International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

PhytoPark Syrup: Herbal Neuroprotective Syrup in Parkinson's disease

Urjita R. Sanghavi[1], Twinkle J. Bhatt[2]

[1]Student, Bachelor of Pharmacy, Gyanmanjari Pharmacy College
[2]Assistant Professor, Department of Pharmacognosy,Gyanmanjari Pharmacy College

ABSTRACT

This research reports the formulation and extensive evaluation of PhytoPark Syrup, a new phytopharmaceutical preparation with the purpose of inducing neuroprotection and cognitive improvement. The syrup consists of thoroughly researched medicinal plants such as Mucuna pruriens, Withania somnifera, Bacopa monnieri, Curcuma longa, Ginkgo biloba, and Piper nigrum, which are all characterized by their synergistic neuroprotective, antioxidant, anti-inflammatory, and cognition-enhancing effects. The preparation is based on honey and sorbitol syrup, increasing bioavailability, hiding bitter herbal flavor, and increasing patient compliance, especially in elderly patients and patients with dysphagia.

Mucuna pruriens, a natural L-DOPA source, is the major neuroactive ingredient, providing dopaminergic activity in Parkinson's disease. The product was formulated by employing judiciously optimized extraction and mixing processes for maintaining the bioactive components along with synergistic activity. Prolonged physicochemical characterization studies were performed, comprising pH, viscosity, refractive index analysis, and microbial load testing and accelerated stability studies, all of which established the quality, safety, and shelf life stability of the formulation over a period of time.

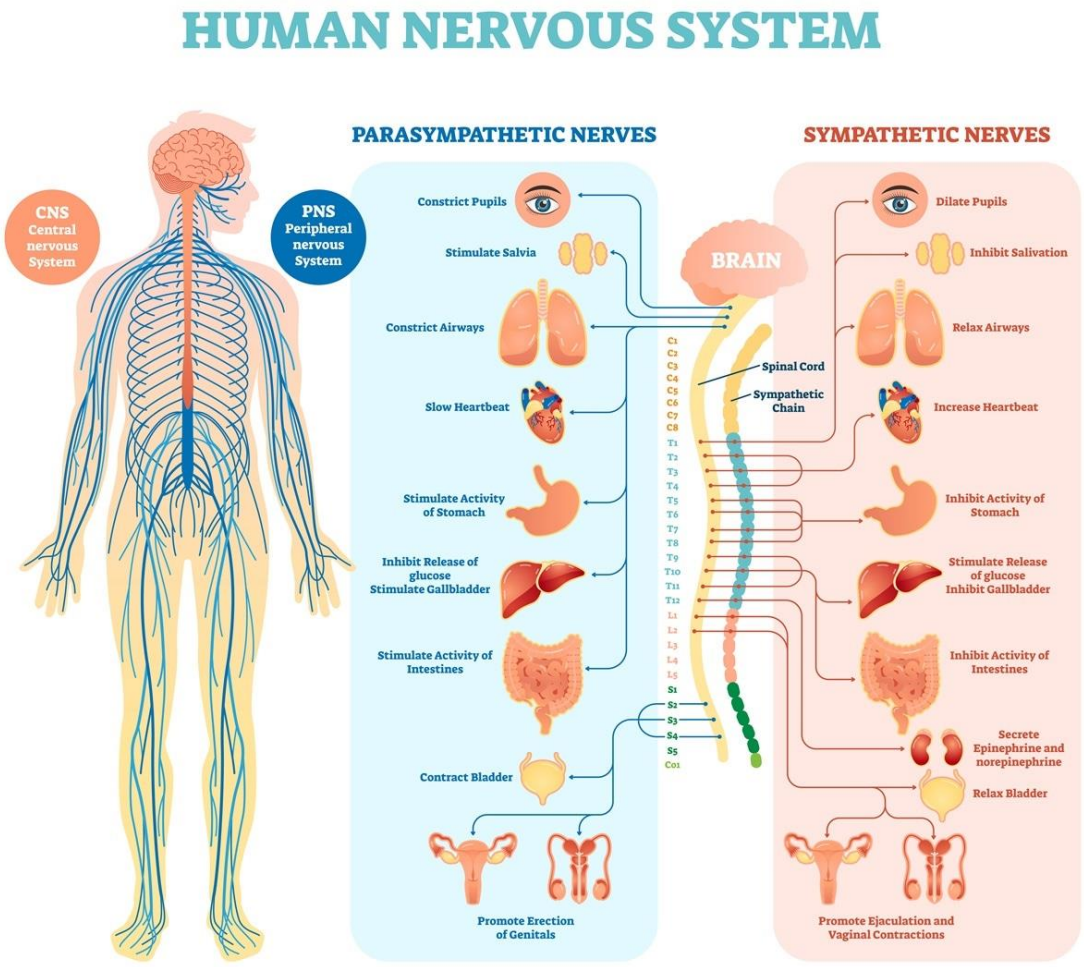
Preliminary results show that PhytoPark Syrup is organoleptically acceptable, stable, and of much interest as a natural remedy for the treatment of neurodegenerative disorders and age-related cognitive impairment. By leveraging the therapeutic potential of classic botanicals in contemporary, user-friendly form, PhytoPark Syrup is a promising addition to the discipline of herbal neuropharmacology. Additional in vivo experiments and clinical trials should be conducted to confirm its efficacy and determine its marketability and regulatory approval potential.

Keywords: Neuroprotection, Cognitive enhancement, Parkinson's disease, Herbal syrup, Natural dopamine booster, Antioxidant therapy, Bioavailability enhancement, Phytopharmaceutical formulation, Herbal medicine, Brain health

1. INTRODUCTION

In the past two to three decades, there has been significant progress in the understanding, diagnosis, and management of neurodegenerative disorders like Parkinson's disease (PD) and cognitive impairment. Improvements in neuroscience, pharmacology, and biomedical engineering have enhanced diagnostic accuracy, therapeutic strategies, and patient outcomes. The development of personalized medicine, through the use of genetic testing and risk assessment based on biomarkers, has made treatment more targeted as it is driven by an individual's neurophysiological profile. The incorporation of digital health

technology has also amplified remote patient monitoring and early detection of disease, further revolutionizing neurological care.



[Figure: 1 – Nervous System]

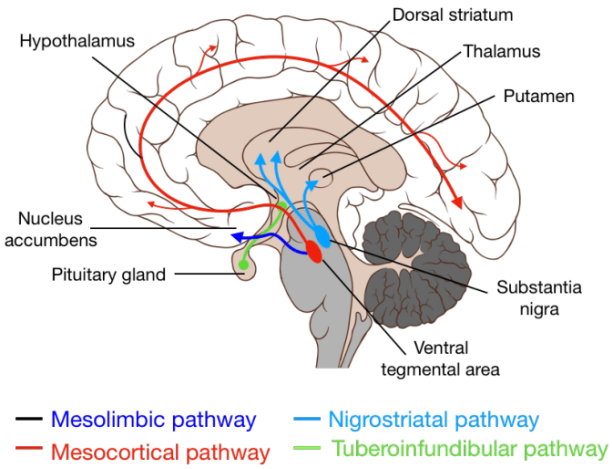
Natural remedies have become the subject of widespread interest in recent years due to their potential neuroprotective actions. A number of medicinal plants, such as Mucuna pruriens, Withania somnifera, Bacopa monnieri, Curcuma longa, Ginkgo biloba, and Piper nigrum, have been thoroughly investigated for their ability to improve cognitive function, alleviate oxidative stress, and regulate neurotransmitter activity.[1] These plants possess bioactive compounds having antioxidant, anti-inflammatory, and neuroprotective activities, indicating that they are potential targets for the treatment of neurodegenerative disorders.[2]

1.1 BASIC PHYSIOLOGY OF THE NERVOUS SYSTEM

The nervous system is a network of intricate complexity whose role is to coordinate activities of the body as well as mediate communication among different organs. It comprises two major divisions:

- Central Nervous System (CNS) – The brain and spinal cord, which are in charge of processing and integrating information.[3]
- Peripheral Nervous System (PNS) – Nerves and ganglia, which conduct signals from the CNS to the rest of the body.

