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Review paper

Qualitative Phytochemical Screening of Gymnanthemum Amygdalinum (Delile) Sch. Bip. Ex Walp.) Stems from Telangana, India

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Abstract

The present investigation focuses on the qualitative phytochemical screening of Gymnanthemum amygdalinum (Delile) Sch. Bip. ex Walp. (Asteraceae) stem extracts collected from Telangana, India. Ethanol and petroleum ether extracts were evaluated for the presence of secondary metabolites using standard phytochemical protocols. The ethanol extract revealed a broad spectrum of bioactive compounds, including alkaloids, flavonoids, tannins, phenols, terpenoids, and saponins, whereas the petroleum ether extract exhibited a narrower profile dominated by terpenoids and steroids. The findings provide evidence supporting the ethnomedicinal relevance of this species and suggest that stem extracts can serve as a potential source of pharmacologically active compounds.

Keywords: *Gymnanthemum Amygdalinum; Phytochemical Screening; Stem Extract; Telangana Flora; Ethnobotany; Bioactive Compounds.*

1. Introduction

Medicinal plants are an invaluable source of bioactive compounds that form the backbone of traditional and modern medicine. Among them, Gymnanthemum amygdalinum (Delile) Sch. Bip. ex Walp., commonly known as bitter leaf, is widely recognized for its diverse therapeutic potential, particularly in African and Indian ethnomedicine. Belonging to the family Asteraceae, this plant is reputed for its anti-inflammatory, antidiabetic, and antimicrobial properties, primarily attributed to the rich presence of secondary metabolites (Akinmoladun et al., 2021).

While previous studies have focused extensively on the leaves and roots of G. amygdalinum, the stem remains relatively unexplored. Understanding the phytochemical composition of different plant organs is vital since bioactive compounds often vary across tissues and solvent systems (Bessada et al., 2015). This study aims to identify and compare the major phytoconstituents present in ethanol and petroleum ether extracts of the stem, thus contributing to a more comprehensive phytochemical profile of the species.

Classification of Plants
Kingdom: Plantae
Class: Dicotyledonae
Sub-class: Gamopetalae
Series: Inferae
Order: Asterales
Family: Asteraceae
Genus: Gymnanthemum
Species: G. amygdalinum

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Fig. 1: G. Amygdalinum Plant.

Fig. 2: G. Amygdalinum Plant In Flowering Stage.

2. Materials and Methods

2.1. Plant collection and identification

Healthy stems of Gymnanthemum amygdalinum were collected from the botanical garden of Nizam College, Hyderabad, Telangana (17.40°N, 78.47°E). The plant was authenticated by a taxonomist at the Department of Botany, Nizam College, Osmania University, and a voucher specimen (NCB-2025-GA01) was deposited for reference.

2.2. Preparation of extracts

The collected stems were thoroughly washed, shade-dried for two weeks, and powdered using a mechanical grinder. About 50 g of powdered material was extracted separately with ethanol and petroleum ether using a Soxhlet apparatus for 6–8 hours. The resulting extracts were concentrated under reduced pressure using a rotary evaporator and stored at 4°C until further use.

2.2.1. Ethanol extraction

The properties of ethanol extraction include its ability to extract a wider variety of molecules, including both polar and non-polar phytochemicals, and its greater polarity as compared to ethyl acetate. It is frequently employed to extract phenolic acids, flavonoids, alkaloids, and other substances that are soluble in water. The purpose of using ethanol is to extract bioactive substances like polyphenols, glycosides, and tannins that are soluble in alcohol. Additionally, it's frequently used to prepare extracts for pharmacological study.

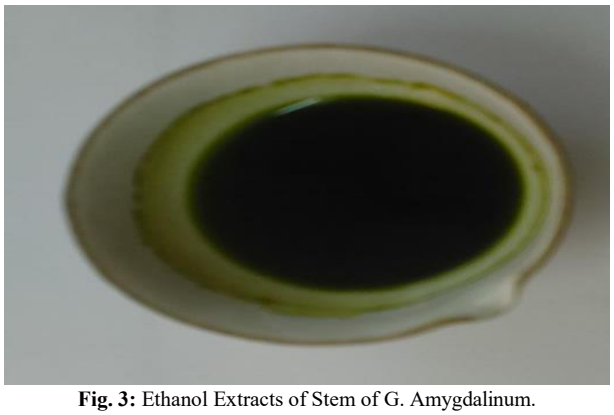

Fig. 3: Ethanol Extracts of Stem of G. Amygdalinum.

2.2.2. Petroleum ether extraction

The properties of petroleum ether as a moderately polar solvent make it useful for the extraction of substances such as alkaloids, terpenoids, and flavonoids. It is frequently employed to extract a range of secondary metabolites, particularly those with moderate polarity, from plant material. Petroleum ether is used to help separate substances that are less polar and may not dissolve as well in ethanol or water. In phytochemical and pharmacological research, it also aids in the extraction of volatile chemicals.

