

PHYTOCHEMICAL SCREENING OF THREE TRADITIONAL MEDICINAL PLANTS: *TARAXACUM OFFICINALE*, *GERANIUM WALLICHIANUM*, AND *ELAEAGNUS PARVIFOLIA*

FAHAD SAID KHAN¹, MUHAMMAD AKRAM¹, ABID RASHID²,
SYED MUHAMMAD ALI SHAH¹ AND SULTAN AYAZ¹

¹Department of Eastern Medicine, Government College, University Faisalabad-Pakistan

²Faculty of Medical Sciences, Government College, University Faisalabad-Pakistan

*Corresponding author's email: dr.fahadsaid@gmail.com

Abstract

The purpose of this research is to determine the phytochemical analysis of traditional medicinal plants: *Taraxacum officinale*, *Geranium wallichianum*, and *Elaeagnus parvifolia*. Phytochemical screening of plants is an essential step in discovering bioactive components of medicinal plants, which might contribute to the formulation of novel medicines and improve the medications. The presence of important bioactive components in these three traditional medicinal plants commonly used in Asia has been identified to correlate with their ethnomedicinal importance. These plants include *Taraxacum officinale*, *Geranium wallichianum*, and *Elaeagnus parvifolia*. We used standard techniques to reveal the existence of secondary metabolites that include tannins, flavonoids, phenols, saponins, sterols, cardiac glycosides, and alkaloids. All the three species of plants showed different results. Tannins and saponins were mostly present in *Taraxacum officinale*. *Geranium wallichianum* contains most of terpenoids. Phytosterol, glycosides and carbohydrates were found in *Taraxacum officinale* and *Geranium wallichianum*. Alkaloids, saponins and flavonoids are present in all the three species therefore all of these plants have antioxidants properties and are of great medicinal use as well.

Keywords: Phytochemicals screening; Medicinal Plants; *Taraxacum officinale*; *Geranium wallichianum*; *Elaeagnus parvifolia*.

Introduction

Herbal medicine is a significant part of Pakistan's healthcare system, with 70% of the population utilizing it to treat various ailments (Shinwari, 2010). Herbs laid the groundwork for the advanced traditional medicine (TM) practiced by people worldwide for thousands of years. Individuals and communities benefit significantly from medicinal plants. Furthermore, herbs to cure disease and infections have a long history. According to the World Health Organization (WHO), TM disciplines are used worldwide due to their efficacy and affordability (Anon., 1985). Furthermore, it is argued that many plants have medicinal properties because of phytoconstituents that have specific physiological effects on the human body. Natural products, mainly from plants, including fruits, have long been studied for their nutritional and health benefits. Recent scientific research has confirmed that medicinal plants are essential for good health, making phytochemistry even more valuable.

Herbal medicine is also a significant element of Pakistan's health-care system, with 70% of the population utilizing it to treat a variety of ailments. Pakistan has a diverse range of herbal plants due to its environment and vegetation. In Pakistan, there is over 6000 medicinal plant species, 600 of which are regarded highly medicinally significant (Shinwari, 2010).

Phytonutrient-rich plants when consumed protect the human body from chronic illness and other health issues (Lee *et al.*, 2008; Christen *et al.*, 2008).

Understanding the link between phytoconstituents and bioactivity is essential in developing possible drugs that might be utilized to treat various health issues. The therapeutic effects of crude chemical compounds on crops and plants and phytochemical investigations of different medicinal plant species have shown encouraging findings (Fujii *et al.*, 2004).

Medicinal plants typically include a variety of chemical components that work together to improve health, either separately, additively, or synergistically (Gurib-Fakim, 2006). For instance, flavonoids are believed to stimulate digestion, whereas phenolic components are responsible for anti-inflammatory and antioxidative properties. As a result, the awareness has shifted to finding these pharmacologically significant chemicals in plants in recent research. Three species were found promising for possible sources of important phytochemicals that could be used for drug development because of their known ethnomedicinal benefits. These are *Taraxacum officinale*, *Geranium wallichianum*, and *Elaeagnus parvifolia*.

Plant compounds are classified as secondary metabolites because they may not be needed by the plants that make them. These chemicals can be found in all parts of plant, including bark, leaves, rhizomes, flowers, fruits, and berries (Shah *et al.*, 2019). In other words, active components may be found in any part of the plant. These molecules act in cycle with nutrients and fibers to build a comprehensive defensive mechanism against a variety of illnesses and stressors (Thilagavathi *et al.*, 2015). Alkaloids, terpenoids, tannins, saponins, and phenolic compounds are the most significant bioactive phytochemicals (Edeoga *et al.*, 2005).