The brain serves as the regulating center of intellectual and motor activity, and the spinal cord as a pathway for sensory and motor signals. Neurotransmitter balance between dopamine, acetylcholine, serotonin, and GABA is very important in keeping cognitive function, motor coordination, and emotional well-being intact.[4]



[Figure: 2- Brain anatomy and dopamine pathways]

1.1.1 Dopaminergic System and Parkinson's Disease

The dopaminergic system includes neurons that produce and secrete dopamine, a neurotransmitter responsible for motor function and motivation. Parkinson's disease (PD) is defined by progressive degeneration of dopaminergic neurons within the substantia nigra, causing dopamine deficiency and motor dysfunction in the form of tremor, rigidity, and bradykinesia.[5]

Herbal treatments, like Mucuna pruriens (naturally occurring source of L-DOPA), have been found to have promise in restoring levels of dopamine and treating Parkinsonian symptoms.[6]

1.2 FUNCTION OF THE NERVOUS SYSTEM

- **Neurotransmission**: Enables communication between neurons by chemical messengers.
- **Motor Control**: Controls voluntary and involuntary movements.
- **Cognitive Function**: Controls memory, learning, and problem-solving ability.
- **Maintenance of Homeostasis**: Controls bodily functions like heart rate, digestion, and breathing.
- **Neuroplasticity**: Validates the brain's capacity to change and reorganize in response to stimulation.[7]

1.3 INTRODUCTION TO HERBAL SYRUPS

Definition:

Herbal syrups consist of liquid form of bioactive plant extracts dissolved in a sweetened vehicle such as honey or sorbitol to improve taste, stability, and bioavailability. In contrast to traditional drug therapy, herbal syrups offer a complementary approach by synthesizing several phytochemicals that have additive therapeutic effects due to synergistic interactions.[8]

Advantages of Herbal Syrups:

- **Improved Absorption:** Liquid forms provide better bioavailability than tablets or capsules.
- **Geriatric-Friendly:** Syrups are simpler to swallow, thus ideal for elderly patients.

- **Multifunctional Effects:** Offer antioxidant, anti-inflammatory, and neuroprotective effects.[9]

1.4 TYPES OF HERBAL FORMULATIONS

- Single Herb Extracts: Have a pure bioactive agent from one plant.
- Polyherbal Formulations: Mix several herbs for a synergistic therapeutic effect.
- Standardized Extracts: Provide reproducible phytochemical content for consistent efficacy.[10]

1.5 MECHANISM OF ACTION OF PHYTOPHARMACEUTICALS

The neuroprotective properties of herbal extracts are ascribed to various mechanisms, which include:

Modulation of Dopaminergic Pathway: Mucuna pruriens offers L-DOPA, which is a dopamine precursor.[11]

Free Radical Neutralization: Curcuma longa and Bacopa monnieri eliminate free radicals, lowering neuronal damage due to oxidative stress.[12]

Anti-Inflammatory Effect: Withania somnifera inhibits pro-inflammatory cytokines, preventing neuronal injury from chronic inflammation.[13]

Promoting Cerebral Circulation: Ginkgo biloba increases brain perfusion, optimizing cognition.[14]

Bioavailability Boost: Piper nigrum enhances the bioavailability and strength of active ingredients.[15]

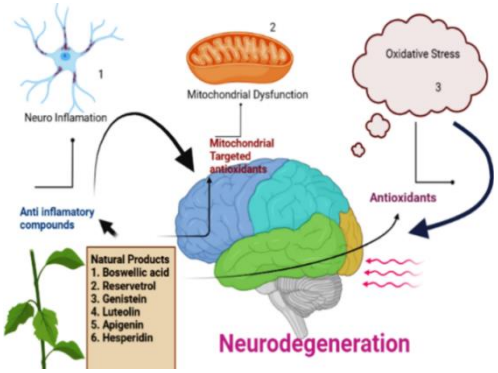
1.6 ROLE OF HERBAL MEDICINE IN NEUROLOGICAL DISORDERS

Herbal medicines are widely recognized for their ability to:

- Delay the progression of neurodegenerative diseases.
- Improve cognitive function and memory retention.
- Provide natural alternatives to synthetic pharmaceuticals with fewer side effects.[16]

1.6.1 Market Potential for Herbal Neuroprotective Syrups

As the incidence of neurodegenerative disorders increases, there is growing need for safe, effective, and natural herbal preparations. PhytoPark Syrup fills this gap by providing a holistic, plant-based solution to cognitive well-being and Parkinson's care.[17]



[Figure 3: Mechanism of neurodegeneration]

2. REVIEW OF LITERATURE:

2.1 LITERATURE REVIEW ON PARKINSON'S DISEASES

Bobby Thomas and M. Flint Beal (2007) presents oxidative stress as a top contender for Parkinson's disease (PD) pathology. The susceptibility of dopaminergic neurons of the substantia nigra is emphasized as a result of increased metabolic activity, dopamine metabolism, and iron burden. Reactive oxygen

species (ROS), mitochondrial impairment, and the role of environmental toxins are emphasized. Antioxidant therapy is proposed as a potential means for PD management.

Naik GS, Dr. Raja Gulfam Shaikh, Dr. Satish P. Dipankar, et.al (2024) provides details of PD etiology, pathology, and herbal medicine's role. It gathers information from plant-based research such as Mucuna pruriens, Withania somnifera, and Bacopa monnieri and their antioxidant and neuroprotective effects. The ability of the phytochemicals to suppress oxidative damage and dopaminergic neuron loss is highlighted.

2.2 LITERATURE REVIEW ON HERBAL SYRUP

Dr. Javesh K. Patil, Dipali R. Mali, Komal R. More and Shraddha M. Jain (2019) states that herbal syrup can be prepared by adding concentrated decoction of herbs with either honey or sugar and we can also use alcohol. For thickening and preserving the formulation, we usually mix the decoction of herbs with sugar. The evaluation parameters for the same are determination of density, specific gravity, viscosity, and pH. The physicochemical characteristics like colour, odour, taste and stability testing is done simulataneously.

Maedeh Rezghi, Seyed Alireza Mortazavi, Rasool Choopani, Shirin Fahimi, et.al. (2019) concludes that short term thermal stability can be determined by placing 3 bottles of syrup in refrigerator (4^{o}C) and another 3 samples in incubator at 40^{o}C. After 7 days, replacement of bottles is done. Sedimentation, taste, odor and colour are evaluated after the 14 day's cycle.

2.3 LITERATURE REVIEW ON MUCUNA PRURIENS

Roberto Cilia, Janeth Laguna, Erica Cassani, et.al. (2025) emphasizes the high L-DOPA content in Mucuna pruriens, making it a natural alternative to synthetic dopamine precursors. The literature review presents studies showing its effectiveness in improving motor function and reducing dyskinesia in PD models. Its anti-oxidant and neuroprotective qualities are highlighted as additional benefits supporting its therapeutic potential.

Sanjay Kasture, Mahalaxmi Mohan, Veena Kasture (2013) states that kampavat, the ayurvedic name for Parkinson's disease caused due to excess of Vata is treated extensively by Mucuna pruriens. The constituents showing neuroprotective activity and supporting the antiPD activity of levodopa are genistein, gallic acid, unsaturated acids, nicotine, bufotenin, harmin alkaloids, lecithin, etc.

R Katzenschlager, A Evans, A Manson et.al, (2004) emphasizes that the rapid onset of action and longer on time without concomitant increase in dyskinesias on mucuna seed powder formulation suggest that this natural source of l-dopa might possess advantages over conventional l-dopa preparations in the long term management of PD. It belongs to Fabaceae family and Papilionaceace subfamily. It has neuroprotective and antioxidant property.

