INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Paper

A Comprehensive Review of Commonly Available Anticancer Plants

Yadav Priyanka, Herwade Bhakti, Shedbale Sindhutai

Bachelor of Pharmacy, Womens College of Pharmacy, Peth Vadgaon, Maharashtra 416112

ARTICLE INFO

Published: 18 May 2025
Keywords:
anticancer activity; toxicity profile; Datura stramonium; Catharanthus roseus; Withania somnifera; physicochemical test.
DOI:
10.5281/zenodo.15454752

ABSTRACT

This comprehensive study explores the anticancer potential of Datura (Datura stramonium), Vinca (Vinca rosea), and Ashwagandha (Withania somnifera), three prominent plants known for their traditional medicinal uses. Datura, often employed for its analgesic and antispasmodic properties, contains alkaloids such as atropine and scopolamine, which have shown cytotoxic effects against cancer cells. Vinca, particularly its alkaloids vincristine and vinblastine, has long been utilized in chemotherapy regimens due to its ability to inhibit microtubule formation, leading to cell cycle arrest and apoptosis in cancer cells. Ashwagandha, a well-known adaptogen, exhibits anticancer activity through its bioactive compounds, such as withaferin A, which promotes apoptosis, inhibits angiogenesis, and suppresses metastasis in various cancer models. The study synthesizes recent findings from in vitro and in vivo studies to assess the molecular mechanisms underlying the anticancer effects of these plants, focusing on their potential synergistic interactions, efficacy, and safety profiles. By evaluating their pharmacological properties, this study aims to provide insight into the therapeutic viability of these natural products in cancer treatment.

INTRODUCTION

1) Datura Plant:
Kingdom- Plantae
Clade – Angiodsperms
Order - Solanales
Family – Solanaceae
Genus - Datura
Species – D. stramonium
Class – Magnoliopsida

Fig. *Datura stramonium*

***Corresponding Author:** Yadav Priyanka
Address: *Bachelor of Pharmacy, Womens College of Pharmacy, Peth Vadgaon, Maharashtra 416112.*
Email ✉: khotsanjay72@gmail.com
Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Introduction:

D. stramonium seeds are often smoked to create a psychedelic effect. A variety of bioactive compounds with pharmacological properties can be found in medicinal plants, which are the source of many traditional medications [1]. The *Solanaceae* family includes the flowering herb *Datura spp.*, which is used mostly for its intoxicating and hallucinogenic qualities. It is grown in a variety of tropical and subtropical regions, including South Africa, Asia, Europe, and the Americas. Datura grows best in nutrient-rich, damp, or alkaline soil, however it may tolerate ordinary dirt. Despite its narcotic properties, it has beneficial medical effects due to its antibacterial, antidiabetic, anti-asthmatic, anti-inflammatory, antioxidant, analgesic, insecticidal, cytotoxic, wound-healing, and neurological properties. Datura also has larvicidal properties against the red flour beetle *(Tribolium castaneum)* and repels mosquitoes. It has been used to help ease the pain associated with animal bites, particularly those from snakes. D. stramonium, a well-known species of this plant, is used for spiritual and religious purposes in addition to being used as a medicinal herb. The plant, scientifically known as *Datura stramonium,* belongs to the *Solanaceae* family. Also known as mad apple or devil's trumpet, it is frequently referred to as thornapples or jimsonweed. Other names include moonflower, hell's bells, and devil's weed. Datura's seeds and blooms, in particular, can cause severe side effects like fever, delirium, respiratory depression, arrhythmias, hallucinations, anticholinergic toxidrome, and even death if consumed. All Datura species are very poisonous and psychoactive.

Description:

Height	Grow to be 2-5ft. (60-150cm) tall
Flowers	Trumpet – shaped, 2.5- 3.5in. (6-9 cm) long
Seeds	Egg-shaped capsules that are 1-3 (3-8cm) in diameter
Steam	Robust, upright, smooth, leafy, and pale yellow-green to reddish-purple in hue.
Root	Long, thick fibrous and white

Cultivation:

Although some tuberous-rooted perennial varieties of Datura can withstand the winter with the right care, most species are grown annually from seeds generated in spiny capsules. The majority of species like warm, sunny locations and well-dried soil, and they flourish whether planted outdoors or in containers. Anaerobic organic matter, such as composted manure, should not be used on these plants since they are susceptible to root fungus. The anthers of the blooms frequently dehisce lengthwise, and the corolla is elongated and funnel-shaped with pointed lobes. A dry, four-valved capsule, the fruit typically stays affixed to the persistent calyx. The plants usually contain 12 pairs of chromosomes, and the seeds are flat with a bent embryo. Species of Datura come from all over the world. The annual plant *D. stramonium* has smooth, branching stems that grow up to one meter tall from a grassy base. It typically grows in a forked pattern and has sturdy, upright branches with pale yellow or green leaves.

A: Datura plant

B: *D. stramonium* fruit

C: *D. stramonium* flower

Toxicity:

All Datura plants contain tropane alkaloids, such as scopolamine and atropine, which are mostly found in the seeds, flowers, and roots of certain species, such *D. wrightii*. Because of these elements, datura has been utilized for a very long time in various civilizations. Despite some beneficial health benefits, Datura species are harmful to the nervous system because they contain anticholinergic alkaloids like tropane. Poisoning symptoms include fever, dry skin, dry mouth, headache, convulsions, hallucinations, a fast, weak pulse, confusion, delirium, tachycardia, coma, and even death. Histological studies show that poisoning causes liver damage, reduced organ weight, and elevated serum levels of alkaline phosphatase, glutamyl pyruvic transaminase, and glutamic oxaloacetic transaminase. Because *D. stramonium* is poisonous, it should be avoided in cases of glaucoma, pyloric stenosis, paralytic ileus, tachycardia, arrhythmias, enlarged prostate, and acute pulmonary edema. Negative physiological changes might occur when seed extract concentrations exceed 0.5%. All parts of Datura have strong anticholinergic actions that can inhibit peripheral and central cholinergic neurotransmission, ultimately leading to death. Datura intoxication affects the central nervous system and can cause disorientation, memory loss, difficulty processing information, pupil dilation-induced vision impairment, myoclonic jerks, high fever, and issues with the respiratory and cardiovascular systems. At 400 and 800 mg/kg, however, rats administered aqueous extracts of *D. metel* leaves and seeds exhibited neurological effects, including increased brain motor activity, aggravated catalepsy, antagonized ptosis, and decreased barbiturate-induced sleep duration. At lower doses, the extracts also demonstrated antidepressant qualities. Additionally, the study showed that seed extracts had a better anesthetic effect and were comparatively safer at promoting sleep [1].

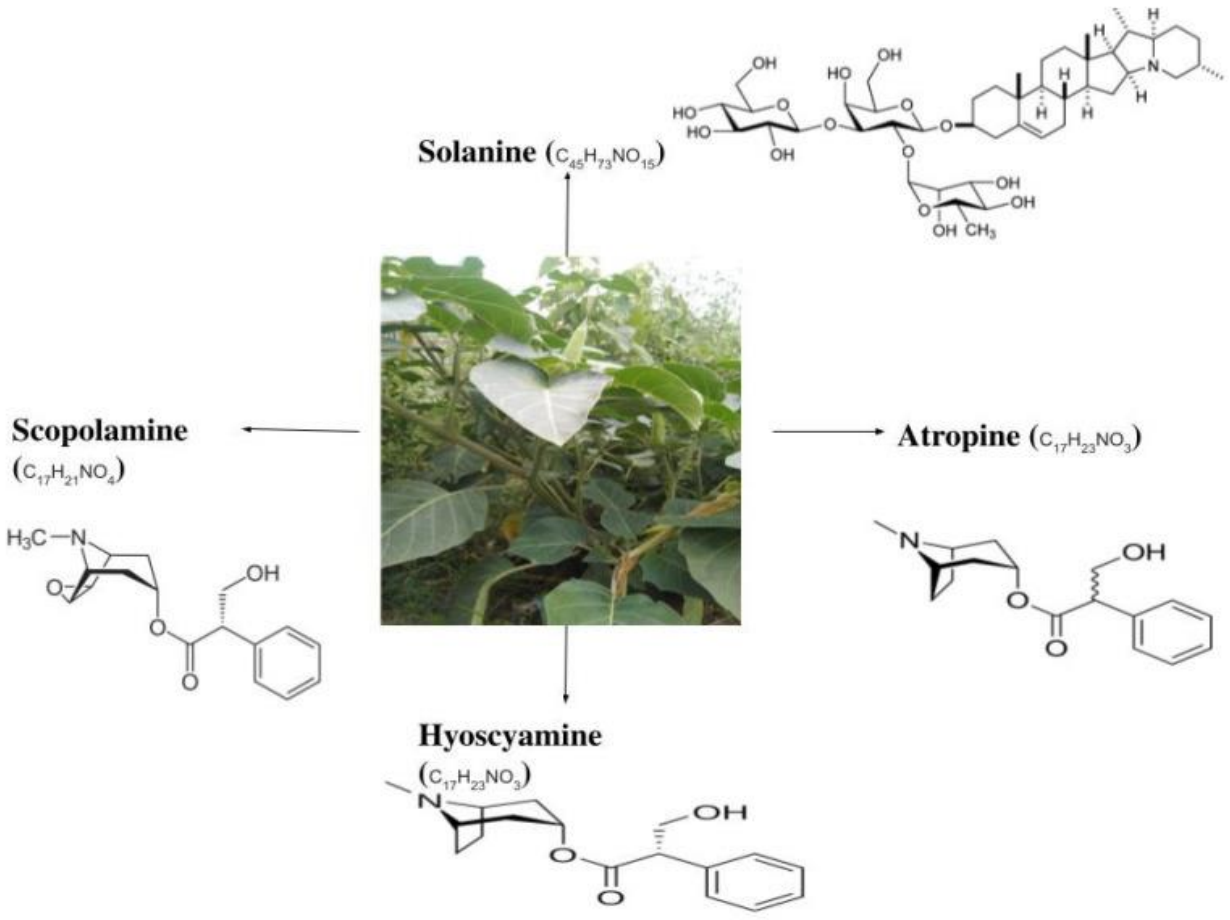
Biochemical Composition of Datura:

Datura plants contain significant amounts of moisture, ash content, protein, lipids, carbs, and crude fiber. They also include a range of phytochemicals, including cardiac glycosides, flavonoids, tannins, phenolic compounds, and alkaloids [2, 3]. Additionally, the seeds are abundant in amino acids such as glutamate, tyrosine, phenylalanine, and alanine [4]. Notably, Datura species contain a large number of tropane alkaloids, the main one being hyoscine (sometimes called scopolamine), which varies in concentration throughout the plant along with hyoscyamine and atropine [5, 6]. Datura metel leaves, for instance,

have 0.426% atropine, whilst the seeds have 0.426% hyoscyamine and the flower has 0.43% [6]. Throughout *D. metel's* growth, the alkaloid content of scopolamine and atropine gradually rises, reaching a peak near the conclusion of the reproductive phase [7, 8]. In contrast, *D. stramonium* exhibits the highest levels of alkaloids approximately ten weeks following seed germination, following which they progressively decline as the plant progresses into the generative phase. In general, the amounts of alkaloids in Datura plants differ based on the portion of the plant and stage of growth. For example, the vegetative phase of leaves has the highest concentrations of alkaloids, whereas the generative phase sees a significant decline in concentrations [9, 10]. While atropine and scopolamine concentrations differ between young and mature plants as well as between plant parts, hyoscyamine is primarily present in the stems and leaves of young plants.

The percentage of chemical components found in D. metel, D. stramonium, and D. innoxia seeds [11].

Chemical Constituents	***D. metel* (%)**	***D. stramonium* (%)**	***D. innoxia* (%)**
Lipid/fat	14.72	16.60	15.52
Carbohydrate	51.22	26.20	-
Protein	20.73	16.20	13.90
Content of Moisture	4.63	8.50	10.00
Ash content	5.14	8.70	8.26
Crude fibre	17.35	23.70	6.55

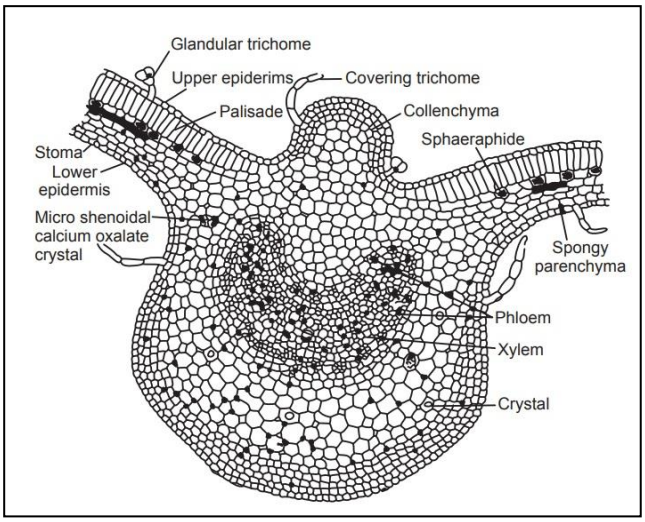


Chemical Composition of *Datura Stramonium* [12]

Atropine and scopolamine concentrations (ug/mg) in various *D. stramonium* plant sections [11].

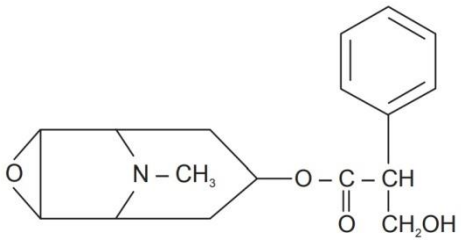
Plant Parts	Alkaloid	Young Plant	Adult Plant
Stems	Atropine	0.915 ± 0.015	0.001 ± 0.001
	Scopolamine	0.129 ± 0.014	
seeds	Atropine	0.670 ± 0.003	0.387 ± 0.015
	Scopolamine	0.012 ± 0.001	0.089 ± 0.010
Flowers	Atropine	0.299 ± 0.021	0.270 ± 0.026
	Scopolamine	0.106 ± 0.031	0.066 ± 0.004
Roots	Atropine	0.121 ± 0.015	
	Scopolamine	0.014 ± 0.004	
Medium leaves	Atropine	0.831± 0.014	0.150 ± 0.002
	Scopolamine	0.041± 0.005	0.022 ± 0.005

T.S of Datura Leaf:



Chemical Constituents:

The Datura herb contains up to 0.5% of all alkaloids, with hyoscine (scopolamine) being the main alkaloid and very trace levels of l-hyoscyamine (scopoline) and atropine.



Scopolamine

Pharmacological Activity:

Anti -Cancer Activity:

It is necessary to manage cancer with an integrated approach that makes use of the growing body of information brought about by scientific discoveries. Thousands of herbal and traditional ingredients are being investigated globally to verify their potential as anti-cancer drugs. The therapeutic dose of *D. stromonium* used to treat cancer ranged from 0.05 to 0.10 g. Despite the possibility of interactions with anticholinergic drugs, it is likely to induce nausea, hypertension, and unconsciousness that may lead to a coma [13].

Anti-inflammatory Activity:

Coriandrum sativum (C. sativum), D. stromonium, and Azadirachta indica (A. indica) are commonly used to alleviate inflammation. *D. stromonium* leaf and *C. sativum* fruit ethanolic extracts. Ethanolic extracts of *C. sativum* fruits, *D. stromonium* leaves, and *A. indica* leaves were tested for their anti-inflammatory qualities in albino rats. In rats with paw edema caused by carrageenan, all ethanolic extracts had potent anti-inflammatory effects comparable to those of the widely used drug diclofenac sodium. Of these plants, *A. indica*

had the most potent anti-inflammatory effects per hour [14].

Pesticide toxicity:

The toxicity of the cypermethrin pesticide was effectively countered by *D. stromonium* extract [15].

Antifungal Activity:

Against *Fusarium mangiferae*, a mixture of *D. stromonium*, *Calotropis gigantea*, *A. indica* (neem), and cow dung (T1) and methanol-water (70/30 v/v) extracts of *D. stromonium*, *Calotropis gigantea*, and *A. indica* T2 demonstrated antifungal activity. The study shown that the mixture-brewed compost T1 is an effective, economical, easy-to-make, and ecologically friendly way to minimize floral malformation in mangos when sprayed at the bud break stage and again at the fruit set stage [16].

Chemical Tests:

1. Vitali-Morin test: A methanolic potassium hydroxide solution is added to an acetone solution containing nitrated residue after the tropane alkaloid has been treated with fuming nitric acid and dried by evaporation. The violet hue is caused by tropane derivatives.

2. A yellowish white precipitate that is soluble in diluted ammonia but insoluble in nitric acid is produced when silver nitrate solution is added to hyoscine hydrobromide solution.

