World Journal of Pharmaceutical Science and Research
www.wjpsronline.com
Research Article
ISSN: 2583-6579
SJIF Impact Factor: 6.916
Year - 2026
Volume: 5; Issue: 5
Page: 392-403

PHYTOCHEMICAL SCREENING AND COMPARATIVE ACCOUNT OF SOME FRUITING AND MEDICINAL PLANTS

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Article Received: 4 March 2026 | | ***Article Revised: 26 March 2026*** | | ***Article Accepted: 15 April 2026***

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How to cite this Article: Ritu Bharti, Shipra Shakya, Ranjana Roy Mishra (2026) PHYTOCHEMICAL SCREENING AND COMPARATIVE ACCOUNT OF SOME FRUITING AND MEDICINAL PLANTS. World Journal of Pharmaceutical Science and Research, 5(5), 392-403.

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ABSTRACT

Phytochemicals are naturally occurring bioactive compounds present in plant and have various therapeutic roles. Qualitative analysis is primary step for detecting the presence of major phytochemicals before quantitative and pharmacological studies. The present study focuses on comparative preliminary qualitative analysis of the three selected fruiting and flowering trees *Carissa carandas, Gymnema sylvestre, Psidium guajava* growing in Kalindi college campus, University of Delhi. Simple aqueous extract of fresh leaves were used to detect phytochemicals presence. Leaves were used for the present study because they easily available than any other part of plant. In the present study fresh as well as dry leaves were used for comparative phytochemical matrix. The plants with best results will be further examined.

KEYWORDS: Phytochemical, medicinal plant, therapeutic, secondary metabolites, Kalindi college, *Carissa carandas, Gymnema sylvestre, Psidium guajava*, Aqueous extract.

INTRODUCTION

Inactive lifestyle and wrong food habits leads to cardiac diseases, cancer, diabetes, neurological diseases (Pattaluchetty, 2025). From ancient times medicinal properties of plants are widely used and in recent years has gained more scientific interest in their therapeutic properties (Yadav & Agarwala, 2011). Approximately 80% of the population in developing countries still use traditional herbal medicines made from medicinal plants as reported by World Health Organization (WHO) (Doss & Phil, 2009; Yadav & Agarwala, 2011). The therapeutic properties of medicinal plants to cure various ailments is due to their phytochemical compositions (El-Saadony et al., 2025). According to Khan et al. (2019) approximately 25% of modern medicines used today are derived from plants. These types of medications also known as phytochemicals are actually secondary metabolites. which are categorized as flavonoids, glycosides, alkaloids, phenols, steroids, tannins etc. (Mishra, 2024).

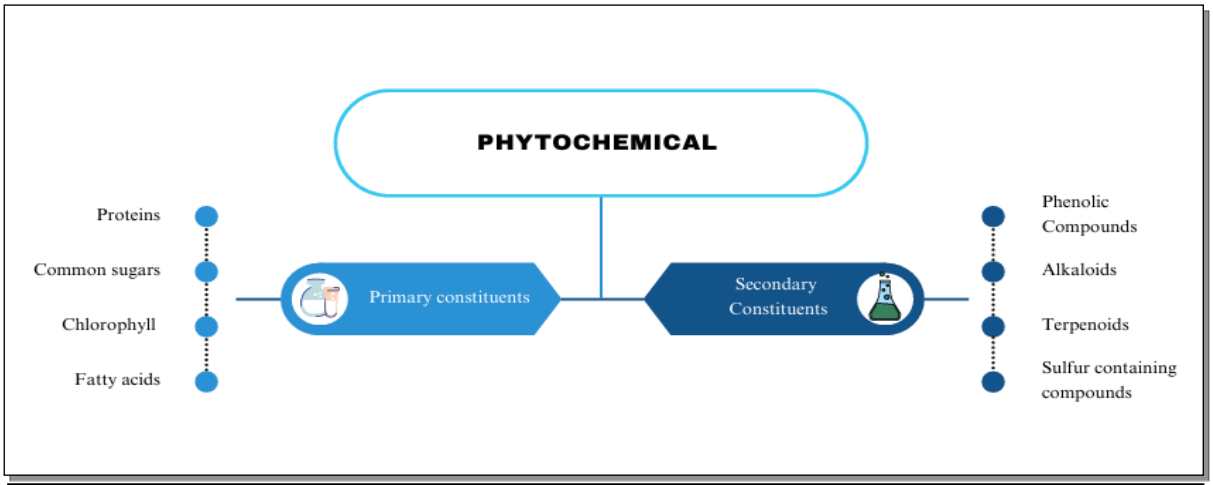


Fig 1- Primary and secondary phytochemical constituent that are present in plants.