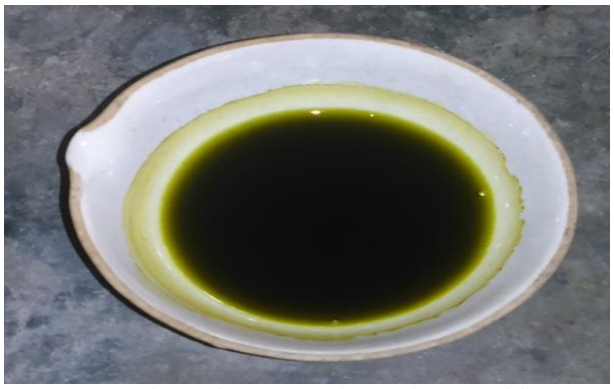

Fig. 4: Petroleum Ether Extracts of Stem of G. Amygdalinum.

2.3. Qualitative phytochemical screening

Standard phytochemical tests were performed following the methods described by Harborne (1998) and Trease & Evans (2009) to detect the presence of alkaloids, flavonoids, tannins, phenols, terpenoids, steroids, saponins, and glycosides. Observations were recorded as present (+) or strongly present (++).

2.3.1. Test for tannins

0.5 g of undiluted plant extract was heated and filtered after being diluted in 20 ml of water. After adding FeCl3 (0.1%) to the filtrate, the samples' blue to black color revealed the presence of tannins.

2.3.2. Test for flavonoids

1ml of HCl and a magnesium chip were added to the 0.5g of extract, and the extract's color was monitored. Flavonoids are confirmed to be present in the sample by the colors red, crimson, orange, and magenta.

2.3.3. Test for alkaloids

According to Hager's test, this was done. Filtered 1grm of extract after adding 4ml of HCl. Following that, drop by drop of saturated picric acid was added. Yellow-coloured precipitation shows if the extracts contain alkaloids.

2.3.4. Test for terpenoids

Concentrated Sulfuric acid (3 ml) was carefully added to the extract (5 ml) together with 2 ml of chloroform to produce a layer. The interface developed a reddish-brown tint, indicating the presence of terpenoids.

2.3.5. Test for anthraquinones

This was carried out by using Borntrager's approach. 0.5 g of extract was collected, combined with 2 ml of benzene, and shaken before filtering. Next, 10 ml (1%) ammonium solution was added to the filter. After one minute of shaking the mixture, the color change was noticed. The presence of violet color in the lower phase is indicative of anthraquinones.

2.3.6. Test for glycosides

1gm extract was dissolved in FeCl3 (0.5ml) and 4ml acetic acid followed by Conc. Sulfuric acid (2ml). A brown ring indicates that glycosides are present in the sample.

2.3.7. Test for saponins

After adding enough water to a test tube containing one gram of extract and stirring it, the tube was heated. The presence of Saponins is indicated by frothing seen in the tube.

2.3.8. Test for steroids

Add 2ml of chloroform and concentrated sulphuric acid to 0.5 g of extract. The extract's green color denotes the presence of steroids.

3. Results

3.1. Phytochemical composition

The results of the qualitative phytochemical screening are summarized in Table 1. The ethanol extract exhibited a higher diversity of secondary metabolites compared to the petroleum ether extract. Alkaloids, flavonoids, phenols, tannins, terpenoids, and saponins were abundant in ethanol extracts, whereas petroleum ether extracts predominantly showed terpenoids and steroids.

Table 1: Qualitative Phytochemical Screening of G. amygdalinum Stem Extracts

Phytochemical Constituents	Ethanol Extract	Petroleum Ether Extract
Alkaloids	++	+
Flavonoids	++	–
Tannins	+	–
Phenols	++	+
Terpenoids	++	++
Steroids	+	++
Saponins	+	–

(++) = Strongly present; (+) = Present; (–) = Absent.

4. Discussion

The presence of multiple bioactive compounds confirms the medicinal potential of G. amygdalinum stems. Ethanol, being a polar solvent, efficiently extracted a wide range of compounds, especially alkaloids and flavonoids, which are associated with antioxidant and antimicrobial properties (Omoregie et al., 2020). In contrast, petroleum ether predominantly extracts non-polar constituents like terpenoids and steroids, which are known for their anti-inflammatory and analgesic effects (Abbas et al., 2018).

The results correspond well with earlier studies on leaves and roots, suggesting that different plant parts of G. amygdalinum contain complementary phytochemicals. The presence of flavonoids and phenolic compounds suggests potential applications as natural antioxidants and free radical scavengers. Tannins and saponins may contribute to antimicrobial and anti-inflammatory activities, while alkaloids have been linked to antidiabetic and antihypertensive actions.

Furthermore, the diverse phytochemical profile supports the ethnomedicinal usage of G. amygdalinum in traditional systems for managing malaria, diabetes, and gastrointestinal disorders (Akinmoladun et al., 2021). Future work involving quantitative estimation and in vitro bioactivity assays could provide a stronger correlation between phytochemical presence and biological efficacy.

5. Conclusion

This study reveals that Gymnanthemum amygdalinum stem extracts contain a rich array of secondary metabolites, particularly in ethanol extracts. The qualitative screening underscores the pharmacological potential of this underutilized plant part, suggesting its suitability for further biochemical and pharmacological investigations. The results affirm the importance of exploring different organs of medicinal plants to discover novel bioactive compounds for therapeutic use.

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Conflict of Interest

The authors declare no conflict of interest.

Ethical Considerations

Originality: This manuscript is an original work and has not been published or submitted elsewhere for consideration.
Human and Animal Subjects: The present study did not involve human participants or animal experimentation.

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