A Review: Antimicrobial Activity and Photochemical Analysis of Marigold Flower (Tagetes erecta)

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Abstract

Synthetic Antimicrobial drugs are ineffectual against multidrug-resistant bacteria, resulting in a loss of funding for the treatment of infectious diseases around the world. As a result, alternative antimicrobial medicines for the treatment of infectious disorders are urgently needed. One method is to screen medicinal plants for antibacterial characteristics, which is innovative, low-cost, and effective against pathogenic microorganisms. Antimicrobial defenses have evolved in bacteria, and disease drug resistance is on the rise. This is due to the rapid evolution of multidrug resistance, the limited antibacterial spectrum, and the side effects of currently available antimicrobial medications. This entails the creation of novel antimicrobials with a wide range of structures and modes of action. Marigold (Tagetes erecta) is a common ornamental plant. Eastern countries use the flowers of this plant in garlands or loose for social and religious purposes. After their religious uses, the flowers are normally discarded. The Asteraceae family includes this plant (Composited). Marigold is its English name. Folk medicine makes use of several components of this plant, especially the flower. Skin complaints, wounds and burns, conjunctivitis and poor vision, monthly irregularities, varicose veins, hemorrhoids, duodenal ulcers, and other conditions have all been treated with it in traditional and homeopathic medicine. Dental caries is not an unusual place for continual oral contamination that affects children in particular. The most regular causal agent of dental caries is Streptococcus mutants. The antibacterial hobby of methanol and chloroform extracts of Tagetes erecta L. flowers have become tested using the agar diffusion method in competition to Streptococcus mutants in this study. Preliminary phytochemical screening of T. erecta L. flowers extracts in methanol and chloroform located the presence of alkaloids, carbohydrates, proteins, Anthraquinons, tannin, cardiac glycosides, fatty acids, and oils with inside the methanol and chloroform extracts. Saponin and amino acids, on the opportunity hand, had been now not observed in each extract. Flavonoids had been now not located in chloroform extract. The GCMS assessment of methanol extract identified seven chemicals.

Keywords: Medicinal plants, Multidrug resistant ,Solvents, Antimicrobial Activity, Synergistic activity, Phytochemical Analysis, Antioxidant activity, Antidepressant activity, Antifungal activity,Antiplasmodial activity, Anticancer activity, Insecticidal activity.

INTRODUCTION

Plants continue to be a valuable medicinal assistance in the treatment of human illnesses. In this study, different sections of Calendula officinalis (root, leaf, and flowers) were tested for antibacterial activity against a variety of bacteria, including E. coli, Salmonella typhi, *Klebsiella pneumoniae*, *Enterobacter aerogenes*, and Agrobacterium tumefactions. Using the agar disc diffusion method, antibacterial activity was tested in aqueous, alcohol, chloroform, and petroleum ether extracts [1]. Although as a result, six different solvents were used for extraction in this investigation, and an effort was also made of dried leaves had the strongest antibacterial activity against *Klebsiellosis pneumoniae*. There was also a phytochemical analysis[8]. For millennia, medicinal plants have been renowned for their healing or disease-curing properties. Active secondary metabolites of medicinal plants were purified and employed as a component of medications at the turn of the nineteenth century. The source of antibacterial substances has been researched in several kinds of natural items[7]. Many naturally occurring chemicals found in plants have been demonstrated to have antifungal, antibacterial, and antiprotozoan properties, and can be utilized systemically or locally as antimicrobial agents [1].Considering these facts, evaluation of the antimicrobial activity of different extracts and fractions from the flowers, foliage, and roots of *T. patula*. Has been initiated and is described in this paper. The current investigation is a continuation of our efforts on the discovery of bioactive constituents from *Targets*. Species [19]. The usage and study of therapeutic plant elements has become increasingly popular all around the world, from traditional to modern, and even in industrial settings [27].The flavonoids in these foods have been shown to protect against heart disease and cancer in studies [28]. A number of studies, particularly in Latin America, have looked at the inhibitory properties of flavonoids against bacteria and yeast. More than 400 flavonoids have been discovered in plants. Flavonoids are essential elements for good health and a balanced diet. Nutrient Compare Defense Again a wide range of bacterial and viral illnesses, including urinary tract infections and HIV [29]. Tulukka samandi is the Tamil word for marigold, which is particularly famous as a garden plant and for its blooms because of its vivid yellow flowers and elegantly dissected foliage. The flower heads were used as decorations at religious rituals.[30] Cactacae plants are tropical or subtropical plants that originated in South America and were then dispersed in Mexico before being introduced to China in 1979 as a food source[31]. Malaria chemotherapeutic investigations revealed that the majority of compounds are alkaloids [32].Six Quinines were isolated from Cassia occidental is, Cassia alata, and Ocimum basillicum. Quinines from Cassia occidental is, Cassia alata, and Ocimum basillicum were shown to be the most active, with an IC50 value of less than 1g/ml [33]. During the bioassay of pea stem sections, vitamins K (tocopherol) and K1 showed that auxins were

