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Chemical profiling, *in vitro* antibacterial, and cytotoxic properties of *Elytranthe parasitica* (L.) Danser – A hemiparasitic Indian mistletoe

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ABSTRACT

Elytranthe parasitica, popularly known as *Macrosolen parasiticus,* is a hemiparasitic mistletoe species in India. It has been traditionally used in veterinary medicine. The main objective of this research is to examine its chemical constituents, and *in vitro* antibacterial, and cytotoxic activities. The qualitative screening of phytoconstituents revealed the existence of tannins, phenols, glycosides, flavonols, sterols, saponins, terpenoids, carbohydrates, fixed oil, and fats. Gas Chromatography-Mass Spectroscopy screening of stem methanol extract showed the appearance of 11 bioactive phytoconstituents. Octadecenoic acid,4-hydroxybutyl ester (22.95%); 2H-1-Benzopyran-7-ol, 3,4-dihydro-5-methoxy-2-phenyl- (21.90%); Oleic acid (14.18%); and 9-Hexadecenoic acid (10.59%) were the major identified compounds. The methanolic stem extract exhibited considerable antibacterial activity and showed a good inhibition zone against *Xanthomonas campestris* (19.83 ± 44 mm) followed by *Salmonella typhi* (15.50 ± 0.28 mm) and *Enterococcus faecalis* (15.50 ± 0.28 mm) and the minimum inhibition zone showed against *Escherichia coli* (12.66 ± 0.33 mm). The methanolic stem extract showed, moderate cytotoxicity on prostate, and pancreatic cancer cell lines at higher concentrations with the inhibitory concentration at 50% growth values 372.27 ± 22.07 µg/mL and 443.33 ± 17.85 µg/mL, respectively, but it has no cytotoxic effects on normal mouse embryo fibroblast cells (MEF-L239).

1. INTRODUCTION

Mistletoe, a common name used generally for woody shoot parasites, belongs to the order Santalales, it includes Loranthaceae, Santalaceae, and Misodendraceae families [1]. Historically, the word mistletoe originated from the Celtic word which means "all-heal" and it was used to treat several ailments [2]. There are more than 1500 species of mistletoe documented globally [3]. They have been widely utilized in ethno medicine for a variety of purposes, including antihypertensive, anticancer, antispasmodic, and antidiabetic, as well as therapy for epilepsy, headache, infertility, menopausal syndrome, and rheumatism. Due to its many traditional uses, mistletoe has been referred to as "an all-purpose herb" [4]. In northern America, mistletoe was used as an abortifacient, by veterinarians and formers for "clearing cattle" [5]. Mistletoe is used to treat a wide range of stomach issues in Africa, including diarrhea, diabetes, schizophrenia, and hypertension. In addition, it was utilized to strengthen the immunological system. Similarly, Argentina and ancient Greeks used these mistletoes to treat menstrual and spleen ailments. In Japanese traditional medicine, mistletoe (*Taxillus kaempferi*) was used as a remedy for hypotension, while some other members of mistletoes (*Loranthus parasiticus*, *Loranthus yadoriki*, and *Viscus coloratum*) were used in folk Chinese medicine to treat hypertension, rheumatic pain, and spasms of heart and locally to treat frostbite. In India, tea is prepared from mistletoe tree leaves and is traditionally used to treat diabetes [6].

Medicinal plants may constitute a reservoir of new bioactive compounds which seem to be new antimicrobial compounds such compounds are yet to be discovered. To defend themselves against a broad range of pathogens, plants are known to generate a variety of chemicals [7]. The emergence and spread of antimicrobial resistance in microorganisms need greater efforts in the discovery of novel antibiotics. Even though several plants with antimicrobial properties have been found, many remain unidentified. Many plants are being used as antibacterial or fungicidal agents [8]. Wound healing is an important biological process for preventing infections [9]. Over time, the search for new biological agents to treat wound infections has attracted interest. There have been numerous studies on the antibacterial activities of medicinal plants on pathogenic bacterial strains that cause skin infections [10].