2.4 LITERATURE REVIEW ON BACOPA MONNIERI

Dr. Hardy Daniel and Dr. Ravinrdan Rajan (2019) reviews the neuroprotective potential of Bacopa monnieri, known for its antioxidant and anti-inflammatory actions. Preclinical models show improved motor behavior, increased dopamine levels, and reduced oxidative damage. The herb's impact on mitochondrial function and synaptic plasticity is discussed.

Gunduluru Swathi, Cherukupalle Bhuvaneswar and Wudayagiri Raajendra (2013) discusses Bacopa monnieri (Brahmi) as a memory-enhancing herb with strong neuroprotective effects. The literature review summarizes findings on its active compounds—bacosides—showing antioxidant, cholinergic, and neurotrophic properties. Previous studies have reported improvements in learning, memory, and reduced neural oxidative stress, supporting the plant's use in combating neurodegenerative diseases like Parkinson's.

2.5 LITERATURE REVIEW ON WITHANIA SOMNIFERA

Jay Prakash, Satyndra Kumar Yadav, Shikha Chouhan and Surya Pratap Singh (2014) investigates Withania somnifera (Ashwagandha) root extract's neuroprotective effects in a PD mouse model induced by maneb and paraquat. It shows that the extract improves motor function, reduces oxidative stress markers, and restores tyrosine hydroxylase levels. The findings support the antioxidant and protective effects of W. somnifera.

Jay Prakash, Shikha Chouhan, Satyndra Kumar Yadav, Susan Westfall, Sachchida Nand Rai, Surya Pratap Singh (2014) reviews how Withania somnifera (Ashwagandha) provides neuroprotection in Parkinson's disease models. The literature cited covers its adaptogenic, antioxidant, and anti-apoptotic effects. Previous studies demonstrate that Ashwagandha root extract can restore dopamine levels, reduce oxidative damage, and inhibit alpha-synuclein aggregation. The paper uses these findings to support its experimental focus on Ashwagandha's molecular influence in PD.

Nidhi Singh, Sachchida Nand Rai, Divakar Singh, Surya Pratap Singh (2015) states that Withania somnifera contains several active components like withaferin A, withanone and other flavonoids showing strong anti-oxidant properties. It shows neuroprotective action of dopaminergic neurons in substania nigra pars compacta region of mid-brain.

2.6 LITERATURE REVIEW ON CURCUMIN

R.B. Mythri and M.M. Srinivas Bharath (2012) states that Curcumin, a bioactive from turmeric, has been widely studied for its antioxidant and anti-inflammatory properties. The literature review outlines past research showing curcumin's role in reducing oxidative stress, preserving mitochondrial function, and modulating signaling pathways like NF-κB and Nrf2. The article focuses on curcumin's potential to alleviate PD symptoms and slow neurodegeneration through these mechanisms.

2.7 LITERATURE REVIEW ON GINKGO BILOBA

Shaosong Kuang, Lin Yang, Ziliang Rao, et,al. (2017) states that the extract of ginkgo biloba from its leaves contains 2 active constituents : flavonoids and terpenoids.They have the ability to eliminate oxygen-free radicals and act as antioxidants. So, ultimately they can improve dopamine expression, inhibiting the development of PD.

Patricia Rojas, Pedro Montes, Carolina Rojas, et.al. (2012) emphasizes that Ginkgo biloba extract is used to treat dementia and vaso-occlusive and cochleovestibular disorders. It is a standardized extract of complex mixture of compounds and is non-toxic drug. It can decrease oxidative stress and thus show neuroprotective activity.

2.8 LITERATURE REVIEW ON PIPER NIGRUM

Alyne Oliveira Correia, Abílio Augusto Pimentel Cruz, Arôdo Tenório Ribeiro de Aquino,et.al. (2015) emphasizes oxidative stress as a shared mechanism in neurodegenerative diseases (NDs), including PD. Previous studies cited confirm the antioxidant, anti-glycation, anti-acetylcholinesterase, and anti-amyloid properties of Piper nigrum, mainly due to its active compound, piperine. The article builds on this by investigating its multitarget neuroprotective potential in hydrogen peroxide-induced oxidative stress in SH-SY5Y neuroblastoma cells.

Himadri Sharma, Niti Sharma and Seong Soo A. An (2023) states that the extracts of black pepper exhibited neuroprotection by significantly decreasing the oxidative stress and restoring the mitochondrial membrane potential in the cells. They are inhibitors of AChE. The active constituent is an alkaloid piperine having anti-AChE and anti-amyloid activity. It has antioxidant and shows protection against cognitive

decline and hippocampal nerve damage. It reduces ROS production and maintains mitochondrial membrane integrity, showing the antioxidant potential of the extracts.

3. AIM AND OBJECTIVE

3.1 AIM

The purpose of this research is to design and test a new neuroprotective herbal syrup, PhytoPark Syrup, with Mucuna pruriens, Withania somnifera, Bacopa monnieri, Curcuma longa, Ginkgo biloba, and Piper nigrum. The purpose is to evaluate their combined efficacy in maintaining cognitive function and neuroprotection, especially in diseases such as Parkinson's disease. This includes studying the synergistic action of these bioactive molecules on dopamine control, antioxidant capacity, and reduction of neuroinflammation. In addition, considerations of safety, bioavailability, and stability will be assessed to provide a standard and effective formulation. The formulation is intended to offer a natural and age-friendly option for cognitive improvement, with the potential for further preclinical and clinical substantiation.

3.2 OBJECTIVES

Formulation and Evaluation: Create a stable, tasty, and bioavailable herbal syrup of Mucuna pruriens, Withania somnifera, Bacopa monnieri, Curcuma longa, Ginkgo biloba, and Piper nigrum in an appropriate syrup base.

Neuroprotective Synergy: Explore the synergistic effects of these herbal compounds in elevating dopamine levels, lowering oxidative stress, and enhancing cognitive function.

Safety and Optimization: Make the syrup safe to ingest with minimal side effects. Optimise formulation parameters for maximum stability and bioavailability.

Quality Control & Standardization: Develop physicochemical parameters, phytochemical profiling, and microbial safety limits in order to ensure product quality and consistency.

3.3 SCOPE OF FURTHER STUDY

Owing to restricted access to sophisticated research laboratories, certain analytical assessments will need to be further optimized. This research can be expanded and enhanced by:

Advanced Extraction Techniques: Maximization of herbal extract yield by utilizing advanced extraction techniques like ultrasound-assisted extraction (UAE) or supercritical fluid extraction (SFE).

Standardization of Bioactive Compounds: Quantitation of L-DOPA (from Mucuna pruriens), withanolides (from Withania somnifera), bacosides (from Bacopa monnieri), and curcuminoids (from Curcuma longa) for accurate dosing and efficacy guarantee.

Pharmacokinetic and Clinical Studies: In-vitro, in-vivo, and human clinical trials to confirm the efficacy, safety, and bioavailability of the syrup formulation.

3.4 PLAN OF WORK

The research adopts a stepwise systematic approach to promote scientific validity and consistency:

Literature Review

Critically review the existing literature on neurodegenerative diseases, cognitive function, and herbal neuroprotection.

Examine research on the pharmacological activity of each herb and their applicability in Parkinson's disease and cognitive impairment.

Compare presently available marketed herbal neuroprotective products to recognize the shortcomings in existing treatment.

Pharmacognostical Study

Macroscopic and microscopic authentication of raw herbs.

Phytochemical screening to elucidate key bioactive constituents in each herb.

Organoleptic testing (color, odor, texture) for raw material standardization.

Physicochemical Analysis

pH, viscosity, density, and refractive index of the syrup for determination of formulation stability.

Formulation Development

Choosing a suitable syrup base (honey/sorbitol) for palatability and bioavailability.

Adding herbal extracts at optimal levels for synergistic neuroprotective effects.

Homogenization and stability tests to ascertain uniformity and long-term survival of the formulation.

Evaluation Parameters

Physical & Organoleptic Properties: Color, odor, taste, and texture.