Elaeagnus is a deciduous tree that grows in Pakistan's Himalayan area (Ahmad *et al.*, 2006; Sabir *et al.*, 2003). China, Afghanistan, India, Japan, and Korea are also home to this species. The Elaeagnaceae family includes this plant, which is utilized in food pantries, baskets, and ropes (Ahmad *et al.*, 2006). Fruits and berries are the plant's edible portions. Fordham *et al.*, (2001) found that *E. umbellata* contains 7 to 17 times more lycopene than tomatoes, as well as -cryptoxanthin, -carotene, lutein, phytoene, and phytofluene. Lycopene is thought to be protective against cancer (Collins *et al.*, 2006). In folk

medicine, *E. umbellate* has been used as an anti-inflammatory, muscle relaxant, antipyretic, analgesic, astringent, antiulcer, antidiabetic, anti-diarrheal, and a tonic to cure coughs and pulmonary complications (Ghias & Rauf, 2012; Rafique *et al.*, 2016). The fruits are associated with delayed Alzheimer's disease and other brain-related disorders because of their antioxidant, anti-inflammatory, and anti-proliferative thus reducing and halting the growth of cancer by consuming them (Matthews, 1994; Subash *et al.*, 2014; Kim *et al.*, 2016; Figueira *et al.*, 2017).

Geranium wallichianum, sweet "geranium" is commonly known as "ratangut" (Nadkarni *et al.*, 1976). It is often called the Wallachusett account (Siva *et al.*, 2007). The English name is Blue Buxton and traditionally also known as Rus Jot (Ahmad *et al.*, 2012). It is also known as Sra zeal (Razzaq *et al.*, 2015), cerebrum, srazela (Akhtar *et al.*, 2013) and ratinloog and rattenjot. The root is used in backache, sexual debility, joint pain, colic, jaundice, and kidney and spleen disorder (Ahmad *et al.*, 2012). antibacterial (Ismail *et al.*, 2012); astringent, toothache, ear and eye disorder (Vikram, 2014); root, fruit is used as astringent, toothpaste, toothache and eye infection (Siva, 2007); root as tonic and is used to treat jaundice and lowers blood pressure, cough, fever, urinary problems, fever, headache, analgesic, respiratory, genital, sexual diseases (Akhtar *et al.*, 2013); vision problem and blood purification, jaundice, spleen problems, kidney and roots are used for mouth ulceration, dysentery, diarrhea, passive hemorrhage, leucorrhoea, tonic for physical fitness and internal body complaints astringent and clotting agent, the whole plant for curing stomach acidity, gastric problems, stomachache, arthritis, back pain and rheumatism, decoction with hydrazine used to treat gonorrhoea, leucorrhoea and diabetes. Rhizomes are used to treat ulceration, dysentery, diarrhea, hemorrhage, leucorrhoea (Qureshi *et al.*, 2009); crushed mixture of dried root is mixed with milk and sugar to treat backpain, gout and strengthening of body muscles, and bones (Gilani *et al.*, 2006); roots are used to treat mouth ulceration, astringent is given for chronic dysentery, diarrhea and leucorrhoea (Ha *et al.*, 2011); leaves to treat liver problem (Rana *et al.*, 2014).

Taraxacum officinale, locally known as Dandelion, is popular in Pakistan as its leaves are used as food and extracts for food flavorings (Pădureț *et al.*, 2016). Its popularity is attributed to its many therapeutic effects (Jeon *et al.*, 2008). Dandelion extracts were observed to have *In vitro* antimicrobial activity. Dandelion is a plant that may be found throughout Asia, Europe, and North America and is utilized in many traditional and modern herbal medicines. The plant is used as a stimulant and diuretic, and the root is a strong digestive booster that stimulates digestion and liver function. Studies on the impact of several dandelion extracts on immune system have found that they have anti-tumor and anti-inflammatory properties. This might mean that dandelion extract affects distinct types of lymphocytes or tissues, or that dandelion regulates immunological responses.

