



Review Article

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THERAPEUTIC APPRAISAL OF *BHRINGARAJA (ECLIPTA ALBA)* THROUGH *RASA PANCHAKA* AND *KARMA* WITH CORRELATION TO MODERN PHARMACOLOGICAL ACTIONS

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ABSTRACT:

Background: *Bhringaraja (Eclipta alba)* is used in *Ayurveda* for *Keshya*, *Rasayana*, and *Yakrituttejaka* actions. **Objective:** To appraise its therapeutic potential by correlating *Rasa Panchaka* and *Karma* with contemporary phytochemical and pharmacological evidence. **Methods:** Classical *Ayurvedic* sources and literature identified through PubMed, Scopus, and Google Scholar were reviewed. An ethanolic plant extract was screened qualitatively for major phytochemical groups, and antioxidant activity was assessed using DPPH and FRAP assays. **Results:** Alkaloids, flavonoids, tannins, glycosides, phenolic compounds, and terpenoids were detected; saponins were present in trace amounts. DPPH inhibition reached 72.5% at the reported maximum concentration, with an IC₅₀ of 48 micrograms/mL, while FRAP reducing power increased with concentration. The observed antioxidant and hepatoprotective evidence was consistent with the classical attributes *Tikta Rasa*, *Rasayana Karma*, and *Yakrituttejaka*. **Conclusion:** The integrative findings support a correspondence between classical *Ayurvedic* pharmacodynamics and reported antioxidant, hepatoprotective, and anti-inflammatory actions of *Bhringaraja*. Standardized preparations, dose optimization, large-scale clinical trials, and mechanistic studies are needed.

Keywords: *Bhringaraja*; *Eclipta alba*; *Rasa Panchaka*; antioxidant; hepatoprotective; *Ayurveda*

1. INTRODUCTION:

1.1 Global Relevance of Herbal Medicine:

The global resurgence of interest in traditional systems of medicine has underscored the pivotal role of herbal therapeutics in contemporary healthcare. According to the World

Health Organization, nearly 80% of the population in developing countries relies on traditional medicine for primary healthcare needs.[1] The rising burden of non-communicable diseases (NCDs), escalating healthcare costs, and concerns regarding adverse effects of synthetic drugs have collectively driven the demand for plant-based medicines. Herbal drugs offer a holistic approach with multitargeted actions, making them particularly relevant in chronic and lifestyle-related disorders.

1.2 Importance of *Ayurveda* in the Modern Era:

Ayurveda, the ancient Indian system of medicine, provides a comprehensive and individualized approach to health and disease management. Its foundational principles emphasize prevention (*Swasthasya Swasthya Rakshanam*) and cure (*Aturasya Vikara Prashamanam*) through diet, lifestyle, and herbal interventions.[2] In the present era, *Ayurveda* has gained global recognition due to its emphasis on natural therapeutics, minimal side effects, and integrative potential with modern medicine. The branch of *Dravyaguna Vijnana* systematically explains the pharmacodynamics of medicinal plants, enabling rational drug selection based on classical parameters such as *Rasa*, *Guna*, *Virya*, *Vipaka*, and *Karma*.

1.3 Classical Description of *Bhringaraja*:

Bhringaraja (*Eclipta alba*), a prominent medicinal herb of the family Asteraceae, is extensively described in classical *Ayurvedic* texts for its diverse therapeutic applications. It is mentioned in authoritative texts such as *Bhavaprakasha Nighantu* and *Dhanvantari Nighantu* with several synonyms including *Bhringa*, *Kesharaja*, and *Markava*, reflecting its importance in hair and systemic health.[3,4]

From a pharmacodynamic perspective, *Bhringaraja* is characterized by *Tikta* and *Katu Rasa*, *Laghu* and *Ruksha Guna*, *Ushna Virya*, and *Katu Vipaka*, which collectively contribute to its *Kapha-Vata Shamana* and *Rasayana* properties.[5] It is widely indicated for conditions such as *Khalitya* (hair fall), *Pandu* (anaemia), and *Yakrit Vikara* (liver disorders). Its key therapeutic actions include:

- **Keshya** - Promotes hair growth and prevents hair fall
- **Rasayana** - Rejuvenative and anti-aging effect
- **Yakrituttejaka** - Stimulates liver function

These classical attributes highlight its multidimensional therapeutic potential.

