**Withania somnifera: Therapeutic Uses and Phyochemical Constituents**

Ritu Sharma¹, Anita Chauhan², Priyanka Chaudhary²*

¹PG Student, Department of Botany, DPG Degree College, Gurugram, Haryana
²Assistant Professor, Department of Botany, DPG Degree College, Gurugram, Haryana

*Corresponding Author: biopriyanka88@gmail.com

**Abstract**

Withania somnifera (Ashwagandha) commonly known as ‘winter cherry’ is an herbaceous plant belongs to family Solanaceae or night shade family. The plant is an erect, evergreen, branching, shrub of 30 to 150 cm in height and its leaves possess a strong smell of green tomatoes. The plant is widely distributed in tropical region of Africa, South Africa, India, southern China and Sri Lanka. W. somnifera is an imperative medicinal plant and has been used in ayurvedic medicines for centuries in the treatment of several disorders such as anaemia, ulcers, asthma and high blood pressure. Numerous pharmacological properties such as antitumour, antioxidant, anti-stress, neuroprotective, anti-arthritis, analgesic and anti-inflammatory have been reported in W. somnifera. These pharmacological activities are due to the occurrence of various phytochemicals such as Withaferin A, Withanolide, sitoindosides, beta-sitosterol and somniferine. Thus the plant has enormous useful applicability in biomedicine as well as veterinary medicine focusing its effective role in the protection of sound health.

**Keywords:** Antioxidant, Ayurvedic, Herbaceous, Solanaceae, Pharmacological, Phytochemicals

**Introduction**

Plant is an important source of medicine and plays a key role in world health. Medicinal herb or plants have been known to be an important potential source of therapeutics or curative aids some contain active ingredients bioactive components and substance obtained from plant. Withania somnifera also known as Ashwagandha, Indian ginseng, Winter cherry and is recognised as an important medicinal plant used in Ayurvedic medicine. The term Ashwagandha describe smell of its root like horse. This plant was first describe in Charaka, Samhita, Sushruta, Samhita and used for wide variety of condition for its restorative benefits and is in use for a very long time for all age groups and both Withaniasomnifera is used as antioxidant, liver tonic, astringent, antiinflammatory agent and more recently to treat bacterial infection, senile dementia, ulcers. Ashwagandha is also used to inhibit the development of tolerance and dependence on chronic use of various psychotropic drugs. The traditional use of Ashwagandha is to increase endurance, strength energy, health and also increase fat, blood, muscle, cell production (1-4). Ashwagandha or Indian ginseng is commercially available in the form
of fine powder and can be taken orally with water, ghee or milk (5, 6). Phytochemically this plant is unique because it possesses the largest and most structurally diverse set of withanolides with glycowithanolides being the major bioactive constituent of Withania somnifera.

**Classification of Withania somnifera**
- **Kingdom** – Plantae
- **Sub-kingdom** – Tracheobionta
- **Super division** – Spermatophyta
- **Division** – Angiosperma
- **Class** – Dicotyledons
- **Order** – Tubiflorae
- **Family** – Solanaceae
- **Genus** – Withania
- **Species** – somnifera Dunal

**Common name of Withania somnifera**
- Hindi – Asgand, Punir
- Sanskrit – Ashwaganda,
- English – Winter cherry
- Gujarati – Ghoda, Asoda
- Rajasthani – Chirpotan
- Telugu – Panneru
- Tamil – Ashwagandhi
- Punjabi – Asgand
- Goa – Fatarfoda

**Habit/ Habitat**
Ashwagandha is a xerophytic plant. Wintercherry grows in drier parts of India, Sri Lanka, Baluchistan, Afghanistan, Sind Africa, Congo, South Africa, Egypt, Morocco, and Jordan. *Withania somnifera* widely grows in drier parts of subtropical India and occurs in Punjab plains, Madhya Pradesh, Uttar Pradesh and northwest parts of India like Rajasthan and Gujarat. It is found in high altitude ascending to 5,500 feet in the Himalayas. It grow wildly throughout India particularly in hotter parts on waste place and on road sides. Ashwagandha widely cultivated in Bikaner and Pilani areas of Rajasthan (7).

