Qualitative analysis of secondary metabolites in *Cordia myxa* L. fruits: a multipurpose tree species

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Abstract

Cordia myxa L., a widely used multipurpose tree species, has been employed in traditional medicine for its diverse therapeutic properties. The present study aimed to investigate the qualitative composition of secondary metabolites in *C. myxa* fruits. Phytochemical analysis of aqueous, methanol, and ethanol extracts revealed the presence of tannins, saponins, flavonoids, phenolic compounds, steroids, and alkaloids. The identified bioactive compounds suggest potential antioxidant, anti-inflammatory, antimicrobial, and antidiabetic properties, supporting the use of this plant in traditional medicine. This study provides a foundation for further research into the pharmacological and therapeutic applications of *C. myxa* fruits.

Keywords: Anti-inflammatory, antioxidant, multipurpose tree, pharmacological potential

Introduction

Cordia myxa L., a species of flowering plant in the Boraginaceae family, is a widely used multipurpose tree species found in various parts of the world (Aleem *et al.,* 2017). The plant has been used in traditional medicine for centuries, with its different parts being used to treat a range of ailments (Kumar *et al.,* 2021). Recent studies have shown that the studied plant possesses various biological activities, including antioxidant, anti-inflammatory, and antimicrobial properties (Singh *et al.,* 2022). The plant extract was helpful for treating cognitive dysfunction in rodents (Al-Musawi *et al.,* 2022; Kendir *et al.,* 2022). Secondary metabolites, such as alkaloids,

flavonoids, and phenolic acids, are known to play a crucial role in the medicinal properties of plants (Al-Khafaji *et al.,* 2021). Therefore, it is essential to investigate the preliminary qualitative composition of secondary metabolites in *C. myxa* fruits to understand their potential health benefits. The present study aims to investigate the preliminary qualitative composition of secondary metabolites in fruits of the studied plant using various solvent extracts. The study will provide valuable information on the phytochemical composition of *C. myxa* fruits, which can be used to develop new drugs and therapies. Additionally, the study will contribute to the conservation and sustainable use of *C. myxa*, a valuable multipurpose tree species.

Figure 1: Fruits of *C. myxa*

Materials and methods

The fruits of *C. myxa* were collected from the bank of Mahanadi River areas in Cuttack district of Odisha in October 2024 (Figure 1; Kumar *et al.,* 2021).

Authors have identified the plant specimen. Fruit extracts of aqueous, ethanol, and methanol were prepared, and nine different bioactive compounds were detected using standard methods (Devi *et al.,* 2023; Marndi *et al.,* 2024; Devi *et al.,* 2024).

Detection of nine secondary metabolites was conducted using standard methods and as followed by previous work of our laboratories (Kokate *et al.,* 2006; Jena *et al.,* 2024; Pradhan *et al.,* 2024).

Test for tannin: About 1 ml of the fruit extract was taken. 3-5 drops of 10% lead acetate solution were added to it. The gelatinous precipitate formation confirmed the presence of tannin.

Test for saponin: About 1 ml of the fruit extract was taken and 1 ml of distilled water was added and shaken well. The formation of persistent froth was observed confirming the presence of saponin.

Test for flavonoids: About 1 ml of the fruit extract was taken. 2 ml of 2% NaOH solution and 3 to 4 drops of dilute hydrochloric acid were added to it. The colour initially turned to an intense yellow colour with NaOH solution and later became colourless. This colour change appearance confirmed the presence of flavonoids.

Test for terpenoids: About 1 ml of the filtrate was added with 6 drops of chloroform and placed in the water bath for a few minutes. Then 6 drops of concentrated H_2SO_4 were added. The reddish- brown interface confirmed the presence of terpenoids.

Test for phenolic groups: About 1 ml of the filtrate extract was taken. A few drops of 5% Ferric chloride solution were added. The dark bluish-black appearance confirmed the presence of phenolic compounds.

Test for reducing sugars: About 1 ml of the fruit extract was taken and 2 drops of Fehling's solution A followed by Fehling's solution B were added and kept in the water bath for some time. The presence of red-orange precipitate confirmed the presence of reducing sugar.

Test for steroids: About 1 ml of the fruit extract was taken. 1 ml of chloroform and 1 ml of concentrated sulphuric acid was added gently into it touching test tube mouth. The appearance of upper red and lower yellow with green fluorescence provides the presence of steroids.

Test for alkaloids: About 1 ml of the fruit extract was taken and added 3 to 4 drops of Dragendroff's reagent. The formation of a reddish-brown precipitate confirmed the presence of alkaloids.

Test for carbonyl compounds: About 1 ml of the fruit extract was taken and added 3 to 4 drops of 2,4- Dinitrophenylhydrazine (DNPH) reagent. The formation of yellow crystal confirmed the presence of carbonyl compounds.

Results and discussion

The phytochemical analysis of *C. myxa* fruits revealed the presence of various bioactive compounds. The aqueous extract contained tannins, saponins, flavonoids, phenolic compounds, steroids, and alkaloids (Table 1; Figure 2). The methanol extract contained saponins, flavonoids, phenolic compounds, and steroids, but no tannins or alkaloids. The ethanol extract contained saponins, flavonoids, phenolic compounds, steroids, and alkaloids, but no tannins (Figure 3). The presence of these bioactive compounds suggests that *C. myxa* fruits may have various pharmacological properties (Tak *et al.,* 2024). The saponins, flavonoids, and phenolic compounds present in all three extracts may have a major pharmacological role in treating various health problems. Table 1 provides a comprehensive overview of the phytochemical analysis of *C. myxa* fruits. The table shows that the different extracts (aqueous, methanol, and ethanol) contain varying levels of bioactive compounds.