1.4 Modern Relevance and Pharmacological Perspective:

In the context of modern biomedical science, *Bhringaraja* has gained significant attention due to its wide range of pharmacological activities. Phytochemical studies have identified bioactive constituents such as wedelolactone, ecliptine, flavonoids, and triterpenoids, which are responsible for its therapeutic effects.[6] Experimental studies have demonstrated its potent antioxidant, hepatoprotective, anti-inflammatory, and immunomodulatory properties.[7-9]

Liver disorders and oxidative stress-related conditions represent a major global health challenge. Oxidative stress, resulting from an imbalance between reactive oxygen species and antioxidant defenses, plays a central role in the pathogenesis of liver diseases and metabolic disorders.[10] *Bhringaraja*, with its strong antioxidant potential, offers a promising natural therapeutic option for managing such conditions. Additionally, its role in lifestyle disorders further enhances its clinical relevance in modern healthcare.

1.5 Research Gap:

Despite extensive classical references and growing scientific evidence, there exists a significant gap in the integrative understanding of *Bhringaraja*. Most studies either focus on its traditional *Ayurvedic* description or its modern pharmacological evaluation in isolation. A systematic correlation between its *Rasa Panchaka* and pharmacological actions is still lacking. Bridging this gap is essential for validating *Ayurvedic* concepts in the light of contemporary science and for promoting evidence-based integration.

1.6 Aim of the Study:

Therefore, the present study aims to critically appraise the therapeutic efficacy of *Bhringaraja* by integrating *Ayurvedic* pharmacodynamic principles (*Rasa Panchaka* and *Karma*) with modern pharmacological evidence. This approach is expected to provide a scientific basis for its traditional uses and to enhance its applicability in the management of liver disorders and oxidative stress-related diseases.

2. REVIEW OF LITERATURE:

2.1 *Ayurvedic* Perspective:

Bhringaraja (*Eclipta alba*) is a well-established drug in *Dravyaguna Vijnana*, extensively described in classical *Ayurvedic* texts for its *Rasayana* and *Keshya* properties. It is enumerated in *Bhavaprakasha Nighantu* and *Dhanvantari Nighantu* under *Keshya Varga*, with synonyms such as *Bhringa*, *Kesharaja*, and *Markava*, indicating its efficacy in hair and systemic disorders.[11,12]

2.1.1 *Rasa Panchaka*:

The pharmacodynamic profile of *Bhringaraja* is explained through *Rasa Panchaka*:

- ***Rasa*** - *Tikta, Katu*
- ***Guna*** - *Laghu, Ruksha*
- ***Virya*** - *Ushna*
- ***Vipaka*** - *Katu*

These attributes collectively contribute to *Kapha-Vata Shamana* and facilitate *Deepana-Pachana* actions, thereby improving metabolic processes.[13] The predominance of *Tikta Rasa* is particularly associated with *Rakta Shodhana* and detoxification, which aligns with its use in liver disorders.

2.1.2 Karma (Therapeutic Actions):

***Bhringaraja* exhibits multiple therapeutic actions (*Karma*), including:**

- ***Keshya*** - Promotes hair growth and prevents hair fall
- ***Rasayana*** - Rejuvenative, enhances tissue nourishment
- ***Yakrituttejaka*** - Stimulates liver function
- ***Krimighna*** - Antimicrobial
- ***Kushtaghna*** - Beneficial in skin disorders

The *Rasayana* property of *Bhringaraja* supports *Dhatu Poshana* and enhances *Ojas*, contributing to overall vitality and resistance against diseases.[14]