2) Vinca Plant:

Fig. *Catharanthus roseus*

Kingdom - Plantae
Clade – Trachaophytes
Order – Gentianales
Family – Apocynaceae
Genus - Vinca L 1753.
Species – Croscus
Class - Magnoliopsida

Introduction:

The genus Vinca is a member of the *Apocynaceae* family of flowering plants and is indigenous to Europe, northwest Africa, and southwest Asia. *Catharanthus roseus (Linn.)*, a herbaceous subshrub of the *Apocynaceae* family, is often referred to as Madagascar periwinkle, *Vinca rosea*, or *Lchnera rosea*. The main reason this plant is grown is for its alkaloids, which have anticancer qualities [17]. The active chemicals discovered in *Vinca rosea* are largely alkaloids and tannins. Over 100 monoterpenoid indole alkaloids (TIA) are produced by the plant in different areas [18]. The roots contain antihypertensive substances including ajmalicine and serpentine, while the leaves and stems are the primary sources of the dimeric alkaloids vincristine and vinblastine, which are crucial in the treatment of cancer [19]. In some nations, including Nigeria, the West Indies, and India, the leaves have long been used to cure diabetes [20].Among other pharmacologically advantageous substances, the plant's leaves

contain more than 150 active alkaloids. Numerous investigations have documented noteworthy hypotensive and antihyperglycemic effects of hydroalcoholic or dichloromethane-methanol leaf extracts in experimental animals [21]. Additionally, it has been shown that both normal and alloxan-induced diabetic rabbits' blood glucose levels are lowered by fresh leaf juice [22]. *Catharanthus roseus* leaves and twigs have also demonstrated hypoglycemic activity in rats with diabetes induced by streptozotocin [23].The effects of methanolic extracts from the whole *Vinca rosea* plant on rats with diabetes induced by alloxan, however, have not been examined in any prior research. By analyzing its effects on fasting blood glucose levels and biochemical indicators such serum cholesterol, LDL, HDL, creatinine, urea, and alkaline phosphatase in diabetic rats, this study seeks to assess the antidiabetic potential of the entire *Vinca rosea* plant.

Description:

Height	6 – 12 inches.
Flowers	Funnel - shaped, five petals, colours vary from blue to purple, pink or white
Seeds	Five lobed corolla and 2 -3 cm in diameter.
Steam	thin trailing stems that are 1-2 meters long and don't get longer than 20-70 cm.
Root	The roots have a light grey hue. Vinca tastes harsh and has a distinct smell.

Cultivation:

Vinca grows up to 500 meters in India. In the southern and northeastern Indian states, it thrives in tropical and subtropical climates. Vinca doesn't require any particular soil conditions, with the exception of extremely alkaline or waterlogged soil. Light sandy soils that are high in humus are ideal for its growth. Both *Vinca major* and *V. minor* are commonly planted as decorative flowering evergreens. They are common alternatives for ground cover in garden landscapes and container gardens due to their low growth and quick spread. Additionally, they have long been utilized as an evergreen ground cover that requires little care in older cemeteries. There are many varieties that offer different plant sizes, leaf shapes, flower colors, and growth patterns. To guarantee robust development and colorful blooms, vinca plants—including *vinca major* and *minor*—need to be cultivated in a number of ways. This is a guide on growing vinca [24].

1. Site Selection:

- **Sunlight**: Vinca plants may tolerate some shade, but they prefer full to partial light. For growth, they require four to six hours of direct sunlight per day.
- **Soil**: They favor slightly acidic, well-drained soil over neutral soil. They can withstand unfavorable soil conditions and thrive in sandy or loamy soils.

2. Planting:

- **Spacing**: Vinca spreads quickly, so plant them 6 to 12 inches apart to give them freedom to develop without getting crowded.
- **Depth**: As in their nursery pots, plant the Vinca at the same depth. Root rot may result from planting too deeply.
- **Containers**: Vinca thrives in containers as well. To avoid waterlogging, make sure there is enough drainage.

3. **Watering:**

- **Consistency**: To maintain the soil's constant moisture content, water it frequently, but not too much. Once established, vinca can withstand some drought, but young plants require constant hydration.

- **Avoid Waterlogging**: To avoid root rot, make sure the soil drains properly. It can be beneficial to use raised beds or containers with enough drainage holes.

4. Fertilizing:

- Vinca plants typically don't need a lot of fertilizer. Use a balanced, slow-release fertilizer in the early spring to encourage growth.
- If you wish to increase flowering throughout the growth season, you may also apply a liquid fertilizer.

5. Pruning:

- Pruning Vinca plants on a regular basis promotes additional growth and blossoms while also keeping them neat. Remove any dead flowers, leaves, or lanky stalks.
- After the blooming season, trim back the plant to avoid it becoming overly invasive.

6. Pest and Disease Management:

- Aphids, scale insects, and occasionally vine weevils can affect vinca, despite its general resistance to pests.
- Fungal diseases may also affect them, particularly if the soil remains excessively moist. To lower the danger of disease, make sure there is adequate ventilation around plants and steer clear of crowding.

7. **Winter Care:**

- Although vinca plants are evergreen, they might require some winter care in colder climates. To protect the roots and prevent the soil from freezing, mulch the base.
- Some types may die back in the winter but reappear in the spring in very cold areas.

8. Propagation:

- **Cuttings**: Early summer stem cuttings can be used to propagate vinca. Until the cuttings form roots, keep them in a damp area with indirect light.
- **Division**: To reproduce new plants, established plants can also be divided in the fall or early spring.

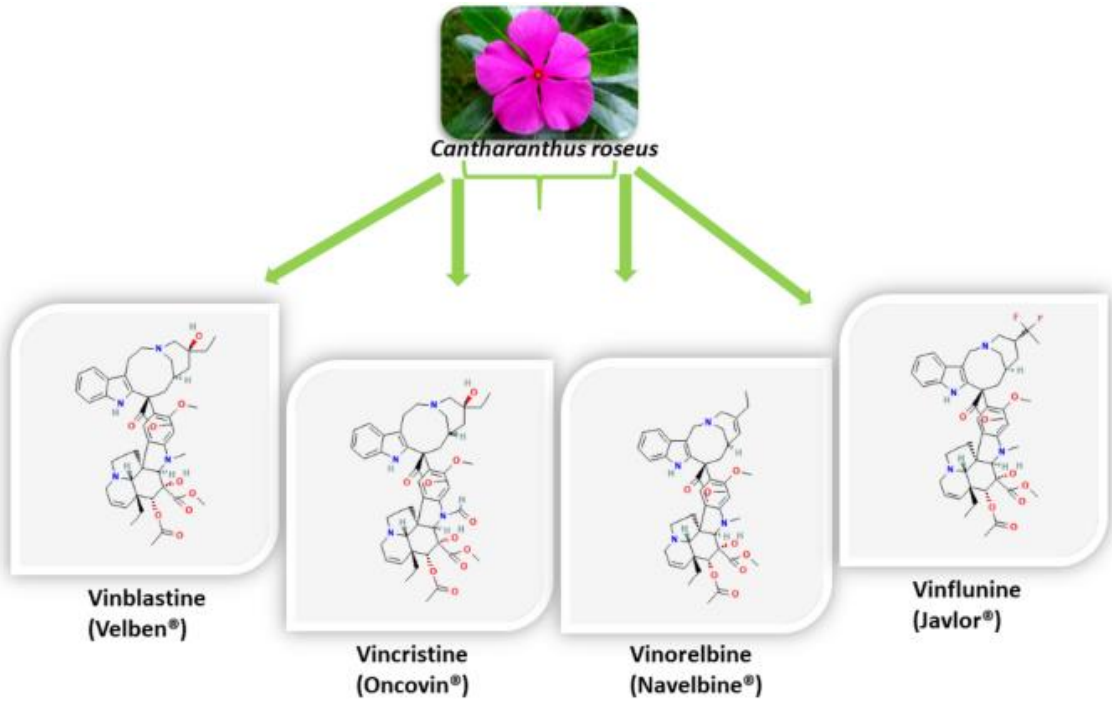
Toxicity:

If consumed by humans, *C. roseus* (previously *Vinca rosea*) is extremely toxic. The plant is deadly in all sections, and eating it can cause symptoms including minor cramping in the stomach, heart problems, low blood pressure, and paralysis, which can be fatal. Because of its toxicity, the plant is listed in Louisiana State Act 159. Even before the tangena fruit was employed, the Malagasy people were aware of the deadly qualities of *C. roseus* and had long used it in trial ordeals. As a result, the plant was given the name vonenina, which translates to "flower of remorse" in Malagasy, a reflection of its harmful properties. Due to the possibility of birth malformations, patients who are pregnant, intend to become pregnant, or are nursing should refrain from using these drugs. Additionally, because the drug may impair immunity and make a person more prone to disease, patients on this prescription should not get any immunizations [25]. Patients should tell their doctor about any other medications they are taking and any illnesses they may have, including gout, kidney stones, liver disease, infections, chickenpox, herpes zoster infection, or problems of the nerves and muscles [25]. In the end, the medication's concentration and treatment time have a major role in determining drug accumulation and cytotoxicity; research suggests that the most important component influencing the effects of a drug is reaching a crucial threshold concentration [26].