enhanced [34]. India is known for its diverse plant species, and over 2500 medicinal plants are currently utilized in various manufacturing businesses [35].

BIOASSAY-DIRECTED ISOLATION WORK ON FLOWERS

T. patula flowers (750 g) were air-dried, uncrushed, and extracted twice for 48 hours at room temperature (27°C) using petroleum ether (P.E.) and methanol. Using a rotary evaporator (60–65°C), the extracts were separated and antibacterial activity was assessed, yielding dry P.E. methanol residue (JFM, 300 g) and residue (JFP, 691 g).On TLC, the extract JFP (Rf. = 0.45, silica gel 60F254, P.E.), which had good action against Gram-negative bacteria, had a considerable spot (Rf. = 0.45, silica gel 60F254, P.E.). And identified as -terthienyl, The gummy methanol extract (JFM) was found to be Bioassay-guided fractionation employing the solvent-solvent extraction method was chosen as the most active. To make the P.E. phase (JFMP), the extract (JFM) was partitioned between distilled water and petroleum ether, and the aqueous layer was then treated with chloroform (three times, JFM-C), ethyl acetate (six times, JFM-EA), and butanol (four-times, JFM-Bu). Each stage is different. The aqueous layer was next treated with chloroform (three times, JFM-C), ethyl acetate (six times, JFM-EA), and butanol (three times, JFMB) (four-times, JFM-Bu). They were combined and the solvent was removed *in vacuo*. Resulting in the formation of a residue (JFM-EA, 14 g) that was determined to be the most active against a variety of bacteria [12].

YIELD OF EXTRACTION

Alkaloids, flavonoids, tannins, phlorotannins, triterpenes, steroids, Saponin, and cardiac glycosides were among the phytochemicals studied [13]. The extraction yield of T. erecta flowers was measured using various solvents. The maximum extractive yield was found in the aqueous extract, which was followed by the methanol extract. Water > methanol > hexane > acetone > ethyl acetate > toluene has the highest capability to extract extractable components from flowers, followed by methanol > hexane > acetone > ethyl acetate > toluene. Aqueous extracts had a better ability to extract phytoconstituents from T. erecta (18.11%). The yield from toluene extraction is the lowest (0.96 %) [13]. extraction with the lowest yield being toluene (0.96%). Although both methanol and acetone are polar solvents, methanol had a higher extractive yield. Hexane, a nonpolar solvent, had a higher extractive yield than acetone, a polar solvent, while ethyl acetate and toluene, semi-polar solvents, had the lowest extractive yield. We can infer that polar molecules have advantages over non-polar compounds. The varying polarity of the solvents may be the cause of the significant variations in extraction yield among the various solvents. The choice of solvent has a significant impact on the yield of the extraction, but this does not necessarily mean that the solvent with the highest yield will also have the highest during the research. Other researches have reported on the impact of the extraction solvent on the antibacterial and antioxidant properties of medicinal plant extracts [72].