Phytochemicals are the naturally occurring active chemical compounds which are present in plants (Saxena et al., 2013; Yadav et al., 2017) and it provides more benefits in terms of health rather than macronutrient and micronutrient.

Phytochemicals exit in different parts of plant such as roots, stems, leaves, flowers, fruits and seed (Saxena et al., 2013; Shaikh & Patil, 2020) . Due to biotic and abiotic stresses like infection, climatic change, plants start producing these secondary metabolites.

These metabolites also gives colour, fragrance and flavor to plants (Maheshwaran et al., 2024) and helps in defence mechanism and prevention of several aliments (Wadood, 2013). Phytochemicals present in plants are classified into two types called primary metabolites and secondary metabolites (Maheshwaran et al., 2024; Wadood, 2013) shown in figure 1.

The phytochemical 'alkaloids' contain nitrogen and have potent pharmacological effects. It shows antiarrhythmic, antimalarial, antimicrobial, anticancer, central nervous system stimulant properties and steroidal efficacy (El-Saadony et al., 2025; Maheshwaran et al., 2024; Saxena et al., 2013). Alkaloids are widely used in narcotics, as stimulants and in pharmaceuticals. They also assist in plant's defense mechanism against pathogens and herbivores. Only 20% of plant species contains more than 12,000 alkaloids and only small fraction of alkaloids have been utilized in medicinal role (Hamuel, 2012). Berberine, Caffeine, Solasodine, ephedrine are some common examples of alkaloids (Hamuel, 2012; Maheshwaran et al., 2024).

Terpenoids are secondary metabolites, which are biosynthesized from acetyl CoA or intermediates of glycolysis (El-Saadony et al., 2025). These are made from 5 carbon isoprene units and have bitter and fragrant flavor (Maheshwaran et al., 2024; Saxena et al., 2013). Terpenoids has properties of anti-bacterial, anti-viral, anti-cancer, anti-malarial, anti-inflammatory, and inhibition of cholesterol synthesis (Wadood, 2013). Some common examples of terpenoids found in plants are Oleanolic acid, Limonene, Taxol.

'Saponins' a plant secondary metabolite are glycosides that resembles the soap or foam like properties. It exhibit hepatoprotective and neuroprotective effects also and has immune modulating and lowering-cholesterol qualities

(Maheshwaran et al., 2024). On the basis of structure, it is of two types: Triterpene glycosides and Steroid glycosides (Hamuel, 2012) . Example are Ginsenosides and Dioscin (Pattaluchetty, 2025)

The most widely researched phytochemical is polyphenol due to their strong antioxidant properties. They are separated into following categories: Lignans, Flavonoids, Phenolic acids and Kaempferol. They exhibit antioxidant, anti-inflammatory, anticancer, cardiovascular protection (Pattaluchetty, 2025). Additionally it promotes reproduction and healthy plant growth, boosting seed germination before harvest and also shielding against morbidity and predators(El-Saadony et al., 2025).

Phytochemicals are crucial to pharmacognosy and drug development which aid in the identification of bioactive chemicals that are utilized in novel interventions. Additionally, it flourish the agriculture sector by aiding in production of natural biomaterials, and increasing agriculture productivity. Food industries use the natural antioxidants and apply it in the preservation of food and improving nutritional value. Plant extract are also used in cosmetic products such as haircare and skincare. In nutraceuticals it aids in advancement of nutritional supplement and functional foods to improve health (Desouza, 2025).



Fig. 2: *Carissa carandas, Gymnema sylvestre* and *Psidium guajava* plants growing in Kalindi College campus.

Qualitative Phytochemical screening is a key step in determining the bioactive chemicals found in specific medicinal plants. It is beneficial for future study towards the quantitative analysis and pharmacological research of these phytochemicals (Rao et al., 2023). In the present study, *Carissa carandas*, *Gymnema sylvestre* and *Psidium guajava* (figure 2) are selected medicinal plants on which qualitative phytochemical analysis was done.

