches across. They bloom from midsummer to frost and are popular in gardens for their aromatic essential oil, used in high-grade perfumes[8] and has long been used in traditional medicine[3]. Phytochemicals are essential non-nutrient plant chemicals that help prevent diseases and support health. The detection of these compounds in *Tagetes erecta* highlights its

potential as a source of natural antioxidants and medicinal agents. Previous research has demonstrated the plant's effectiveness in traditional treatments for wounds, ulcers, and digestive issues[6]. This analysis utilizes established qualitative methods, such as Dragendorff's test for alkaloids, ferric chloride test for phenolics, and frothing test for saponins, to thoroughly examine the phytochemical components of *Tagetes erecta*[7]. Essential oil from marigold is known for its effective free radical scavenging properties, while its ethanol extract has shown efficacy against parakeratosis. There is a growing global interest in the research and application of medicinal plant components, spanning traditional, modern, and industrial sectors[1,12,14]. Numerous studies indicate that long-term dietary intake of polyphenols through food or supplements can help protect against various chronic diseases[15]. Edible flowers are defined as non-toxic and safe plant parts that provide health benefits when included in the human diet[2,9]. These flowers can be eaten as part of a dish, such as in salads, vegetables, and beverages, used fresh as garnishes for various cooked meals, or as fillings in stir-fried dishes[4]. This study aims to conduct a qualitative phytochemical analysis of *Tagetes erecta* to identify its bioactive compounds, such as flavonoids, alkaloids, tannins, saponins, and phenolics, which contribute to its therapeutic effects[11].

Collection and processing of plants :

The leaves and flowers of *Tagetes erect* were collected from the southern side of P.G Dept. of Botany, campus of Patna Science College, Patna Bihar. *T. erecta* flowers and leaves were washed thoroughly with distilled water and allowed to shade dry and then wrapped with aluminium foil and kept in incubator, Dried leaves and flowers were grinded into fine powder with the help of blender.

Extract preparation in different solvents :

The powder of dried flowers and leaves were dissolved in 100 ml distilled water, 50% methanol and in chloroform, and filtered through Whatman filter paper. The residue were resuspended in all three fresh solvents and the process repeated till the residue turned colourless. After the initial extraction, collected filtrate was dried under rotaevaporator under reduced pressure and temperature at 30-45 °C, and kept at 4 °C for further use.

Test for Phytochemicals :

Test for alkaloids:

A) Dragendorff's test- To 1 ml of plant extract, few drops of Dragendorff's reagent was added (Potassium bismuth iodide solution). Formation of reddish precipitate confirms the presence of alkaloids.

B) Mayer's test - To 1ml of plant extract, few drops of Mayer's reagent was added (potassium mercuric iodide solution). Formation of white precipitate confirms the presence of alkaloids.

Test for Flavonoids :

A) Alkaline reagent test- To 1 ml of plant extract, 2 ml of 2N sodium hydroxide was added. Formation of yellow colour indicates the presence of flavonoids.

B) Ferric chloride test- To 1 ml of plant extract, few drops of ferric chloride solution was added. Formation of green colour indicates the presence of flavonoids.

Test for terpenoid: chloroform test- To 1 ml of plant extract, 3ml of chloroform, then 3ml of concentrated sulphuric acid was added and then solution was allowed to heat for 2 minutes. Formation of reddish- brown colouration indicates the presence of terpenoid.

Test for carbohydrate: Molisch's test- To 1ml of plant extract, 2ml of Molisch's reagent and then few drops of concentrated sulphuric acid were added. Presence of purple or reddish colour confirms the presence of carbohydrates.

Test for protein: Biuret test- To 1 ml of sample 4% NaOH solution and few drops of 1 % copper sulphate solution were added. Formation of violet colour confirms the presence of protein.

Test for tannin : To 1ml of plant extract, 2 ml of 5% ferric chloride was added. Presence of greenish-black or dark blue indicates the presence of tannins.

Test for saponin : Froth test- To 1ml of plant extract, 2 ml of distilled water was added and then the solution was shaken lengthwise in a graduated cylinder for 10 minutes. Formation of foam confirms the presence of saponin.

Test for Glycosides : To 1ml of plant extract, 2 ml of chloroform and 10% ammonia solution were added. Formation of pink colour confirms the presence of glycosides.

Test for steroids : To 1ml of plant oil sample, 1 ml of chloroform and few drops of concentrated sulphuric acid were added. Appearance of brown ring indicates the presence of steroids.

Test for coumarins : To 1ml of plant extract, 1 ml of 10% NaOH was added, formation of yellow colour indicates the presence of coumarins.

Naturally occurring plants are rich in phytochemicals such as alkaloids, terpenoids, flavonoids, and tannins. These compounds exhibit various therapeutic properties, including anti-inflammatory, antioxidant, antimicrobial, cardioprotective, neuroprotective, and anti-hyperglycemic activities[10]. Different plant parts contain distinct bioactive components. *Tagetes erecta* for instance, is renowned for its antioxidant, anti-diabetic, anti-cancer, and anti-inflammatory activities[5]. In the present study, the qualitative analysis of phytochemical in *T. erecta* leaves and flowers was conducted using three solvent extracts: aqueous, methanol, and chloroform. The analysis revealed the presence of various phytochemical including alkaloids, flavonoids, terpenoids, carbohydrates, proteins, tannins, saponins, glycosides, steroids, and coumarins[13]. The table summarizes the phytochemical content in *T. erecta* leaves and flowers across different solvent extracts. Alkaloids were detected in both plant parts, suggesting their potential use in analgesic and antispasmodic treatments. Flavonoids, known for their anti-oxidant properties, were abundantly present in both extracts, indicating their possible role in combating stress-related diseases. Tannins, which are known for their astringent properties, were also found in significant amount in flowers of both methanol and chloroform extracts, further validating the traditional use of the plant in treating wounds and inflammations. Saponins, identified in both flower and leaf of methanol and chloroform

Fig: Phytochemical analysis of *Tagetes erecta* in different solvents.

Phytochemical Tests	Aqueous		Methanol		Chloroform	
	Flower	Leaf	Flower	Leaf	Flower	Leaf
Alkaloid	+	+	+	+	+	+
Flavonoid	+	+	+	+	+	+
Terpenoid	+	+	+	+	-	+
Carbohydrate	+	+	+	-	+	+
Protein	-	-	+	+	+	+
Tannin	-	-	+	-	+	-
Saponin	-	-	+	+	+	+
Glycosides	+	+	+	+	+	+
Steroids	-	-	+	-	-	-
Coumarins	+	+	+	-	-	-

extracts, possess anti-microbial and immune-boosting properties. Glycosides were found abundantly in both the parts of all the three solvent extracts, suggesting the potential exploitation of plant for cardiovascular benefits. Steroids were found only in flower of methanolic extract while terpenoids were found abundantly in both the parts in all the three solvent extracts investigated, contributing to the role of the plants in anti-inflammatory and anti-cancer activities. These findings highlight the diverse therapeutic potential of *T. erecta* and underscore the importance of different plant parts and extraction methods in maximising the benefits of phytochemical.

The qualitative phytochemical analysis of *Tagetes erecta* reveals a rich array of bioactive compounds, confirming its traditional medicinal uses and highlights its pharmacological potential. The diverse phytochemical found in both the flower and leaves support the plant's use in natural remedies and health supplements. Future studies should focus on quantitative analysis, antioxidant properties ,antimicrobial activity and isolating specific compounds to analyse its role against neurodegenerative diseases and understand their effects better.

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