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Phytochemical Analysis of *Terminalia arjuna* in South Central Rajasthan: A Study of its Traditional Medicinal Uses

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Abstract
The current study's objective was to use qualitative screening techniques to identify main phytochemicals in four distinct solvent extracts of *Terminalia arjuna*. The root, stem, and leaf powders were extracted using ethanol, methanol, chloroform, and hexen as solvents. Standard techniques were accustomed to assay secondary metabolites, including anthroquinones, steroids, terpenoids, saponins, phenolic chemicals, alkaloids, flavonoids, tannins, and anthroquinones. In contrast to other solvents, phytochemical study of ethanolic or methonolic extracts of roots, stems, and leaves demonstrated the existence of the majority of active components. Secondary metabolites were more prevalent in ethanolic or methonolic extracts of *Terminalia arjuna* than in hexen or chloroform extracts.

Keywords: *Terminalia arjuna*, arjun, ethnomedicine, phytochemical analysis, and leaf, stem, root

1. Introduction & Review

Plants have been utilized for a long time by humans as a food source, medicine, and numerous other essentials. Many people continue to rely significantly on the plants in their immediate environment, as do primitive tribal societies. Due to ongoing human-caused deforestation and frequent landslides, several medicinal plants that are very beneficial to people are currently in danger. The raw medicinal components used in India's many ancient medical systems are primarily sourced from local plant species. As a result, conventional medicine is now needed because it may be a novel therapeutic agent.
The Indian subcontinent is home to *Terminalia arjuna*, also referred to as Arjuna, a significant medicinal plant species (Kumar et al., 2018). The plant's Bark has been utilized for millennia to treat a variety of metabolic and cardiovascular conditions in Ayurvedic medicine (Singh et al., 2019). According to Sharma et al. (2020), the bark's therapeutic qualities are attributed to flavonoids, tannins, and glycosides, which were identified by phytochemical research. Based on research, *Terminalia arjuna* may be used as a treatment for a number of illnesses because of its anti-inflammatory, antioxidant, and cardioprotective properties (Kumar et al., 2018). Additionally, the herb has been utilized historically to address several conditions, like diabetes, hypertension, and heart failure (Singh et al., 2019). Furthermore, recent studies have examined into *Terminalia arjuna's* potential for managing and preventing a number of lifestyle-related conditions, including metabolic syndrome and obesity (Sharma et al., 2020). Many plant components of *Terminalia arjuna*, such as the leaves, stems, and roots, have been shown to have numerous therapeutic attributes that are beneficial for human bodies. These plant components include a

range of secondary metabolites, such as tannin, saponin, flavonoids, phenol, terpenoid, coumarin, anthraquinone, or steroids. We extracted ethanol, methanol, chloroform, or hexen to acquire all of these secondary metabolites.

2. Materials and Procedures

2.1 Gathering of plant material

Terminalia arjuna (Specimen No. SUBH1073) which we also call arjun, white marudah in local language. This endangered plant was studied in Bhilwara district of south-central Rajasthan region. Arjuna was collected from Harni Mahadev forest area of Bhilwara district. Its latitude is 25.313517° and longitude is 74.652919°. Its average height is 30-32 m (98 - 104 feet). The bark of *Terminalia arjuna* is collected because of its medicinal properties.

2.2 Botanical Description

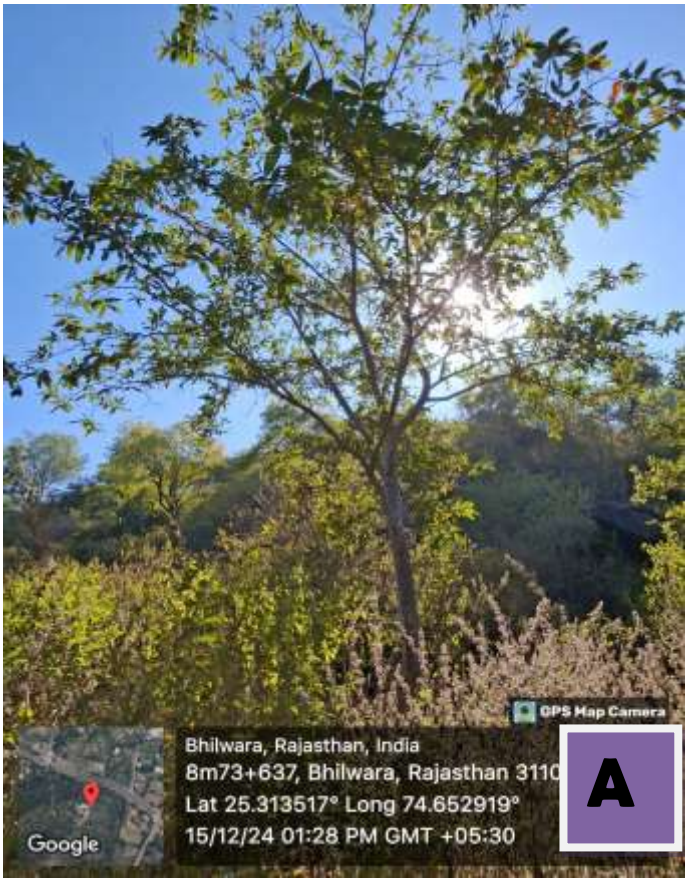
LOCAL NAMES - Bengali (arjhan); Gujarati (vellamatta,sadado,sadada); Hindi (koha,arjun,arjuna,arjan,kahu); Tamil (vellai maruthu, vellamatta marutae); Thai (dhanvi,rok faa khaao,kakubha); English (white marudah,tropical almond,arjun, Malabar almond,arjuna); and trade name (arjun).