Carissa carandas is a deciduous evergreen shrub that belongs to Apocynaceae family and is called karonda in hindi (Tesfaye & Ravichadran, 2018). The plant has fruit which is berry shaped and widely used in north India in the form of pickles or spices (Singh et al., 2020). Secondary metabolites such as saponins, cardiac glycosides, phenolic components, flavonoids, alkaloids, and triterpenoids are present in *Carissa carandas* (Bilal et al., 2015; Kaunda & Zhang, 2017). The folk names of *C. carandas* in different languages are Karmard, Sushena in Sanskrit; Karamarda in

Hindi; Cranberry Bengal currant in English; (Kumar & Gupta, 2013). From ancient times *Carissa carandas* is widely used to treat many aliments which includes headache, fever, cold, malaria, leprosy, and neural disorders (Bilal et al., 2015). The root extract of this plant is used to treat chest pain, helps in lowering blood pressure, helps in treating stomach pain and manage diabetes (Bilal et al., 2015; Singh et al., 2020). The leaves of *Carissa carandas* show anti-cancerous properties, treat fever, diarrhea , soreness of throat and mouth and ear pain (Bilal et al., 2015; Bint-e-Sadek et al., 2013; Kumar & Gupta, 2013). The fruit of *Carissa carandas* is repository of vitamin C, pectin and iron therefore used in treating anaemia. It helps in purification of blood and has antibacterial and antifungal activities also. Its juice is used in cleaning of old injury (Kumar & Gupta, 2013; Singh & Uppal, 2015).

Gymnema sylvestre is a medicinal plant belonging to dicotyledonous class of the Apocynaceae family (Khan et al., 2019; Tiwari et al., 2014). It is commonly known as madhunashini (Sanskrit) and Gurmar (hindi) (Muddapur et al., 2024). From ancient times and also in ayurveda *G. sylvestre* is widely used for its therapeutic value in controlling diabetes, maintaining optimum levels of blood sugar, helps in managing obesity, used in cough, malaria, cardiovascular diseases, asthma, cancer (Khan et al., 2019; Muddapur et al., 2024; Patel, 2017). The important Phytochemical found in the G.sylvestre are Gymnemic acids, Polypeptide Gurmarine and Gymnemasaponins (Muddapur et al., 2024; Saneja et al., 2010). These compounds are widely used in treatment of diabetes and pharmacognosy research as they help in reducing blood sugar levels and also limits the sugar cravings and helps in managing overall weight (Muddapur et al., 2024) which is necessary for healthy lifestyle.

Psidium guajava (Guava), a fruit producing plant that belong to family Myrtaceae. It is traditionally used as medicinal plant for managing and treating various ailments (Ekeleme et al., 2017). Various secondary metabolites are present in *P.guajava* which includes saponins, carotenoids, flavonoids, alkaloids, triterpenes, tannins and phenols (Möwes et al., 2025). The fruit of *Psidium guajava* has iron, calcium, phosphorous and also vitamin C & A. The flavonoid & Lycopene which are present in this plant are important source of antioxidants. They helps in the treatment of cancer and also prevent before time skin ageing (Naseer et al., 2018). For the treatment of a various aliments *Psidium guajava* is utilized all over the world for managing various, illnesses such as wounds, blood sugars, hypertension, inflammation, fever, oral problems, locomotion synchronization and pain relief. (Arya et al., 2012; Naseer et al., 2018).

Although, there are various individual studies on each plant, but no comparative qualitative phytochemical screening of these plants is available. Also, there is no comparative data available on the analysis of fresh and dry samples of chosen plants in the previous literatures.

In this study, qualitative phytochemical analysis of leaves of *Carissa carandas*, *Gymnema sylvestre* and *Psidium guajava* is carried out in aqueous extract. The study's objectives is to perform a qualitative phytochemical analysis of chosen three plants growing in college campus (Kalindi college) also, to perform a presence and absence matrix on plant's fresh and dry leaves and to relate these phytochemical classes with traditional therapeutic use of the selected plants.