With all the above enumerated ethnomedicinal uses of the three species, they can be considered good choice to be studied for the possible presence of phytochemicals. Therefore, the aim of current study was to investigate

Taraxacum officinale, *Geranium wallichianum*, and *Elaeagnus parvifolia* in order to reveal the bioactive compounds.

Material and Methods

Basic collection: Plant samples (*Geranium wallichianum*, *Elaeagnus parvifolia*, and *Taraxacum officinale*) were collected from the Rawalakot District Poonch, Azad Kashmir. The Department of Botany, University of Poonch Rawalakot, taxonomically recognized and validated the plant samples. Then, each sample was grounded to a powder.

Plant extract preparation: The plant material was dried in the shade until all water was removed and the plant was ready for grinding. After cleaning, the contents of the plant were ground into a fine powder fitted with a stirrer and stored in an airtight container with a suitable sealant for future use.

Hot water extraction: Five gram of finely powdered herbs was mixed in a beaker with 200 mL warm water. The mixture was cooked for 20 minutes in a roasting oven at 30-40°C, then the extract was filtered by filter paper before being used for phytochemical tests. The extract was stored in the refrigerator.

Solvent extraction: The Soxhlet extraction system is used for crude plants extract. About 20 g of powder was collected individually in a thimble and extracted in 250 ml of 70% alcohol solvent. The extraction was carried out for another 24 hours, or until the solvent in the syphon tube had turned colorless. The resulting mixture was placed in a beaker and boiled in an oven preheated to 30-40°C until all solvents had evaporated. The dry extract was stored at 4°C in the refrigerator for further phytochemical tests.

Phytochemical screening: The methods of Shanmugam *et al.*, (2010) and Banu *et al.*, (2015) were used to perform for the following preliminary qualitative phytochemical screening.

Alkaloid detection

Diluting the hydrochloric acid with a solvent and purification.

a. Mayer's test: Mayer's reagent (potassium mercury iodide) was used to make the filtrate. The presence of alkaloids was indicated by the development of a yellow material (Evans, 1997).

b. Wagner's test: We mixed 1 mL of the extract with 1 mL of reagent Wagner (aqueous iodine solution). The presence of alkaloids was indicated by the formation of a reddish-brown substance.

c. Dragendroff test: Dragendroff reagent (potassium bismuth iodide solution) was used to treat the filter. The presence of alkaloids was indicated by the development of a reddish material.

d. Hager test: Hager reagent (solution of pyric acid) was used to treat filtrates. The development of yellow stuff indicated the presence of alkaloids.

Carbohydrate detection

After dissolving in 5 mL of warm water, we filtered each item one by one. The filter showed the presence of hydrocarbons.

a. Molisch test: In the test tube, two drops of α -naphthol alcohol were applied to the filter. We slowly added a few drops of sulfuric acid. The presence of carbohydrates was shown by the violet circle on the cross.

b. Benedict's test: The filter was prepared with Benedict's reagent, which was heated slowly. Orange and red color indicated a decrease in carbohydrates.

c. Fehling test: Fehling A and B solution were mixed equally, added to extract and boiled in dilute HCL solution. The development of red precipitate in bottom indicated a lack of carbohydrates.

Flavonoid detection

a. Alkaline reagents test: The substance was treated with a solution of ammonium hydroxide. When a weak acid was introduced, a bright yellow color appeared in front of the flavonoids.

b. Lead acetate test: A few drops of lead acetate solution were added to the extract. The presence of flavonoids was indicated by the production of a yellow material.

c. Shinoda test: We added 8-10 drops of hydrochloric acid and sprinkled with a mixture of magnesium powder or 1 ml of extract. The sample cook for 10-15 minutes before removing from heat. Red colorization indicated presence of flavonoids.

Phytosterol detection

a. Salkowski test: We cleaned the material with chloroform until the material was completely purified. The filtrate was handled in a small amount of sulfuric acid, stirred and allowed to rest. Yellowish-yellow color signified the incidence of triterpene.

b. Liebermann Burchard's test: We put 2 mL of acetic anhydride and 2 mL of H_2SO_4 concentrate and 0.5 mL of extract in the tube. The creation of a greenish color confirmed the presence of steroids (Finar, 1986).