The deciduous *Terminalia arjuna* tree has a broad, fluted trunk that is frequently buttressed and can reach heights of 30-32 m and 2.4 m. It extends radially along the banks of streams. with a thin, superficial root system. Drooping branches emerge from the broad, spreading crown. Bark is thick, smooth, and peeling in thin, uneven sheets that are either grey or pinkish-green. The simple, opposite to sub-opposite leaves are 5–24 × 4–8 cm, oblong or elliptic oblong, glabrous, rigid, and sometimes equilateral with a base that is rounded or occasionally cordate, apex that is obtuse or sub-acute, and margins that are frequently crenulate.

The petiole is sericeous, short (2–5 cm), and has two (or one) conspicuous glands at the tip. Inflorescences are tiny terminal panicles or short axillary spikes that are 9–12 cm long with branches that are 2.4-6 cm long. The pubescent rachis is short and white.

Lower container 0.8–1.5 mm long, short, sericeous, with a glabrous upper receptacle that is 1.5–1.78 mm lengthy, with a little pubescence at the base. The Flowers possess a distinct honey aroma, are small, cup-shaped, regular, sessile, polygamous, and white, creamy, or greenish-white. The fruit is oblong-oblong, 2.5-6.1 x 1.8-2.7 cm long, dark brown to reddish-brown, fibrous woody, indehiscent, glabrous, with five to six equal, thick, narrow, stiff wings that are striated with many upward-curving veins. The Latin words "terminus" or "terminalis" (ending) are the source of the generic name *Terminalia*, which describes the tendency of the foliage to be borne or packed on the terminals among the shoots.

