RESEARCH ARTICLE

Qualitative phytochemical analysis in *Tagetes erecta* (African marigold) extracted in different solvents

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African marigold or *Tagetes erecta*, is a brittle, blooming, efflorescent, annual and houseplant that is universally cultivated. In the modern world, plant-derived phytochemicals are basic because each phytochemical is responsible for different functions in the preparation of food products, dye for clothing, pharmaceuticals, anti-inflammatory, anti-diabetic, anti-aging, antibacterial, antiparasitic, antidepressant, anti-cancer, antioxidant and wound healing. Phytochemical properties of *Tagetes erecta* plant parts like fresh and dry leaves, flowers and roots were treated with different solvents (Aqueous, Chloroform and Methanol). The alkaloids, flavanoids, steroids, terpenoids, glycosides, coumarins, tannins, saponins, proteins and carbohydrates are found using standard screening methods and were found to be present in all the fresh and dry plant parts treated with different solvents. The following alkaloids, flavonoids, and glycosides are primarily detected in aqueous, chloroform, and methanol solvents, according to ten phytochemical analyses that were conducted.

Key Words: *Tagetes erecta; Phytochemical; Chloroform; Methanol; Aqueous*

INTRODUCTION

Humans can naturally benefit from the materials found in nature. A natural resource with plant origins, phytochemicals are potent compounds. The popular names for *Tagetes erecta* also include "Mexico marigold," "Big marigold," "African marigold" and "American marigold". The short, outstanding *Tagetes erecta* plant grows compactly in both a pot and the field. The entire plant could withstand both heat and rain. 13-18°C (55-64°F) at night and 18-23°C (64-73°F) during the day. The early flowers' poor quality is a result of too low temperatures and flower heads shrink in size in response to too high temperatures. Plants intended for early sale should be gradually toughened at 10-13°C (50-55°F). Frost is not tolerated by *T. erecta* [1]. The nectar plant *Tagetes erecta*, which resembles orange and yellow flower varieties, attracts butterflies [2].

For the treatment of a variety of human illnesses, *Tagetes erecta* has been acknowledged in various systems of traditional medicine [3]. This plant's many parts, especially the blooms, are used in folk medicine to treat a variety of illnesses. As an antimicrobial and for renal problems, muscle aches, piles and external boils, leaves are utilized. The flower is used for illnesses of the eyes as well as for fevers, epileptic fits, scabies, liver complaints, astringent, carminative, stomachic and liver ailments [4] anti-diabetic, anti-cancer, and anti-epileptic properties of *Tagetes erecta* have been discovered in various portions of the plant [5-8]. The *Tagetes erecta* plant cultivates trap crops, numerous genera of nematode-suppressing plants, solarization of the soil, and crop rotation in an environmentally beneficial manner [9]. The *Tagetes erecta* plant is a rich source of coumarin, which has pharmacological effects, as well as flavonoids with antimicrobial properties [10]. Because they lower cholesterol and low-density lipoprotein levels, saponins have hypolipidemic qualities and may be useful in the treatment of dyslipidemia [11]. In the lives of living things, glycosides have a variety of crucial functions. The inactive glycosides are used to store chemicals by many plants. Plant alkaloids guard against pests and control growth [12].

Taxonomic classification

Kingdom; Plantae

Class; Dicotyledoneae

Order; Asterales

Family: Asteraceae

Genus; *Tagetes*

Species; *Erecta*

MATERIALS AND METHODS

Sample collection

Tagetes erecta plant was collected from Jayaraj Annapackium College Campus in Periyakulam, Theni district, Tamilnadu.

Preparation of fresh samples in various solvents

All the healthy fresh samples of *Tagetes erecta* plant parts the flower, leaf, and root were thoroughly washed with tap water to remove soil, dirt, etc., and finally with double distilled water. Twenty-five grams of each part of the fresh and dry plant was taken and cut into small pieces soaked in 250 ml Erlenmeyer flask containing 200 ml of aqueous, chloroform, and methanol for seven days of percolation, the extract was extracted through sterile muslin cloth and filtrate using Soxhlet apparatus and the resulted residue obtained after evaporation was dissolved in sterile distilled water and desired doses were prepared.