ORGANISMS FOR TESTING

Staphylococcus aureus 1 (SA1) ATCC25923, Staphylococcus aureus 2 (SA2) ATCC29737, Staphylococcus Albas (SAL) NCIM2178, Bacillus cereus (BC) ATCC11778, Bacillus subtilis (BS) ATCC6633, Staphylococcus aureus 2 (SA2) ATCC29737, and Staphylococcus Albus (SAL) NCIM21 Megaterium BacillusListeria monocytogenes (BM) ATCC9885, Coryne Escherichia coli (EC) NCIM2931, and Listeria monocytogenes (LM) ATCC19112,Proteus, Pseudomonas pseudoalcaligenes (PPA), and Pseudomonas Testosterone (PT) aeruginosa (PA) ATCC27853, Pseudomonas morganii (PMO) NCIM2040, and Klebsiella pneumoniae (KP) NCIM2719, Pro Cryptococcus neoformans (CN), ATCC2091, Candida albicans (CA), NCIM3542, Candida The yeasts utilised in the experiment were Candida glabrata (CG) NCIM3448 and Candida epicola (CN) NCIM3367. Candida glabrata and Cryptococcus neoformans (CN) NCIM3542 were the yeasts used in the experiment (CG) Candida epicola (CN) NCIM3367 and NCIM3448 [8].

ANTIMICROBIAL ACTIVITY

There has been a dramatic increase in the quest for natural compounds with antimicrobial properties in recent years because they provide the prospect of discovering novel medications or pharmacological leads with promising antibacterial activity and fewer adverse effects on humans. Assessing flower peels, fruit rinds, seeds, and other objects that are often tossed into the environment is all the more crucial. In this study, T. erecta flowers were extracted using hexane, toluene, ethyl acetate, acetone, methanol, and water. The extracts were tested against eight Gram-positive bacteria, eight Gram-negative bacteria, and four fungal strains for antibacterial activity.[15].

SYNERGISTIC ACTIVITY

The synergistic effect of acetone extract of T. erecta flower with various conventional antibiotics such as chloramphenicol and ceftazidime against bacteria. With FIC values of 0.312 and 0.093, respectively, the combination of acetone extract and ceftazidime had a synergistic effect on the development of B. subtilis and P. aeruginosa. This shows that the acetone extract of this flower has the potential to boost antibiotic performance. With an FIC value of 0.6, a partial synergistic effect was seen against S. Albus. Against the remaining bacterial strains, the combination had an additive/ indifferent effect. The combination of acetone extract and chloramphenicol, on the other hand, had an antagonistic impact against P. aeruginosa while not affecting the other bacterial strains. the synergy between acetone extract and ceiazidime showed a higher also decrease in MIC and a strong bactericidal activity. These results indicated that a combination between acetone extract and ceiazidime could be useful in fighting emerging drug-resistant microorganisms. A similar synergistic Effect of *T. catappa* extract and *Eucalyptus camaldulensis* extract with Different antibiotics is reported by Rakholiya and Chanda and Pereira identified the various compound present in *Tagetes patula* L. essential oil by gas chromatography. the results showed that the two most abundant component present in the oil is piperine and piperitonone which is responsible for antifungal activity.[19]

QUALITATIVE PHYTOCHEMICAL ANALYSIS

The phytonutrients terpenoids, alkaloids, flavonoids, quinones carbohydrates, tannins, and coumarins were discovered in the qualitative analysis. The discovery of these chemicals backs up the usage of these oils in traditional medicine because they have antifungal, antibacterial, and anti-inflammatory activities. [25] Terpenoids were found in all samples of Tagetes erecta L. essential oil extracted by both hydro-distillation and solvent extraction by the production of a red colour after adding chloroform and sulphuric acid. After adding 2N sodium hydroxide to all of the samples, the bioactive component flavonoid was recognised by the presence of yellow colour. Almost all of the flower and leaf samples tested positive for alkaloid, with green colour developing with the addition of conc. hydrochloric acid, indicating that Tagetes erecta L. can be used to treat anthelminthic, ear irritation, and carminative. In contrast to Burkil, 1984 and Gills, 1992, it was also observed[26].After adding Molisch's reagent and a few drops of strong sulphuric acid to each sample, the presence of carbohydrates was plainly visible. Only in the dry flower oil sample extracted by soxhlet apparatus did blue green colour development appear, indicating the presence of Triterpenoids in Tagetes oil. The presence of coumarins in all oil samples was determined by adding 0.5ml of 10% NaOH to the sample, which resulted in the production of a yellow colour, indicating the presence of coumarins in all samples. only in the soxhlet-extracted sample of dry floral oil apparatus did blue green colour development appear, indicating the presence of Triterpenoids in Tagetes oil. The presence of coumarins in all oil samples was determined by adding 0.5ml of 10% NaOH to the sample, which resulted in the production of a yellow colour, indicating the presence of coumarins in all samples. All leaf samples were devoid of phenols, regardless of whether they were extracted using a hydro-distillation or a soxhletdevic [36].