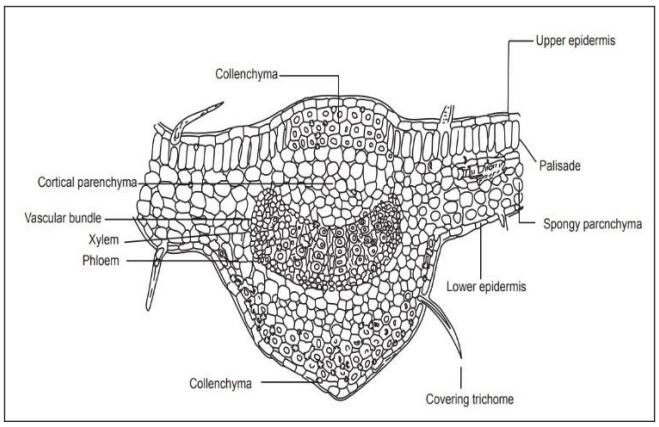
Chemical Constituents:

Despite being extremely toxic, a number of alkaloids found in *C. roseus* have potential uses in the treatment of cancer, according to researchers looking into the plant's therapeutic qualities. Insects, fungus, and herbivorous animals are just a few of the dangers that plants may fend off with the help of the many chemical compounds they can produce. Among the substances found in *C. roseus* are alkaloids, which are the most pharmacologically active, flavonoids, carbohydrates, and saponins. The plant is reported to contain about 400 different alkaloids, which are used in medicines, food additives, agrochemicals, fragrances, and insecticides. The plant's roots are rich in ajmalicine, vinceine, vineamine, raubasin, reserpine, and catharanthine, while the aerial sections primarily include significant alkaloids such actineoplastidemeric, vinblastine, vincristine, vindesine, and tabersonine. Furthermore, rosindin, an anthocyanin pigment, is present in C. roseus flowers [27].

- **Vinblastine**: An anticancer medication made from the plant's leaves.
- **Vincristine**: An anticancer medication made from the plant's leaves.
- **Tabersonine**: An alkaloid with anticancer activity.
- **Vinceine**: An alkaloid present in the plant's basal stem and roots.
- **Catharanthine**: An alkaloid present in the plant's basal stem and roots.



T.S of Vinca:



The structure of the mesophyll, which is located between the upper and lower epidermis, is visible in a cross-section of a vinca leaf. Both spongy and palisade parenchyma make up the mesophyll.

- **Epidermis**: A single layer of rectangular cells with a thick layer of cuticle covering them makes up the epidermis.
- **Palisade parenchyma**: Directly beneath the upper epidermis, there is a single layer of elongated cells.
- **Spongy parenchyma**: This consists of five to eight layers of cells, filling most of the intercellular spaces.
- **Midrib**: Two to three layers of collenchyma and a vascular bundle made up of xylem and phloem are found in the midrib.
- **Upper cuticle**: The cuticle on the upper epidermis.
- **Lower cuticle**: The cuticle on the lower epidermis.

Pharmacological Activity:

Antimicrobial Activity:

The bactericidal qualities of crude extracts from different plant sections were assessed. The efficacy of the leaf extract was noticeably higher. Microorganisms including Salmonella typhimurium NCIM2501, Pseudomonas aeruginosa NCIM2036, and Staphylococcus aureus NCIM5021 were used to investigate the leaf extract's antibacterial properties. The findings suggested that the leaf extract might be used as a preventative measure to cure a number of illnesses [28].

Anti-Diarrheal Activity:

Castor oil was used to produce diarrhea in Wistar rats, and the extract was used as a treatment to assess the in vivo anti-diarrheal properties of *Catharanthus roseus* ethanolic leaf extract. As reference medications, atropine sulfate and loperamide were utilized. The ethanolic extract of C. roseus demonstrated a dose-dependent decrease in castor oil-induced diarrhea at 200 and 500 mg/kg. The extract significantly reduced the amount and weight of wet fecal pellets, and the animals treated with the extract had less severe diarrhea than the control group. The extract's 200 and 500 mg/kg dosages also prevented diarrhea brought on by castor oil and decreased gastrointestinal motility, as evidenced by the decreased passage of charcoal meal through the digestive tract. The traditional use of C. roseus to treat and manage diarrhea is supported by these findings [29, 30].

Anticancer Activity:

In clinical practice, *Catharanthus roseus (C. roseus)* is usually administered intravenously, where it is subsequently metabolized by the liver and ultimately removed from the body. Hair loss, peripheral neuropathy, gastrointestinal blockage, and hyponatremia are the main adverse effects linked to this medication. Vinorelbine and vinflunine, two semi-synthesized alkaloids from *C. roseus,* have been produced to improve therapeutic efficacy. These substances bind to tubulin to produce their anti-cancer actions. On a variety of human malignancies, vinorelbine and

vinflunine have growth-inhibitory actions. Another alkaloid, vinblastine, is suggested for choriocarcinoma and Hodgkin's disease and is used experimentally to treat neoplasms. Significant anticancer efficacy has been demonstrated by *Catharanthus roseus* in vitro, especially against tumor cell lines that are resistant to many drugs. Vinca alkaloids, sometimes referred to as mitotic spindle poisons, prevent microtubule assembly, which stops mitosis in the cell cycle. They therefore stop cancer cells from proliferating. As cell cycle-specific substances, several vinca alkaloids have unique characteristics, yet they all work by stopping cells in mitosis [31]. The alkaloids attach themselves to β-tubulin and prevent it from polymerizing with α-tubulin to create microtubules. Chromosomes cannot align at the division plate in the absence of a functional mitotic spindle, which prevents cell division during the metaphase stage. Apoptosis frequently occurs in cells that are stopped in the middle of mitosis. Additionally, these substances are utilized to treat diseases like testicular cancer, lymphomas, and leukemias [32].

Anthelmintic Activity:

Both humans and livestock suffer from chronic health problems as a result of helminth infections. Using Pherithema posthuma as the experimental model and piperazine citrate as the reference standard, the anthelminthic activity of *C. roseus* was assessed. At a dosage of 250 mg/ml, the ethanolic extract exhibited significant anthelminthic effects, with a death time of 46.33 minutes. By contrast, a death time of 40.67 minutes was achieved with the usual medication at 50 mg/ml. This study backs up *C. roseus's* traditional ethnomedical use as an anthelminthic herb [33].

Chemical Tests:

1. Mayer's Test:

Using Mayer's reagent, an alkaloid-precipitating solution, the Mayer's Test is a technique for identifying alkaloids in natural goods. 1.36 grams of mercuric chloride and 5.00 grams of potassium iodide are dissolved in 100.0 milliliters of water to create Mayer's reagent. A few drops of Mayer's reagent are applied to the tube walls after 3 milliliters of the extract are put in a test tube for the test.

2. Picric acid Test:

To perform the picric acid test, 1 gram of picric acid is dissolved in one hundred milliliters of distilled water to create Hager's reagent. The test involves filling a test tube with three milliliters of the extract and applying a few drops of Hager's reagent along the tube's walls.