Glycoside detection

Hydrochloric acid dissolved in water was used as a catalyst prior to glycoside analysis (Evans *et al.*, 1997).

a. Liebermann's test: The extract was treated with 2 mL chloroform and acetic acid. H_2SO_4 was added after the liquid was chilled in ice. The presence of glycoside was detected by a color shift from violet to blue to green.

b. Legal's test: To dissolve the solvent, sodium nitroprusside, pyridine, and sodium hydroxide were utilized. The presence of cardiac glycosides is indicated by the formation of pink or crimson.

c. Keller-Kelani test: We added 1 drop of ferric chloride solution to 5 mL extract and 2 mL glacial acetic acid with 1 mL sulfuric acid. A brown ring at the interface indicated the presence of cardiac glycosides.

Phenol detection

a. Ferric chloride test: A ferric chloride solution of 3–4 drops was added in extract. The presence of phenols was indicated by the dark green color.

b. Lieberman test: In a test tube, 1 ml of sodium nitrite was added along with 1 mL extract. After sometime, few drops of sulfuric acid solution and 2 mL sodium hydroxide solution were also added. The presence of phenols indicated by red, green, or blue color.

c. Lead acetate test: After dissolving the extract in water, 3 mL of a 10% lead acetate solution was added. A white precipitate indicated the presence of phenols.

Tannins detection

a. Gelatin test: The extract was dissolved in 1% gelatin solution containing sodium chloride. The presence of tannins was indicated by the development of white matter.

b. Prussian blue test: We added 1 mL of 0.008M potassium ferricyanide and 1 mL 0.02 M $FeCl_3$ to 0.1 M hydrochloride in a solution of 1 mL. The presence of tannins was indicated by the blue color.

Saponin detection

a. Froth test: In a water bath, dissolve 2 g of powder in 20 mL hot water, filter, and bring to a boil. To make a stable foam, combine 10 ml filter with 5 ml warm water and aggressively mix them, shake quickly to combine the foam with 3 tablespoons of olive oil. The composition of emulsion shows the presence of Saponin.

b. Foam test: Using a shaker, we mixed 2 mL of water with 0.5 g of extract. The resulting foam lasted for more than 10 minutes before saponins.

Protein and amino acids detection

a. Xanthoproteic test: A small amount of nitric acid was added to extract. Yellow color indicated the presence of protein.

b. Ninhydrin test: 0.25% w / x when ninhydrin reagent was added, dry the server for a few minutes. The presence of amino acids was shown by the blue hue.

Diterpenes detection

a. Copper acetate test: In a test tube, 3–4 drops of copper acetate solution were added in extract. The presence of diterpenes was indicated by the color emerald green.

Detection of terpenoids

a. Salkowski test: We added 2 mL of chloroform to 3 mL of H₂SO₄ based on 5 mL solution. A yellow ring formed at the interface between the two streams and then turned reddish-brown after 2 min, indicating the presence of terpenoids.

Starch detection

A 50% iodine solution was added to detect the presence of starch. Blue and black dots was the indication of starch.

Results

The various tests for the existence of different phytochemicals show alkaloids, sugars, glycosides, flavonoids, phenols, terpenoids, tannins, saponins, terpenoids, phenols, and phytosterols were identified in *T. officinale*. Alkaloids, glycosides, carbohydrates, flavonoids, phenols, terpenoids, phenols, phytosterols, and starches are the primary phytochemicals identified in *G. wallichianum*. Alkaloids, flavonoids, phenols, starches, and terpenes are the primary phytochemicals identified in *E. parvifolia* (Table 1). Furthermore, variations in the three species of plants based on the different tests. *T. officinale* is distinct, having detected Tannins in two tests, Saponins in two tests, the presence of steroids, and one test for carbohydrates. *G. wallichianum* is distinct for having terpenoids and proteins. *G. wallichianum* and *E. parvifolia* were tested for the presence of Diterpenes and starch. In contrast, *T. officinale* and *G. wallichianum* were positive for two tests for Carbohydrates, all the glycosides, and phytosterol (Fig. 1, Table 1). The phytochemical variance between the three species shows significant differences between the various phytochemicals (Table 2, p=0.074).

Table 1. Preliminary qualitative phytochemical analysis of *T. officinale*, *G. wallichianum*, and *E. parvifolia*.