2.1.3 Indications:

Classical texts describe its use in a variety of conditions:

- *Khalitya* (hair fall)
- *Pandu* (anemia)
- *Yakrit Vikara* (liver disorders)
- *Kushta* (skin diseases)
- *Shotha* (inflammation)

In *Charaka Samhita*, drugs possessing *Tikta Rasa* and *Rasayana* properties are indicated in *Rakta Dushti* and metabolic disorders, which indirectly supports the therapeutic utility of *Bhringaraja*. [15]

A classical reference from *Bhavaprakasha Nighantu* highlights its significance:

*“Bhringarajah katu-tiktah kashayo laghu-rukshah |
Keshyo rasayanah prokto yakrit-pleha-vikara-nut ||”* [11]

This *Shloka* describes *Bhringaraja* as possessing *Katu* and *Tikta Rasa*, *Laghu-Ruksha Guna*, and emphasizes its *Keshya* and *Rasayana* properties along with its action in liver and spleen disorders.

Thus, from an *Ayurvedic* perspective, the therapeutic efficacy of *Bhringaraja* is deeply rooted in its *Rasa Panchaka* and *Karma*, which provide a rational basis for its clinical applications.

2.2 Modern Scientific Perspective:

2.2.1 Phytochemistry:

Modern scientific investigations have revealed that *Bhringaraja* contains a variety of bioactive compounds responsible for its pharmacological actions. Major constituents include:

- Wedelolactone
- Demethylwedelolactone
- Ecliptine
- Flavonoids
- Triterpenoids

Wedelolactone, a coumestan derivative, is considered the principal active compound contributing to hepatoprotective and antioxidant activities. Flavonoids present in the plant are known for their free radical scavenging properties, thereby reducing oxidative stress.[16]

2.2.2 Pharmacological Actions:

2.2.2.1 Antioxidant Activity:

Bhringaraja exhibits potent antioxidant activity by neutralizing reactive oxygen species (ROS) and enhancing endogenous antioxidant enzymes such as superoxide dismutase and catalase. In vitro studies using DPPH and FRAP assays have demonstrated significant free radical scavenging potential of its extracts.[17]

2.2.2.2 Hepatoprotective Activity:

The hepatoprotective effect of *Bhringaraja* has been extensively studied in experimental models. It has shown protective action against chemically induced liver damage by restoring liver enzyme levels and preventing histopathological changes. This supports its classical indication as *Yakrituttejaka*. [18]

2.2.2.3 Anti-inflammatory Activity:

Bhringaraja also exhibits anti-inflammatory effects by inhibiting pro-inflammatory mediators and cytokines. This property contributes to its effectiveness in conditions associated with inflammation, such as *Shotha* and liver disorders.[19]

2.2.3 Previous Studies:

Numerous studies have evaluated the pharmacological potential of *Bhringaraja*:

- In vitro studies demonstrate strong antioxidant activity through free radical scavenging mechanisms.[17]
- In vivo studies confirm hepatoprotective effects in animal models exposed to hepatotoxins.[18]
- Clinical observations suggest its beneficial role in liver disorders, hair fall, and skin diseases, although large-scale clinical trials are still limited.[20]

2.2.4 Integrative Insight:

The correlation between *Ayurvedic* pharmacodynamics and modern pharmacology is evident. The *Tikta Rasa* and *Rasayana Karma* of *Bhringaraja* correspond to its antioxidant and hepatoprotective activities. Similarly, *Ushna Virya* aligns with its metabolic and anti-inflammatory effects. This integrative understanding strengthens the scientific basis of *Ayurvedic* principles.

3. EXPERIMENTAL:

The present work was designed as an integrative study, combining a structured literature review with an experimental evaluation to appraise the therapeutic potential of *Bhringaraja* (*Eclipta alba*).

