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SUCCESSIVE PHYTOCHEMICAL SCREENING AND STUDY OF TOTAL PHENOLS AND FLAVONOIDS CONTENT IN EXTRACT OF *ZYGOPHYLLUM ARABICUM*

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Abstract

The study aimed to investigate the phytochemical composition and quantify the total phenol and flavonoid content in various extracts of *Zygophyllum arabicum*. Extracts were prepared using chloroform, ethyl acetate, and methanol, yielding 4.46%, 5.31%, and 8.29% respectively. Phytochemical screening revealed the presence of flavonoids, diterpenes, phenols, and saponins, particularly in the methanol extract, which exhibited the highest concentration of these bioactive compounds. Quantitative analysis showed the total flavonoid content as quercetin equivalents (QE) and total phenolic content as gallic acid equivalents (GAE). The methanol extract contained the highest levels of flavonoids (0.766 mg/100 mg) and phenols (1.583 mg/100 mg). These findings confirm *Zygophyllum arabicum*'s significant antioxidant potential, supporting its traditional medicinal uses and highlighting its promise as a natural source of therapeutic agents. The results provide a scientific basis for further pharmacological studies to explore the plant's health benefits.

Keywords: *Zygophyllum arabicum*, phytochemical screening, total phenol content, total flavonoid content, antioxidant potential.

Introduction

Phytochemicals are bioactive compounds found in plants that play a significant role in the prevention and treatment of various diseases due to their diverse therapeutic properties, including antioxidant, anti-inflammatory, and antimicrobial activities (Craig, 1999). The genus *Zygophyllum*, belonging to the Zygophyllaceae family, is known for its rich phytochemical composition, particularly flavonoids, saponins, and phenolic acids (El-Ghazali et al., 2009). Among the species of this genus, *Zygophyllum arabicum* has garnered attention for its medicinal potential in traditional medicine practices in arid regions.

Zygophyllum arabicum is a perennial shrub commonly found in desert areas, particularly in the Arabian Peninsula. It has been used traditionally to treat a variety of ailments, including inflammation, gastrointestinal disorders, and skin diseases (Al-Yahya et al., 1990). The therapeutic efficacy of *Zygophyllum arabicum* is largely attributed to its phytochemical constituents, which necessitates a detailed study of its phytochemical profile to explore its potential as a source of natural bioactive compounds.

Phenolic compounds and flavonoids are among the most important phytochemicals due to their potent antioxidant activities, which can neutralize free radicals and prevent oxidative stress-related damage (Rice-Evans et al., 1997). The antioxidant properties of phenolics and flavonoids contribute to their role in reducing the risk of chronic diseases such as cardiovascular diseases, cancers, and neurodegenerative disorders (Middleton et al., 2000). Given the significance of these compounds, assessing the total phenolic and flavonoid content in plant extracts provides valuable insights into their potential health benefits.

This study aims to conduct a successive phytochemical screening of the *Zygophyllum arabicum* extract to identify its major bioactive constituents. Additionally, the total phenolic and flavonoid content of the extract will be quantified to evaluate its potential antioxidant capacity. By elucidating the phytochemical profile and antioxidant properties of *Zygophyllum arabicum*, this research seeks to validate its traditional uses and pave the way for its application in the development of natural therapeutic agents.

Material and Methods

Collection of plant material

Whole plant materials of *Zygophyllum arabicum* were collected from Vindhya Herbal, Bhopal in the month of December, 2023. Drying of fresh plant parts was carried out in sun but under the shade.

Extraction procedure

Following procedure was adopted for the preparation of extract from the shade dried and powdered whole plant materials part (Khandelwal, 2005):

Defatting of plant material

47gm of shade dried whole plant materials of *Zygophyllum arabicum* were extraction with petroleum ether using maceration method. The extraction was continued till the defatting of the material had taken place.

Extraction by maceration Method

Defatted plant material were extracted in four solvents of different polarity viz methanol, ethyl acetate and chloroform by maceration method. The resultant content was filtered with

whatman filter paper no.1 and kept for evaporation of solvent to get the dry concentrated extract. The dried crude concentrated extract was weighed to calculate the extractive yield then transferred to glass vials (6 ×2 cm) and stored in a refrigerator (4°C), till used for analysis (Mukherjee, 2007).