Microbial Contamination Tests: Compliance with safety standards.

Stability Testing: Assessment of the shelf-life of the formulation under accelerated conditions.

Result and Discussion

Analysis of formulation success, stability results, and efficacy determination.

Comparison with currently available herbal neuroprotective formulations.

Detection of prospective difficulties and avenues for improvement.

Summary and Conclusion

Synthesis of the findings of the study, implications, and future potential.

Suggestions for pharmacological validation and clinical translation in the future.

4.1. PLANT PROFILE

Selection of Herbs:

The seeds of Mucuna pruriens was purchased from Sanjivani Aushadhalay, Bhavnagar. The powder of ashwagandha, brahmi, turmeric and black pepper was purchased from Sanjivani Aushadhalay, Bhavnagar. The powder of ginkgo biloba was purchased from Hielen Biopharm. Honey was purchased from Patanjali.

4.1.1 Mucuna pruriens (Velvet Bean)

[Figure 4: Mucuna pruriens]

Synonyms:

- Cowhage
- Kapikacchu
- Atmagupta

Family:

- Fabaceae (Legume family)

Vernacular Names:

- Kiwanch (Hindi)
- Mucuna (English)
- Poonaikali (Tamil)

Phytochemical Constituents:

- Primary: L-DOPA (precursor to dopamine)
- Other: Alkaloids, flavonoids, saponins, tannins

Therapeutic Uses:

- Antiparkinsonian (boosts dopamine levels)
- Aphrodisiac (enhances libido and fertility)
- Neuroprotective (supports brain function)
- Antioxidant and anti-inflammatory properties[18]

Microscopic evaluation:

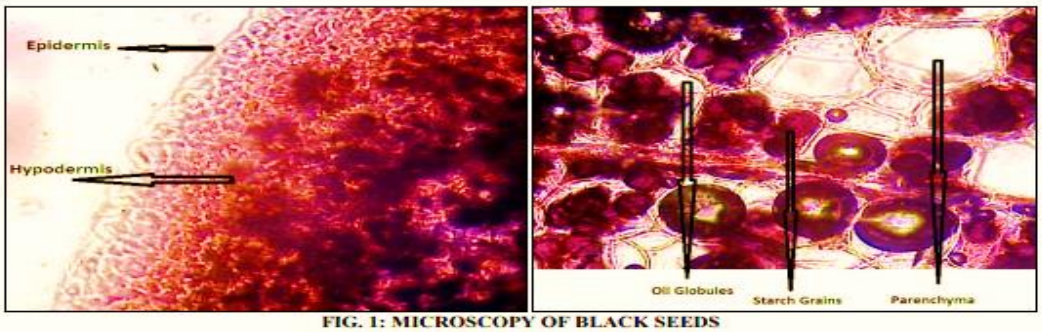


FIG. 1: MICROSCOPY OF BLACK SEEDS

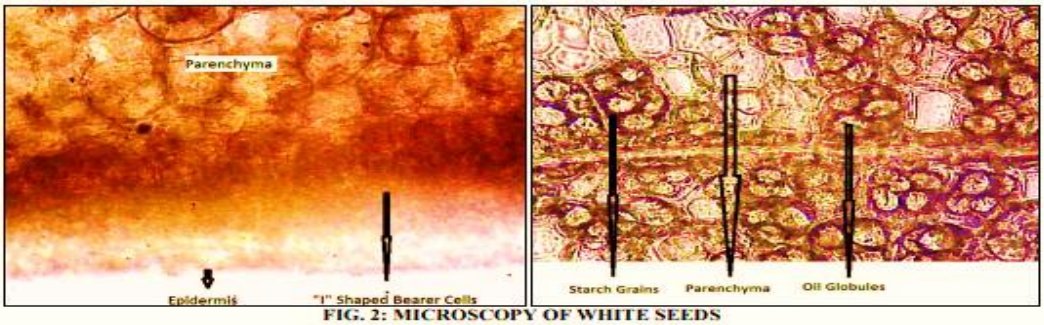


FIG. 2: MICROSCOPY OF WHITE SEEDS

[Figure 5: Microscopy of Mucuna Pruriens]

TABLE 1: MACROSCOPICAL EXAMINATION OF SEEDS

S. No.	Observed for	Black seeds	White seeds
1	Shape & structure	Oval	Oval
2	Colour	Black	White
3	Odour	Odourless	Odourless
4	Touch	Smooth	Smooth
5	Taste	Sweetish-bitter	Sweetish-bitter

TABLE 2: MACROSCOPICAL EXAMINATION OF SEEDS POWDER

S. No.	Sample	Colour	Taste	Odour	Texture
1.	Black seeds Powder	Pale cream	Sweetish-bitter	Non irritant	Fine powder
2.	White seeds Powder	Off white	Sweetish-bitter	Non irritant	Fine powder

[Figure 6: Macroscopy of Mucuna Pruriens]

4.1.2 Withania somnifera (Ashwagandha)

[Figure 7: Ashwagandha]

Synonyms:

- Indian Ginseng
- Winter Cherry

Family:

- Solanaceae (Nightshade family)

Vernacular Names:

- Ashwagandha (Hindi)
- Amukkara (Tamil)
- Ayurvedic Ginseng (English)

Phytochemical Constituents:

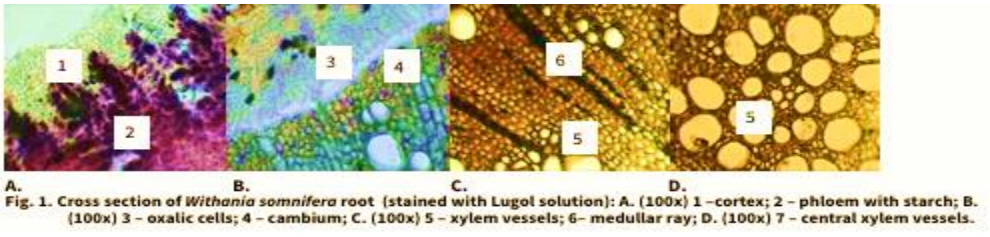
- Primary: Withanolides (steroidal lactones with adaptogenic properties)
- Other: Alkaloids, flavonoids, tannins

Therapeutic Uses:

- Adaptogen (reduces stress and anxiety)
- Enhances muscle strength and stamina
- Improves cognitive function
- Anti-inflammatory and immune-boosting properties[19]

Macroscopy of Ashwagandha

Fragmented vegetable drug consists from root specimens of 5-6 cm in length and 1,0 to 2,5 cm in diameter. Outer surface is gray yellow with longitudinal wrinkles. The dried roots are cylindrical, gradually tapering down with a brownish white surface and pure creamy white inside when broken. They have a short and uneven fracture. Odour, characteristic; mucilaginous bitter and acrid taste.



[Figure 8: Microscopy of Ashwagandha]

4.1.3 Bacopa monnieri (Brahmi)

[Figure 9: Bacopa monnieri]

Synonyms:

- Water Hyssop
- Herb of Grace

Family:

- Plantaginaceae (formerly Scrophulariaceae)

Vernacular Names:

- Brahmi (Hindi)
- Jalaneem (Sanskrit)
- Thyme-leaved Gratiola (English)

Phytochemical Constituents:

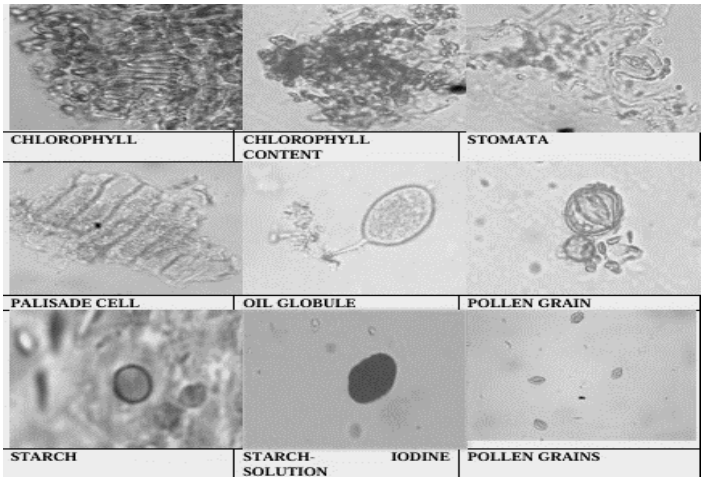
- Primary: Bacosides (responsible for cognitive benefits)
- Other: Alkaloids, saponins, flavonoids

Therapeutic Uses:

- Enhances memory and cognitive function
- Reduces anxiety and stress
- Neuroprotective (supports mental clarity)
- Anti-inflammatory and antioxidant properties[20]

Macroscopy of Brahmi:

- Macroscopically, Bacopa monnieri powder should appear as a fine, light-green to yellowish-green powder with a characteristic, slightly earthy odor.