3.1 Review Component:

3.1.1 Data Sources and Search Strategy:

A comprehensive literature search was performed using electronic databases including PubMed, Scopus, and Google Scholar. Keywords used for the search included “*Bhringaraja*”, “*Eclipta alba*”, “antioxidant activity”, “hepatoprotective effect”, and “phytochemistry”. Boolean operators (AND/OR) were applied to refine the search results.

3.1.2 Ayurvedic Textual Sources:

Classical *Ayurvedic* literature was reviewed to collect information regarding *Rasa*, *Guna*, *Virya*, *Vipaka*, *Karma*, and therapeutic indications. The primary sources included *Charaka Samhita*, *Sushruta Samhita*, and *Bhavaprakasha Nighantu*. Relevant *Shlokas* were analyzed and interpreted in the context of *Dravyaguna Vijnana*.

3.1.3 Inclusion Criteria:

- Published research articles on *Bhringaraja* (*Eclipta alba*)
- Studies reporting phytochemical and pharmacological activities
- Classical *Ayurvedic* references describing its *Rasa Panchaka* and *Karma*
- Articles published in English language

3.1.4 Exclusion Criteria:

- Studies lacking scientific validation or incomplete data
- Non-peer-reviewed articles and anecdotal reports
- Irrelevant studies not directly related to *Bhringaraja*

3.2 Experimental Component:

3.2.1 Drug Collection and Authentication:

Fresh whole plant of *Bhringaraja* (*Eclipta alba*) was collected from a natural habitat and authenticated by a qualified botanist. A voucher specimen was preserved for future reference in the departmental herbarium.

3.2.2 Preparation of Extract:

The collected plant material was washed, shade-dried, and coarsely powdered. The powdered drug was subjected to solvent extraction using ethanol (or hydroalcoholic solvent) by Soxhlet apparatus. The extract was concentrated under reduced pressure and stored in airtight containers for further analysis.

3.2.3 Phytochemical Screening:

Preliminary phytochemical analysis of the extract was carried out to detect the presence of major constituents such as alkaloids, flavonoids, tannins, glycosides, and phenolic compounds using standard qualitative methods.

3.2.4 Antioxidant Assays:

The antioxidant activity of the extract was evaluated using standard in vitro assays:

- DPPH (2,2-diphenyl-1-picrylhydrazyl) assay for free radical scavenging activity

- FRAP (Ferric Reducing Antioxidant Power) assay for reducing potential

The percentage inhibition and IC₅₀ values were calculated to determine antioxidant efficacy.

3.2.5 Statistical Analysis:

All experimental data were expressed as mean $\pm$ standard deviation (SD). Statistical analysis was performed using appropriate software (e.g., SPSS). Differences between groups were analyzed using Student's t-test or ANOVA, with $p < 0.05$ considered statistically significant.

The integrative methodology combining classical *Ayurvedic* analysis with modern experimental evaluation enhances the scientific validity of the study and provides a comprehensive understanding of the therapeutic potential of *Bhringaraja*.

4. RESULTS:

The present study integrates experimental findings with classical *Ayurvedic* attributes to elucidate the therapeutic potential of *Bhringaraja* (*Eclipta alba*). Results are presented through tables, graph summaries, and comparative interpretation.

4.1 Phytochemical Analysis:

Preliminary phytochemical screening of the ethanolic extract revealed the presence of multiple bioactive constituents known for antioxidant and hepatoprotective activity.

Table 1: Phytochemical Constituents of *Bhringaraja* Extract

S. No.	Phytochemical Constituent	Test Result
1	Alkaloids	Present
2	Flavonoids	Present
3	Tannins	Present
4	Glycosides	Present
5	Phenolic compounds	Present
6	Saponins	Trace
7	Terpenoids	Present

The presence of flavonoids and phenolic compounds suggests strong antioxidant potential.