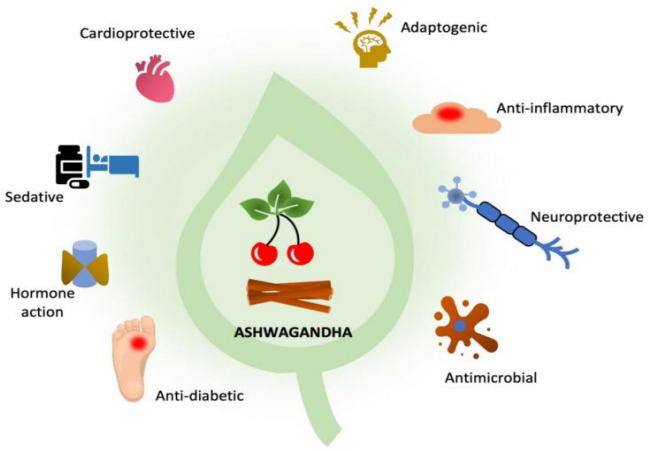
3) Ashwagandha Plant:

Fig. *Withania somnifera*

Kingdom - Plantae
Clade – Trachaophytes
Order – Solanales
Family – Solanaceae
Genus - Withania
Species – W. somnifera
Class - Magnoliopsida

Introduction:

Indian ginseng, also known as ashwagandha, Indian winter cherry, or Vitania sluggard (Withania somnifera), is a plant whose root is utilized in medicine. Derived from the word "ashwa," which meaning horse, the phrase "ashwagandha" refers to the power that a person can gain by consuming the root, much like a horse. The fresh root's unique aroma is referred known as "gandha" [34]. Ashwagandha has long been utilized to strengthen and support the neurological system in Ayurvedic therapy. Its adaptogenic characteristics and therapeutic benefits are part of the "rasayana" system. The extensive list of health advantages linked to ashwagandha is depicted in Figure 1 below.



For about 3,000 years, ashwagandha has been a part of traditional Indian medicine. Aphrodisiac, narcotic, tonic, diuretic, anthelmintic, and stimulant are only a few of the uses for its root. Although it is indigenous to India, it is also grown in the Mediterranean, the Himalayas, Africa, the Canary Islands, the Cape of Good Hope, and Australia [34, 35, 36]. In recent years, ashwagandha's putative health benefits—particularly for stress reduction, cognitive function, and physical performance—have garnered increased attention. Ashwagandha has been shown to have antibacterial, immunomodulatory, and anti-inflammatory properties, as well as neuroprotective effects and to help treat obsessive-compulsive disorder. Supplementing with ashwagandha may help treat diabetes, cancer, and infertility, according to more research. Additionally, it may have cardioprotective benefits, help treat sleep disorders, improve muscle strength and recovery, increase stress resilience, lower anxiety, and promote the treatment of hypothyroidism [37].

Description:

Height	A short shrub with a height of 35–75 cm (14–30 in).
Flowers	Small, green, bell-shaped.
Seeds	Small, green, and can be sown1-3cm deep in soil.
Leaves	Oval, dull green, and typically 10–12 cm (3.9–4.7) long.
Root	Stout, long tuberous, fleshy, whitish-brown.

Cultivation:

Known for its numerous therapeutic advantages, ashwagandha is frequently referred to as a "wonder herb." The name "Ashwagandha" comes from the herb's energy-boosting properties and horse-like scent. Many therapeutic concoctions are made from its roots, seeds, and leaves. These preparations are frequently used to control illnesses including schizophrenia, senile malfunction, anxiety, depression, and phobias as well as to reduce stress. The shrub can grow to a height of 30 to 120 cm and has deep, whitish-brown roots. It produces greenish blossoms and orange-red fruit. Ashwagandha grows mostly in the Indian states of Rajasthan, Punjab, Haryana, Uttar Pradesh, Gujarat, Maharashtra, and Madhya Pradesh [38].

Soil Requirements: The ideal soil for ashwagandha is sandy loam or moderately red soil that drains well and has a pH between 7.5 and 8.0.

It cannot be grown in soil that is soggy and retains moisture. Loose, deep, and well-drained soil is preferable; heavy or black soils provide enough drainage.

Land Preparation: The soil needs to be leveled and finely ground before ashwagandha may be planted. Plowing or harrowing should be done prior to the monsoon season, and the field should be plowed two to three times for the best tilth. During this procedure, which usually takes place in April or May, the land should be treated with farmyard manure.

Sowing Time: For Ashwagandha cultivation, prepare the nursery in June or July. Spacing: The recommended spacing is 20 to 25 cm between rows, with a plant-to-plant distance of 10cm, depending on the growth pattern and germination rate.

Sowing Depth: The seeds should typically be shown at a depth of 1 to 3cm.

Sowing Method: Transplanting seedlings into the main field is the preferred method.

Seed rate: For optimal varieties, use 4-5kg of seeds per acre.

Seed Treatment: To protect the crops from seed-borne diseases and pests, treat the seeds with Thiram or Dithane M-45 (Indofil M-45) at a rate of 3grams per kilogram of seeds before sowing. After treatment, air-dry the seeds before planting.

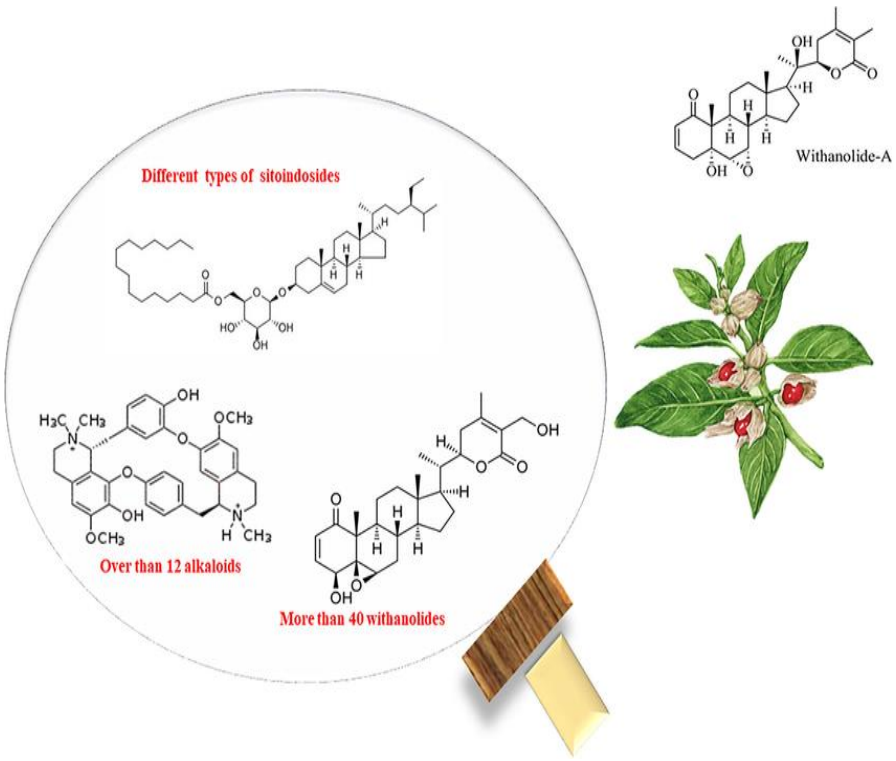
Toxicity:

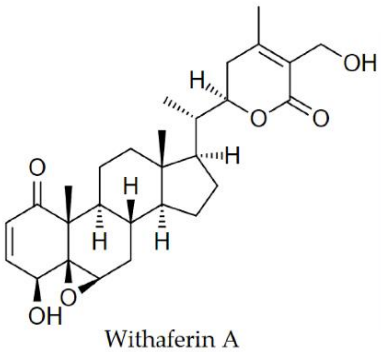
The acute toxicity of *W. somnifera* HAE was investigated in rats given a single oral dose of 250, 500, and 1000 mg per kg. Up to 48 hours, no death was noted, suggesting that *W. somnifera's* LD50 is higher than 1000 mg/kg. Initial excitation was followed by mild depression, dullness, decreased breathing, and decreased SMA at the 1000 mg/kg dose. The same doses utilized in the acute toxicity trial were used in the three-week-long chronic toxicity research. Lower dosages showed no discernible negative effects, but the 1000 mg/kg dose brought on the same unpleasant side effects, including excitation, mild depression, drowsiness, decreased breathing, and decreased SMA. These toxicity tests assisted in determining the extract's LD50 and offered insightful information about its possible therapeutic qualities. We can conclude that *W. somnifera* is free of both acute and chronic toxicity based on the observed symptoms and medication activity. The LD50 of *W. somnifera* was confirmed by earlier research, including that conducted by Dhar et al. (1968), which likewise revealed either acute or chronic toxicities or severe toxic effects. Although the medicine did not exhibit any hazardous symptoms at 1000 mg per kg, it is advised to use half of that dosage (500 mg per kg) for therapeutic purposes because it has some effects at that level [39].