Typically an evergreen, *T. arjuna* produces new leaves prior to leaf fall in the midst of the summer, which originates from February to April. Before they bloom, trees may occasionally go for a very brief period without leaves. Six to seven years after planting, fruit starts to appear. The fruit ripens the following February to May, almost a year after the blooms appear, after flowering starts in April and lasts until May. In general, a strong seed year occurs every third year. There is little variation in the flowering and fruiting patterns across different regions.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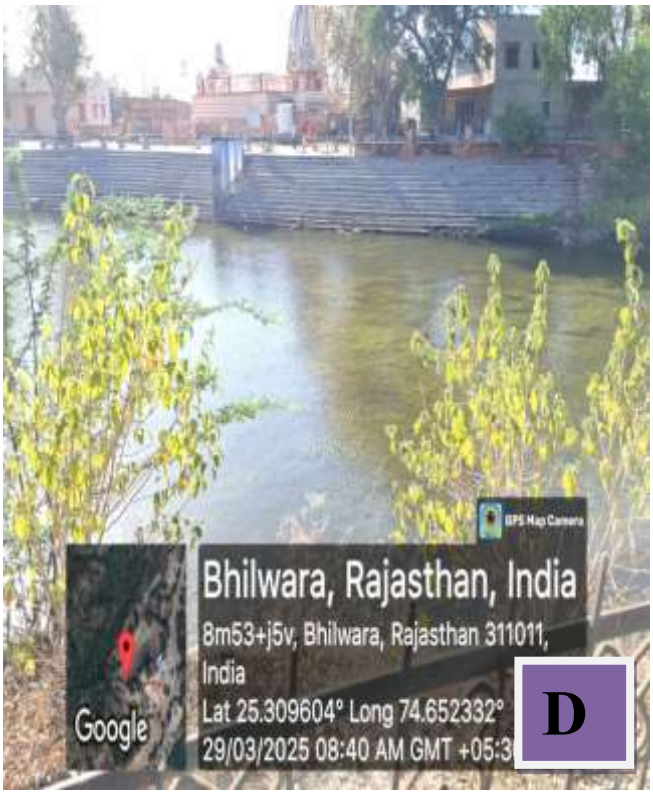
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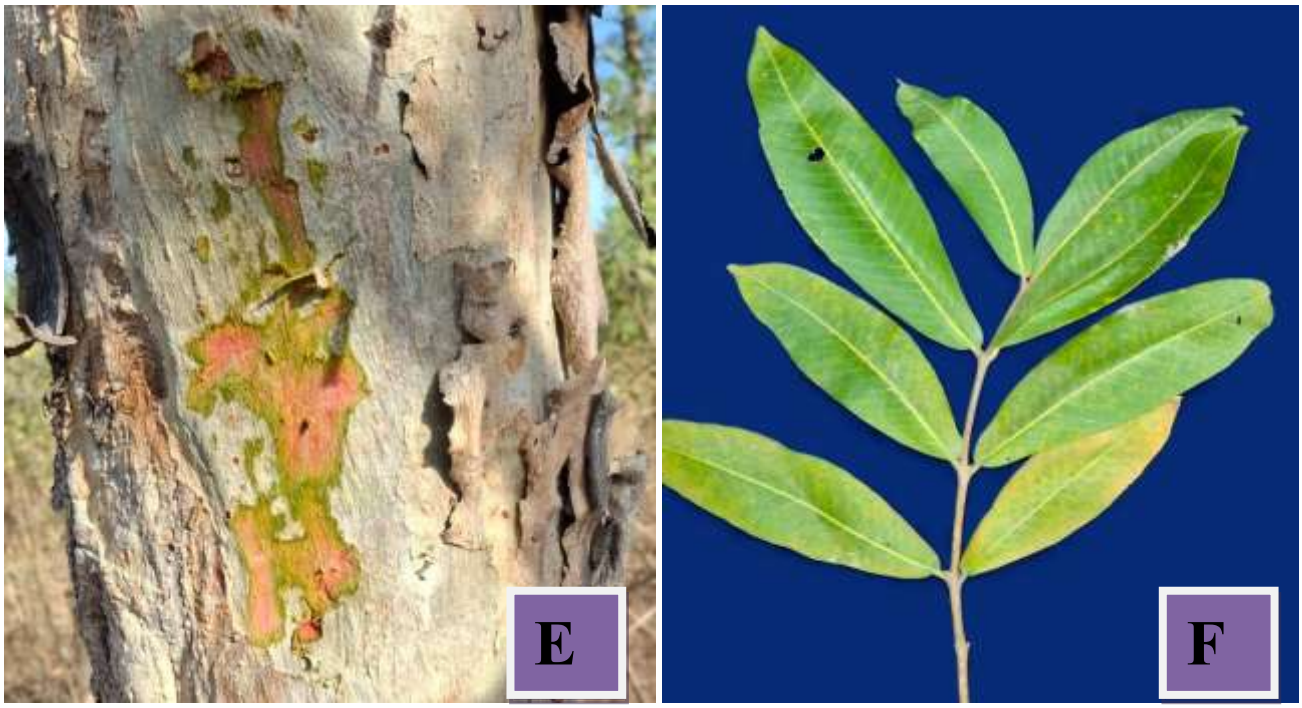


Figure 1 :- *Terminalia arjuna* :- (A) whole Plant (B) Stem (C) Harni Mahadev Pond (D) Harni Mahadev Temple (E) Stem/Bark Colour (F) Leaf

2.3 Plant extract preparation

The gathered plant material (leaves, roots, and stems) was carefully cleaned, let to dry in the shade, and then ground into a powder using a blender. One gram of powder was dissolved in ten milliliters of ethanol, methanol, chloroform, or hexane, and At room temperature, the combination was left for twenty-four hours. After that, the mixture was filtered using Whattmen No. 1 filter paper, and the spectrophotometer was used to record the filter's reading or curve. Afterward, the filter was subjected to various phytochemical qualitative tests.