Phytochemical class	Reagents/test	Indication	<i>Taraxacum officinale</i>	<i>Geranium wallichianum</i>	<i>Elaeagnus parvifolia</i>
Alkaloids	Dragendorff's	Reddish brown ppt's	+	+	+
	Mayer's	Creamy precipitate	+	+	+
	Wagner's	Reddish brown ppt's	+	+	+
	Hager's	Yellow ppt's	+	+	+
Saponins	Froth	Persistent froth	+	-	-
	Lead acetate	White ppt's	+	-	-
Flavonoids	Shinoda's	Red or pink color	+	+	+
	Alkaline reagent	Yellow color	+	+	+
	AlCl ₃	Yellow ppt's	+	+	+
Tannins	FeCl ₃	Black color appears	+	-	-
	Gelatin	Green black color	+	-	-
Steroids	H ₂ SO ₄	Red color in lower layer.	+	-	-
Carbohydrates	Fehling's	Brick red ppt's	+	+	-
	Molisch Test	Volatile ring	+	-	-
	Benedict's Test	Red and orange color	+	+	-
Coumarins	NaOH	Yellow fluorescence under UV	+	+	+
Glycosides	Keller Killani	Brown ring	+	+	-
	Liebermann's	volatile or blue to green	+	+	-
	Legal's Test	Pink color	+	+	-
Terpenoids	Salkowski	Reddish brown color	-	+	-
Phenols	Liebermann's	Red, green, or blue color.	+	+	+
	Ferric Chloride	Blue-black color	+	+	+
	Lead acetate	White ppt's	+	+	+
Phytosterols	Salkowski's	Golden yellow color	+	+	-
	Liebermann's Burchard's	Green color	+	+	+
Proteins	Xanthoproteic	Blue color	-	+	-
Diterpenes	Copper acetate	emerald, green color	-	+	+
Starch	Iodine	blue-black speck	-	+	+

(+) presence of phytochemicals and (-) indicate the absence of phytochemicals

Table 2. Analysis of phytochemical variance between the three species.

Source of variation	SS	Df	MS	F-test	P-value	F critical
Between species	1.166667	2	0.583333	2.817073171	0.074208	3.284918
Within species	6.833333	33	0.207071			
Total	8	35				

SS: Sum of squares; Df: Degrees of freedom; MS: Mean square within

Fig. 1. Seriation analysis of variations in phytochemicals present between the three species of ethnomedicinal plants based on various biochemical test procedures.

	<i>Taraxacum officinale</i>	<i>Geranium wallichianum</i>	<i>Elaeagnus parvifolia</i>
Alkaloids	Present	Present	Present
Saponins	Present	Present	Present
Flavonoids	Present	Present	Present
Tannins	Present	Present	Present
Steroids	Present	Present	Present
Carbohydrates	Present	Present	Present
Coumarins	Present	Present	Present
Glycosides	Present	Present	Present
Terpenoids	Present	Present	Present
Phenols	Present	Present	Present
Phytosterols	Present	Present	Present
Proteins	Present	Present	Present
Diterpenes	Present	Present	Present
Starch	Present	Present	Present

Discussion

Phytochemical analysis of many plant chemicals, like as alkaloids, saponins, flavonoids, stimulants, tannins, and others, have been discovered and these may be responsible for pharmacological activities of plants. Alkaloids, sugars, glycosides, flavonoids, phenols, terpenoids, tannins, saponins, terpenoids, phenols, and phytosterols are the phytochemicals found in *Taraxacum officinale*. Alkaloids, glycosides, carbohydrates, flavonoids, phenols, terpenoids, phenols, phytosterols, and starches are the primary phytochemicals identified in *Geranium wallichianum*. Alkaloids, flavonoids, phenols, starches, and terpenes are the primary phytochemicals identified in *Elaeagnus parvifolia*.

The presence of tannins, saponins, and phenols in *T. officinale* provide an excellent basis for the plant's medicinal value. Most studies demonstrated that phenols act as antioxidants protecting many forms of health problems related to oxidative stress-driven pathologies. These health problems include cardiovascular diseases, inflammation, cancer, and neurodegenerative diseases (Olas, 2018; Zeb, 2020). The presence of saponins in the plant is a good indication that the plant has inflammatory, diuretic effects. Likewise, saponins are known to have a functional impact on the body. Many of these compounds are responsible for reducing blood lipids, lowering risks for cancer, and blood glucose, thus a good cure for diabetes. These compounds also have importance in teeth protection by preventing caries and even platelet aggregation and reducing high levels of calcium in the blood. The detection of steroids further increases the basis of the medicinal values of *T. officinale*. Studies show that natural steroids from plant sources are involved in many physiological processes in the human body. These include response to stress, immune response, metabolism of carbohydrates and proteins, electrolyte levels in the blood, inflammation regulation, and behavior (Patel *et al.*, 2015).