Preparation of dry samples in various solvents

All the healthy fresh samples of *Tagetes erecta* plant part of the leaf, flower, and root were thoroughly washed with tap water to remove soil, dirt, etc., and finally with double distilled water and shade dried at room temperature for 20 days. The dried flower, leaf and root were macerated in a mixer grinder, and a fine powder was taken. The powdered material of selected plants was separately extracted in a Soxhlet apparatus for 6 hrs with aqueous, methanol, and chloroform.

Phytochemical screening tests

The *Tagetes erecta* fresh and dried samples screened the phytochemicals [13].

Test for alkaloid: Alkaloids to 0.5 ml of the sample, 0.5 ml of concentrated hydrochloric acid were added. Then few drops of Mayer's reagent were added. The presence of green color or white precipitate indicated the presence of alkaloids.

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Test for flavonoids: 0.5 ml of sample, 1 ml of 2N sodium hydroxide was added. The presence of yellow color indicated the presence of flavonoids.

Test for tannins: 0.5 ml of the sample and 1 ml of 5% ferric chloride was added. The formation of dark blue or greenish black indicated the presence of tannins.

Test for saponins: To 0.5 ml of oil sample, 1 ml of distilled water was added and shaken in a graduated cylinder for 15 minutes lengthwise. The formation of a 1 cm layer of foam indicated the presence of saponins.

Test for proteins: To 0.5 ml of sample, 4% NaOH solution and few drops of 1% CuSO4 solution were added. Violet colour appears, indicated the presence of protein.

Test for carbohydrates: To 0.5 ml of sample, 1 ml of Molisch's reagent and a few drops of concentrated sulphuric acid were added. The presence of purple or reddish color indicated the presence of carbohydrates.

Test for glycosides: To 1 ml of oil sample, 2 ml of chloroform and 10% ammonia solution were added. The formation of pink color indicated the presence of glycosides.

Test for coumarins: To 0.5 ml of sample, 0.5 ml of 10% NaOH was added. The formation of yellow colour indicated the presence of coumarins.

Test for steroids: To 0.5 ml of oil sample equal volume of chloroform was added and subjected to a few drops of concentrated sulphuric acid where the appearance of a brown ring indicated the presence of steroids.

Test for terpenoids: To 0.5 ml of a sample, 2 ml of chloroform was added and concentrated sulphuric acid was added carefully, formation of red-brown color at the interface indicated the presence of terpenoids.

RESULTS AND DISCUSSION

All kinds of naturally occurring plants are rich in phytochemicals. Each phytochemical has unique medicinal properties. By using the extract from different parts of plants i.e., leaves, flowers and roots, different compounds were isolated from each part and their compounds play an important role in the development of novel formulations. The findings of the qualitative analysis carried out revealed the presence of alkaloids, coumarins, glycosides, carbohydrates, saponin, tannin, steroids, terpenoids, proteins and flavonoids. The present study evaluates the qualitative phytochemical screening of several portions of *Tagetes erecta* in different solvents in Tables 1-3. The identification of bioactive compounds namely terpenoids, alkaloids, flavonoids, quinones, carbohydrates, tannins and coumarins [14]. For this experiment, the samples taken were the fresh, flower, leaves and roots treated with aqueous, chloroform, and ethanol extract, again dry leaves, flower and root were added to aqueous, chloroform and ethanol solution, then the following reactions, the extracts were taken and tested for alkaloids, coumarins, glycosides, carbohydrates, steroids, saponin, tannin, terpenoids, proteins and flavonoids (Tables 1-3).

Tagetes erecta fresh and dry plant parts of chloroform extract shows coumarins, glycosides, carbohydrates, terpenoids, proteins, alkaloids and flavonoids. The chemoprofile of the chloroform extract of E. microphylla leaves the phytochemical screening showed the presence of saponins, steroids, lipids and terpenoids [15]. *Tagetes erecta* fresh and dry flower results showed the presence of phytochemicals like alkaloids, flavonoids, saponins, steroids, tannins and carbohydrates. Similarly, *Tagetes erecta* flower and dry powder showed the presence of phytochemicals is saponins, flavonoids, steroids, alkaloids and tannin [16]. Alkaloids, flavonoids, carbohydrates, glycosides and terpenoids are shown to be present in all the solvent extracts of fresh and dry roots. Plant roots are a prospective source of bioactive substances that can be investigated to create treatments for diabetes and issues associated with the disease, *Tagetes erecta* leaves and roots have nematicidal traits [17,18]. *Tagetes erecta* fresh and dry leaves showed the presence of phytochemicals are Alkaloids, flavonoids, saponins, terpenoids and coumarins.

