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Review Paper

Standardization and Biological Evaluation of Bauhinia variegata Bark: Anthelmintic Activity

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ABSTRACT

Medicinal plants have been widely explored for their therapeutic potential because of their safety, affordability, and traditional importance. Bauhinia variegata, commonly known as Kachnar, is an important medicinal plant used in traditional systems of medicine for treating various disorders including infections, inflammation, ulcers, and helminthic diseases. The bark of the plant possesses several phytoconstituents such as tannins, flavonoids, glycosides, alkaloids, and saponins which contribute to its pharmacological properties. This review focuses on the standardization parameters and biological evaluation of Bauhinia variegata bark with special emphasis on anthelmintic activity. Pharmacognostic studies, physicochemical evaluation, phytochemical screening, and biological investigations are discussed to establish quality, purity, and efficacy of the crude drug. The bark extracts, especially ethanolic and aqueous extracts, have shown promising anthelmintic activity against different helminths due to the presence of tannins and phenolic compounds. Therefore, Bauhinia variegata bark can be considered a potential natural source for the development of safer herbal anthelmintic agents

INTRODUCTION

Often referred to as the orchid tree or Kachnar, Bauhinia variegata is a significant medicinal plant that is found in China, India, and Southeast Asian nations. It is a member of the Fabaceae

(Caesalpiniaceae) family and has been widely utilised to cure a variety of illnesses in traditional medical systems like Ayurveda, Unani, and folk medicine. The plant's bark, leaves, roots, flowers, and seeds are among the various sections that have

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important medicinal qualities. Among these, the bark's rich phytochemical makeup and variety of pharmacological properties make it extremely important. Ulcers, skin conditions, inflammation, tumours, diarrhoea, microbiological infections, and helminthic infestations have all historically been treated with *Bauhinia variegata* bark. Often referred to as the orchid tree or Kachnar, *Bauhinia variegata* is a significant medicinal plant that is found in China, India, and Southeast Asian nations. It is a member of the Fabaceae (Caesalpiniaceae) family and has been widely utilised to cure a variety of illnesses in traditional medical systems like Ayurveda, Unani, and folk medicine. The plant's bark, leaves, roots, flowers, and seeds are among the various sections that have important medicinal qualities. Among these, the bark's rich phytochemical makeup and variety of pharmacological properties make it extremely important. Ulcers, skin conditions, inflammation, tumours, diarrhoea, microbiological infections, and helminthic infestations have all historically been treated with *Bauhinia variegata* bark. Because they contain a variety of secondary metabolites, including alkaloids, tannins, flavonoids, glycosides, saponins, terpenoids, and phenolic compounds, medicinal plants are regarded as a significant source of bioactive substances. Numerous pharmacological actions, such as antibacterial, antioxidant, anti-inflammatory, antidiabetic, hepatoprotective, and anthelmintic effects, are caused by these phytochemicals. Scientists have recently concentrated on assessing the safety and therapeutic effectiveness of traditional medicinal herbs. Due to its many therapeutic benefits and long-standing application in treating parasite illnesses, *Bauhinia variegata* has garnered significant interest.

Important phytoconstituents such tannins, flavonoids, steroids, glycosides, saponins, carbohydrates, proteins, and phenolic compounds are found in *Bauhinia variegata* bark. The

anthelmintic activity of these components is thought to be primarily caused by tannins and polyphenolic chemicals. Tannins work by attaching themselves to proteins on helminth cuticles, damaging the worms' outer layer of defence and resulting in paralysis and death. Additionally, flavonoids and phenolic substances may disrupt parasites' physiological processes and energy metabolism. Thus, ethanolic and aqueous bark extracts from *Bauhinia variegata* have demonstrated encouraging anthelmintic action against experimental worms like *Pheretima posthuma*.

To guarantee the quality, efficacy, safety, and purity of herbal medications, standardisation is a crucial step. Due to variations in storage conditions, drying procedures, collection techniques, and geographic factors, the chemical composition of herbal medications may vary. For medicinal plant authentication and quality control, appropriate standardisation parameters are also necessary. Common techniques for standardising crude pharmaceuticals include pharmacognostic evaluation, physicochemical analysis, extractive values, ash values, moisture content determination, and phytochemical screening. These investigations aid in detecting contamination, adulteration, and preserving the uniformity of herbal compositions.

The macroscopic and microscopic properties of *Bauhinia variegata* bark, such as colour, odour, taste, texture, cork cells, fibres, calcium oxalate crystals, starch grains, and stone cells, are evaluated in pharmacognostic investigations. The purity and quality of the crude medication can be ascertained using physicochemical criteria such extractive values, acid insoluble ash, water soluble ash, and total ash value. The presence of significant secondary metabolites that are responsible for biological action is confirmed by preliminary phytochemical screening.