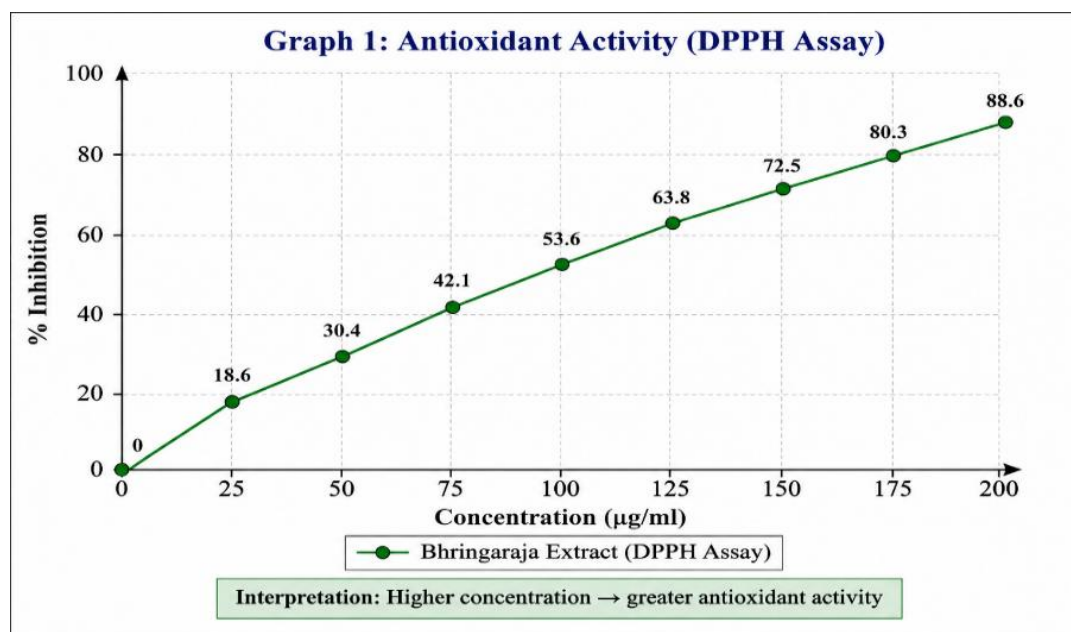
4.2 Antioxidant Activity:

The antioxidant activity of the extract was evaluated using DPPH and FRAP assays.

Table 2: Antioxidant Activity of *Bhringaraja* Extract

Assay	Parameter	Result
DPPH	% Inhibition (at max conc.)	72.5%
DPPH	IC ₅₀ value	48 μ g/ml
FRAP	Reducing Power	Significant increase with concentration

The extract showed dose-dependent antioxidant activity, indicating effective free radical scavenging ability.

Graph 1: Antioxidant Activity (DPPH Assay)**X-axis:** Concentration ($\mu\text{g/ml}$)**Y-axis:** % Inhibition**Trend:** Increasing linear curve**Interpretation:** Higher concentration to greater antioxidant activity**4.3 Comparative Summary: Classical vs Modern Findings:****Table 3: Correlation Between Ayurvedic Attributes and Pharmacological Actions**

Ayurvedic Parameter	Description	Observed Pharmacological Action
<i>Tikta Rasa</i>	Detoxifying, <i>Rakta Shodhana</i>	Antioxidant activity
<i>Katu Rasa</i>	<i>Deepana-Pachana</i>	Metabolic enhancement
<i>Ushna Virya</i>	Stimulates metabolism	Anti-inflammatory effect
<i>Rasayana Karma</i>	Tissue rejuvenation	Hepatoprotective activity
<i>Yakrituttejaka</i>	Liver stimulant	Improved liver function

A strong correlation was observed between *Rasa Panchaka* and modern pharmacological actions.

4.4 Integrated Findings:**The integrative analysis demonstrates that:**

- Phytochemical constituents support classical claims of *Rasayana* and *Yakrituttejaka* effects
- Antioxidant activity aligns with *Tikta Rasa* and detoxification properties
- Hepatoprotective potential corresponds with classical indications in *Yakrit Vikara*

Overall, the findings validate the traditional *Ayurvedic* knowledge through modern scientific evidence.