Elytranthe parasitica (L.) Danser is a hemiparasitic shrub popularly known as *Macrosolen parasiticus* and belongs to the Loranthaceae family [11]. In Karnataka, known as Bandanekke or Baranike, it has been used in traditional veterinary treatment and as a leaf paste to eradicate ticks [12]. It grows extensively in the Western Ghats regions of India [13]. The previous studies on *E. parasitica* have suggested that it has antioxidant properties [14,15] and cytotoxic properties against different cancer cell lines [16-19]. However, the antibacterial and anticancer properties of this plant on prostate and pancreatic

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cancer cell lines have not been investigated. Hence, an attempt was made to check its phytochemical constituents, antibacterial potential, and cytotoxic activity against prostate and pancreatic cancer cells.

2. MATERIALS AND METHODS

2.1. Plant Samples Collection and Identification

The fresh stem samples of *E. parasitica* (L.) Danser were collected from the Western Ghats region of Karnataka, India. The taxonomical identification of the test plant was done using the Flora (Gamble, 1935), and a voucher specimen is deposited with a sample code (KU/AB/RN/KPS-001).

2.2. Preparation of Plant Samples and Extraction

The collected plant samples were washed under running tap water, shade dried for about 25-28 days, and mechanically pulverized. The powdered samples were subjected to Soxhlet extraction, with petroleum ether, chloroform, and methanol solvents. All the obtained crude extracts were concentrated in a rotary flash evaporator with reduced pressure and controlled temperature. Stored at 4°C in airtight glass vials.

2.3. Preliminary Phytochemical Profiling

Preliminary profiling of phytochemicals to identify the variety of phytoconstituents, which includes, tannins, alkaloids, saponins, flavonoids, phenols, steroids, and glycosides using standard methods [20,21].

2.4. Gas chromatography and Mass Spectroscopic Profiling

Gas chromatography and mass spectroscopic profiling of the methanolic stem extracts of *E. parasitica* was performed using the equipment Thermo GC-Trace Ultra Version: 5.0, Thermo MS DSQ II. The equipment has DB 35 – MS Capillary Standard non-polar column with 30 mm × 0.25 mm ID × 0.25 µm film dimensions. The carrier gas used is helium, and the flow detector's temperature was set at 250°C with a flow rate of 1.0 mL/min. The temperature of the oven was programmed as follows: 60°C for 15 min, then gradually increased to 280°C at 3 min. The components of extract and fractions were identified based on the spectra of the unidentified constituent matched with the spectra of the identified component stored in the National Institute Standard and Technology-based Automated mass spectral deconvolution and identification software V 2.69 software. The name, retention time, percentage area, and molecular weight of the constituents of the test sample were determined.

2.5. Antibacterial Activity

The agar well diffusion method was used to test the methanolic stem extract of *E. parasitica* for its antibacterial activities. The crude methanolic extract (10 mg) was dissolved in 1000 µL of dimethyl sulfoxide (DMSO) and diluted to 100, 50, and 25% concentrations. 20 µL of the extract was poured into each well of the agar plate. Triplicates of the test were performed. Amoxicillin and DMSO, respectively, were employed as positive and negative controls. The test bacterial strains included five human pathogenic bacterial strains which include *Escherichia coli* (MTCC-1599); *Klebsiella pneumonia* (MTCC-7028); *Staphylococcus aureus* (MTCC-4734); *Salmonella typhi* (MTCC-734); and *Enterococcus faecallis* (MTCC 439) and one plant pathogenic bacterial strain *Xanthomonas campestris* (MTCC-228). The plates were inoculated and incubated at 35–37°C overnight to determine the inhibition zone [22].

2.6. Cytotoxic Activity

2.6.1. Culturing of cell lines

Prostate and pancreatic cancer cell lines were purchased from National Center for Cell Science, Pune, India. In tissue culture flasks, the cells were subcultured in Dulbecco Modified Eagle Medium with 10% fetal bovine serum, 1% penicillin-streptomycin, and 1% non-essential amino acids. The flasks were, then, incubated in a condition with 95% humidity and a 5% carbon dioxide incubator. After trypsinization, the cells were counted and the viability of the cells was determined. To perform, an 3-(4, 5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) test, a known quantity of cells (20,000 cells per well in 200 µL cell suspension), was placed onto 96-well plates.