Table 1: Qualitative phytochemical analysis of *C. myxa* using different extracts

Bioactive compounds	**Extracts**		
	Aqueous	**Methanol**	**Ethanol**
Tannin	+ve	-ve	-ve
Saponin	+ve	+ve	+ve
Flavonoids	+ve	+ve	+ve
Terpenoids	-ve	-ve	-ve
Phenolic compounds	+ve	+ve	+ve
Reducing sugars	-ve	-ve	-ve
Steroids	+ve	+ve	+ve
Alkaloids	+ve	-ve	+ve

Carbonyl compounds	-ve	-ve	-ve

(+ve**:** Positive; **-**ve**:** Negative)

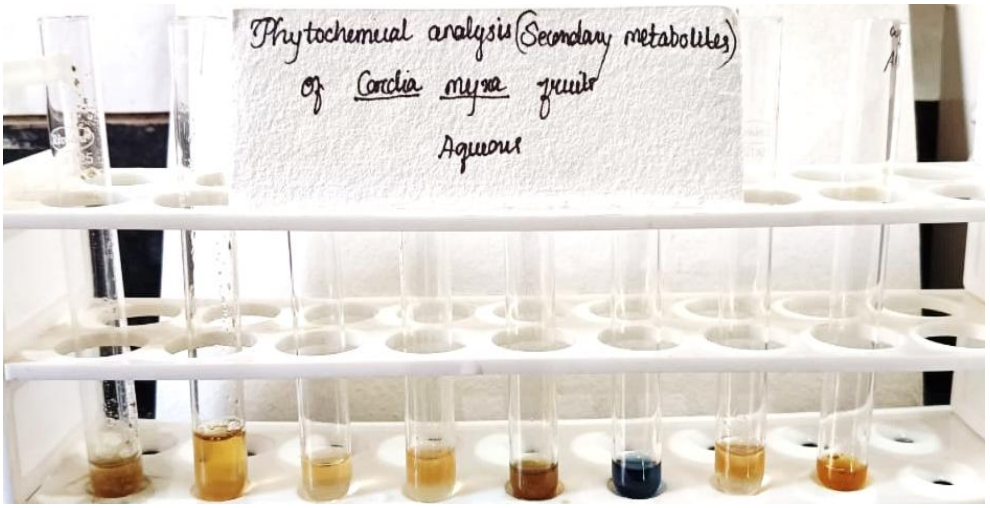

Figure 2: Detection of secondary metabolites of *C. myxa* using aqueous extract

Figure 3: Detection of secondary metabolites of *C. myxa* using ethanol extract

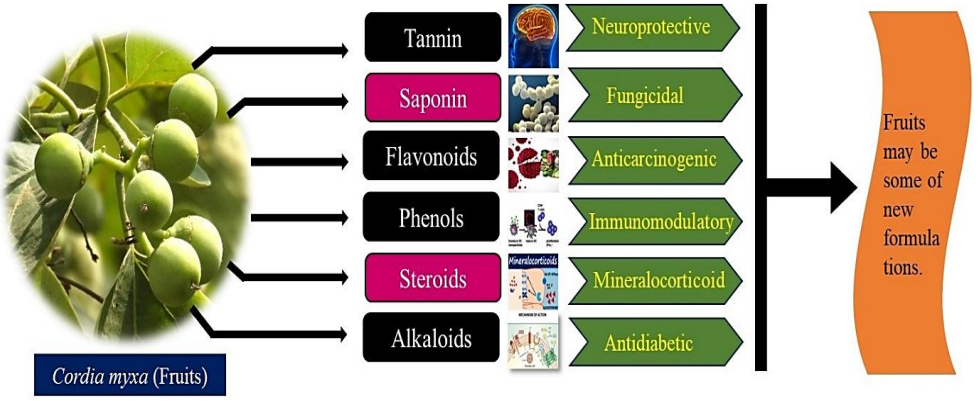

Figure 4: Pharmacological potentials of *C. myxa* fruits

The result suggests that the choice of extract may be important for specific applications. Table 1 and Figure 4 show that the fruits may have a range of biological activities, including neuroprotective, fungicidal, anticarcinogenic, immunomodulatory, and antidiabetic effects. This suggests that fruits may be a valuable source of bioactive compounds with potential therapeutic applications. The presence of tannins, saponins, flavonoids, phenolic compounds, steroids, and alkaloids in the fruit extracts suggests that *C. myxa* may possess antioxidant, anti-inflammatory, antimicrobial, and antidiabetic properties, among others (Figure 4). The fruits are edible. With high nutrition and medicinal value, the fruits can be utilized as functional fruit (Tak *et al.,* 2024).

Conclusion

The present study has successfully identified and characterized the secondary metabolites present in *C. myxa* fruits, revealing a diverse range of bioactive compounds with potential therapeutic applications. These findings provide a scientific basis for the traditional use of *C. myxa* in medicine and highlight its potential as a valuable source of natural products for the development of new drugs and therapies.

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