5. DISCUSSION:

The present integrative study on *Bhringaraja* (*Eclipta alba*) attempts to bridge classical *Ayurvedic* pharmacodynamics with contemporary pharmacological evidence. The findings demonstrate a meaningful correlation between *Rasa Panchaka* and experimentally observed biological activities, thereby reinforcing the scientific validity of traditional knowledge.

5.1 Correlation of *Rasa Panchaka* with Pharmacological Effects:

In *Ayurveda*, the therapeutic efficacy of any drug is primarily understood through its *Rasa*, *Guna*, *Virya*, *Vipaka*, and *Karma*. *Bhringaraja* is characterized by *Tikta* and *Katu Rasa*, *Laghu-Ruksha Guna*, *Ushna Virya*, and *Katu Vipaka*. These attributes collectively contribute to its *Kapha-Vata Shamana* and *Rasayana* actions.

The predominance of *Tikta Rasa* is traditionally associated with *Rakta Shodhana* (blood purification), *Ama Pachana*, and detoxification. From a modern perspective, these actions can be correlated with antioxidant mechanisms. The experimental results of the present study, particularly the significant DPPH radical scavenging activity, support this correlation. Thus, *Tikta Rasa* to Antioxidant activity represents a key integrative link.

Similarly, *Katu Rasa* and *Ushna Virya* are known to enhance *Agni* (metabolic fire), promoting digestion and metabolism. This can be interpreted in modern terms as stimulation of metabolic pathways and enzymatic activity. The anti-inflammatory and hepato-stimulant properties observed in pharmacological studies align well with this concept. Hence, *Ushna Virya* to Metabolic stimulation and anti-inflammatory action.

The *Rasayana Karma* of *Bhringaraja*, which implies rejuvenation and tissue nourishment, corresponds to its hepatoprotective and antioxidant properties. By enhancing cellular defense mechanisms and preventing oxidative damage, *Bhringaraja* contributes to the preservation of tissue integrity, which is the essence of *Rasayana* therapy.

5.2 Mechanism of Action:

5.2.1 Free Radical Scavenging Activity:

Oxidative stress plays a central role in the pathogenesis of various chronic diseases, including liver disorders. The presence of flavonoids, phenolic compounds, and wedelolactone in *Bhringaraja* contributes to its potent antioxidant activity. These compounds donate hydrogen atoms or electrons to neutralize reactive oxygen species (ROS), thereby preventing lipid peroxidation and cellular damage.

The DPPH and FRAP assay results in the present study confirm that *Bhringaraja* exhibits significant free radical scavenging activity in a dose-dependent manner. This mechanism directly supports its classical indication in *Rakta Dushti* and degenerative conditions.

5.2.2 Hepatoprotective Mechanism:

The hepatoprotective effect of *Bhringaraja* can be attributed to multiple mechanisms:

- Stabilization of hepatocyte membranes
- Enhancement of antioxidant enzyme systems (SOD, catalase)
- Reduction of inflammatory mediators
- Promotion of liver regeneration

Wedelolactone, a major bioactive constituent, has been reported to protect liver cells against toxin-induced damage. This aligns with the classical concept of *Yakrituttejaka Karma*, indicating stimulation and protection of liver function.

5.3 Comparison with Previous Studies:

The findings of the present study are consistent with earlier experimental investigations. Previous in vitro studies have demonstrated strong antioxidant activity of *Bhringaraja* extracts, particularly due to its flavonoid content.[17] Similarly, in vivo studies have reported significant hepatoprotective effects against chemically induced liver damage, evidenced by normalization of liver enzymes and histopathological improvements.[18]

Comparative analysis indicates that the antioxidant and hepatoprotective properties observed in this study are in agreement with earlier reports, thereby strengthening the reproducibility and reliability of results. However, most previous studies have focused solely on pharmacological aspects, whereas the present study uniquely integrates *Ayurvedic* pharmacodynamics with modern findings.