[Figure 10: Microscopy of Brahmi]

4.1.4 Curcuma longa (Turmeric)

[Figure 11: Turmeric]

Synonyms:

- Haldi
- Indian Saffron

Family:

- Zingiberaceae (Ginger family)

Vernacular Names:

- Haldi (Hindi)
- Curcuma (French)
- Gelbwurz (German)

Phytochemical Constituents:

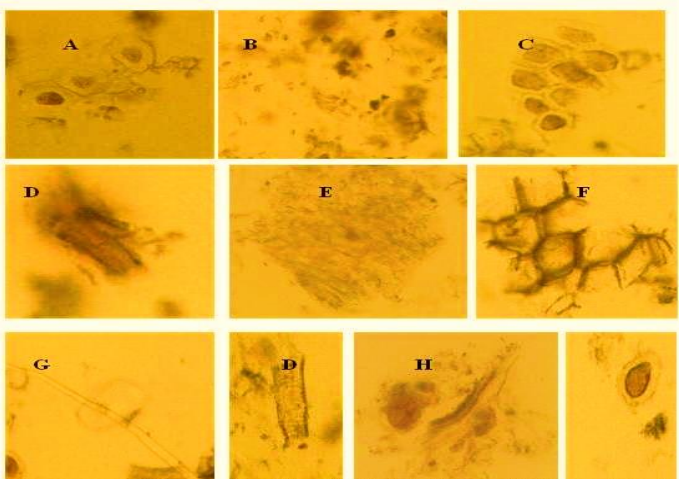
- Primary: Curcumin (anti-inflammatory and antioxidant properties)
- Other: Essential oils, polysaccharides, flavonoids

Therapeutic Uses:

- Anti-inflammatory and pain relief
- Boosts immunity
- Supports liver function and detoxification
- Antioxidant and neuroprotective properties[21]

Macroscopy of Turmeric:

Macroscopically, authentic turmeric powder should be a bright yellow-orange, with a fine, soft texture and an aromatic, slightly bitter taste. Microscopically, it reveals features like yellow clumps of gelatinized starch, starch granules, fibers, vessels, and trichomes, along with cells containing oleoresin (curcumin and volatile oil).



[Figure 12: Microscopy of Turmeric]

4.1.5 Ginkgo biloba (Maidenhair Tree)

[Figure 13: Ginkgo biloba]

Synonyms:

- Ginkgo
- Fossil Tree

Family:

- Ginkgoaceae

Vernacular Names:

- Ginkgo (English)
- Yin Xing (Chinese)

Phytochemical Constituents:

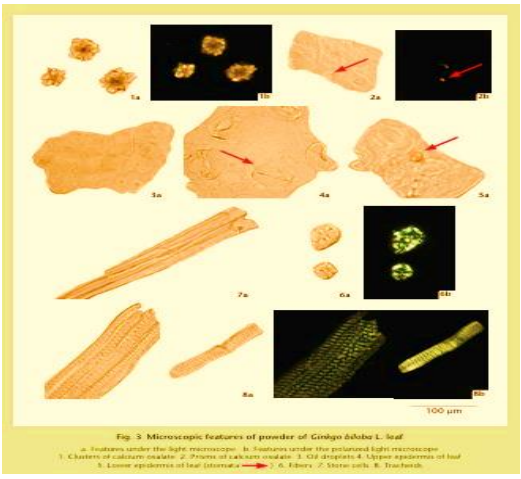
- Primary: Ginkgolides and bilobalide (support brain function)
- Other: Flavonoids, terpenoids, antioxidants

Therapeutic Uses:

- Enhances cognitive function and memory
- Improves circulation and cardiovascular health
- Antioxidant and neuroprotective properties[22]

Macroscopy of Gingko Biloba:

Dark green to yellowish green; Leaves fan-shaped with tapering cuneate base; Center of apex notched and dividing blade into distinct lobes; Petiole long, with upper surface grooved. Leaf surface glabrous without midrib, and has wrinkled appearance.



[Figure 14: Microscopy Of Gingko Biloba]

4.1.6 Piper nigrum (Black Pepper)

[Figure 15: Black Pepper]

Synonyms:

- Kali Mirch
- King of Spices

Family:

- Piperaceae (Pepper family)

Vernacular Names:

- Kali Mirch (Hindi)
- Poivre noir (French)
- Schwarzer Pfeffer (German)

Phytochemical Constituents:

- Primary: Piperine (enhances bioavailability of other herbs)
- Other: Volatile oils, flavonoids, alkaloids

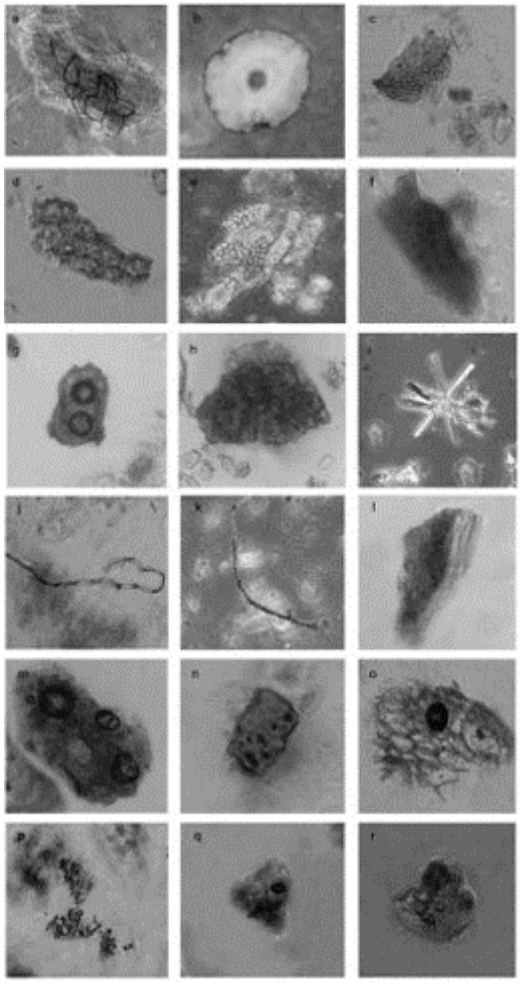
Therapeutic Uses:

- Enhances digestion and nutrient absorption
- Anti-inflammatory and antioxidant properties
- Boosts metabolism and immune function
- Aids in respiratory health[23]

Table 1. Macroscopic evaluation of *Piper nigrum* fruit.

Color	Blackish brown
Odor	Aromatic
Taste	Pungent
Size	4-6 mm in diameter (Average = 5.4 mm diameter)
Shape	Almost globular
Texture	Rough, corrugated and wrinkled

[Figure 16: Macroscopy of Black Pepper]



[Figure 17: Microscopy of Black Pepper]

4.1.7 Honey

[Figure 18: Honey]

Not a Plant, But Produced By:

- Honeybees (Apis mellifera)

Family:

- Apidae (Bee family)

Description:

- A sweet, viscous liquid produced from the nectar of flowers.
- Varies in color and taste based on floral source (e.g., clover honey, wildflower honey).