DETERMINATION OF MINIMUM INHIBITORY CONCENTRATION (MIC) AND MINIMUM BACTERICIDAL CONCENTRATION (MBC)

The term "minimum inhibitory concentration" refers to the lowest amount of an antimicrobial agent needed to prevent the tested bacterium from growing visibly[6]. Because they contain a variety of phytoconstituents, acetone extracts demonstrated strong synergistic antibacterial action[7]. The findings demonstrated that many of the bacteria implicated in the etiology of human diseases were resistant to the acetone extract of T. erectaflower. The existence of broad spectrum antibiotic compounds is shown by the showing of antibacterial action against both Gram positive and Gram negative bacteria[11*P. aeruginosa, P. pseudoalcaligenes, P. morganii, and P. mirabilis* had MIC values of 312 g/ml in acetone extract, 625 g/ml in fraction 2, and 1250 g/ml in acetone extract, respectively, for Gram negative bacteria. The MBC measurements ranged from 625 g/ml to more than 1250 g/ml. B. subtilis (312 g/ml) in fraction 1, S. aureus 2 (625 g/ml) in acetone extract and its fraction 2, L. monocytogenes (156 g/ml), and S. albus (312 g/ml) in acetone extract all exhibited moderate antibacterial activity. The reported MBC values ranged from 1250 g/ml to more than 1250 g/ml [8].Table-1also shown MIC and MBC values (µg/ml) of T. erecta flower extracts against Gram positive Bacteria and Gram Negative Bacteria of Antimcrobial Activity of T. erecta flower acetone extract (FA)

Microorganism		Extract Of Flower	
		MIC	MBC
Gram Positive Bacteria	BC	78	625
	BS	1250	>1250
	SA2	620	>1250
	SAL	312	>1250
	LM	156	>1250
Gram Negative Bacteria	PA	620	>1250
	PMI	1250	>1250
	PPA	312	>1250
	KP	78	312
	PMO	1250	>1250

Table-1 MIC and MBC values (µg/ml) of T. erecta flower extracts against Gram positive Bacteria And Gram Negative Bacteria of Antimcrobial Activity of T. erecta flower acetone extract (FA)

ANTIBACTERIAL ACTION AGAINST GRAM NEGATIVE BACTERIA

Different solvent extracts have been found to have antibacterial action against Gram negative bacteria Only E. aerogenes, P. pseudoalcaligenes, and P. morganii were susceptible to the aqueous extract. Hexane, a non-polar solvent, inhibited 6 Gram negative bacteria, while toluene and ethyl acetate, both semipolar solvents, inhibited 3 and 7 species, respectively. Both polar solvents, acetone and methanol, showed the greatest inhibition. Almost all Gram-negative bacterial strains were inhibited by them E. aerogenes was not inhibited by acetone extract, while P. aerogenosa and E. aerogenes were not inhibited by methanol extract. All five organic solvents had the highest antibacterial activity against K. pneumoniae, with hexane extract having the highest P. Mirabilis and P. testosterone both showed a similar pattern. Hexane extract, a non-polar solvent,has the most effectiveness against Different organic solvent extracts contain different phytoconstituents in different concentrations, which explains why the bacteria are inhibited differently [16].