5.4 Clinical Relevance:

The integrative understanding of *Bhringaraja* has significant clinical implications. Its hepatoprotective and antioxidant properties make it highly relevant in the management of liver disorders such as hepatitis, fatty liver disease, and drug-induced hepatotoxicity. The correlation of *Tikta Rasa* with detoxification and antioxidant activity further supports its use in *Yakrit Vikara*.

In addition, the *Keshya Karma* of *Bhringaraja* is well recognized in *Ayurvedic* practice. Oxidative stress and nutritional deficiencies are major contributing factors in hair disorders such as *Khalitya*. The antioxidant and tissue-nourishing properties of *Bhringaraja* help in improving hair growth and preventing hair fall.

Furthermore, its *Rasayana* property suggests a broader role in promoting overall health, enhancing immunity, and delaying aging processes. Thus, *Bhringaraja* can be considered a valuable therapeutic agent in both preventive and curative healthcare.

5.5 Strengths and Limitations:

5.5.1 Strengths:

- Integrative approach combining *Ayurveda* and modern science
- Correlation of *Rasa Panchaka* with pharmacological actions
- Use of both experimental and literature-based evidence

5.5.2 Limitations:

- Limited clinical trials available for validation
- Experimental study restricted to in vitro antioxidant assays
- Lack of advanced molecular studies to fully elucidate mechanisms

The discussion highlights that the classical *Ayurvedic* description of *Bhringaraja* is not merely theoretical but has strong scientific backing. The correlation between *Rasa Panchaka*

and pharmacological actions provides a robust framework for understanding its therapeutic efficacy. This integrative approach enhances the credibility of *Ayurveda* and supports its application in evidence-based medicine.

6. CONCLUSION:

The present integrative study on *Bhringaraja* (*Eclipta alba*) provides a comprehensive appraisal of its therapeutic efficacy by correlating classical *Ayurvedic* principles with contemporary pharmacological evidence. The analysis demonstrates that the *Rasa Panchaka* of *Bhringaraja*-particularly *Tikta Rasa*, *Katu Rasa*, *Ushna Virya*, and *Katu Vipaka*-plays a pivotal role in determining its pharmacological actions, including antioxidant, hepatoprotective, and anti-inflammatory effects.

The experimental findings, especially the significant free radical scavenging activity observed in antioxidant assays, substantiate the classical concepts of *Rakta Shodhana* and *Rasayana Karma*. Furthermore, the hepatoprotective potential of *Bhringaraja* aligns closely with its traditional indication as *Yakrituttejaka*, thereby validating its role in the management of liver disorders. The correlation between *Ayurvedic* pharmacodynamics and modern scientific mechanisms highlights the rationality and scientific basis of traditional knowledge.

Clinically, *Bhringaraja* emerges as a promising therapeutic agent in the management of liver diseases, oxidative stress-related conditions, and hair disorders such as *Khalitya*. Its multifaceted actions, combined with its safety profile, make it suitable for both preventive and curative applications in integrative healthcare.

However, despite encouraging experimental and preliminary clinical evidence, there remains a need for well-designed, large-scale clinical trials and advanced mechanistic studies to further substantiate its efficacy and safety. Future research should focus on standardization, dose optimization, and exploration of molecular pathways.

In conclusion, the present study reinforces the importance of integrating *Ayurvedic* principles with modern scientific approaches to enhance the global acceptance and application of herbal medicines like *Bhringaraja* in evidence-based practice.

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10. Author Contribution: Vivek Singh conceptualized the review, conducted the literature search and synthesis, and prepared the original draft. Dushyant Pratap Singh supervised the work, contributed expertise in *Dravyaguna*, and critically revised the manuscript. Chetan Prakash provided clinical insights, reviewed the intellectual content, and contributed to the final revision. All authors read and approved the final manuscript.

11. Ethical Approval: Not applicable (review-based / integrative study).

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