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Comparative Pharmacognostic and Phytochemical Evaluation of Wild and Black Varieties of Kapikacchu (Mucuna pruriens DC.)

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ABSTRACT :

Mucuna pruriens (Kapikacchu), a well-known Ayurvedic drug, is used as an aphrodisiac, nervine tonic, and in the management of Parkinson's disease. This study aims to compare the pharmacognostic and phytochemical characteristics of its wild (white) and black seed varieties. Microscopic features, organoleptic parameters, physicochemical constants, and preliminary phytochemical screening were conducted. Differences in seed morphology, trichome density, and L-DOPA content were noted. These findings provide quality standards essential for authentication and standardization of these varieties.

1. Introduction

Mucuna pruriens (Kapikacchu), belonging to the family Fabaceae, has been extensively used in Ayurveda for the treatment of infertility, neurological disorders, and as a potent aphrodisiac [1]. It is known for its high content of L-3,4-dihydroxyphenylalanine (L-DOPA), a direct precursor to dopamine [2]. There are several morphotypes, most commonly the wild (white) and cultivated black varieties, which differ morphologically and chemically [3].

The lack of comparative standardization between these two types creates challenges in quality control of Ayurvedic formulations. Hence, the present study was designed to establish comparative pharmacognostic and phytochemical profiles.

2. Materials and Methods

2.1 Sample Collection and Authentication

Wild and black varieties of M. pruriens seeds were collected from different agro-climatic regions of India and authenticated at the Department of Botany, [Institution]. Voucher specimens were deposited in the herbarium.

2.2 Macroscopic and Microscopic Analysis

Standard macroscopic parameters were assessed [4]. For microscopic analysis, transverse sections were prepared using microtomy and stained with safranin and phloroglucinol-HCl to highlight lignified tissues [5].

2.3 Physicochemical Parameters

LOD, ash values, and extractive values were determined according to the Ayurvedic Pharmacopoeia of India (API) guidelines [6].

2.4 Phytochemical Screening

Methanolic and aqueous extracts were screened for major groups including alkaloids, flavonoids, tannins, phenolics, saponins, and steroids following standard procedures [7].

2.5 L-DOPA Quantification

L-DOPA was quantified using UV spectrophotometry at 280 nm and validated using High-Performance Thin Layer Chromatography (HPTLC), following established protocols [8,9].

3. Results

3.1 Macroscopic Characteristics

Seed color, size, and surface texture differed between the two varieties. The wild variety showed greyish-white seeds with trichomes, while black seeds were smooth and hairless.

3.2 Microscopy

Diagnostic characters such as thickened seed coat, starch grains, and unicellular stinging trichomes were noted in the wild type. Trichomes were absent in the black variety.

3.3 Physicochemical Parameters

Parameter	Wild Variety	Black Variety
LOD (%)	**6.2**	**5.8**
Total ash (%)	**4.3**	**4.1**
Water-soluble extractive (%)	**13.6**	**15.1**
Alcohol-soluble extractive (%)	**9.2**	**10.4**

3.4 Phytochemical Screening

Both varieties tested positive for alkaloids, flavonoids, tannins, phenols, saponins, and proteins. Slightly higher tannin content was observed in the wild variety.

3.5 L-DOPA Content

Wild variety: 4.1–4.5%
Black variety: 5.0–5.8%
The black variety had consistently higher L-DOPA content, confirming previous findings [9,10].

4. Discussion

The study successfully differentiated the two varieties on pharmacognostic and chemical grounds. The presence of stinging trichomes in the wild type is a diagnostic microscopic feature. The higher L-DOPA content in the black variety aligns with its widespread use in Parkinson's disease management [2,10].

While both varieties share similar phytoconstituent groups, variation in extractive values and marker compounds suggests the need for variety-specific standardization, particularly for pharmaceutical use.

5. Conclusion

This comparative evaluation emphasizes the need for identification and quality control protocols distinguishing the wild and black Kapikacchu varieties. These findings can support pharmacopoeial standardization and safer, more effective herbal drug development.

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