ANTIBACTERIAL ACTION AGAINST GRAM POSITIVE BACTERIA

The antibacterial efficacy of different solvent extracts against Gram positive bacteria. Hexane, a non-polar solvent, had antibacterial action against just B. cereus and C. rubrum, while toluene and ethyl acetate, semipolar solvents, had antibacterial

activity against Gram positive bacteria, respectively. The antibacterial activity of ethyl acetate and acetone extracts against B. cereus and L. monocytogenes was the highest. Acetone and methanol, both polar solvents, had antibacterial action against Gram positive bacteria, respectively. Almost all Gram-positive bacterial strains were inhibited by them S. albus was not inhibited by acetone extracts, while B.subtilis and S. aureus were not inhibited by methanol extracts 1. Only B. subtilis, S. aureus 1 and S. aureus 2 demonstrated action against aqueous extract. B. cereus and K. pneumoniae were suppressed by all solvent extracts except aqueous extract, out of the eight Gram positive and Gram negative bacteria examined B.cereus had the highest antibacterial activity among Gram positive bacteria, followed by S. aureus and L.monocytogenes, whereas K. pneumoniae had the highest antibacterial activity among Gram negative bacteria, followed by P. pseudoalcaligenes.[22]The antibacterial activity of A. muricata (L) leaf extract against K.pneumoniae was the greatest. Acetone extract outperformed the other six solvents in terms of activity against Gram negative and positive bacteria [23].

THE ANTIFUNGAL ACTIVITY

The antifungal activity of toluene extract was limited to C. neoformans and C. glabrata, while acetone and ethyl acetate extracts were active against all four yeasts. Hexane, methanol, and water, for example, have negligible antifungal activity. The bulk of the organisms tested were acetone extract susceptible, with inhibition zones ranging from 10 to 16 millimetres. The bacterial strain examined was suppressed by acetate and toluene in 81 percent and 43 percent of cases, respectively. Hexane, a non-polar solvent, only inhibited 50% of the bacteria, whereas aqueous extract only inhibited 37.5 percent. Hexane, methanol, and aqueous extract had no antifungal action, although toluene inhibited 25% of the fungal strains examined, and ethyl acetate and acetone inhibited 100% of the fungal strains. The polarity of the solvents was expected to have a clear effect on us. It also implies that determining the antibacterial activity of medicinal plants requires the use of an extracting solvent T. erecta flowers included alkaloids, flavonoids, tannins, triterpenes, and cardiac glycosides, according to qualitative phytochemical study.[18] *T erecta* flowers are rich in flavonoids alkaloids and glycosides. Plants rich in phytoconstituents like alkaloids, flavonoids, tannins, terpenoids, and steroids have antibacterial properties.[21] Secondary metabolites such as tannins and other compounds of phenolic nature are also classified as active antimicrobial compounds. Alkaloid enriched extract from *Prosopis multiflora* pods showed good antibacterial activity Hereford it can be suggested that the antibacterial activity observed with various solvent extracts of *T.* erecta was chosen for this investigation because of the many phytoconstituents it contains[2].The medicinal properties of Tagetes erecta (petals) have been widely researched in the literature. It is said to have a broad pharmacological spectrum, including antibacterial, antioxidant, hepatoprotective, wound-healing, and analgesic properties [60]. Flowers of several plants, such as Cassia fistula L. flower against Candida, Aspergillus, and grass of Spinifex littoreus plant against Candida, Aspergillus, and Pencillium species, have been found to have antifungal action. [58,59] The hunt for novel and effective chemicals in conventional medicine can help future generations control fungal diseases more efficiently. The existence of terpene / terpenoid chemicals, which have displayed major effects on fungal cell wall, cell proliferation, fungal mitochondria, as well as suppression of biofilm development, can explain the mechanisms underlying promising components from traditional remedies.[61] The hunt for novel and effective chemicals in conventional medicine can help future generations control fungal diseases more efficiently. The existence of terpene / terpenoid chemicals, which have displayed major effects on fungal cell wall, cell proliferation, fungal mitochondria, as well as suppression of biofilm development, can explain the mechanisms underlying promising components from traditional remedies. The extract's antifungal activity was determined by comparing the diameter of ZOI in the agar diffusion method. Controls included amphotericin B, a fungicidal drug, and fluconazole, an azole antifungal that is largely fungistatic. Because it is simple and inexpensive, the diffusion method waschosen as the first screening tool. The likely mechanism of antifungal action must be investigatedfurther, as well as determining the minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of the extract using the serial dilution method.[62] Table 2. Comparing antifungal activity of ethanolic extract with amphotericin-B and fluconazole as controls.