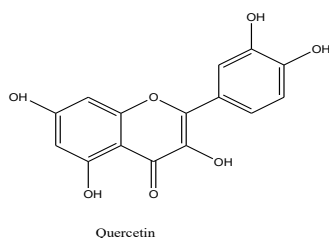
In vitro anthelmintic models including earthworms such as *Pheretima posthuma* are typically used for biological evaluation of *Bauhinia variegata* bark. Standard medications like albendazole are evaluated and compared with various doses of ethanolic and aqueous bark extracts. The time it takes for the worms to become paralysed and die is used to evaluate the activity. According to several research, ethanolic extracts have more anthelmintic efficacy because they extract more tannins and phenolic chemicals.

Therefore, the goal of this review is to provide an overview of the biological assessment and standardisation characteristics of *Bauhinia variegata* bark, with a focus on its anthelmintic activity. The study underlines the need for additional pharmacological and clinical research for therapeutic applications and stresses the significance of medicinal plants as possible sources of safer herbal anthelmintic drugs.

PLANT PROFILE:

Parameter	Description
Botanical Name	<i>Bauhinia variegata</i>
Family	Fabaceae / Caesalpinaceae
Common Name	Kachnar
Part Used	Bark
Habitat	Tropical and subtropical regions
Traditional Uses	Anthelmintic, anti-inflammatory, antimicrobial, tonic

STRUCTURE:



Structure of quercetin that are present in the bark region

PHYTOCHEMICAL CONSTITUENTS:

The bark contains: Flavonoids, Tannins (Gallic acid, Gallo tannic acid, ellagic tannic acid), Saponins, Alkaloids, Glycosides

The Leaves contains: Tannins (Gallic acid), Alkaloids, Cardiac glycosides, Flavonoids i.e. quercetin, rutin, quercetin, apigenin and apigenin 7-O-glucoside.

The Flowers contains: Quercitroside, Isoquercitroside, rutoside, taxifoline rhamnoside, kaempferol-3-glucoside.

The Buds contain: alanine, aspartic acid, glycine, serine, glutamic acid, phosphoenolpyruvic acid, oxaloacetic acid.

WHY WE SELECT THIS COMPONENT FOR THE STUDY?

Bauhinia bark is selected for anthelmintic studies primarily due to its rich history in traditional and folklore medicine and its proven high concentrations of bioactive secondary metabolites (Tannins, flavonoids, terpenoids, etc.)

TAXONOMICAL CLASSIFICATION OF *BAUHANIA VARIGETA*:

- Kachnar (*Bauhinia variegata*) is a beautiful flowering tree commonly found in India and other tropical regions. It belongs to the family - *Fabaceae* (*Leguminosae*).
- Kingdom Plantae
- Super Division Spermatophyta
- Division Magnoliophyta
- Class Magnoliopsida
- Sub Class Rosidae
- Order Fabales
- Family Fabaceae
- Genus Bauhinia
- Species Variegata

MEDICINAL USES:

- Treating intestinal worms
- Improving digestion
- Used in the treatment of Cough



- Treating Skin Issues
- Having Anti-Inflammatory & Antioxidant Properties
- Help in wound healing.

PROCEDURE:

The study was done to compare the anthelmintic activity of ethanolic and aqueous extracts of *Bauhinia variegata* using Albendazole as the standard drug.

↓
Adult Indian earthworms (*Pheretima posthuma*) were selected because they resemble human intestinal worms and were cleaned with normal saline before use.

↓
Albendazole solution and the Ethanolic and Aqueous extracts were prepared in required concentrations for testing.

↓
The experiment was divided into four groups: Albendazole, Ethanolic extract, Aqueous extract, and Normal Saline as control.

↓
Four healthy earthworms were placed in each Petri plate containing the respective solutions and kept at room temperature for observation.

↓
Time of paralysis was noted when worms stopped moving, and time of death was noted when no movement occurred even in the water.

↓
The average paralysis and death times were compared to determine which extract showed better anthelmintic activity.

↓
Calculated the mean time of paralysis and death for each group to compare efficacy.

Active Constituents of *Bauhinia variegata* Bark:

The bark of *Bauhinia variegata* contains several pharmacologically active phytoconstituents responsible for its medicinal and anthelmintic properties.