MATERIALS AND METHODS

Plant material

Fresh and healthy leaves of *Carissa carandas*, *Gymnema sylvestre* and *Psidium guajava* were taken from the Kalindi College campus, University of Delhi. Plant leaves were washed thoroughly with distilled water for 2-3 times and

divided into two categories of fresh leaves and dry leaves. Leaves were shade-dried for some time and pulverized into coarse powder for the analysis. Leaves were selected over other plant parts due to high concentration of phytochemicals, softness, availability in large quantities, and ease of crushing (Mishra, 2024). The experiments was conducted in the months of October to December of 2025. To validate the findings, the experiments were conducted in triplicates.

Extraction

Approximately 20g of fresh leaves were taken and grinded into mortar and pestle for 10-15mins to make a fine slurry. For slurry making 80 ml of distilled water was added and mixed well, and filtered through muslin cloth. For dry leaves 20g of shade dried leaves were grinded into mortar and pestle to make fine powder. Using procedures outlined in the previous literature(Arya et al., 2012; Ekeleme et al., 2017; Maheshwaran et al., 2024; Mishra, 2024; Möwes et al., 2025; Shaikh & Patil, 2020), all qualitative phytochemical tests were conducted on fresh filtrate at room temperature. All the tests were done in aqueous extract as it fast, simple, safe, economic and cost effective.

Qualitative phytochemical tests

1. Test for Alkaloids (Mishra, 2024)

Fresh extract and dry extract (5ml) were acidified by addition of 5ml of 1.5% HCl. The solution was used for detection of alkaloids by following tests:

Mayer's test: To 2ml of extract, few drops of Mayer's reagent (consist of mixture two solution of Mercuric chloride and potassium iodide) were added. Creamy white precipitate confirms the presence of alkaloids.

Hager's test: To 2ml of extract, few drops of Hager's reagent was added. Yellow precipitate indicated the presence of alkaloids.

Wagner's test: To 2ml of extract, few drops of Wagner's reagent was added. Reddish-brown precipitate confirms the presence of alkaloids.

2. Test for Saponin (Mishra, 2024)

Foam test: To 2ml of extract was mixed with 10ml of doubled distilled water in test tube and shaken vigorously. Persistent foam development indicates the presence of saponins.

3. Test for Tannins (Mishra, 2024)

Ferric Chloride Test: To 2ml of aqueous extract, 2ml distilled water was added then few drops of 5% FeCl3 solution was added. Development of greenish or blue-black precipitate indicates the presence of tannins.

4. Test for Flavonoids (Mishra, 2024)

Alkaline reagent test: In 1ml of extract few drops of NaOH (w/v) solution was added in a test tube. The formation of dark yellow color will disappears on addition of dilute acid's few drops, that marks the presence of flavonoids.

5. Test for Glycosides (Mishra, 2024)

Keller-Killiani test: To 2ml of extract, 3ml glacial acetic acid and drop of 5% FeCl3 was added. Blue color indicates the presence of cardiac glycosides.

6. Test for Sterols (Mishra, 2024)

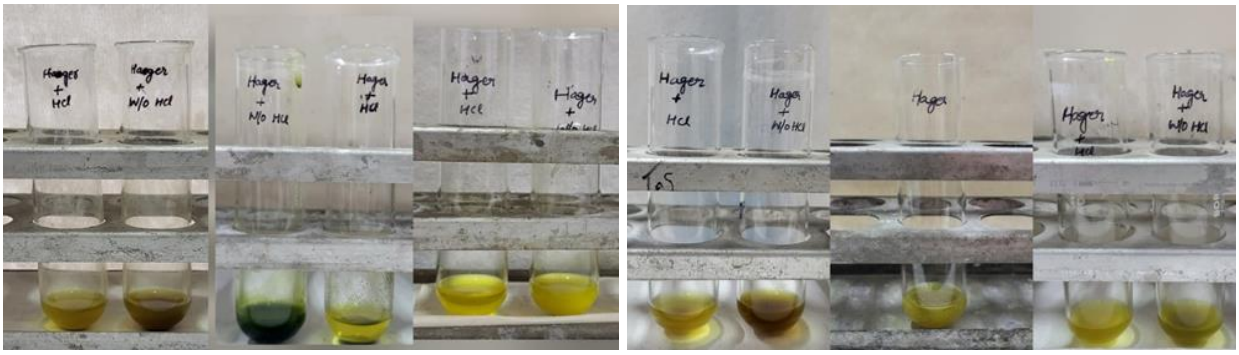
Salkowski test: Heat the 2ml of filtrate to dryness and add 2ml of Chloroform then add 2ml of Conc. H2SO4 shake and allow to stand. Formation of red color in chloroform layer indicates the presence of sterols.