Chemical Constituents:

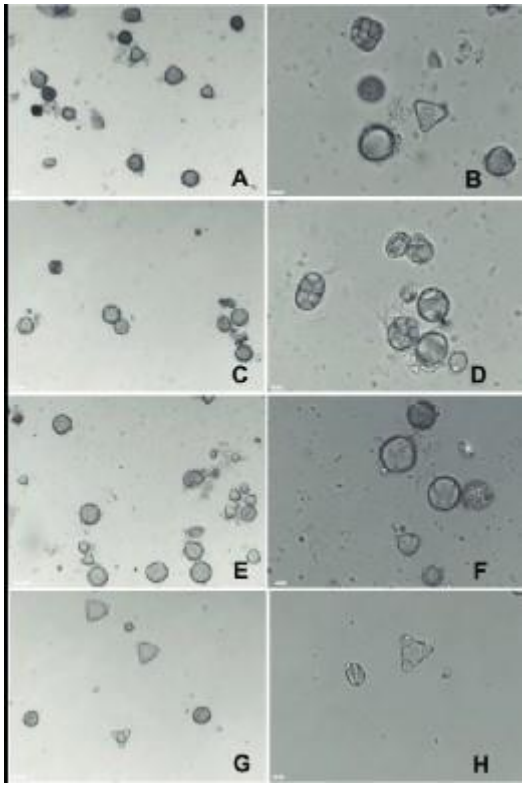
- Primary: Fructose and glucose (simple sugars responsible for sweetness)
- Other: Water, vitamins, minerals, enzymes, phenolic compounds

Therapeutic Uses:

- Wound healing and antibacterial properties
- Soothes sore throats and suppresses coughs
- Provides natural energy and promotes better digestion
- Antioxidant and anti-inflammatory benefits[24]

Parameter	Observation Details
Appearance	Viscous liquid; may be clear, amber, yellow, or dark brown depending on floral source.
Color	Ranges from water white to dark amber; determined by floral source and storage.
Odor/Aroma	Pleasant, characteristic floral scent. May vary with botanical origin.
Taste	Sweet, slightly acidic. Flavor varies with source.
Consistency	Thick, sticky, and syrupy. Flows slowly due to high viscosity.
Ph	Slightly acidic, usually between 3.2 – 4.5.

[Table 1: Macroscopy of Honey]



[Figure 20: Microscopy of Honey]

5.1 MATERIALS AND EQUIPMENTS

5.1.1 List of herbs with quantity:

Sr. no.	Name of herb	Quantity (100 ml)
1.	Mucuna pruriens extract	3 ml
2.	Withania somnifera extract	2 ml
3.	Bacopa monnieri extract	1.5 ml
4.	Curcuma longa extract	1 ml
5.	Ginkgo biloba extract	1 ml
6.	Piper nigrum extract	0.5 ml
7.	Honey/Sorbitol syrup base	Up To 100 ml
8.	Citric acid	0.02%
9.	Sodium benzoate	0.1%
10.	Purified water	QS (quantum sufficit)

(Table 2: List of herbs used in formulation)

5.1.2 List of equipment:

Sr. no.	Equipment name	Role
1.	Weigh balance	For weighing
2.	Muffle furnace	Determination of ash value
3.	Digital pH meter/pH paper	Determination of pH
4.	Hot air oven	Drying and moisture content determination
5.	Water bath	Extraction
6.	Sieve	Sieving of powder
7.	Hot Plate	Syrup formulation
8.	Soxhlet apparatus	For extraction process

(Table 3: List of equipments used)

5.2 Preparation of Herbal Extracts

[Figure 21: Soxhlet apparatus for extraction]

1. **Mucuna pruriens Extract:**
   - **Solvent:** Ethanol (70%)[25]
   - **Procedure:**
1. Weigh 10 g of dried Mucuna pruriens seed powder.
2. Macerate the powder with 100 ml of 70% ethanol in a closed container for 24 hours with occasional shaking.
3. Filter through Whatman No. 1 filter paper and concentrate the filtrate using a water bath at 40°C.
4. Dry the concentrated extract in a vacuum oven to obtain a powdered form.

2. **Withania somnifera Extract:**
   - **Solvent:** Water[26]
   - **Procedure:**
1. Take 10 g of dried Withania somnifera root powder.
2. Reflux the powder with 100 ml of distilled water at 60°C for 2 hours.
3. Filter the solution, and concentrate it on a water bath to obtain a semi-solid extract.

3. **Bacopa monnieri Extract:**
   - **Solvent:** Methanol (80%)[27]
   - **Procedure:**
1. Weigh 10 g of Bacopa monnieri dried aerial parts powder.
2. Extract using Soxhlet apparatus with 80% methanol for 6 hours.
3. Cool the extract, filter, and evaporate the solvent under reduced pressure to obtain the extract.

4. **Curcuma longa Extract:**
   - **Solvent:** Ethanol (95%)[28]
   - **Procedure:**
1. Weigh 10 g of dried Curcuma longa rhizome powder.
2. Extract with 95% ethanol using a maceration process for 24 hours with occasional stirring.
3. Filter, evaporate the ethanol, and dry the extract in a desiccator.

5. **Ginkgo biloba Extract:**
   - **Solvent:** Acetone:Water (60:40)[29]
   - **Procedure:**
1. Use 10 g of dried Ginkgo biloba leaves powder.
2. Extract using Soxhlet apparatus with 60:40 acetone-water mixture for 8 hours.
3. Remove the solvent using a water bath and dry the extract.

6. **Piper nigrum Extract:**
   - **Solvent:** Ethanol (70%)[30]
   - **Procedure:**
1. Take 10 g of black pepper powder.
2. Extract with 70% ethanol using maceration for 24 hours.
3. Filter, concentrate the extract, and dry in a vacuum oven.

5.3 Method of syrup formulation

1. In a clean vessel, dissolve the required quantity of honey or sorbitol in purified water (80% of the total volume).
2. Add citric acid and sodium benzoate, and heat the solution gently to 50–60°C with constant stirring until completely dissolved.

Syrup Formation

1. Slowly add each herbal extract (prepared as above) into the syrup base while stirring continuously.
2. Maintain the temperature at 40–45°C to prevent degradation of active constituents.

Adjust Consistency and pH

1. Use purified water to adjust the final volume to 100 ml.
2. Measure the pH using a pH meter and adjust to 6.5–7.0 using citric acid or sodium hydroxide solution.

Final Filtration

1. Pass the prepared syrup through a fine muslin cloth or filter paper to remove any undissolved particles or impurities.

Packaging

1. Fill the syrup into amber-colored glass or PET bottles to protect against light and moisture.

5.4 PHYTOCHEMICAL SCREENING

All the above prepared extracts were subjected to preliminary phytochemical screening tests to identify the presence of various components, by using different test and reagents.

1. Mucuna pruriens (L-DOPA)

Test: Ninhydrin Test

- Procedure:

1. Take 1 ml of the Mucuna pruriens extract.
2. Add 1 ml of Ninhydrin reagent (1% in acetone).
3. Heat in a water bath for 5 minutes.

- Observation: A purple or blue color indicates the presence of L-DOPA (an amino acid derivative).[31]

2. Withania somnifera (Withanolides)

Test: Keller-Kiliani Test (for Withanolides - steroidal lactones)

- Procedure:
  - Take 2 ml of extract.
  - Add 1 ml of glacial acetic acid and a few drops of ferric chloride solution.
  - Add 1 ml of concentrated sulfuric acid (H_2SO_4).
- Observation: A brown ring at the junction of the two layers confirms the presence of withanolides.[32]

3. Bacopa Monnieri (Brahmi)

Test:Keller-Kiliani Test (For Cardiac Glycosides & Bacosides)

- Procedure:

1. Take 2 ml of Bacopa monnieri extract in a test tube.
2. Add 2 ml of glacial acetic acid and one drop of 5% ferric chloride solution.
3. Carefully add 1 ml of concentrated sulfuric acid (H_2SO_4) along the side of the test tube without mixing.