2.4 Preliminary phytochemical analysis

1. **Tests for Anthraquinone glycoside**
   Bontrager's test: The hydrolysate was shaken vigorously after chloroform was added. After applying an ammonia solution, the organic layer was shook. The existence of a substance known as anthraquinone glycosides was as shown by the development of a pink tint.
2. **Tests for Coumarins:**
   After that, the hue became vivid yellow two milliliters of leaf, stem, and rhizoid extract were mixed with 10% NaOH and shaken for five minutes. A yellowish-green hue appears when coumarins are present.
3. **Tests for Anthraquinone**
   The required consistency was obtained by mixing 2 milliliters of leaf, stem, and rhizoid extract with 0.5 milliliters of chloroform and 1 milliliter of ammonia, then shaking the mixture well for five minutes. Appearance of pink colour indicates the absence of anthraquinone.
4. **Tests for Sterols and Triterpenoids**
   Salkowski's test: After treating the leaf, stem, and rhizoid extract in chloroform with a few drops of sulfuric acid that is concentrated and vigorously shaking the mixture for a while, the development of

a golden hue in the lower layer showed the existence of triterpenoids; the appearance of a red color in the lower layer revealed the existence of sterols.

5. **Alkaloids tests**

   Mayer's Test: Two to three milliliters of the leaf, stem, and rhizoid extract were combined with a little quantity of the Mayers reagent. Alkaloids would precipitate out as a white or cream color when they were present

6. **Flavonoids tests**

   Alkaline reagent test: A few drops of sodium hydroxide solution were added to the tiny amount of extract. The presence of flavonoids was shown by the production of a bright yellow color, which disappeared when a few drops of diluted acid were applied.

7. **Tests for Tannins and Phenolic compounds**

(A) **Nitric acid test:** Two milliliters of leaf, stem, and rhizoid extract were combined. with diluted nitric acid. The evolution of a reddish to yellowish color indicated the presence of tannins and phenolic compounds.

(B) **Ferric chloride test:** In a test tube, combine 2 milliliters of leaf, stem, and rhizoid extract with 5% ferric chloride solution. The presence of tannins and phenolic compounds was shown by the bluish-black precipitate.

8. **Test for Saponins**

   Foam Test : The concentration was measured after 20 milliliters One milliliter of extract and one milliliter of distilled water were combined, and the mixture was shaken violently for 15 minutes. The formation of a bluish-black precipitate is a sign of saponin presence

3. Result & Conversation

Medicinal substances have been found in nature for thousands of years, and a remarkable number of contemporary medications have been derived from natural sources. Among the many secondary metabolites that plants can make are flavonoids, coumarin, anthraquinone, alkaloids, triterpenoids, phenols, tannins, and phytosterols. Secondary plant metabolites have received a lot of attention lately as a potential source of therapeutic compounds. Because they don't hurt higher plants, animals, or people, plant products are more necessary than synthetic substances when it comes to treating illnesses. The ambition to study new natural medicines is increasingly shifting from the herbalist's store to drug research labs, departing from the original texts.

The solvent extracts of *Terminalia arjuna's* leaves, roots, and stems revealed the presence of phytoconstituents like alkaloids, phenolic compounds, flavonoids, anthroquinones, and steroids in the current preliminary phytochemical investigation (Table 1 and Figure 2). Phenolic chemicals were found in the solvent extracts of the stems, roots, and leaves.The presence of alkaloids, tannin, saponin, flavonoid, phenol, terpenoid and steroids was observed in the ethanolic, methonolic extracts. Similarly, the presence of terpenoids or steroids was observed in the chloroform or hexane extracts.