Fungal strains	*Tagetes erecta* petal			Amphotericin-B 1 mg/ml (mm)	Fluconazole 1 mg/ml (mm)
	1000 µg/ml ZOI (mm)	750 µg/ml ZOI (mm)	500 µg/ml ZOI (mm)		
Candida albicans	15	12	11	9	7
Aspergillus niger	18	14	14	14	14
Aspergillus flavus	21	21	20	12	12
Penicillium chrysogenum	18	18	18	9	10

Table 2 .Comparing antifungal activity of ethanolic extract with amphotericin-B and fluconazole as controls (ZOI-Zone of Inhibition measured in millimeter, and graded concentrations of plant petal extract were compared with two standard antifungal drugs)

ANTICANCER ACTIVITY

Anticancer medication development relies heavily on medicinal herbs. Many plants, such as Allium sativum, Ginkgo biloba, Withania somnifera, and Zingiber officinale, show substantial anticancer effect against lymphomas, breast, ovarian, lung, liver, stomach, prostate, and testicular cancers, thanks to their active components.[63] Plant flowers, in particular, are being studied to

see if they have a cytotoxic effect on tumours such hepatic carcinoma. Using the MTT assay, extract from Bauhinia tomentosa flowers was found to have an anticancer impact against HePG2 cell lines.[64]The leaves of the Ageratum conyzoides L., a member of the Tagetes erecta (Asteraceae) family, were discovered to have anticancer action against human breast carcinoma cell line (MDAMB-231), human prostate carcinoma cell line (DU-145), and human hepatic carcinoma cell line (DU-145) (BEL-7402)[65]MTT assays employing the MCF-7 cell line for breast carcinoma indicated that Marrubium persicum extract has cytotoxic activity31. As a result, natural compounds can be effective leads in the development of new anticancer drugs. Polyphenolic chemicals, such as flavonoids, tannins, and curcumin, are responsible for plants' powerful anticancer effect by altering the regulation of signal transducers, transcription proteins, and inhibiting NF-KB, which is required for cancer cell survival and angiogenesis.[66] The MCF-7 cell line for breast carcinoma was employed in this study, which is one of the most common tumours in India and around the world. The MTT test was used to investigate the anticancer activity of T. erecta petal extract in the MCF-7 cell line for breast carcinoma, and the results were compared to the standard treatment. 5-fluorouracil The MTT assay is a frequently used colorimetric assay in the early screening of drugs having cytotoxic potential because it is simple, quick, inexpensive, and reliable. This assay is based on the ability of the NADPH dependent oxido-reductase enzyme present in live cells to convert tetrazolium to colorful formazan product. This reducing enzyme is primarily found in mitochondria, but it can also be found in the cytosol, lysosome, and plasma membrane.[67]5-Fluorouracil, the standard medication, is an antimetabolite anticancer medicine commonly used to treat solid tumours. The medicine works by blocking thymidylate synthase, which causes DNA and RNA damage and cell death.[68] Flavanoids like quercetin, quercetagetin, and 6-hydroxykaempferol were discovered to be the bioactive ingredients of T. erecta flowers. These chemicals were found to suppress theproliferation of human liver cancer cell lines (HepG2) and lung cancer cell lines, as well as cause cytotoxicity (A549) [69].

