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Phytochemical Analysis of Two Medicinally Important Wild Plants Physalis Angulata and Rivea Hypocrateriformis

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Abstract

The study investigates the phytochemical composition of two medicinally important wild plants, *Physalis angulata* and *Rivea hypocrateriformis*. Qualitative screening revealed the presence of alkaloids, flavonoids, tannins, saponins, terpenoids, and glycosides. Methanolic extracts showed the highest concentration of bioactive compounds. The results support the traditional medicinal use of both plants and indicate their potential as natural sources of antioxidant and antimicrobial agents.

Keywords: Phytochemical analysis, *Physalis angulata*, *Rivea hypocrateriformis*, Wild Medicinal plants, Secondary metabolites

1. Introduction:

Wild Medicinal plants have long been regarded as an essential source of bioactive compounds that form the foundation of both traditional and modern medicine. They serve as rich reservoirs of secondary metabolites such as alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and steroids, which are responsible for a wide range of pharmacological and therapeutic activities (Harborne, 1998; Kokate, 1999). These naturally occurring compounds play crucial roles in plant defense mechanisms against pathogens, pests, and environmental stress while also contributing to their medicinal properties and applications in human health care (Sofowora, 1993).

The increasing global demand for safer and more effective natural remedies has renewed scientific interest in the phytochemical exploration of wild and traditionally used medicinal plants. Phytochemical analysis assists in identifying chemical constituents responsible for specific biological activities and provides a foundation for further pharmacological, toxicological, and clinical investigations (Trease & Evans, 2002).

Physalis angulata L. (Family: Solanaceae), commonly known as "Cut leaf Ground cherry," is a wild herb widely distributed in tropical and subtropical regions. It is traditionally used in folk medicine to treat ailments such as fever, inflammation, asthma, and liver disorders (Kamble et al., 2010). The plant contains several bioactive compounds, including physalins, withanolides, and flavonoids, which have demonstrated antimicrobial, antitumor, and antioxidant activities (Wu et al., 2006).

Rivea hypocrateriformis (Desr.) Choisy (Family: Convolvulaceae) is another medicinally important wild climber distributed across India. It has been traditionally used for treating skin infections, rheumatism, and gastrointestinal disorders (Jain & De Filipps, 1991). Preliminary reports indicate the presence of alkaloids, glycosides, and flavonoids, contributing to its therapeutic potential (Patil et al., 2012). However, detailed phytochemical investigations on this species remain limited.

Despite their ethnomedicinal significance, comparative scientific documentation on the phytochemical composition of *Physalis angulata* and *Rivea hypocrateriformis* is scarce. Therefore, the present study was undertaken to conduct a systematic phytochemical screening of these two wild medicinal plants. The objective of this research was to identify and compare the major classes of secondary metabolites present in their extracts and provide a scientific basis supporting their traditional medicinal uses.

2. Materials and Methods:

2.1 Collection of Plant Material

Fresh and healthy plant samples of *Physalis angulata* L. and *Rivea hypocrateriformis* (Desr.) Choisy were collected during the flowering stage from wild habitats in the Khandesh region of Maharashtra, India, during the period of June to September 2025. The plants were identified and authenticated by Dr. S. K. Tayade Head of Dept. Botany, P.S.G.V.P. Mandal ACS College Shahada, Dist. Nandurbar. And voucher specimens were deposited in the departmental herbarium for future reference. The collected plant materials were washed with distilled water to remove dust and impurities, then shade-dried at room temperature (25 ± 2°C) for 10–15 days to preserve thermolabile constituents (Harborne, 1998). The dried materials were ground into a fine powder using an electric grinder and stored in airtight containers until further analysis.

2.2 Preparation of Extracts

The powdered plant materials were subjected to successive extraction using solvents of increasing polarity—hexane, ethyl acetate, methanol, and distilled water—following the Soxhlet extraction technique described by Harborne (1998) and Kokate (1999). Approximately 50 g of each powdered sample was extracted with 250 mL of solvent for 8–10 hours. Each extract was filtered through Whatman No. 1 filter paper and concentrated under reduced pressure using a rotary evaporator at 40–45°C to obtain a crude extract. The extracts were then stored in sterilized amber bottles at 4°C until further use. The percentage yield of each extract was calculated on a dry weight basis. Methanol and aqueous extracts were used for further phytochemical screening, as they are known to yield a wide range of polar bioactive compounds (Sofowora, 1993; Tiwari et al., 2011).

2.3 Phytochemical Screening

The crude extracts of *Physalis angulata* and *Rivea hypocrateriformis* were subjected to preliminary qualitative phytochemical screening to identify major classes of secondary metabolites, including alkaloids, flavonoids, tannins, saponins, terpenoids, steroids, and glycosides. The analyses followed standard protocols described by Harborne (1998), Trease and Evans (2002), and Kokate (1999). These tests rely on characteristic color changes or precipitate formation to indicate the presence and relative abundance of specific compounds (Sofowora, 1993). Methanolic and aqueous extracts were primarily examined due to their efficiency in extracting polar bioactive constituents. The following various qualitative tests were carried out:

- **Alkaloids:** Detected using Mayer's and Dragendorff's reagents. Formation of a cream-colored precipitate with Mayer's reagent and an orange to reddish-brown precipitate with Dragendorff's reagent confirmed the presence of alkaloids (Kokate, 1999).
- **Flavonoids:** Identified by the Shinoda and Alkaline Reagent tests. Development of a pink to red coloration in the Shinoda test and a yellow color that disappeared upon acidification in the Alkaline Reagent test indicated the presence of flavonoids (Harborne, 1998).
- **Tannins:** Confirmed using ferric chloride and lead acetate tests. A blue-black or greenish-black coloration with ferric chloride and a yellowish precipitate with lead acetate signified the presence of tannins (Trease & Evans, 2002).
- **Saponins:** Confirmed by Froth and Foam tests. Persistent frothing or a stable foam layer after shaking the extract with distilled water indicated the presence of saponins (Sofowora, 1993).
- **Glycosides:** Tested using the Keller–Killiani and Liebermann–Burchard tests. Formation of a reddish-brown ring at the interface in the Keller–Killiani test and bluish-green coloration in the Liebermann–Burchard test confirmed the presence of glycosides (Harborne, 1998).
- **Terpenoids:** Detected by the Salkowski test. A reddish-brown coloration at the interface upon addition of concentrated sulfuric acid indicated the presence of terpenoids (Kokate, 1999).
- **Steroids:** Identified using the Liebermann–Burchard test. The development of a green or blue coloration indicated the presence of steroids (Trease & Evans, 2002).

The appearance of characteristic color changes or precipitate formation confirmed the presence of these secondary metabolites. The qualitative observations for each test are summarized in Table 1.

2.4 Qualitative Analysis

Qualitative analysis of *Physalis angulata* and *Rivea hypocrateriformis* revealed varying levels of secondary metabolites. The intensity of color reactions during phytochemical tests indicated their relative abundance (Harborne, 1998; Trease & Evans, 2002). Results were recorded as strongly present (+++), moderately present (++), slightly present (+), or absent (−).

Methanolic and aqueous extracts showed stronger reactions, suggesting higher concentrations of polar compounds like flavonoids, tannins, and glycosides (Kumar et al., 2009). All tests were performed in triplicate to ensure accuracy (Sofowora, 1993). These qualitative differences highlight the plants' rich phytochemical diversity and provide a basis for further quantitative and pharmacological studies (Tiwari et al., 2011; Wolfe et al., 2003).

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Table:-1. Qualitative Phytochemical Analysis of *Physalis angulata* and *Rivea hypocrateriformis*

Phytochemical Constituents		Solvent Extracts	Physalis angulata		Rivea hypocrateriformis		Relative Abundance Key
Alkaloids		Hexane	+		+		+ = Slightly present
		Ethyl acetate	++		+		++ = Moderately present
		Methanol	+++		++		+++ = Strongly present
		Aqueous	++		+		− = Absent
Flavonoids		Hexane	−		−		
		Ethyl acetate	++		++		
		Methanol	+++		+++		
		Aqueous	++		++		
Tannins		Hexane	−		−		
		Ethyl acetate	+		+		
		Methanol	+++		++		
		Aqueous	++		++		
Saponins		Hexane	−		−		
		Ethyl acetate	+		+		
		Methanol	+++		++		
		Aqueous	++		++		
Glycosides		Hexane	−		−		
		Ethyl acetate	+		+		
		Methanol	++		++		
		Aqueous	++		++		
Terpenoids		Hexane	++		+		
		Ethyl acetate	++		++		
		Methanol	+++		++		
		Aqueous	+		+		
Steroids		Hexane	+		+		
		Ethyl acetate	++		+		
		Methanol	++		++		
		Aqueous	+		+		

3. Results and Discussion:

The qualitative phytochemical screening of *Physalis angulata* and *Rivea hypocrateriformis* revealed the presence of major secondary metabolites, including alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and steroids, with varying intensities across solvent extracts. Methanolic and aqueous extracts of *P. angulata* showed the strongest reactions, indicating a higher concentration of polar bioactive compounds, especially alkaloids, flavonoids, and tannins. In contrast, *R. hypocrateriformis* exhibited moderate levels of flavonoids and glycosides, with weaker responses in non-polar extracts. Overall, *P. angulata* demonstrated richer phytochemical diversity, suggesting greater potential for antioxidant and antimicrobial activities, while *R. hypocrateriformis* also showed promising yet comparatively lower phytochemical abundance.

Table:-2 Summary of Qualitative Phytochemical Constituents in *Physalis angulata* and *Rivea hypocrateriformis*.

Phytochemical Constituents	Physalis angulata	Rivea hypocrateriformis	Interpretation
Alkaloids	+++	++	Strongly present in *P. angulata*; moderate in *R. hypocrateriformis*
Flavonoids	+++	++	High in both species, indicating antioxidant potential
Tannins	+++	++	More abundant in *P. angulata*; contributes to antimicrobial activity
Saponins	++	+	Moderately present; linked to anti-inflammatory properties
Glycosides	++	++	Present in both species; may contribute to therapeutic effects
Terpenoids	++	++	Present in both; associated with anti-inflammatory and hepatoprotective activity
Steroids	++	+	Moderate in *P. angulata*, slightly present in *R. hypocrateriformis*

4. Conclusion:

The qualitative phytochemical analysis of *Physalis angulata* and *Rivea hypocrateriformis* revealed that both species are rich in bioactive secondary metabolites, confirming their medicinal potential. Major phytochemical groups such as alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and steroids were identified, though their intensity varied between species and solvents.

Physalis angulata showed a more diverse and abundant phytochemical profile, especially in methanolic and aqueous extracts, indicating a higher content of polar compounds like flavonoids and tannins. These constituents are associated with strong antioxidant, antimicrobial, and anti-inflammatory activities, supporting its ethnomedicinal uses.

Rivea hypocrateriformis exhibited moderate levels of bioactive compounds, suggesting lower but notable pharmacological potential. The variation in phytochemical content between the two plants reflects differences in their metabolic and environmental adaptations.

Overall, the study validates the traditional uses of both species and highlights *P. angulata* as a promising candidate for further phytochemical and pharmacological investigations aimed at developing natural therapeutic agents.

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