Additionally, detecting proteins in *Geranium wallichianum* indicates that the plant is a good source of nutrients, fibers, and antioxidants that can improve human health. Studies show that these plant-based proteins are unsaturated, thus lowering bad cholesterol LDL thus

protecting the body against heart diseases (Hertzler *et al.*, 2020). The presence of terpenoids in the plant also shows that its use may explain its anti-inflammatory effects. Studies found terpenes helpful in ear edema, bronchitis, chronic pulmonary diseases, inflammation of the skin, and osteoarthritis (Tanaka *et al.*, 2002; Bruix *et al.*, 2001; Llovet *et al.*, 2008). Many studies show that terpenes found in plants may help prevent many forms of human diseases such as cancer. Many studies show antimicrobial, antiparasitic, antiviral, anti-allergenic, antispasmodic, antihyperglycemic, anti-inflammatory, and immunomodulatory properties (Rabi & Bishayee, 2009; Sultana & Ata, 2008; Shah *et al.*, 2009).

As well, Glycosides and phytosterols detected in *T. officinale* and *G. wallichianum* show that these two species have a basis for their medicinal importance. Phytosterols are compounds similar to cholesterol. They are essential in the body by blocking cholesterol from absorption by blocking intestinal cholesterol absorption and recirculating biliary cholesterol. Glycosides in the two plants may play significant roles in human health. The two plant species may contain cardiac glycosides, essential in treating heart ailments such as heart failure and irregular heart beating or arrhythmia (Kelly, 1990; Nigam, 2021). They may also have alcoholic glycosides, which are known to be used as analgesic and anti-inflammatory (Khan *et al.*, 2020).

In addition, *G. wallichianum* and *E. farvicola* were detected to have diterpenes and starch. Many studies have shown that isolated diterpenes in plants have many biological activities and are used as medicines for cardioprotection, analgesic, anti-inflammatory, antioxidant, and inhibitor of platelet-activating factors (Mafu & Zerbe, 2018). Studies also show cytotoxicity against selected cancer cell lines, antiplasmodial, hypoglycemic, hypolipidemic, antimicrobial, antiviral, antifouling, larvicidal.

All three species were detected to show the presence of alkaloids, flavonoids, phenols, coumarins, and phytosterols. These compounds indicate that these three species of plants have much medicinal importance. Plant alkaloids have anti-inflammatory, anti-cancer, analgesic, local anesthetic and pain relief, neuropharmacological, antimicrobial, antifungal, and many other activities (Matsuura & Fett-Neto, 2015; Debnath *et al.*, 2018; Heinrich *et al.*, 2021). Studies on Flavonoids show these

compounds have anti-allergic, anti-cancer, antioxidant, anti-inflammatory, and antidiabetic, including cognitive diseases like Alzheimer's and dementia Panche *et al.*, 2015). Phenolic compounds were shown in studies to act as an antioxidant, protecting the body from diseases related to oxidative stress, such as cardiac diseases, inflammation, cancer, and neurodegenerative disease (Olas, 2018; Zeb, 2020). Coumarins are known to dilate coronary arteries block calcium channels, antispasmodics, antibiotics, and treat prostate cancer, renal carcinoma, leukemia, and cancer therapy. They are also anti-inflammatory, anticoagulant, antihypertensive, antituberculous, antihyperglycemic, antioxidant, and neuroprotective properties (Heghes *et al.*, 2022). The presence of phytosterols in these three species indicates that they can block cholesterol from being absorbed, thus preventing heart disease (Kopylov *et al.*, 2021).

Plants' therapeutic value is determined by particular compounds that have physiological impacts on human. Many phytochemicals have been discovered to have a variety of actions that can help in the prevention of chronic illness. For example; alkaloids protect against chronic illness, saponins contain antibodies and protect against hyperlipidemia, analgesic properties are found in steroids and triterpenoids, central nervous system is regulated by steroid and saponin hormones. Also, the significance of alkaloids, saponins, and tannins in the form of antibiotics used to treat infectious conditions was recently reported (Mensah, 2008).