2.6.2. Treatment groups

Prostate and pancreatic cancer cells were treated with methanolic stem extract of *E. parasitica*. Before the experiment, the preferred concentrations of test samples were prepared in DMSO. The reactant mixtures were diluted with medium, and cells were treated with various concentration ranges (31.25–500 µg/mL) of the extract and incubated for 24 h. The effect of induced was compared with a standard drug used, namely, curcumin. The study has established the following test groups. Negative control: Cancer cells only; Positive control: Cancer cells + curcumin (10 µM); and Treatment group: Cancer cells + methanolic extracts. The same treatment group was used for the normal cell lines MEF-L239 (mice embryo fibroblast).

2.6.3. MTT cell viability assay

After 24 h of incubation, remove the plates from the incubator, discard the used medium, and then add the MTT reagent at a final level of 0.5 mg/mL of the overall amount. Plates should be placed back in the incubator and incubated for 3 h. Following incubation, 100 µL of DMSO solution was added to solubilize the formazan that had been generated. The suspension was placed on a gyratory shaker for 5 min; then, the absorbance was measured at 570 nm and 630 nm by an Enzyme-Linked Immunosorbent Assay reader. The inhibitory concentration at 50% growth (IC_{50}) was determined.

3. RESULTS

3.1. Extracts Yield of *E. parasitica* Stem with Different Solvents

The obtained extracts yield of *E. parasitica* stem using petroleum ether, chloroform, and methanol were 18.24 g, 21.52 g, and 58.46 g, (weight), respectively, concerning the shade-dried plant material of about 750 g.

3.2. Preliminary Qualitative Screening of Phytoconstituents

The qualitative screening of secondary metabolites using different solvent extracts revealed the presence of a variety of phytoconstituents [Table 1]. The methanolic stem extract shows the existence of tannins, phenols, glycosides, flavonols, sterols, saponins, terpenoids, carbohydrates, oil, and fats. Whereas, the presence of glycosides, terpenoids, and sterols was detected in chloroform extract. Petroleum ether extracts reveal the presence of glycosides and sterols. Methanolic extracts revealed the occurrence of a maximum number of phytoconstituents. Hence, we used methanolic extract for further pharmacological research.

3.3. Quantitative Gas Chromatography-Mass Spectroscopy (GC-MS) Profiling of Stem Methanol Extract of *E. parasitica*

GC-MS profiling of the stem methanolic extract of *E. parasitica* reveals the presence of eleven bioactive chemical constituents [Figure 1]. The name, retention time, percentage area, molecular weight, molecular formula, and properties of the phytoconstituents are represented in Table 2. The identified compounds include Octadecenoic acid,4-hydroxybutyl ester (22.95%); 2H-1-Benzopyran-7-ol, 3,4-dihydro-5-methoxy-2-phenyl- (21.90%); Oleic acid (14.18%); 9-Hexadecenoic acid (10.59%); Hexadecanoic acid, 2,3-dihydroxypropyl ester (8.15%); Z-8-Methyl-9-tetradecenoic acid (8.05%); β-D-Glucopyranose, 1,6-anhydro-(6.54%); n-Hexadecanoic acid (2.86%); 1-Nitro-beta-d-arabinofuranose, tetraacetate (1.87%); Pentadecanoic acid (1.62%); and Ethyl iso-allocholate (1.20%).

3.4. Antibacterial Screening of Stem Methanolic Extract of *E. parasitica* against Selected Bacterial Pathogens

The antibacterial activity of *E. parasitica* (L.) Danser. methanolic stem extract against selected bacterial pathogens exhibited a concentration-dependent zone of inhibition. The methanolic stem extract exhibited considerable antibacterial activity and showed a maximum inhibition zone of 19.83 ± 0.44 mm against *X. campestris* followed by *S.* Typhi (15.50±0.28 mm) and *E. faecallis* (15.50±0.28 mm) and the minimum inhibition zone against *E. coli* (12.66 ± 0.33 mm). The results of the experiment were triple-checked, and they were presented as mean ± standard error of the mean. The inhibition zone is measured in millimeters [Table 3 and Figure 2].