7. Test for Terpenoids (Mishra, 2024)

To 2ml of extract add 2ml of chloroform and heat to dryness then add 2ml of Conc. H2SO4 then again heat for 2mins. Formation of greyish precipitate marks the presence of terpenoids

RESULT AND DISCUSSION

Qualitative phytochemical tests were performed on the aqueous leaf extracts of *Carissa carandas*, *Gymnema sylvestre* and *Psidium Guajava*. Alkaloid test was done on both fresh and dry leaves *of C.carandas* (karonda), *G.sylvestre* (madhunashini) and *P.guajava* (guava) (Figure 3). Mayer's test, Hager's test, Wagner's test were used to detect the presence of alkaloids. Wagner's test produced the best result out of three tests followed by Mayer's. For dried leaves we used Hager's test only as it was giving best results.



(A) Fresh Leaves **(B) Dry leaves**

Fig. 3: Alkaloid test of *Carissa carandas*, *Gymnema sylvestre*, *Psidium guajava* (A) fresh leaves, (B) Shade dried leaves.

Highest concentration of **alkaloids** in both fresh and dry sample was observed in *Carissa carandas* and then in *Psidium guajava* and *Gymnema sylvestre* as shown in table 1 and 2. The alkaloids present in karonda is accountable for the antibacterial and ant inflammatory effects. 'Carissine', an alkaloid present in karonda is responsible for stopping microbial growth and lowering inflammation, making karonda a therapeutic plant for the treatment of various infections (Akinyemi, 2025).

Table 1: Observation table of qualitative phytochemical analysis of fresh leaves of selected plants.

Phytochemicals	***Carissa carandas***	***Gymnema sylvestre***	***Psidium guajava***
Alkaloids	++++	+++	+++
Glycoside	+++	++++	+++
Saponins	++	++++	+
Flavonoids	+	++	++
Tannins	+++	+++	++
Terpenoids	++	+++	+++
Sterols	-	+	-

+ indicates presence; + +, moderate, + + +, High, + + + + Very high concentration − indicates absence

Table 2: Observation table of qualitative phytochemical analysis of shade-dried leaves of selected plants.

Phytochemicals	*Carissa carandas*	*Gymnema sylvestre*	*Psidium guajava*
Alkaloids	++++	++++	+++
Glycoside	-	-	+++
Saponins	++	+++	++
Flavonoids	++++	++	+++
Tannins	++++	+++	++++
Terpenoids	+++	+++	+++
Sterols	++	+++	+

+ indicates presence; + +, moderate, + + +, High, + + + + Very high concentration − indicates absence

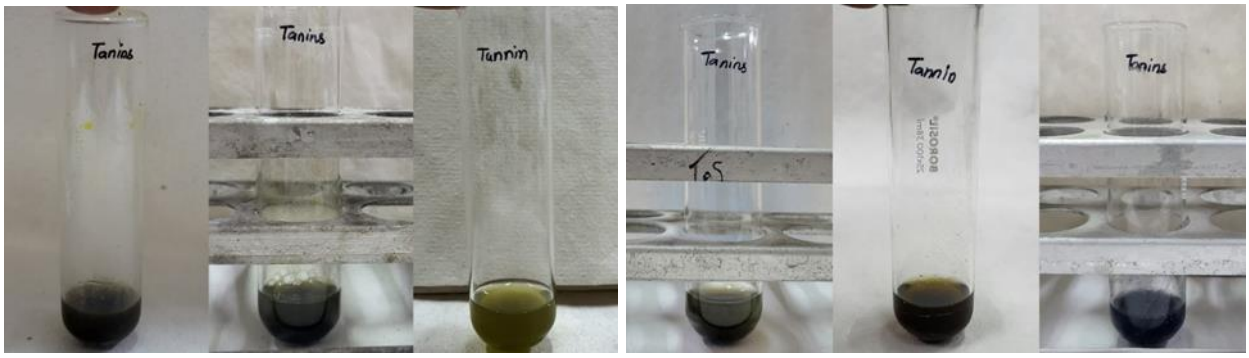
Saponin test was done on the both fresh and dry leaves of three plants. Highest concentration of saponin was observed in *Gymnema sylvestre* followed by *Carissa carandas* and *Psidium guajava* (Figure 4). When shaken with water, these chemical exhibit surfactant effect and produce stable forth. Saponin shows anti-inflammatory, antibacterial, anti-parasitic properties (Kregiel et al., 2017).