MTT assay and resultant cell viability with positive control 5-Fluorouracil

S.no	Concentration (µg/ml)	Dilutions	Absorbance (O.D)	Cell viability (%)
1	1000	Neat	0.089	959
2	500	1:1	0.155	16.70
3	250	1:2	0.219	23.59
4	125	1:4	0.285	30.71
5	62.5	1:8	0.352	37.93
6	31.2	1:16	0.414	44.61
7	15.6	1:32	0.481	51.83
8	7.8	1:64	0.544	58.62
9	Cell control	-	0.928	100

O.D - Optical Density, % - percentage, Percentage cell viability of graded concentrations of positive control 5-Fluorouracil

ANTIOXIDANT ACTIVITY

The yellow colour of the test fluid changes to green based on the reducing power of the test specimen in a reducing power assay. The Fe3+/ ferricyanide complex is reduced to the ferrous form in the presence of reductants in the solution. As a result, Fe2+ can be monitored using a 700 nm absorbance test. According to previous research, the reducing properties have been demonstrated to have antioxidant qualities by donating a hydrogen atom to break the free radical chain. The ability to reduce increases as the absorbance at 700 nm rises. The antioxidants in Tagetes erecta extracts reduced the Fe3+ / ferricyanide complex to the ferrous form, demonstrating the plant's reducing power.[37] The antioxidant testing of the entire methanolic extract of T. erecta flowers and the\sinvestigated fraction (Fr 4) containing over 85 percent quercetagitrin was carried out comparatively utilising two famous methods: 15-lipoxygenase (15-LOX) inhibition assay and metal\schelation activity test. The samples' abilities to chelate iron ions, as well as to impede EC50 and IC50 values were used to express lipoxygenase. The outcomes attained compared to those of the positive control (quercetin) were also shown in order to Analyze their efficiency. Fr 4 demonstrated the most promising lipoxygenase inhibitory activity (16.49 ± 0.19 µg/mL \sfinal solution), the resultant value being even lower than that of quercetin, which was used \sas a positive controlHowever, considering the iron-chelating activity, the whole extract demonstrated a better \sactivity overall (0.390 ± 0.001 mg/mL final solution), comparable to that of quercetin, while sFr 4 showed reduced antioxidant activity by this mechanism (0.529 ± 0.001 mg/mL \sfinal solution)[71]. Table-4 Shown Total extract and fraction of T. erecta's antioxidant activity 4

*Total extract and fraction of T. erecta's antioxidant activity 4

	Lipoxygenase Inhibition	Iron-Chelating Activity
Sample	IC50 (µg/mL Final Solution)	EC50 (mg/mL Final Solution)
Total extract	25.85 ± 0.67 *	0.390 ± 0.001
Fr 4	16.49 ± 0.19	0.529 ± 0.001
Quercetin	17.45 ± 0.33 *	0.417 ± 0.011

Table 4 - Total extract and fraction of T. erecta's antioxidant activity 4

PROXIMATE ANALYSIS

The total ash value, acid insoluble ash, water-soluble ash, petroleum ether soluble extractive value, chloroform soluble extractive value, methanol soluble extractive value, water-soluble extractive value, and moisture content of Tagetes erecta were all measured. The moisture content of the air-dried sample is 11.42 percent. Microorganisms would be hampered by the leaf's low moisture content, and storage life would be extended [38].

ANTIDEPRESSANT ACTIVITY

The essential oil of Tagetes minuta aerial parts has been shown to have antidepressant properties by inhibiting GABAergic function.[39] The marigold, Tageteserecta, demonstrated some antidepressant properties. A study was done to determine the hydromethanolic flower extract of T. erecta's antidepressant effects. Using a forced swim test on mice, the extract's potential as an antidepressant was assessed. In the forced swim test, T. erecta considerably reduced the immobility period in mice.. In the forced swim test, T. erecta considerably reduced the immobility period in mice (P 0.05). T. erecta (25 mg/kg, i.p.) increased the anti-immobility effects of antidepressant medications such imipramine, fluoxetine, and p-chlorophenylalanine, but a significant attenuation of its antidepressant effect was seen with an inhibitor of serotonin production. Pretreating mice with nitric oxide synthase inhibitors potentiated the antidepressant effect of T. erecta in the forced swim test, but pretreating animals with L-arginine and sildenafil prevented it. The antidepressant effects of T. erecta were blocked by progesterone, a sigma receptor antagonist, while pentazocine, a high-affinity sigma receptor agonist, induced synergism with the effective dose of T. erecta. At the studied doses, however, there was no impact on locomotor activity [70].