3.5. Effect of *E. parasitica* Methanolic Stem Extracts on Prostate Cancer Cell Lines (PC-3) and Pancreatic Cancer Cell Line (PANC-1) Cancer Cells

In vitro cytotoxic effect of *E. parasitica,* methanolic stem extract was evaluated against human prostate and pancreatic cancer cells using MTT assay, at various concentrations (31.25, 62.5, 125, 250, and 500 µg/mL) and 24 h of incubation time. The results of the MTT assay revealed dose-dependent cytotoxic activity on both the cancer cells, but to a different extent. The methanolic stem extract showed more cytotoxic activity against PC-3 cancer cell lines when compared with the PANC-1 cancer cells and it exhibited no cytotoxic activity against normal cell lines (MEF-L929 mice embryo blast) [Table 4 and Figure 3]. The results of the cytotoxic effects of methanolic stem extract are comparable to those of conventional chemotherapic drugs like curcumin, which is frequently used to treat cancer. The IC_{50} values of methanolic stem extracts against PC-3 and PANC-1 cell lines are 372.27 ± 22.07 µg/mL and 443.33 ± 17.85 µg/mL at higher concentrations.

4. DISCUSSION

The present investigations on qualitative analysis of phytoconstituents of *E. parasitica* revealed the presence of various secondary metabolites

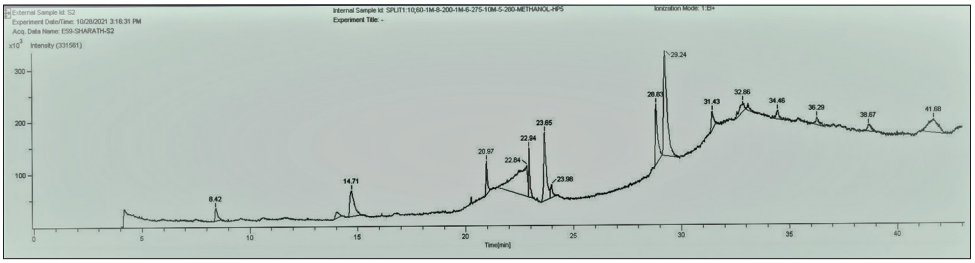

Figure 1: GC-MS chromatogram of methanolic stem extracts of *Elytranthe parasitica.*

Table 1: Preliminary qualitative screening of phytoconstituents of *Elytranthe parasitica* stem extracts.

Secondary metabolites	Name of the test	Petroleum ether	Chloroform	Methanol
Alkaloids	Mayer's test	−	−	−
	Wagner's test	−	−	−
Tannin and Phenolic compounds	Ferric chloride test	−	−	+
	Gelatin test	−	−	+
	Lead acetate	−	−	−
	Salkowski's Test	−	−	+
Glycosides	Keller-killiani's test	+	+	+
	Legal's test	+	+	+
Flavonoids	Ferric chloride test	−	−	+
	Shinoda test	−	−	+
Sterols	Libermann Burchard's Test	+	+	+
Saponins	Foam test	−	−	+
Terpenoids	Libermann Burchard's Test	−	+	+
Carbohydrates	Benedict's Test	−	−	+
	Fehling's Test	−	−	+
Fixed oils and fats.	Saponification Test	−	−	+

−: Negative result; +: Positive results

in different solvent extracts [Table 1]. The biological effects of medicinal plants, such as their anti-microbial, hypoglycemic, anti-diabetic, antioxidant, anti-inflammatory, anti-carcinogenic, anti-malarial, anti-cholinergic, and anti-leprosy properties, are greatly influenced by these secondary metabolites [23]. Phenolic compounds are the main bioactive elements, involved in antioxidant activity through removing free radicals, boosting the immune system, controlling gene expression, and having antimicrobial effects [24]. Tannins are essential in various biological functions, due to their anti-inflammatory, cardiovascular-protective, and antibacterial effects [25,26]. Wang *et al*. have reported that flavonoids have been utilized for diabetes, antimicrobial benefits, anti-inflammation, and anti-aging medications [27]. Besides, saponins act as hypotensive, cardiac depressive, cardiotonic, and hemolytic actions in addition to