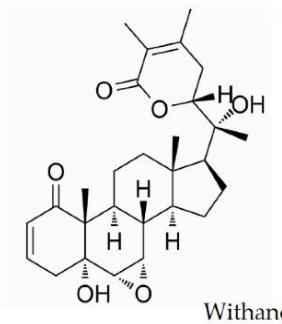
Chemical Constituents:

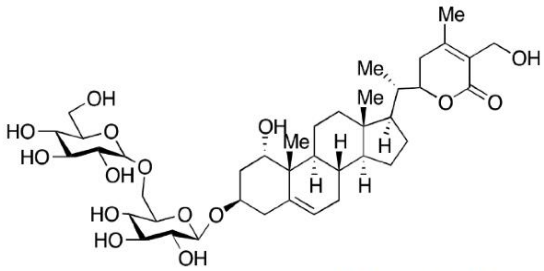
Through chemical analysis of various parts of *W. somnifera*, a large number of compounds from various chemical groups have been found. Biologically active components of the plant include alkaloids (isopelletierine, anaferine), steroidal lactones (withanolides, withaferins), saponins with an additional acyl group (sitoindoside VII and VIII), and withanolides with glucose at carbon 27 (sitoindoside XI and X). Withanolides are a kind of steroidal lactone that have gained increasing application in drug formulations due to their promising therapeutic properties [40]. Much research has been done on the amount, bioactive properties, and characteristic structures of some of the main withanolides that were isolated from *Withania* species. Misra and associates [41]. discovered a number of withanolides from *W. somnifera*, such as Together with common steroids like β-sitosterol, sitosterol, and their glucosides, as well as other compounds like 16β-acetoxy-6α, 7α-epoxy-5α–hydroxy-1-oxowitha-2, 17(20), 24-trienolide, and 5, 7α-epoxy-6α, 20α–dihydroxy-1-oxowitha-2, and 24-

dienolide, there are also withanolide A, withanolide B, 27-hydroxy withanolide B, withanolide D, and withaferin A. Matsuda et al. found seven new withanolide glycosides from *W. somnifera* roots, class VI being the most common. These were referred to as withanosides I through VII. In a separate study, Bessalle and Lavie identified two chlorinated withanolides from dried W. somnifera leaves: withanolide C and 4-deoxyphysalolactone. The primary components of alcoholic ashwagandha extracts are lactones and steroid alkaloids, together known as withanolides. Notably, it has been shown that human cancer cells are cytotoxically affected by withanone and withaferin A.

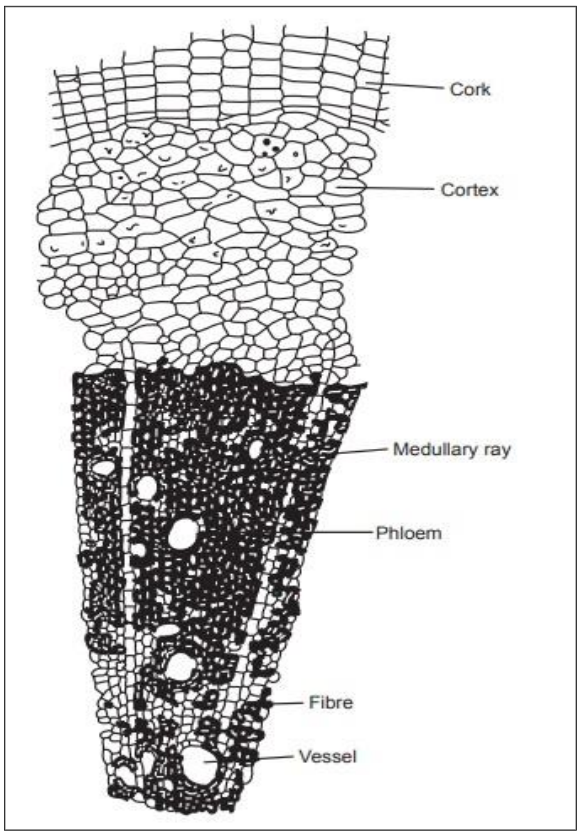



Withaferin A


Withanolide A


Withanoside IV

T.S Of ashwagandha:



A transverse section of the root of *Withania somnifera* (ashwagandha) reveals the presence of the cortex, xylem, phloem, and parenchyma.
Characteristics of a transverse section of *Withania somnifera* root:

- **Young roots**: Feature a less developed secondary tissue and a prominent cortex.
- **Mature roots**: Contain isodiametric cork cells that are non-lignified.
- **Secondary tissue**: Shows an increased number of ray parenchyma cells, which are nearly square and arranged in rows.
- **Xylem**: Contains small vascular bundles with one or two vessels and a few fibers.
- **Phloem parenchyma**: Has intercellular spaces.
- **Xylem parenchyma**: Exhibits bordered pits.
- **Parenchyma of the cortex and vascular region**: Contains simple, reniform, and oval starch grains.

Pharmacological Activity:

Anti-inflammatory Activity:

Withaferin A has potent anti-arthritic and anti-inflammatory properties. Its anti-inflammatory qualities are linked to its physiologically active steroids, among which Withaferin A is a major constituent. It has been shown to be equally efficacious as hydrocortisone sodium succinate when administered at similar quantities [42]. Without having any harmful side effects, withaferin A successfully reduced the symptoms of arthritis. Animals treated with Withaferin A gained weight throughout the arthritic state, in contrast to those treated with hydrocortisone, which caused weight loss. It's interesting to note that withaferin A seemed to be more effective than hydrocortisone in treating rats' adjuvant-induced arthritis, which is quite similar to rheumatoid arthritis in humans. A single dose of Withaferin A showed a lengthy duration of action, effectively lowering inflammation for up to 4 hours after administration, and it displayed a high dose-response in albino rats within the dose range of 12–25 mg/kg body weight in terms of oedema inhibition [43]. In a number of animal models, including adjuvant-induced arthritis, cotton pellet granuloma, and inflammation generated by carrageenan, ashwagandha *(Withania somnifera)* has also been demonstrated to have anti-inflammatory qualities. Other studies that looked at the release of serum β-1 globulin during inflammation provided interesting results using models like the main phase of adjuvant-induced arthritis and formaldehyde-induced arthritis. According to the results, most acute phase responses (APR) were impacted rapidly, and the level of inflammation was significantly reduced [44].

Antibiotic Activity:

According to recent research, the roots and leaves of *Withania somnifera* exhibit antibacterial qualities. Withaferin A inhibited the growth of pathogenic fungi, aerobic and acid-fast bacilli, and certain Gram-positive bacteria at a dose of 10 µg/ml. It was highly effective against Micrococcus pyogenes var. aureus and partially inhibited the activity of Bacillus subtilis glucose-6-phosphate dehydrogenase. Additionally, Withaferin A showed inhibitory effects on the Ranikhet virus and was effective against the Vaccinia virus and Entamoeba histolytica [45]. Mice given ashwagandha showed increased phagocytosis and intracellular death of peritoneal macrophages, suggesting that it protected against systemic Aspergillus infection, most likely due to the activation of macrophage activity [46].The unsaturated lactone ring is what gives Withaferin A its antibacterial properties. In rabbits with intentionally generated abscesses, the lactone showed significant therapeutic effects and even turned out to be somewhat more effective than penicillin. This backs up indigenous medical systems' long-standing usage of the leaves to treat ulcers and carbuncles [47].

Anti-aging Activity:

A double-blind clinical research was conducted to assess the anti-aging properties of ashwagandha. For a year, 101 healthy males between the ages of 50 and 59 were given 3 grams of the plant every day. Hemoglobin levels, red blood cell count, hair pigmentation, and sitting height all significantly improved, according to the data. Furthermore, nail calcium was preserved and serum cholesterol levels dropped. Enhanced sexual performance was reported by 70% of the individuals [48].

Anti-cancer Activity:

The word "cancer" refers to a group of diseases characterized by uncontrolled cell division, which is often caused by mutations in the cell cycle-regulating genes proto-oncogenes and anti-oncogenes. Despite extensive global research efforts, cancer continues to be a leading cause of mortality, making it a critical and expanding health concern. Studies have shown that ashwagandha's root, stem, and leaves, among other parts, have anti-cancer qualities. These substances can be used alone or in combination with other chemotherapeutic drugs to treat cancer [49]. Ashwagandha contains alkaloids called withanolides, which have significant anti-cancer properties. They are important substances in cancer treatment because they are especially notable for encouraging apoptosis. Ashwagandha has demonstrated efficacy against a number of cancer types, including blood, lung, prostate, breast, and colon cancers [50]. ER/PR-positive and triple-negative breast cancer, among other forms of the illness, benefit greatly from its use [51]. In addition to treatment, it might offer preventative benefits and enhance patients' quality of life with breast cancer [51]. It has been demonstrated that withaferin A, another compound derived from ashwagandha, can effectively treat melanoma by inducing apoptosis, reducing cell proliferation, and inhibiting melanoma cell migration [52]. Research on glioblastoma multiforme (GBM) has shown that withaferin A causes intrinsic apoptosis by greatly inhibiting the development of GBM cells in vitro and in vivo. Additionally, it caused a G2/M cell cycle stop by dephosphorylating Thr161 CDK1, which offers promising data for enhancing withaferin A-based treatments for GBM. Additionally, ashwagandha extract and intermittent fasting have shown promise as an effective treatment for breast cancer when paired with cisplatin [53].This combination decreases the toxicity of cisplatin to the liver and kidneys, encourages apoptosis in cancer cells, and inhibits their multiplication [54]. Furthermore, research has demonstrated that ashwagandha extract protects

against radiation-induced damage by lowering inflammation and oxidative stress, especially in the liver and spleen [55]. These findings suggest that *Withania somnifera* root extract could be utilized therapeutically to reduce the harmful effects of radiation on vital organs.