(A) Fresh Leaves **(B) Dry Leaves**

Fig. 4: Saponin test *of Carissa carandas, Gymnema sylvestre, Psidium guajava* (A) fresh leaves, (B) Shade dried leaves.

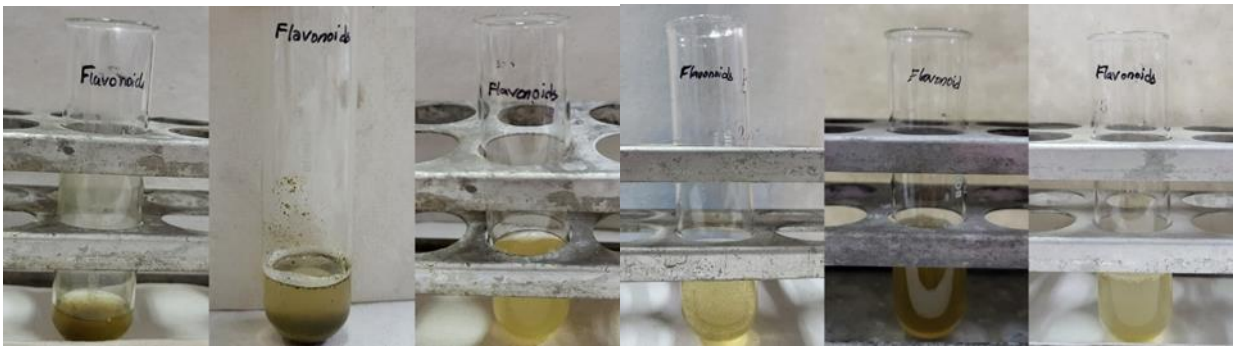
Aqueous extract of plants shown positive results for **tannins**. Tannin concentration was tested through Ferric chloride test. More concentration of tannins was observed in *Carissa carandas* then in *Psidium guajava* and then in *Gymnema sylvestre* (Figure 5). Fresh leaves of *C.carandas* showed Blackish green precipitate, *G.sylvestre* showed dark green precipitate while *P.guajava* showed green precipitate. Dry leaves of *C.carandas* showed dark green precipitate, *G.sylvestre* showed dark green precipitate while *P.guajava* showed bluish-black precipitate. Tannins are astringent substances, a collection of phenolic compounds that serve as a barrier against herbivores (Mishra, 2024). Tannins extracts widely show anti-inflammatory, antiseptic, antioxidant, and hemostatic medications, as well as against diarrhea and stomach and duodenal tumors. In recent years tannin gained more focus in the fatal diseases like cancer and AIDS (Saxena et al., 2013). Tannins concentration was more in dry leaves than fresh leaves as shown in table 2.



(A) Fresh leaves **(B) Dry leaves**

Fig. 5: Tannin test of *Carissa carandas*, *Gymnema sylvestre*, *Psidium guajava* (A) fresh leaves, (B) Shade dried leaves.

Flavonoids were detected by Alkaline reagent test and showed positive result in all three plants (Figure 6).