**Botanical description**
Ashwagandha is a herbaceous plant that belongs to family Solanaceae or night shade family. It is evergreen shrub. The plant is about 3 feet long and leaves of this plant possess a strong smell of green tomatoes. Roots are stout fleshy, whitish brown, leaves simple, ovate, glabrous. Flower of Ashwagandha is green or yellow in colour, borne in axillary fascicles, umbellate cymes and give rise to red globose fruits when mature. The root of wintercherry is 20-30 cm long and 6-12 mm in diameter. The plant has a characteristic odour, bitter in taste. Seeds are yellow, reniform and 2.5 in diameters (8). The leaves, roots, stem, fruits, bark and seeds of *Withania somnifera* are used in therapy. Roots of *Withania somnifera* is the main portions of the plant used therapeutically (9).
Secondary Metabolites

Secondary metabolites are a distinct type of natural compound produced by specific groups of bacteria, fungi, plants and animals. Secondary metabolites present in the plants are predominantly responsible for treating various ailments. The most important secondary metabolite include phenolics, alkaloids, flavonoids, terpenoids and glycoside which act as an important source for single bioactive ingredients in nutraceuticals and modern medicine. Different type of chemical constituents are present in Ashwagandha. The major biochemical constituents of *Withania somnifera* are steroidal alkaloids and lactones, a class of constituents together known as withanolids (steroidal lactones with ergostane skeleton) (10). Alkaloids includes ashwagandhine, cuscohygrine, anahygine, tropine etc. Steroidal compounds including steroidal lactones, withaferin A, withasomniferin-A, withanolides A-Y, withasaniferols A-C, withanone etc. Apart from these contents plant also contain chemical constituents like starch, reducing sugar, ducitol, withaol, acylsteryl glucosides and a variety of amino acids including proline, tyrosine, alanine, glutamic acid, cystine and high amount of iron. Withaferin A has been recently reported to be inhibitor of angiogenesis and thus protective in certain types of cancers (11). Saponins an additional acyl group: sitoindoside. The diverse active constituents present in different parts of plant are believed to be responsible for the multiple medicinal properties of *Withania somnifera*. At present, more than 12 alkaloids, 40 withanolides and several sitoindosides (a withanolide containing a glucose molecule at carbon 27) have been isolated and reported from aerial parts, roots and berries of this plant. The concentration of major withanolides usually ranges from 0.001 to 1.5% dry weight (12). The reported total alkaloid content in the roots of Indian *Withania somnifera* varies between 0.13% and 0.31% though much higher yields (upto 4.3%) have been recorded in plants of other region (13).
### Table 2: Bioactive Ingredient of Withania somnifera (14)

**Pharmacological Properties of Withania Somnifera**

1. **Anti-Inflammatory Properties**
   Ashwagandha is recognised as an anti-inflammatory herb used for the treatment of arthritis and asthma. Herbal formulation of *Withaniasomnifera* is effective in reducing the rapidity of pain and disability scores of patients with osteoarthritis without any toxic effect (15). *Withaniasomnifera* can inhibit cyclooxygenase, cyclooxygenase (COX) is the enzyme responsible for the formation of important biological mediators of inflammatory and anaphylactic reactions. The phytochemicals of Ashwagandha / *Withania somnifera* is a promising anti-inflammatory and anti-arthritic drug by modulating the level of inflammatory mediators and enzymes without causing any bad effect compared to other non-steroidal anti-inflammatory drugs.

2. **Anticancer Properties**
   Cancer is the growth of abnormal cells anywhere in a body. This abnormal cell termed as cancer cells. There are more than 100 types of cancer like skin cancer, breast cancer, and prostate cancer. Cancer is the major cause of death and is increases rapidly *Withaniasomnifera* has anti-carcinogenic, chemopreventive and radiosensitizing properties. *Withaniasomnifera* helps the patients to recover from the harmful effects of chemotherapy.

The hydroalcoholic root extract of *Withania somnifera* shows a significant decrease in average number of skin lesions on 7, 12-dimethylbenzanthracene (DMBA) induced skin cancer in Swiss albino mice.