ANTIPLASMODIAL ACTIVITY

Five different extracts of Tagetes erecta roots, including petroleum ether, chloroform, ethyl acetate, methanol, and aqueous extracts, as well as a novel bithienyl compound: 2-hydroxymethyl-non-3-ynoic acid is a kind of 2-hydroxymethyl-non-3-ynoic acid. 2-[2,2'] The schizonticidal activity of -bithiophenyl-5-ethylester from the plant's roots was shown to be substantial against chloroquine susceptible and resistant Plasmodium falciparum strains [40].

INSECTICIDAL ACTIVITY

Tageteserecta aqueous leaf extract has a considerable nematicidal impact on Meloidogyne incognita and Rotylenchulus reniformis. And The whole plant acetone extract was found to have growth inhibitory and juvenile hormone mimicking effect against Culex quinquefasciatus larvae.[42]Furthermore, Tagetes erecta leaf extract inhibited the growth of blackgram infected with Glomus faciculatum and Meloidogyne incognita.[43] While dichloro-methane and methanolic extracts of the plant's aerial parts from Argentina have been shown to have strong insecticidal efficacy against Sitophilus oryzae,[44] The antianemic action of hexane, benzene, ethyl acetate, and methanolic extracts, as well as myristic and dodecanoic acids extracted from the hexane extract and the essential oil of Tagetes erecta flowers, was found to be significant against Meloidogyne incognita juveniles.[45] The petroleum ether extract of Tagetes patula roots was found to be poisonous to Culex fatigens third stage mosquito larvae.[46] The roots of Tagetes patula were extracted in petroleum ether and tested for toxicity against Culex fatigens third-stage mosquito larvae.[47] The aqueous extracts of 30 and 60 day old marigold plants (Tagetes patula) were shown to prevent Meloidogne javanica juveniles from hatching.[48] A novel chemical (5E)-ocimenone isolated from Tagetes minuta fresh leaves and flowers showed substantial larvicidal action against Aedes aegypti third instar mosquito larvae[49]. Against the root-knot nematode Meloidogyne incognita, the aqueous extract had a substantial nematicidal impact.[50]

MISCELLANEOUS

Antiviral activity was found in a 50% ethanolic extract of Tagetes minuta's complete plant against the Ranikhet sickness virus[51].While the essential oil of the Tagetes minuta plant has been shown to have sedative, hypotensive, bronchodilatory, spasmolytic, and anti-inflammatory properties[52]. The aqueous extract of Tagetes lucida leaves and flowers showed strong platelet antiaggregant activity [53]. The marigold paste, tincture, and oil made from Tagetes erecta's fresh leaves and flowers were found to be useful in the treatment of hyperkeratotic plantar lesions [54].The aqueous extract of Tagetes lucida leaves and flowers revealed considerable platelet antiaggregant action [55]. The marigold paste, tincture, and oil made from Tagetes erecta's fresh leaves and flowers were found to be useful in the treatment of hyperkeratotic plantar lesions [56]. The protective pad and an ethanolic extract of Tagetes erecta yellow colour petals and leaves were found to be useful in the treatment of parakeratosis. In mice with carrageenan and dextran produced acute paw oedema, the extract showed considerable antiinflammatory action [57].

CONCLUSION

The importance of the T. erecta flower in the quest for novel antibiotics cannot be overstated, as evidenced by the current findings. Plant extracts generally have a good antibacterial effect exclusively against Gram positive bacteria.T. erecta flower extracts, on the other hand, demonstrated broad-spectrum activity, killing Gram-negative bacteria as well, which is an important point to note. The synergistic effect revealed by acetone extract is useful in combating the daunting obstacle of medication resistance. The findings suggest that combining plant extract with antibiotics may be effective in combating rising drug-resistant bacteria and that the solvent used in testing the antimicrobial activity of medicinal plants is important. Flowers can be used as an antibacterial agent against human infections as an alternative. The goal of future research is to identify active chemical classes of compounds that are responsible for antibacterial activity.

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