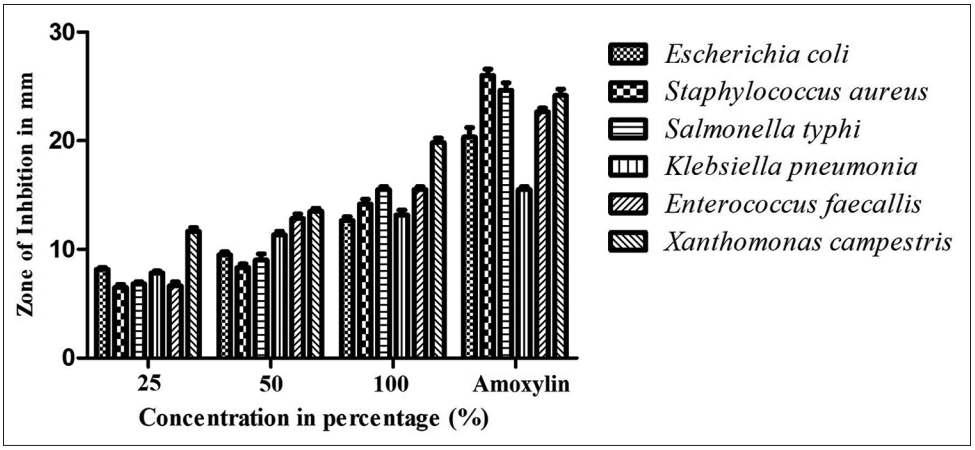

Figure 2: Antibacterial activity of the stem methanolic extract of *E. parasitica* against selected pathogenic bacterial strains.

Table 2: List of identified phytochemicals in methanolic stem extract of *Elytranthe parasitica* (L.) Danser by GC-MS analysis.

Retention time	Average percentage	Chemical compound present	Molecular formula	Molecular weight	Properties
8.42	1.87	1-Nitro-beta-d-arabinofuranose, tetraacetate	$C_{13}H_{17}NO_{11}$	363.27	No significant report.
14.07	1.20	Ethyl iso-allocholate	$C_{26}H_{44}O_5$	436.6	Antimicrobial, diuretic, anti-inflammatory, antiasthma.
14.71	6.54	β-D-Glucopyranose, 1,6-anhydro-	$C_6H_{10}O_5$	162.14	Anti-bacterial and antioxidant activity.
20.97	2.86	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.42	Antioxidant, hypocholesterolemic, nematicidal, pesticide, hemolytic, antiandrogenic, hemolytic, 5-alpha reductase inhibitor, anti-inflammatory activity.
22.84	22.95	Octadecenoic acid, 4-hydroxybutyl ester	$C_{22}H_{44}O_3$	356.6	No significant report
22.94	3.61	Oleic acid	$C_{18}H_{34}O_2$	282.5	Antimicrobial, antioxidant, and apoptotic activity.
23.65	10.59	9-Hexadecenoic acid	$C_{16}H_{30}O_2$	254.41	Anti-inflammatory protective effects on hepatic steatosis and insulin signaling in murine.
23.98	1.62	Pentadecanoic acid	$C_{15}H_{30}O_2$	242.4	Antimicrobial.
28.83	8.15	Hexadecanoic acid, 2,3-dihydroxypropyl ester	$C_{19}H_{38}O_4$	330.5	Palmitate-induced inflammatory effect on microphage
29.24	21.90	2H-1-Benzopyran-7-ol, 3,4-dihydro-5-methoxy-2-phenyl-	$C_{16}H_{16}O_3$	256.30	Anti-inflammatory, anti-allergic agent.
31.43	2.35	Z-8-Methyl-9-tetradecenoic acid	$C_{15}H_{28}O_2$	240.38	No significant report.
32.86	2.73	Oleic acid	$C_{18}H_{34}O_2$	282.5	Antimicrobial, antioxidant apoptotic activity.
33.10	0.98	Z-8-Methyl-9-tetradecenoic acid	$C_{15}H_{28}O_2$	240.38	No significant report.
34.46	1.54	Z-8-Methyl-9-tetradecenoic acid	$C_{15}H_{28}O_2$	240.38	No significant report.
36.29	1.49	Z-8-Methyl-9-tetradecenoic acid	$C_{15}H_{28}O_2$	240.38	No significant report.
38.67	1.69	Z-8-Methyl-9-tetradecenoic acid	$C_{15}H_{28}O_2$	240.38	No significant report.
41.68	7.84	Oleic acid	$C_{18}H_{34}O_2$	282.50	Antimicrobial, antioxidant, and apoptotic activity.

GC-MS: Gas Chromatography-Mass Spectroscopy.