Physicochemical Tests:

1. Test for carbohydrate: After dissolving each extract in 5 ml of distilled water, they were filtered. The resultant filtrates were employed to detect carbohydrates.

Test for carbohydrate	Procedure
Fehling's Test:	1 ml of the extract and 1 ml each of Fehling's A and B solutions should be combined in a test tube. Fehling's test is next conducted by heating the mixture in a water bath for ten minutes. A crimson precipitate indicates the presence of a lowering sugar. For further confirmation, apply 1 ml of Fehling's A and B solutions to the filtrate and then heat it in a boiling water bath for 5 to 10 minutes. The presence of carbohydrates is indicated by the formation of a reddish-orange precipitate.
Benedict's Test:	A few drops of Benedict's reagent should be added to the test solution while it is heated in a water bath. A reddish-brown precipitate could indicate the presence of sugars. The color and amount of the precipitate that forms will depend on the concentration of the reducing sugar; a desirable outcome will show hues ranging from green to yellow to orange to red.
Molisch Test:	Mix 2.0 ml of the extract well with two drops of the Molisch reagent. Next, combine the solution with 2.0 ml of concentrated sulfuric acid. A reddish-violet ring that appears at the junction of the two layers and disappears when too much alkali solution is applied indicates the presence of carbohydrates.

2. Test for Alkaloids: After dissolving each extract in diluted HCl, they were filtered.

Test for Alkaloids	Procedure
Mayer's Test	2 ml of the reagent were applied to 1 ml of the filtrate. When alkaloids are present, a white or pale precipitate will form.
Wagner's Test	2 ml of Wagner's reagent were combined with one to 1 ml of the filtrate. There are alkaloids present when a reddish-brown precipitate forms.
Hager's Reagents	A yellow precipitate is produced when Hager's reagent, which is a saturated solution of picric acid, is added to the acetic test solution.
Ehrlich's Test	Ehrlich's Reagent causes two separate layers of brown and yellow to form in the acidic test solution.
Dragendroff's Test	Dragendorff's reagent was added to the filtrate, and the presence of alkaloids is indicated by the formation of an orange precipitate.

3. Test for flavonoids:

Test for flavonoids	Procedure
Shinoda test (Magnesium hydrochloride reduction test)	The test solution was mixed with 0.5 to 1 ml of magnesium ribbon, and then hydrochloric acid was added gradually. Flavonoids were present in the sample because, after a few minutes, the hue changed from pink scarlet, crimson, and red to occasionally green and blue.
Alkaline reagent test	To the test solution (0.5–1 ml), a few drops of a 10% sodium hydroxide solution were added. Flavonoids are indicated by the emergence of a bright yellow color that goes away when a few drops of diluted acid are added.

Zinc– hydrochloride test	Concentrated hydrochloric acid was carefully applied along the test tube's walls after a little amount of zinc dust was added to the extract; the presence of flavonoids is indicated by the formation of a magenta color.
Lead acetate test	The extract was mixed with a few drops of lead acetate solution. Flavonoids are indicated by the production of a yellow precipitate, whereas flavonones are indicated by the creation of an orange to crimson hue.
Ammonia test	A fraction of the crude extract was mixed with 5 ml of diluted ammonia solution, and then concentrated H2SO4 was added. The presence of flavonoids is indicated by the extract appearing yellow, albeit this color eventually fades.

4. Test for tannins:

Test for Tannins	**Procedure**
Ferric chloride test	2 ml of the test solution were mixed with a few drops of a 5% ferric chloride solution, which caused a vivid blue-black hue to develop.
Lead acetate test	2 ml of the test solution were mixed with a few drops of lead acetate solution, which caused a white precipitate to develop.

CONCLUSION

The review of commonly available anti-cancer plants such as vinca, datura, and ashwagandha underscores the potential therapeutic value of these traditional plant-based remedies. Datura, through controversial and toxic in high doses, has shown anticancer properties in some studies, warranting further research into its safe medicinal use. Vinca, with its alkaloid compounds like vincristine and vinblastine, has long been recognized for its efficacy in treating certain cancers, particularly leukemia and lymphoma. Ashwagandha is well-known for its anti-inflammatory and adaptogenic properties, holds promise in reducing cancer cell proliferation and enhancing the body's overall resilience against cancer. While these plants offer promising results in preclinical and traditional settings, further scientific validation through rigorous clinical trials is essential to establish their safety, optimal dosage, and full therapeutic potential. Integrating these plants into cancer treatment could provide complementary options, but careful consideration of their use alongside conventional therapies is necessary.

REFERENCES

1. Kirtikar KR, Basu BD. Indian medicinal plants. publisher not identified Basu, Bhuwaneśwari Âśrama; 1918.
2. Bagewadi ZK, Muddapur UM, Madiwal SS, Mulla SI, Khan A. Biochemical and enzyme inhibitory attributes of methanolic leaf extract of Datura inoxia Mill. Environmental Sustainability. 2019 Mar 1;2(1):75-87.
3. Fatima H, Khan K, Zia M, Ur-Rehman T, Mirza B, Haq IU. Extraction optimization of medicinally important metabolites from Datura innoxia Mill.: an in vitro biological and phytochemical investigation. BMC complementary and alternative medicine. 2015 Dec;15:1-8.
4. Al-Snafi AE. Medical importance of Datura fastuosa (syn: Datura metel) and Datura stramonium-A review. IOSR Journal of Pharmacy. 2017;7(2):43-58.
5. Sharma M, Dhaliwal I, Rana K, Delta AK, Kaushik P. Phytochemistry, pharmacology, and toxicology of Datura species—A review. Antioxidants. 2021 Aug 15;10(8):1291.

6. Jakabová S, Vincze L, Farkas Á, Kilár F, Boros B, Felinger A. Determination of tropane alkaloids atropine and scopolamine by liquid chromatography–mass spectrometry in plant organs of Datura species. Journal of Chromatography A. 2012 Apr 6;1232:295-301.
7. Lim KM, Dagalea FM, Vicencio MC. Antibacterial activity of Datura metel Linn.(TALONG-PUNAY) fruit extract. J. Pharm. Res. Int. 2020;32(21):96-101.
8. Nandakumar A, Vaganan MM, Sundararaju P, Udayakumar R. Phytochemical analysis and nematicidal activity of ethanolic leaf extracts of Datura metel, Datura innoxia and Brugmansia suaveolens against Meloidogyne incognita. Asian Journal of Biology. 2017;2(4):1-1.
9. Alinejad S, Sarabi V, Bakhtvari AR, Hashempour H. Variation in physiological traits, yield and secondary metabolites of jimsonweed (Datura stramonium L.) under different irrigation regimes and nutrition systems. Industrial Crops and Products. 2020 Jan 1;143:111916.
10. Oseni OA, Olarinoye CO, Amoo IA. Studies on chemical compositions and functional properties of thorn apple (Datura stramonium L) Solanaceae. African Journal of Food Science. 2011 Feb;5(2):40-4.
11. Devi MR, Bawari M, Paul SB, Sharma GD. Neurotoxic and medicinal properties of Datura stramonium L.–review. Assam University Journal of Science and Technology. 2011 Apr 6;7(1):139-44.
12. Butnariu M. An analysis of Sorghum halepense's behavior in presence of tropane alkaloids from Datura stramonium extracts. Chemistry central journal. 2012 Dec;6:1-7.
13. Balachandran P, Govindarajan R. Cancer—an ayurvedic perspective. Pharmacological research. 2005 Jan 1;51(1):19-30.
14. Gupta Sonika GS, Raghuvanshi Manubala RM, Jain Deepak JD. Comparative studies on anti-inflammatory activity of Coriandrum sativum, Datura stramonium and Azadirachta indica.
15. Das BK, Mukherjee SC. Toxicity of cypermethrin in Labeo rohita fingerlings: biochemical, enzymatic and haematological consequences. Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology. 2003 Jan 1;134(1):109-21.
16. Usha K, Singh B, Praseetha P, Deepa N, Agarwal DK, Agarwal R, Nagaraja A. Antifungal activity of Datura stramonium, Calotropis gigantea and Azadirachta indica against Fusarium mangiferae and floral malformation in mango. European journal of plant pathology. 2009 Aug;124:637-57.
17. Jaleel CA, Gopi R, Lakshmanan GA, Panneerselvam R. Triadimefon induced changes in the antioxidant metabolism and ajmalicine production in Catharanthus roseus (L.) G. Don. Plant Science. 2006 Aug 1;171(2):271-6.
18. Jordan MA, Thrower D, Wilson L. Mechanism of inhibition of cell proliferation by Vinca alkaloids. Cancer research. 1991 Apr 15;51(8):2212-22.
19. Kulkarni RN, Baskaran K, Chandrashekara RS, Kumar S. Inheritance of morphological traits of periwinkle mutants with modified contents and yields of leaf and root alkaloids. Plant Breeding. 1999 Mar;118(1):71-4.
20. Cowley RC, Bennett FC. Vinca rosea. Australian Journal of Pharmacy. 1928;9:61.
21. Pillay PP, Nair CP, Santi Kumari TN. Lochnera rosea as a potential source of hypotensive and other remedies. Bulletin of Research Institute of the University of Kerala. 1959;1:51-4.
22. Nammi S, Boini MK, Lodagala SD, Behara RB. The juice of fresh leaves of Catharanthus