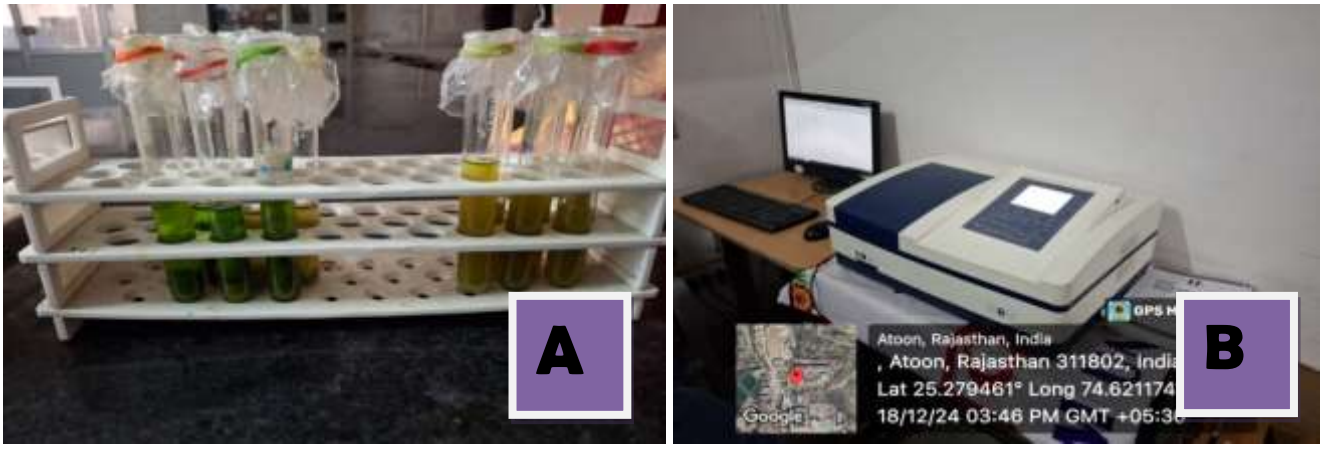
S. No	Plant Part Name	Chemical Extract	Tanin	Saponin	Alkaloid	Flavonoid	Phenol	Terpenoid	Coumarine	Anthroquinon	Steroid
1	***Termin***	Ethanol	+	+	+	+	+	+	-	-	+

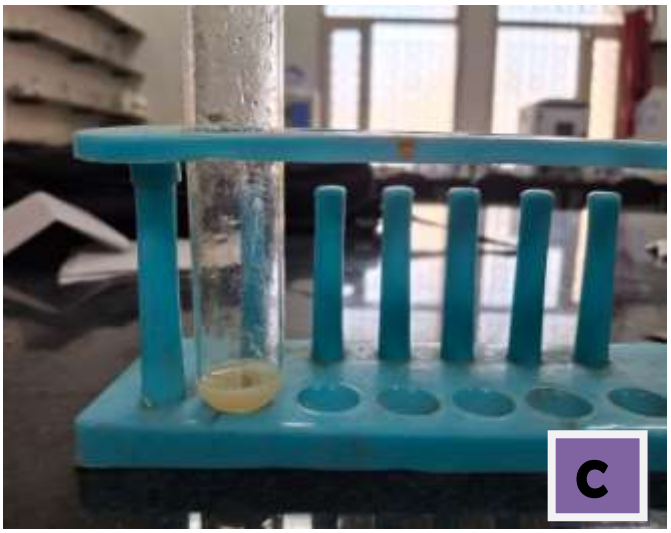
2	***alia arjuna* leaf**	Methanol	+	+	+	+	+	+	-	-	+
3		Chloroform	-	-	-	-	-	+	-	-	+
4		Haxen	-	-	-	-	-	+	-	-	+

S. No	Plant Part Name	Chemical Extract	Tannin	Saponin	Alkaloid	Flavonoid	Phenol	Terpenoid	Coumarine	Anthroquinon	Steroid
1	***Terminalia arjuna* Stem**	Ethanol	+	+	+	+	+	+	-	-	+
2		Methanol	+	+	+	+	+	+	-	-	+
3		Chloroform	-	-	-	-	-	+	-	-	+
4		Haxen	-	-	-	-	-	+	-	-	+

S. No	Plant Part Name	Chemical Extract	Tannin	Saponin	Alkaloid	Flavonoid	Phenol	Terpenoid	Coumarine	Anthroquinon	Steroid
1	***Terminalia arjuna* Root**	Ethanol	+	+	+	+	+	+	-	-	+
2		Methanol	+	+	+	+	+	+	-	-	+
3		Chloroform	-	-	-	-	-	+	-	-	+
4		Haxen	-	-	-	-	-	+	-	-	+

Table 1 :- *Terminalia arjuna* Phytochemicals Result

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F


G

Figure 2 :- Secondary Metabolites Results :- (A) Samples (B) Spectrophotometer (C) Saponins (D) Plants Extract Curv (E) Cumarine & Steroids (F) Antheroquinon (G) Saponin (H) Steroid (I) Tanin

4. Conclusion

Among the phytoconstituents, terpenoids and steroids were present in every leaf extract stem or roots, ethanolic methonolic chloroform and hexen. Coumarin or anthroquinone was absent in every leaf extract stem or roots, ethanolic methanoli chloroform or hexen. The extract of leaf stem and roots showed highest quantity of tannin saponin alkaloids and flavonoids and phenol. According to qualitative analysis, there is phytoconstituents such as flavonoids, alkaloids, phenolic substances, anthroquinones and steroids, respectively, in the current test plant.

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