Table 3: Antibacterial activity of the stem methanolic extract of *Elytranthe parasitica* (L.) Danser against selected pathogenic bacterial strains.

S. No.	Name of the bacterial strains	Inhibition zone in mm (Mean±Standard Error of Mean)				
		Concentration in percentage			Standard (Amoxylin)	Control (Dimethyl sulfoxide)
		100%	50%	25%		
1.	*Escherichia coli*	12.66±0.33	9.50±0.28	8.16±0.16	20.33±0.88	00
2.	*Staphylococcus aureus*	14.16±0.44	8.33±0.33	6.50±0.28	26.00±0.57	00
3.	*Salmonella typhi*	15.50±0.28	9.00±0.57	6.83±0.16	24.66±0.66	00
4.	*Klebsiella pneumonia*	13.16±0.44	11.33±0.33	7.83±0.16	15.50±0.28	00
5.	*Enterococcus faecallis*	15.50±0.28	12.83±0.44	6.66±0.33	22.66±0.33	00
6.	*Xanthomonas campestris*	19.83±0.44	13.50±0.28	11.66±0.33	24.16±0.60	00

Table 4: Cytotoxicity of *Elytranthe parasitica* methanolic stem extracts against prostate and pancreatic cancer cell lines.

S. No.	Concentration (µg/mL)	PC-3 cell lines (Mean±Standard Error of Mean)			PANC-1 cell lines (Mean±Standard Error of Mean)		
		% of cell viability	IC_{50} value (µg/mL)	Standard (curcumin 10 µM) % of cell viability	% of cell viability	IC_{50} value (µg/mL)	Standard (curcumin 10 µM) % of cell viability
1.	Untreated	100±0.00	372.27±22.07	47.95±0.36	100±0.00	443.33±17.85	49.03±0.24
2.	31.25	88.57±0.24			95.51±1.59		
3.	62.5	78.29±2.36			85.32±1.20		
4.	125	67.35±0.75			76.16±0.27		
5.	250	58.99±0.46			61.82±0.34		
6.	500	40.17±3.03			48.30±2.18		

PC-3: Prostate cancer cell lines, PANC-1: Pancreatic cancer cell line

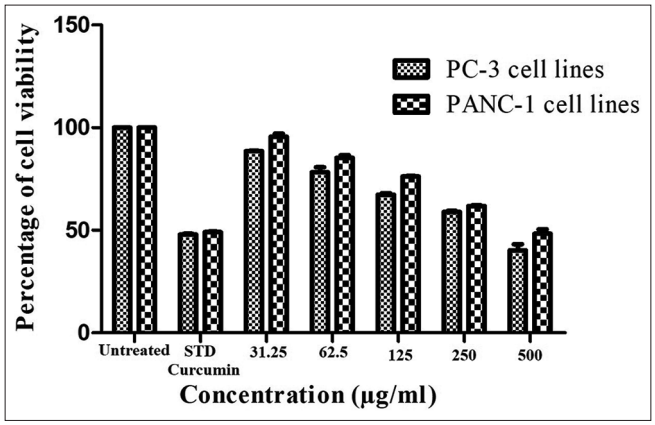

Figure 3: Cytotoxicity of *Elytranthe parasitica* methanol stem extracts against PC-3 and PANC-1 cells. PC-3: Prostate cancer cell lines and PANC-1: Pancreatic cancer cell line.

having anti-inflammatory, antibacterial, antidote, antifungal, anti-yeast, and antifeedant activities [28].

Plants are the main source of many effective medications. Studies on phytochemicals are developing and accurately certified on a regular basis. For bioprospecting for plant bioactive chemicals, GCMS has been demonstrated to be a useful instrument [29]. The identified phytoconstituents in stem methanolic extract, which is responsible for their widespread usage in medical help, include ethyl iso-allocholate reported to possess antimicrobial, diuretic, anti-inflammatory, and antiasthma activities [30]. β-D-Glucopyranose, 1,6-anhydro- shows antibacterial, and antioxidant activity [31].