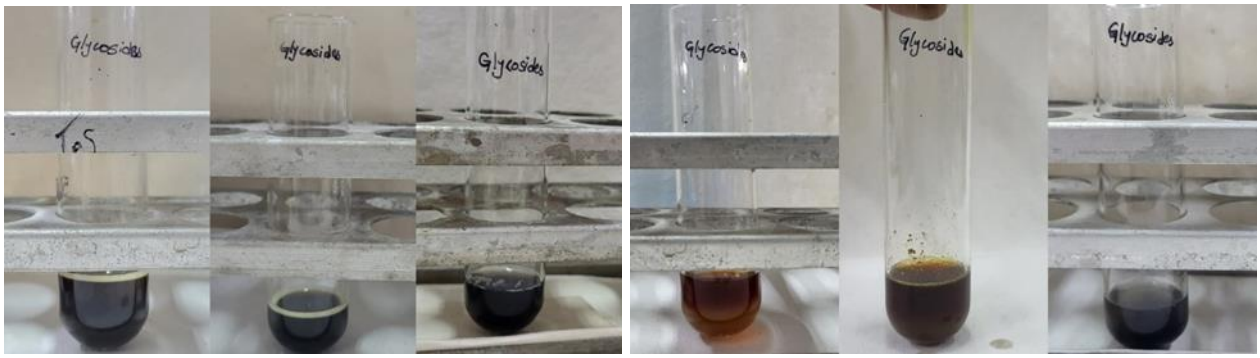


(A) Fresh Leaves **(B) Dry leaves**

Fig. 6: Flavonoid test of *Carissa carandas, Gymnema sylvestre, Psidium guajava* (A) fresh leaves, (B) Shade dried leaves.

Concentration of flavonoids were more in dry leaves as compared to fresh leaves due to abundant water content (Olumide et al., 2022). Dry leaves showed lesser amount of phytochemical as severe and extended drying caused enzymatic destruction of the phytochemicals (Dewi et al., 2019). These are the bioactive compounds which are responsible for imparting complexion to fruits, vegetables and flower and due to microbial infections they are produced in plants (Agidew, 2022; Mishra, 2024). They have antioxidant properties and helps in preventing frormation of reactive oxygen species (ROS) and free radicles in human body (Saxena et al., 2013). Kaempferol and quercetin a type of flavonoid present in *C.carandas* is responsible for its antioxidant properties (Akinyemi, 2025). Guava leaves also possess 'quercitin' a flavonoid which show anti-diarrheal activity (Kiruba, 2014).

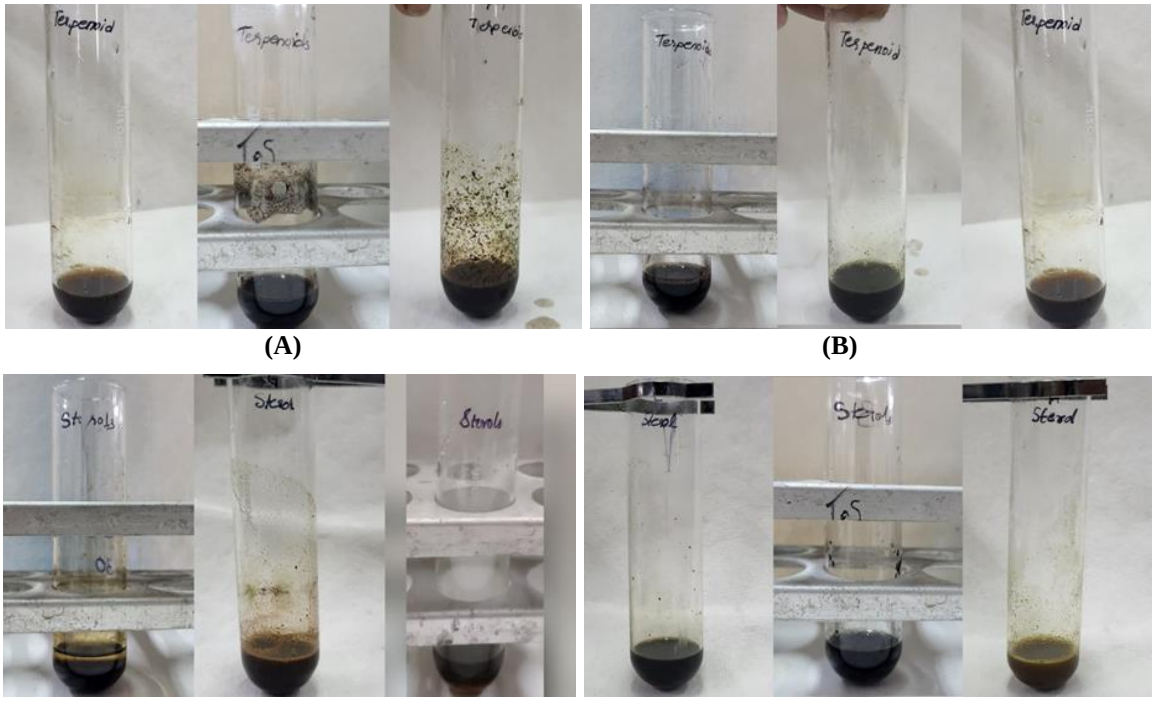
Glycosides test also showed positive results in all three plants. (Figure 7). Glycosides do not have color and are crystalline carbon, hydrogen & oxygen containing compounds which are soluble in water and also present in sap of cell (Hamuel, 2012). They are important in plant development (Maheshwaran et al., 2024) also has blood pressure lowering activity (Yadav & Agarwala, 2011). The best result was shown in the *Psidium guajava* fresh and dried leaves. Dried leaves of *Carissa carandas* and *Gymnema sylvestre* showed absence of glycosides.