- Observation: A reddish-brown ring at the junction of the two layers indicates the presence of bacosides (glycosides).[33]

4. Curcuma longa (Curcuminoids)

Test: Boric Acid Test

- Procedure:

1. Dissolve a small quantity of the extract in alcohol.
2. Add a pinch of boric acid and a few drops of hydrochloric acid.

- Observation: A reddish-brown color confirms the presence of curcuminoids.[34]

5. Ginkgo biloba (Flavonoids & Terpenoids)

Test: Lead Acetate Test (for Flavonoids)

- Procedure:

1. Add lead acetate solution (10%) to the extract.

- Observation: A yellow precipitate confirms the presence of flavonoids.[34]

6. Piper nigrum (Piperine)

Test: Wagner's Test (for Alkaloids)

- Procedure:

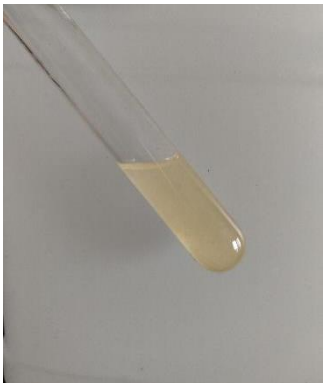
1. Take 2 ml of extract.
2. Add a few drops of Wagner's reagent (Iodine-Potassium Iodide solution).

- Observation: A reddish-brown precipitate indicates the presence of piperine.[35]

L-DOPA

Withanolides

Bacosides



Flavanoids

Alkaloides

(Figure: 22 Phytochemical screening tests)

Chemical test result of some chemical test of phytoconstituents:

Sr. no.	Phytoconstituents	Result
1.	L-DOPA (Amino acid derivative)	+
2.	Withanolides (Steroidal lactones)	+
3.	Bacosides (Flavanoids and Saponins)	+
4.	Curcuminoids	+

5.	Flavonoids	+
6.	Terpenoids	+
7	Alkaloides (Piperine)	+

(Table No. 4: Test results of phytochemical constituents)

6. PHYSICAL PARAMETERS OF PHYTOPARK SYRUP

The physical parameters of PhytoPark Syrup were assessed to ensure the stability, consistency, and efficacy of the formulation. The key parameters evaluated were as follows:

Colour:

The syrup exhibits a **yellowish brown** colour due to the presence of herbal extracts, particularly *Mucuna pruriens*, *Curcuma longa*, and *Bacopa monnieri*. The uniformity of colour was observed, indicating proper dispersion of ingredients.[36]

Appearance:

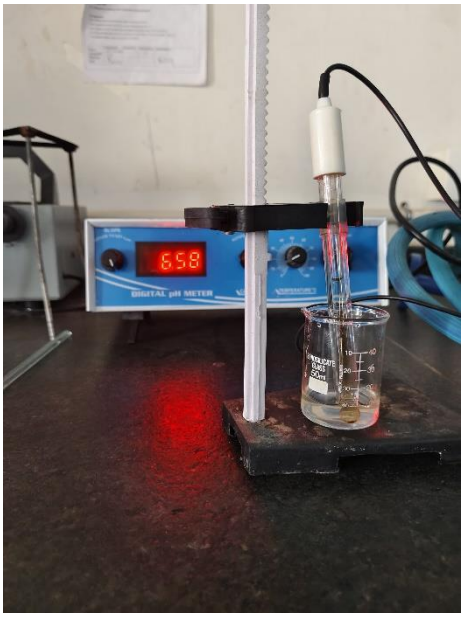
The syrup was visually inspected for **homogeneity, absence of particulate matter, and phase separation**. A smooth and consistent texture was observed with no visible sedimentation immediately after preparation.

Odor:

A characteristic herbal aroma was noted, attributed to *Withania somnifera*, *Ginkgo biloba*, and *Piper nigrum* extracts. No unpleasant or rancid odour was detected.

pH:

The pH of the syrup was measured using a calibrated digital pH meter. The recorded pH was **6.58**,which falls within the acceptable range (6.5–7.0) for oral herbal formulations, ensuring stability and patient compliance.[37]



[Figure 23: pH Measurement]

Viscosity:

Viscosity was determined using a brookfield viscometer at room temperature (25± 2°C). The viscosity was found to be **161.9 mPa.s**, providing a smooth texture while ensuring easy swallowing.[38]

[Figure 24: Viscosity Measurement]

Ash Values

Type of Ash	Value (%w/w)
Total Ash	4.86%
Acid-insoluble Ash	1.15%
Water-soluble Ash	2.79%

[Figure 25 : Ash Value]

Interpretation: The values indicate good purity and absence of excessive inorganic matter or silica (e.g., sand/dust contamination).

Extractive Values (in alcohol and water to determine active constituents)

Solvent Used	Extractive Value (%w/w)
Alcohol-soluble extractive	9.72%
Water-soluble extractive	18.55%

[Figure 26: Extractive Value]

Loss on Drying (LOD)

Parameter	Value (%w/w)
LOD at 105ºC	3.22%

[Figure 27: Hot Air Oven for determination of LOD]

Interpretation: Indicates acceptable moisture content ensuring stability and shelf life.

Conclusion:

The physical and physicochemical evaluation of PhytoPark Syrup confirmed that it is a stable, homogenous, and effective formulation. This evaluation strengthens the formulation's potential as an herbal neuroprotective syrup for Parkinson's disease and cognitive enhancement, differentiating it from synthetic alternatives in the market.[39]

7. DISCUSSION:

The study aimed to formulate and evaluate PhytoPark Syrup, a novel herbal syrup designed for potential therapeutic benefits. The formulation incorporated natural ingredients such as velvet beans, ashwagandha, brahmi, turmeric, gingko biloba, black pepper and honey, known for their medicinal properties. The syrup underwent a series of physical and physicochemical evaluations, including appearance, pH, viscosity, and stability, to assess its quality and effectiveness.

1. Physical Properties:

Sr. No.	Parameters	Observation
1	Colour	Yellowish brown
2	Odour	Sweet, bitter overtone, Characteristic
3	State	Liquid

(Table no:5 Physical properties of PhytoPark Syrup)

2. Determination of pH:

The pH of the syrup was found to be **6.58**, making it suitable for oral intake. The formulation maintained a pH within the required range of **6–7**, ensuring stability and compatibility with physiological conditions.

3. Viscosity:

The viscosity of PhytoPark Syrup was measured using a Brookfield viscometer at 25°C with spindle No.2 at 12 RPM. The viscosity was **161.9mPa.s** ,ensures a smooth consistency suitable for oral administration.

4. Stability Studies (ICH Guidelines):

Days	Temp.	Appearance
0	25°C±1°C	No change
7	25°C±1°C	No change
14	25°C±1°C	No change
21	25°C±1°C	No change
28	25°C±1°C	No change

[Table no.: 6 Stability profile of the formulation]

The stability study was conducted over 28 days, with periodic evaluations of appearance, pH, and viscosity. The results indicated that PhytoPark Syrup remained stable at room temperature, with minimal variations in its physicochemical properties, confirming its shelf-life and formulation integrity.

8.1 RESULT OF WHOLE EXPERIMENT:

SR. NO.	PHYSICOCHEMICAL PARAMETER	OBSERVATION
1	Colour	Yellowish Brown
2	Odour	Characteristic, Sweet, bitter overtone
3	Taste	Sweet
4	PH	6.58
5	Stability study	Stable
6	Viscosity	161.9 mPa.s
7	Consistency	Shake well before use

8	Irritancy	No any irritant effect in cavity

(Table No.:6: Summary of all evaluated parameters)

8.2 CONCLUSION:

In conclusion, the formulation and evaluation of **PhytoPark Syrup**, a polyherbal formulation containing *Mucuna pruriens*, *Withania somnifera*, *Bacopa monnieri*, *Curcuma longa*, *Ginkgo biloba*, and *Piper nigrum*, offers a promising herbal approach for supporting cognitive function and neuroprotection, particularly in conditions like Parkinson's disease.