The remaining phytoconstituents examined were as follows: n-Hexadecanoic acid is reported to have antioxidant, hypocholesterolemic, nematicidal, pesticidal, hemolytic, 5-alpha reductase inhibitor, anti-androgenic, hemolytic [32], and anti-inflammatory activity [33]. The compound oleic acid was recognized to have a number of biological activities, including antimicrobial [34], antioxidant [35], and apoptotic activity [36]. Pentadecanoic acid a phytochemical compound also found in *Aegle marmelos* possesses antimicrobial properties [37]. Hexadecanoic acid, 2,3-dihydroxypropyl ester shows a palmitate-induced inflammatory effect on microphage [38], and it is also used in food additives and cosmetics as an emollient [39]. Another major bioactive compound 2H-1-Benzopyran-7-ol, 3,4-dihydro-5-methoxy-2-phenyl- possesses an anti-inflammatory [40] and anti-allergic agent [41]. The properties of some identified phytoconstituents were not yet identified and reported in Table 1.

Nowadays, many pathogenic bacteria that cause different diseases have developed resistance to a number of pharmaceutical drugs. Thus, scientists are looking at the medicinal properties of traditional plants. There are numerous reports on the antibacterial properties of plants [42-45]. Similarly, in the present investigation, the methanolic extract of *E. parasitica* was tested against selected human and plant pathogenic bacterial strains to check its antibacterial potential. The results of antibacterial activity showed that concentration depending the inhibition zone in all tested bacterial strains. The identified phytoconstituents such as ethyl iso-allocholate; β-D-glucopyranose, 1,6-anhydro-; oleic acid; and pentadecanoic acid by GC-MS screening are previously reported to have antimicrobial properties [Table 2]. Likewise, several mistletoe extracts have been documented to possess antimicrobial qualities [45-52]. These findings demonstrate that the methanolic stem extract *E. parasitica* significantly inhibits the growth of the tested bacterial strains.

The methanolic stem extract of *E. parasitica* showed moderate cytotoxicity against prostate (PC3) and pancreatic (PANC-1) cancer

cell lines [Table 4 and Figure 2]. It has been previously reported to have cytotoxic activities against different cancer cell lines [16-19]. The results of the MTT assay revealed, dose-dependent cytotoxic activity on both the cancer cell lines, but to a varying extent. Major recognized compounds in GC-MS analysis have anticancer properties [Table 2]. *E. parasitica* has been previously reported that has anti-oxidant activity [14,15], whereas plants with anti-oxidant activity also showed anticancer properties by inhibiting the proliferation of multiple human cancer cells [17]. Mistletoes were found to have excellent track records in the treatment of cancer [53].

Stem methanol extract of *E. parasitica* prevented the development of the prostate (PC3) and pancreatic (PANC-1) cancer cell lines *in vitro*, but it had no impact on the growth of mouse embryo fibroblast cell lines (MEF-L929). These selective effects are influenced by variations in the incubation periods and concentrations. Each extract's concentration was measured in duplicate by serial dilution at different concentrations (31.25–500 µg/mL). The methanolic stem extract, at a dosage of 500 µg/mL, had the greatest impact on growth inhibition among all five concentrations.

5. CONCLUSIONS

The findings of the current investigation showed that *E. parasitica* contains a wide variety of phytochemical constituents. The GC-MS screening of the stem methanolic extract showed 11 identified bioactive phytoconstituents, based on mass spectrum, retention time, molecular weight, and peak area. Octadecenoic acid, 4-hydroxybutyl ester (22.95%), and 2H-1-Benzopyran-7-ol, 3,4-dihydro-5-methoxy-2-phenyl- (21.90%) were the major identified compounds. The stem methanolic extracts showed considerable antibacterial efficacy against the examined human and plant pathogenic bacterial strains. It also showed moderate cytotoxicity on both prostate and pancreatic cancer cell lines at higher concentrations, but it did not show any cytotoxicity toward normal mice embryo fibroblast cell lines. However, further isolation of individual bioactive phytoconstituents and subject to their antimicrobial and cytotoxic activities are required to prove the real medicinal potential of the test plant *E. parasitica*.

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7. AUTHORS' CONTRIBUTIONS

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work. All the authors are eligible to be an author as per the International Committee of Medical Journal Editors (ICMJE) requirements/guidelines.

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9. CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

10. ETHICAL APPROVALS

This study does not involve experiments on animals or human subjects.

11. DATA AVAILABILITY

All data generated and analyzed are included in this research article.

12. PUBLISHER'S NOTE

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