Alkaloids are basic in nature due to presence of nitrogen. Alkaloids have widespread role in medicine. Important roles of alkaloids are e.g. Atropine (anti-spasmodic utilized in arrhythmias), cocaine (epitasis), and codeine (antitussive and analgesic) have all been used to treat rheumatism, neuralgia, and sciatica. Vincristine and Taxol work as anti-cancerous, Theophylline and Sanguinarine are used in bronchitis and asthma, Reserpine in hypertension, Morphine is utilized as potent analgesic, Physostigmine and Pilocarpine are helpful in glaucoma, and so on (Schmeller & Wink, 1998). Alkaloids such as Rhynchophylline and Isorhynchophylline isolated from *Uncaria rhychophylla* (cat's claw) act mainly on CVS and CNS including protection of cerebral ischemia, hypotension, bradycardia, and anti-arrhythmia (Shi *et al.*, 2003). An isoquinoline alkaloid called as Berberine presents in *Berberis* species and widely used in Ayurveda and traditional Chinese medicine. Important pharmacological actions include anti-hypertensive, antioxidant, anti-cancer, hepatoprotective, and antimicrobial actions. Recent studies show that Berberine is also effective against depression, diarrhea, and hypertriglyceridemia. Clinically Berberine is used in management of oriental sore, congestive heart failure, hypercholesterolemia, and diabetes mellitus.

Saponins possess molluscicidal activity (monodesmosidic acid, hedrogenin), blood coagulation and anti-allergic (ginsenoside), anti-hypercholesterolemia (ticioside and ilexosaponin β -3) activity, anti-inflammatory (saikosaponin), and anti-diabetic action (christinin A and ginsenoside). Other important actions include anti-cancer activity i.e., Cytotoxic (tubeisomide, astragaloside, and sarasinoides), anti-tumor (ginsenoside and glycosides of

mediagenic acid), anti-mutagenic (glycyrrhizin), immunomodulatory (quillaic acid), anti-viral (protoprimulagenin), anti-hepatotoxic (ginsenoside), and anti-fungal activities (diosgenin and pennogenin) (Lacaille-Dubois & Wagner, 1996). Saponins also possess following important effect on central nervous system e.g., ginseng possess anti-stress, improves physical and mental health and sedative effect (Jujubogenin-3-0-glycosides). Saponins are an excellent choice for the treatment of fungal and yeast infections due to their natural ability to repel microorganisms. These substances work as natural antibiotics, assisting the body in the battle against diseases and microbial assaults (Santhi *et al.*, 2011).

Flavonoids are a class of polyphenolic chemicals found in a wide range of plants. They're commonly employed in medicine to preserve capillary integrity. They also inhibit enzymes e.g. aldose reductase, cyclooxygenase, xanthine oxidase, phosphodiesterases, and lipoxygenase. They possess free radical scavenging activity and are potent antioxidants. Many flavonoids provide protection against cardiovascular mortality and against allergy. They also inhibit the growth of cancer cell lines showing anti-atherosclerotic potential (Agrawal, 2011).

Flavonoids possess radical scavenger, anti-leukemic, and vasodilator activity. They are useful for Alzheimer's disease and for improving blood circulation in brain. Anti-cancer, anti-aging, and anti-bacterial are other properties shown by flavonoids. Another very important role of flavonoids is that they are used as nutraceuticals. The most potent flavonoids against reactive oxygen species are flavones and catechins. Antioxidants like quercetin, rutin, and kaempferol protect against liver disease, cataracts, and cardiovascular disease. Quercetin protects against liver perfusion abnormality and ischemic liver disease. Other important pharmacological actions of flavonoids include anti-diabetic (quercetin), anti-ulcer (hesperidin), anti-arthrosclerosis, cardio protective, anxiolytic (6-bromoflavone), anti-inflammatory (myrectin), and anti-neoplastic properties (Tapas *et al.*, 2008). In addition to their antioxidant capabilities, flavonoids protect against allergies, inflammation, free radicals, platelet aggregation, bacteria, ulcers, hepatotoxins, viruses, and malignancies.

Conclusion

We can say with great conviction that the three species, while varying based on the different tests have phytochemicals that are significant in explaining various claims for their ethnomedicinal importance. More studies are still needed to explore specific compounds the plants possess to address specific health issues. Using chromatographic and spectroscopic methods, the current work can lead to future research in the separation and identification of the active compounds from the selectively used traditional medicinal plants.

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