The syrup was successfully evaluated for various physicochemical parameters, demonstrating favorable results in terms of appearance, pH, viscosity, and stability. The absence of irritancy, further supports its suitability for oral administration.

Based on the results and discussion, the prepared formulations were found to be

Test	Result
Physical appearance	Pass
pH	Pass
Viscosity	Pass
Physicochemical test	Pass
Irritancy test	Pass
Stability studies	Pass

(Table No.: 7 Conclusive test results)

Thus, it can be concluded that **PhytoPark Syrup** is a stable and safe formulation enriched with natural neuroprotective agents. The combined effect of the herbal ingredients provides multiple therapeutic benefits:

- **Dopamine Booster:** *Mucuna pruriens* acts as a natural source of L-DOPA, potentially aiding dopamine replenishment in Parkinson's disease.
- **Neuroprotective:** *Withania somnifera* and *Bacopa monnieri* support neuron health and reduce oxidative stress.
- **Cognitive Enhancer:** *Bacopa monnieri* improves memory and reduces anxiety, complementing overall brain function.
- **Anti-inflammatory and Antioxidant:** *Curcuma longa* and *Ginkgo biloba* combat inflammation and improve cerebral circulation.
- **Bioavailability Enhancer:** *Piper nigrum* increases the absorption of the active constituents, enhancing the effectiveness of the syrup.

Overall, **PhytoPark Syrup** presents itself as a safe, effective, and holistic herbal formulation with the potential to support neurological well-being and improve quality of life for individuals dealing with neurodegenerative conditions.

REFERENCES

1. Saini N., Sharma R., "Herbal Medicines in Neurodegenerative Disorders", Pharmacognosy Review, 2021.

2. Grover M., Dubey V., "Medicinal Plants for Cognitive Enhancement", Journal of Ayurveda and Integrative Medicine, 2020.
3. Tortora G.J., Derrickson B., "Principles of Anatomy and Physiology", Wiley, 2017.
4. Rang H.P., Dale M.M., Ritter J.M., Flower R.J., "Pharmacology (8th ed.)", Elsevier, 2019.
5. Poewe W., Seppi K., Tanner C.M., Halliday G.M., Brundin P., Volkmann J., Schrag A.E., Lang A.E., "Parkinson Disease", Nature Reviews Disease Primers, 2017, 3, Article 17013.
6. Manyam B.V., "Mucuna pruriens in Parkinson's Disease", Journal of Neurology, 1995.
7. Kandel E.R., Schwartz J.H., Jessell T.M., Siegelbaum S.A., Hudspeth A.J., "Principles of Neural Science", McGraw-Hill, 2013.
8. Kokate C.K., "Pharmacognosy", Nirali Prakashan, 2015.
9. Williamson E.M., "Synergy and Other Interactions in Phytomedicines", Phytomedicine, 2002, 9(1), 1–7.
10. Handa S.S., Sharma A., Chakraborti K.K., "Compendium of Medicinal Plants", CDRI Lucknow and ICMR New Delhi, 2008.
11. Katzenschlager R., Evans A., Manson A., Patsalos P.N., Ratnaraj N., Watt H., Timmermann L., Van der Giessen R., Lees A.J., "Mucuna pruriens vs. L-DOPA in Parkinson's", Journal of Neurology, 2004, 251(6), 696–703.
12. Singh H., Soni M., Srivastava N., "Neuroprotective Effects of Curcuma longa", International Journal of Neuroscience, 2021.
13. Kulkarni S.K., Dhir A., "Withania somnifera: Neuropharmacology", Indian Journal of Experimental Biology, 2008, 46, 565–576.
14. Mahadevan S., Park Y., "Ginkgo biloba as Neuroenhancer", Current Topics in Nutraceutical Research, 2008, 6(4), 215–220.
15. Atal C.K., Dubey R.K., Singh J., "Bioenhancers in Traditional Medicine", Journal of Ethnopharmacology, 1985, 11(1), 1–9.
16. Sharma V., Srivastava A., Singh R., "Role of Herbal Formulations in Neurology", Asian Journal of Pharmaceutical Sciences, 2019.
17. Markets and Markets Report, "Global Herbal Medicine Market Trends", 2022.
18. Manyam B.V., "An Alternative Medicine Treatment for Parkinson's Disease: Results of a Multicenter Clinical Trial", Journal of Alternative and Complementary Medicine, 1995, 1(3), 249–255.
19. Tandon N., Yadav S.S., "Contributions of Indian Council of Medical Research (ICMR) in the Field of Medicinal Plants", Indian Journal of Medical Research, 2020, 151(5), 504–513.
20. Russo A., Borrelli F., "Bacopa monniera, a Reputed Nootropic Plant: An Overview", Phytomedicine, 2005, 12(4), 305–317.
21. Hewlings S.J., Kalman D.S., "Curcumin: A Review of Its Effects on Human Health", Foods, 2017, 6(10), 92.
22. Maclennan K.M., Darlington C.L., Smith P.F., "The Neuroprotective Properties of the Ginkgo biloba Leaf: A Review of the Possible Relationship to Platelet-Activating Factor (PAF)", Journal of Ethnopharmacology, 2002, 72(1–2), 1–9.
23. Srinivasan K., "Black Pepper and Its Pungent Principle-Piperine: A Review of Diverse Physiological Effects", Critical Reviews in Food Science and Nutrition, 2007, 47(8), 735–748.
24. Ahmed S., Sulaiman S.A., Baig A.A., Ibrahim M., Liaqat S., Fatima S., Othman N.H., "Honey as a Potential Natural Antioxidant Medicine: An Insight into Its Molecular Mechanisms of Action",

Oxidative Medicine and Cellular Longevity, 2018.
25. Yadav R., Agrawal R., "Extraction and Evaluation of L-DOPA from Mucuna pruriens Seed", International Journal of Pharmaceutical Sciences and Research, 2011, 2(5), 1302–1306.
26. Kulkarni R.R., Patil V.R., "Extraction and Pharmacological Evaluation of Withania somnifera Root Extract", Journal of Pharmacy Research, 2013, 7(4), 328–332.
27. Deepak M., et al., "Determination of Bacoside A Content in Bacopa monnieri Using HPLC", Phytochemical Analysis, 2005, 16(1), 24–29.
28. Paramasivam M., et al., "HPLC Method for Estimation of Curcuminoids in Curcuma longa", Food Chemistry, 2009, 113(2), 640–645.
29. van Beek T.A., Montoro P., "Chemical Analysis and Quality Control of Ginkgo biloba Leaves, Extracts, and Phytopharmaceuticals", Journal of Chromatography A, 2009, 1216(11), 2002–2032.
30. Nadkarni K.M., "Indian Materia Medica", Bombay Popular Prakashan, 2000.
31. Williamson E.M., "Major Herbs of Ayurveda", Churchill Livingstone, 2002.
32. Singh R.H., Sharma P.V., "Pharmacological Studies on Bacopa monnieri", Indian Journal of Medical Research, 2006.
33. Ammon H.P., Wahl M.A., "Pharmacology of Curcuma longa", Planta Medica, 1991, 57(1), 1–7.
34. Mahadevan S., Park Y., "Ginkgo biloba Extract: Review of CNS Effects", Current Topics in Nutraceutical Research, 2008.
35. Pruthi J.S., "Spices and Condiments", National Book Trust, India, 2001.
36. European Medicines Agency (EMEA), "Guideline on Specifications: Herbal Medicinal Products", 2006.
37. World Health Organization (WHO), "Quality Control Methods for Herbal Materials", 2011.
38. Aulton M.E., "Pharmaceutics: The Science of Dosage Form Design (3rd ed.)", Elsevier, 2007.
39. Sharma V., Pandey D., "Herbal Neuroprotective Drugs for Parkinson's Disease: A Review", Journal of Herbal Medicine, 2021.