TABLE 1

Qualitative phytochemical screening of *Tagetes erecta* (Aqueous extract)

Phytochemical tests	Aqueous extract					
	Fresh leaf	Dry leaf	Fresh flower	Dry flower	Fresh root	Dry root
Alkaloid	+	+	+	+	+	+
Flavanoid	+	+	+	+	+	+
Tannin	-	-	-	-	-	-
Saponin	-	-	-	-	-	-
Protein	-	-	-	-	+	+
Carbohydrate	+	+	+	+	+	+
Glycosides	+	+	+	+	+	+
Coumarins	+	+	+	+	-	-
Steroids	-	-	-	-	-	-
Terpenoids	+	+	+	+	+	+

Note: +: Presence of composite, -: Absence of composite.

TABLE 2

Qualitative phytochemical screening of *Tagetes erecta* (Chloroform extract)

Phytochemical tests	Chloroform extract					
	Fresh leaf	Dry leaf	Fresh flower	Dry flower	Fresh root	Dry root
Alkaloid	+	+	+	+	+	+
Flavanoid	+	+	+	+	+	+
Tannin	-	-	+	+	-	-
Saponin	+	+	+	+	-	-
Protein	+	+	+	+	+	+
Carbohydrate	+	+	+	+	+	+
Glycosides	+	+	+	+	+	+
Coumarins	+	-	+	-	-	-
Steroids	-	-	-	-	-	-
Terpenoids	+	+	-	-	+	+

Note: +: Presence of composite, -: Absence of composite.

TABLE 3
Qualitative phytochemical screening of *Tagetes erecta* (Methanol extract)

Phytochemical tests	Methanol extract					
	Fresh leaf	Dry leaf	Fresh flower	Dry flower	Fresh root	Dry root
Alkaloid	+	+	+	+	+	+
Flavanoid	+	+	+	+	+	+
Tannin	-	-	+	+	-	-
Saponin	+	+	+	+	-	-
Protein	+	+	+	+	+	+
Carbohydrate	-	-	+	+	-	-
Glycosides	+	+	+	+	+	+
Coumarins	+	+	+	+	+	+
Steroids	-	-	+	+	-	-
Terpenoids	+	+	+	+	+	+

Note: +: Presence of composite, -: Absence of composite.

CONCLUSION

The phytochemicals found in different solvent extracts of *Tagetes erecta* plant parts are more effective. Plants contain phytochemicals and consuming them typically has positive health impacts. Because of their antioxidant and anti-inflammatory, anti-microbial activities and wound healing properties, phytochemicals may be useful in treating a variety of ailments, according to preclinical, clinical and epidemiological research. *Tagetes erecta* is a plant of traditional, medicinal and commercial. Bioactive substances from *Tagetes erecta* plant parts have therapeutic potential and a clear physiological effect on people and are used for the welfare of mankind. The phytochemicals found in different solvent extracts of *Tagetes erecta* plant parts are leaf, flower, and root shows more effective. Tannin is not expressed in aqueous extracts of fresh and dry leaves. Saponin is absent in fresh and dry roots of all the solvents like aqueous, chloroform and methanol. The steroid is absent in both fresh and dry leaves, flowers and roots in all the solvents but is present in fresh and dry flowers in methanol extract. The study with a comparison of all the solvents is strongly showing the presence of more important bioactive compounds. Comparing this study to all of the solvents showed alkaloids, flavonoids, terpenoids and glycosides are expressed. The potential for T.erecta plant parts to become a medicinal drug, however, necessitates further research employing this plant to ascertain its pharmacological and non-pharmacological action.

AUTHOR CONTRIBUTIONS

Manimegalai conducted the experiments, analysis, writing, referencing, and editing of the manuscript and Iruthaya Kalai Selvam analyzed the results and revising.

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