Active Constituent	Chemical Class	Pharmacological Role
Tannins	Polyphenols	Responsible for anthelmintic activity by damaging parasite cuticle
Flavonoids	Phenolic compounds	Antioxidant and anti-inflammatory activity
Saponins	Glycosides	Membrane permeabilization of parasites
Alkaloids	Nitrogen compounds	Antiparasitic and antimicrobial effects
Glycosides	Secondary metabolites	Therapeutic activity
Steroids	Terpenoid derivatives	Anti-inflammatory property

Terpenoids	Volatile compounds	Antimicrobial and antiparasitic effects
Phenolic compounds	Polyphenols	Antioxidant activity
Carbohydrates	Primary metabolites	Nutritional support
Proteins & Amino acids	Biomolecules	Structural and metabolic functions

Plants with Anthelmintic Activity:

bioactive phytoconstituents such as tannins, alkaloids, flavonoids, terpenoids, and saponins

Several medicinal plants have shown significant anthelmintic activity due to the presence of

Plant Name	Family	Active Constituents	Anthelmintic Property
Bauhinia variegata	Fabaceae	Tannins, flavonoids, glycosides	Paralysis and death of worms
Azadirachta indica	Meliaceae	Azadirachtin, nimbin	Broad spectrum antiparasitic activity
Carica papaya	Caricaceae	Papain, alkaloids	Effective against intestinal worms
Punica granatum	Lythraceae	Pelletierine alkaloids	Traditional vermifuge
Terminalia chebula	Combretaceae	Tannins, chebulinic acid	Antiparasitic activity
Embelia ribes	Primulaceae	Embelin	Potent anthelmintic action
Allium sativum	Amaryllidaceae	Allicin, sulfur compounds	Inhibits helminths
Areca catechu	Arecaceae	Arecoline	Expels intestinal worms
Moringa oleifera	Moringaceae	Flavonoids, saponins	Anthelmintic potential
Ficus religiosa	Moraceae	Phenolics, tannins	Anthelmintic and antimicrobial

Microscopic Characters

Cork Cells – Brown, Polygonal

Phloem Fibers – Thick Walled

Calcium Oxalate crystals – Present(prisms)

Mucilage Cell – Present

Transverse Section of *Bauhinia variegata* bark

Covering Trichome

Xylem Fiber (Water transport)

Phloem Fiber (Transport Nutrient From soil to plant)

Parenchymatous cell (Store Nutrients)

Mechanism of Anthelmintic Action

- Tannins Bind to free proteins in gastrointestinal tract Cause death of parasites.
- Phenolic Compounds Disturb energy generation in worms.
- Saponins Damage cell membranes of parasites.

Advantages of Herbal Anthelmintics

- Natural origin
- Cost effective
- Easily available



- Lower toxicity
- Reduced resistance
- Better patient acceptance

SUMMARY

The anthelmintic activity of *Bauhinia variegata* bark was the main subject of a biological assessment and pharmacognostic standardisation study. Establishing quality control standards and providing scientific validation for the plant's traditional usage in treating helminthic diseases were the goals of the study. Examining both macroscopic and microscopic features, as well as determining ash and extractive values, moisture content, swelling index, and fluorescence studies, were all part of standardising the bark. These criteria aid in determining the crude drug's authenticity, quality, and purity while preventing adulteration.

Bioactive substances including flavonoids, tannins, saponins, glycosides, alkaloids, and phenolic compounds were found in a preliminary phytochemical screening of several bark extracts. The medicinal and antiparasitic properties of these phytoconstituents are well-known. Anthelmintic potential was evaluated biologically using experimental worms. In comparison to the control group, the extracts demonstrated considerable dose-dependent efficacy by paralysing and killing the worms in a shorter amount of time.

The results corroborate the bark extract's traditional therapeutic use and indicate that it has potent anthelmintic qualities. Additionally, the study offers standardisation data that could be helpful for upcoming studies, quality control, and the creation of herbal formulations made from the bark of *Bauhinia variegata*.

CONCLUSION

In addition to establishing crucial pharmacognostic and physicochemical standards,

the current investigation on *Bauhinia variegata* bark showed its considerable potential as a natural anthelmintic agent. The crude drug's identity, purity, and quality were verified by the standardisation parameters, which included organoleptic assessment, ash values, extractive values, moisture content, fluorescence analysis, and microscopic features. The correct authenticity and quality control of herbal materials used in medicinal formulations depend on these criteria.

Biologically active components including flavonoids, tannins, saponins, alkaloids, glycosides, and phenolic compounds were found by preliminary phytochemical screening. By disrupting helminth metabolism and structural integrity, these substances are thought to contribute to the reported anthelmintic action.

According to the biological evaluation, the bark extracts significantly paralysed and killed the experimental worms in a dose-dependent manner, demonstrating an efficient antiparasitic action on par with that of conventional anthelmintic medications.

Overall, the results provide scientific evidence in favour of the traditional usage of *Bauhinia variegata* bark for treating helminthic diseases. The study emphasises its potential for more pharmacological research and the creation of herbal anthelmintic formulations that are standardised, safe, and efficacious.

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