Determination of percentage yield

The percentage yield of yield of each extract was calculated by using formula:

$$\text{Percentage yield} = \frac{\text{Weight of extract}}{\text{Weight of powdered drug taken}} \times 100$$

Phytochemical screening

Phytochemical examinations were carried out extracts as per the following standard methods (Kokate, 1994).

Estimation of total flavonoids content

Determination of total flavonoids content was based on aluminium chloride method (Parkhe and Bharti, 2019). 10 mg quercetin was dissolved in 10 ml methanol, and various aliquots of 5-25µg/ml were prepared in methanol. 10 mg of dried extract was dissolved in 10 ml methanol and filter. Three ml (1mg/ml) of this extract was for the estimation of flavonoids. 1 ml of 2% AlCl₃ solution was added to 3 ml of extract or each standard and allowed to stand for 15min at room temperature; absorbance was measured at 420 nm.

Estimation of total phenol content

The total phenol content of the extracts was determined by the modified folin-ciocalteu method (Parkhe and Bharti, 2019). 10 mg Gallic acid was dissolved in 10 ml methanol, various aliquots of 10-50µg/ml was prepared in methanol. 10 mg of dried extracts was dissolved in 10 ml methanol and filter. Two ml (1mg/ml) of this extract was for the estimation of phenol. 2 ml of each extract and standard was mixed with 1 ml of Folin-Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and 1 ml (7.5g/l) of sodium carbonate. The mixture was vortexed for 15s and allowed to stand for 10min for colour development. The absorbance was measured at 765 nm using a spectrophotometer.

Results and Discussion

The extraction and phytochemical screening of *Zygophyllum arabicum* extracts have revealed diverse chemical compositions and varying levels of bioactive compounds across different solvents. The extraction yields demonstrate that methanol is the most effective solvent, yielding 8.29%, followed by ethyl acetate at 5.31% and chloroform at 4.46%. This

suggests that methanol, due to its polarity, can extract a broader range of phytochemicals from *Zygophyllum arabicum*.

Phytochemical screening results show significant differences in the presence of various constituents among the extracts. Flavonoids were consistently detected in all extracts, with the methanol extract showing the highest content. This was confirmed by positive results in both the alkaline reagent and lead acetate tests. Flavonoids are known for their antioxidant properties, which play a crucial role in protecting cells from oxidative damage. The consistent presence of flavonoids in all extracts indicates that *Zygophyllum arabicum* is a valuable source of these bioactive compounds.

Diterpenes were also detected in all extracts, as evidenced by the positive copper acetate test results. Diterpenes have been associated with various biological activities, including anti-inflammatory, antimicrobial, and anticancer properties. The presence of diterpenes across all extracts suggests that *Zygophyllum arabicum* may have potential therapeutic applications.

Phenolic compounds, another important class of antioxidants, were detected in the ethyl acetate and methanol extracts through the ferric chloride and Folin-Ciocalteu tests. These compounds are known for their ability to scavenge free radicals and chelate metal ions, contributing to their antioxidant activity. The higher content of phenolic compounds in the methanol extract indicates its strong potential as an antioxidant source.

Saponins were detected in all extracts using the froth test. Saponins are known for their ability to lower cholesterol, boost the immune system, and exhibit antimicrobial properties. The consistent presence of saponins in the extracts of *Zygophyllum arabicum* highlights its potential health benefits.

Quantitative analysis of total flavonoids and phenols further supports the phytochemical screening results. The methanol extract exhibited the highest content of both flavonoids (0.766 mg/100 mg) and phenols (1.583 mg/100 mg). The ethyl acetate extract also contained significant amounts of flavonoids (0.646 mg/100 mg) and phenols (0.977 mg/100 mg), while the chloroform extract had the lowest flavonoid content (0.500 mg/100 mg) and no detectable phenol content. These quantitative results align with the qualitative screening, confirming the superior antioxidant potential of the methanol extract.

The significant presence of flavonoids and phenolic compounds in the methanol extract of *Zygophyllum arabicum* suggests its potential as a natural antioxidant source. These compounds contribute to the plant's ability to neutralize free radicals, thereby protecting against oxidative stress and related diseases. The consistent presence of saponins and

diterpenes further enhances the therapeutic potential of *Zygophyllum arabicum*, making it a promising candidate for further pharmacological studies.