(A) Fresh Leaves **(B) Dry Leaves**

Fig. 7: Glycoside test of *Carissa carandas, Gymnema sylvestre, Psidium guajava* (A) fresh leaves, (B) Shade dried leaves.

Terpenoids and sterols were tested by Salkowski test (Figure 8). Terpenoids produced by plant are small molecules which have variety of pharmacological properties such as anti-inflammatory, antimalarial, antibacterial, helps in lowering cholesterol, antiviral and also possess anti-cancerous activities (Agidew, 2022). Triterpenes, tannins, ursolic acid, and carissic acid have all been found in leaves of *Carissa carandas* also four pentacyclic triterpenoids and carissin, were found through analysis of fresh leaves(Kumar & Gupta, 2013). **Sterols** are the large molecules that are identified by particular carbon structure (Agidew, 2022), and show antibacterial property (Mishra, 2024; Yadav & Agarwala, 2011). Fresh leave extract of *Carissa carandas* and *Psidium guajava* showed absence of sterol in aqueous medium. Further studies can be done by using other solvent (non-polar) to confirm the presence of this phytochemical.



(A) **(B)**

(A) **(B)**

Fig. 8: Terpenoid and sterol test of Carissa carandas, Gymnema sylvestre, Psidium guajava (A) fresh leaves, (B) Shade dried leaves.

CONCLUSION

The current study found that aqueous leaf extract of *Carissa carandas*, *Gymnema sylvestre*, *Psidium guajava* contain significant phytochemicals such as alkaloids, saponins, flavonoids, tannins, glycosides, terpenoids and sterols. These bioactive compounds are well known for their therapeutic properties, which helps in contributing their traditional usage. Moreover, type of solvent determines the validity of these results. Under uniform experimental conditions, comparative study among three plants suggest the similarities and differences between them also provides a baseline phytochemical data which will help in supporting the traditional medicinal usage of these selected plants. Shade dried leaves showed high constituent of flavonoids and tannins so, dried forms of these plants can be utilized for antioxidants and anti-inflammatory properties. Bioactive constituent varies from plants to plants as *Carissa carandas* is rich in alkaloids anf flavonoids which provides the antibacterial, antioxidant properties. *Gymnema sylvestre* is rich in saponin, tannins, flavonoids, terpenoids and it has become the foundation for the recent allopathic drugs. It also contains Gymnemic acids which is a triterpenoid saponin that helps in the lowering the blood sugar levels and also helps in treating obesity. *Psidium guajava* showed the presence of alkaloids, flavonoids, sterols that could be accountable for anti-diabetic activity. Further quantitative analysis of these plant's phytochemical should be done for the proper isolation of these compounds and further pharmacological studies. Also, toxicological studies on these plants should be done for their standardization and quality control. The various pharmacological activities by the selected plants makes them a wonderful therapeutic drug for the better health and happy life.

ACKNOWLEDGEMENT

Authors are grateful to the Principal and laboratory staff of Kalindi College, Botany Department for their providing the necessary facilities for the studies. This research was conducted as part of fourth year B.Sc. (Hons.) Botany dissertation.

Declarations

Conflict of interest: There is no conflict of interest.

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