3. **Antimicrobial Potential**
   Medicinal plant shows a rich source of antimicrobial agents. The extract of

<table>
<thead>
<tr>
<th>S. No</th>
<th>Active Ingredient</th>
<th>Structure</th>
<th>Molecular Formula</th>
<th>Location</th>
<th>Pharmacological Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Withanolide (steroidal lactones)</td>
<td><img src="image" alt="Structure" /></td>
<td>22-hydroxyergostan-26-oxic acid-26,22-lactone</td>
<td>Roots and Leaves</td>
<td>It is an important hormonal precursor, can convert into human physiological hormones when the body requires.</td>
</tr>
<tr>
<td>2.</td>
<td>Withaferin A</td>
<td><img src="image" alt="Structure" /></td>
<td>4β,27-dihydroxy-1-oxo-5β,6α-epoxywitha-2-24-dienolide</td>
<td>Root</td>
<td>It has an antibiotic and anti-tumor property.</td>
</tr>
<tr>
<td>3.</td>
<td>Withanolide A</td>
<td><img src="image" alt="Structure" /></td>
<td>C_{29}H_{35}O_{8}</td>
<td>Roots and Leaves</td>
<td>Prevent neurodegeneration, Anticancer agent</td>
</tr>
<tr>
<td>4.</td>
<td>Withanolide D</td>
<td><img src="image" alt="Structure" /></td>
<td>C_{29}H_{35}O_{8}</td>
<td>Root</td>
<td>Significant antitumor and radiosensitizing withanolides</td>
</tr>
</tbody>
</table>
Withaniasomniferarepresent the antibacterial activity against Gram positive and Gram negative bacteria (16). Bacillus, Staphylococcus, Corynebacterium species is found to highly susceptible to Withaniasomnifera extracts. Ashwagandhashow protection against infection of Aspergillus fumigates in Aspergillus Balb-C mice model

4. Musculotropic Activity
The total alkaloids of Ashwagandha shows relaxant and antispasmodic effect against many spasmogens on intestinal, tracheal and blood vascular muscles. The pattern of smooth muscle activity of the alkaloids was similar to that of papaverine which suggested a direct musculotropic action (17).

5. Cardiovascular Protection
Withania somnifera is a useful general tonic, because of its beneficial effect on cardiopulmonary system. Alkaloids had a prolonged hypotensive, respiratory stimulant action in dogs. Effect of Withaniasomnifera is studied on the cardiovascular and respiratory system in frogs and dogs (18). Withania somnifera showed strong cardio protective effect in the experimental model of isoprenaline – induced. The pharmacological action of the total extract of WS roots on the cardiovascular and respiratory system appeared due to its alkaloid content.

6. Chronic stress
Chronic stress (CS) is a result of adverse physiologic conditions including sexual dysfunction, cognitive deficit, gastric ulceration, irregularities in glucose homeostasis and change in plasma Corticosterone level. In an experiment of chronic stress Withaniasomnifera and Panax ginseng extract is compared for their ability to alternate some effect of chronic stress. Both plant is able to decrease the number and severity of reverse chronic stress induced inhibition of male sexual behaviour, chronic stress induced ulcers. Activity of Withania somnifera extract is approximately equal to the activity of Panax ginseng extract.

7. Hepatoprotective Activity
Withaferin A at 10mg/ kg dose showed significantly protective effect against CCl4-induced hepatotoxicity in rats. It was as effective as hydrocortisone dose for dose (19).

8. Effect on Sexual Behavior
In folk medicine Ashwagandha is considered as aphrodisiac and stress buster herbal drug. Withania somnifera has the ability to restore sexual health and improve overall vitality while promoting a calm state of mind. Withania somnifera is also an effective drug for the treatment of male infertility. Improvement in the hormone imbalance can be the major contributing factor to fertility improvement. (20)

Conclusions
The use of herbal drug is increasing worldwide as they have fewer or no side effect. The plant has been used an adaptogen, antioxidant, anticancer, anti-inflammatory, liver tonic, aphrodisiac, central nervous system, hepatoprotective and more recently as an antihyperglycaemic, antitumoral as well as to treat senile dementia, Parkinson’s, Alzheimer’s. The potential beneficial effect of Withaniasomnifera in anxiety, cognitive,
inflammation and neurological diseases. *Withaniasomnifera* is a quiet medicinal herb. *Withaniasomnifera* represent a unique herb which possess potent pharmacological activities not only with active phytochemical constituents but also with protein component. *Withania somnifera* shows great potential as a safe and effective in Immunomodulation and Hematopoiesis. More research is needed to determine if *Withania somnifera* can duplicate this activity in humans and to determine an optimal dosage range for achieving these effects.

**References**