Table 1: % Yield of extracts of *Zygophyllum arabicum*

S. No.	Extracts	% Yield (W/W)
1.	Chloroform	4.46%
2.	Ethyl acetate	5.31%
3.	Methanol	8.29%

Table 2: Result of phytochemical screening of extracts of *Zygophyllum arabicum*

S. No.	Constituents	Chloroform extract	Ethyl acetate extract	Methanol extract
1.	Alkaloids Wagner's Test: Hager's Test:	-ve -ve	-ve -ve	-ve -ve
2.	Glycosides Cons. H ₂ SO ₄	-ve	-ve	-ve
3.	Flavonoids Alkaline Reagent Test: Lead acetate Test:	+ve -ve	+ve -ve	+ve +ve
4.	Diterpenes Copper acetate Test:	+ve	+ve	+ve
5.	Phenol Ferric Chloride Test: Folin-ciocalteu Test:	-ve -ve	-ve +ve	+ve +ve
6.	Proteins Xanthoproteic Test:	-ve	-ve	-ve
7.	Carbohydrate Fehling's Test: Benedict Test:	-ve -ve	-ve -ve	-ve -ve
8.	Saponins Froth Test:	+ve	+ve	+ve
9.	Tannins Gelatin test:	-ve	-ve	-ve
10.	Sterols Salkowski's Test:	-ve	-ve	-ve

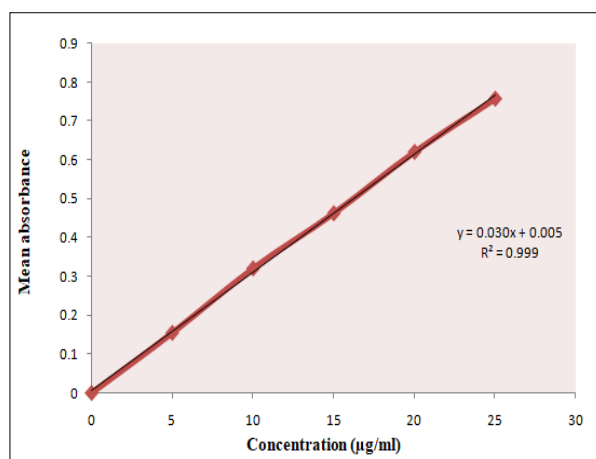


Figure 1: Graph of calibration curve of Quercetin

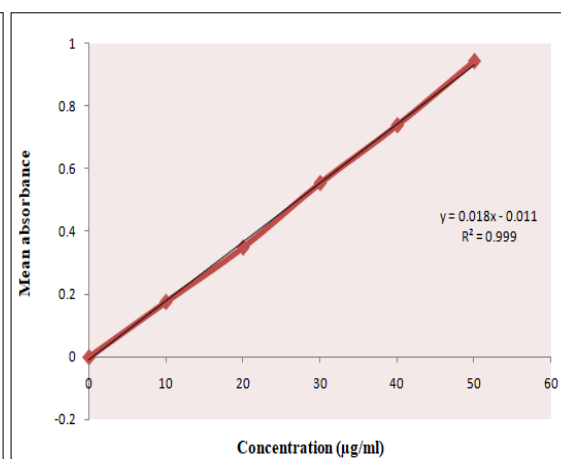


Figure 2: Graph of Calibration curve of Gallic acid

Table 3: Results of total flavonoids and total phenol content in *Zygophyllum arabicum*

S. No.	Extracts	Total flavonoids	Total phenol
		(mg/100mg)	
1	Chloroform	0.500	-
2	Ethyl acetate	0.646	0.977
3	Methanol	0.766	1.583

Conclusion

The study successfully highlighted the phytochemical profile and quantified the total phenol and flavonoid content in chloroform, ethyl acetate, and methanol extracts of *Zygophyllum arabicum*. The methanol extract demonstrated the highest yield and contained significant amounts of bioactive compounds, particularly flavonoids and phenols, which are known for their antioxidant properties. The findings validate the traditional medicinal use of *Zygophyllum arabicum* and suggest that its extracts, especially the methanol extract, can serve as valuable sources of natural antioxidants. This study provides a foundation for further pharmacological investigations to explore the therapeutic potentials of *Zygophyllum arabicum*, aiming to develop natural and effective treatments based on its bioactive compounds.

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