roseus Linn. reduces blood glucose in normal and alloxan diabetic rabbits. BMC complementary and Alternative Medicine. 2003 Dec;3:1-4.
23. Singh SN, Vats P, Suri S, Shyam R, Kumria MM, Ranganathan S, Sridharan K. Effect of an antidiabetic extract of Catharanthus roseus on enzymic activities in streptozotocin induced diabetic rats. Journal of Ethnopharmacology. 2001 Aug 1;76(3):269-77.
24. Tanaka N, Takao M, Matsumoto T. Vincamine production in multiple shoot culture derived from hairy roots of Vinca minor. Plant cell, tissue and organ culture. 1995 Apr;41:61-4.
25. Johnson IS, Armstrong JG, Gorman M, Burnett Jr JP. The vinca alkaloids: a new class of oncolytic agents. Cancer research. 1963 Sep 1;23(8_Part_1):1390-427.
26. Jackson Jr DV, Bender RA. Cytotoxic thresholds of vincristine in a murine and a human leukemia cell line in vitro. Cancer Research. 1979 Nov 1;39(11):4346-9.
27. Bennouna J, Delord JP, Campone M, Nguyen L. Vinflunine: a new microtubule inhibitor agent. Clinical cancer research. 2008 Mar 15;14(6):1625-32.
28. Patil PJ, Ghosh JS. Antimicrobial activity of Catharanthus roseus–a detailed study. British Journal of Pharmacology and Toxicology. 2010 Jul 1;1(1):40-4.
29. Nayak BS, Anderson M, Pereira LP. Evaluation of wound-healing potential of Catharanthus roseus leaf extract in rats. Fitoterapia. 2007 Dec 1;78(7-8):540-4.
30. Patel Y, Vadgama V, Baxi S, Tripathi CB. Evaluation of hypolipidemic activity of leaf juice of Catharanthus roseus (Linn.) G. Donn. in guinea pigs. Acta Pol Pharm. 2011 Nov 1;68(6):927-35.
31. Patharajan S, BalaAbirami S. Antioxidant activity and phytochemical analysis of fractionated leaf extracts of Catharanthus roseus. Int J Pharm. 2014 Feb;1(2):138-43.
32. Bhutkar MA, Bhise SB. Comparative studies on antioxidant properties of Catharanthus rosea and Catharanthus alba.
33. Sekar P. Vedic clues to memory enhancer. The Hindu. 1996;21.
34. Singh N, Bhalla M, de Jager P, Gilca M. An overview on ashwagandha: a Rasayana (rejuvenator) of Ayurveda. African journal of traditional, complementary and alternative medicines. 2011;8(5S).
35. Langade D, Kanchi S, Salve J, Debnath K, Ambegaokar D, Langade DG. Efficacy and safety of Ashwagandha (Withania somnifera) root extract in insomnia and anxiety: a double-blind, randomized, placebo-controlled study. Cureus. 2019 Sep 28;11(9).
36. Połumackanycz M, Forencewicz A, Wesołowski M, Viapiana A. Ashwagandha (Withania somnifera L.)–roślina o udokumentowanych właściwościach prozdrowotnych. Farm Pol. 2020;76(8):442-7.
37. Mirjalili MH, Moyano E, Bonfill M, Cusido RM, Palazón J. Steroidal lactones from Withania somnifera, an ancient plant for novel medicine. Molecules. 2009 Jul 3;14(7):2373-93.
38. Rajeswara Rao BR, Rajput DK, Nagaraju G, Adinarayana G. Opportunities and challenges in the cultivation of Ashwagandha {Withania somnifera (L.) Du-nal}. Journal of Pharmacognosy, ISSN. 2012;3:88-91.
39. Sahni YP, Sharma M, Pandey GP. Studies on phytochemistry and toxicity of Withania somnifera. Intern. J. Animal, Veterinary, Fishery and Allied Sciences. 2014;1:12-6.
40. Jain R, Kachhwaha S, Kothari SL. Phytochemistry, pharmacology, and biotechnology of Withania somnifera and Withania coagulans: A review. Journal of

Medicinal Plants Research. 2012 Oct 25;6(41):5388-99.
41. Misra L, Mishra P, Pandey A, Sangwan RS, Sangwan NS, Tuli R. Withanolides from Withania somnifera roots. Phytochemistry. 2008 Feb 1;69(4):1000-4.
42. Khare CP. Indian medicinal plants: an illustrated dictionary. Springer Science & Business Media; 2008 Apr 22.
43. Rastogi RM. Compendium of Indian medicinal plants. Central Drug Research Institute, Lucknow, India. 1990;1:388-9.
44. Anbalagan K, Sadique J. Withania somnifera (ashwagandha), a rejuvenating herbal drug which controls alpha-2-macroglobulin synthesis during inflammation. International Journal of Crude Drug Research. 1985 Jan 1;23(4):177-83.
45. Sastri BN. The Wealth of India: Publication and information directorate. CSIR, Hillside, New Delhi, India. 1962;336.
46. Dhuley JN. Effect of ashwagandha on lipid peroxidation in stress-induced animals. Journal of ethnopharmacology. 1998 Mar 1;60(2):173-8.
47. Sastri BN. The Wealth of India: Publication and information directorate. CSIR, Hillside, New Delhi, India. 1962;336.
48. Mishra LC, Singh BB, Dagenais S. Scientific basis for the therapeutic use of Withania somnifera (ashwagandha): a review. Alternative medicine review. 2000 Aug 1;5(4):334-46.
49. Mehta V, Chander H, Munshi A. Mechanisms of anti-tumor activity of Withania somnifera (Ashwagandha). Nutrition and Cancer. 2021 Jul 3;73(6):914-26.
50. Singh N, Yadav SS, Rao AS, Nandal A, Kumar S, Ganaie SA, Narasihman B. Review on anticancerous therapeutic potential of Withania somnifera (L.) Dunal. Journal of Ethnopharmacology. 2021 Apr 24;270:113704.
51. Vashi R, Patel BM, Goyal RK. Keeping abreast about Ashwagandha in breast cancer. Journal of Ethnopharmacology. 2021 Apr 6;269:113759.
52. Nagy Z, Cheung BB, Tsang W, Tan O, Herath M, Ciampa OC, Shadma F, Carter DR, Marshall GM. Withaferin A activates TRIM16 for its anti-cancer activity in melanoma. Scientific reports. 2020 Nov 12;10(1):19724.
53. Tang Q, Ren L, Liu J, Li W, Zheng X, Wang J, Du G. Withaferin A triggers G2/M arrest and intrinsic apoptosis in glioblastoma cells via ATF4-ATF3-CHOP axis. Cell Proliferation. 2020 Jan;53(1):e12706.
54. Jawarneh S, Talib WH. Combination of ashwagandha water extract and intermittent fasting as a therapy to overcome cisplatin resistance in breast cancer: an in vitro and in vivo study. Frontiers in Nutrition. 2022 Jul 4;9:863619.
55. Azab KS, Maarouf RE, Abdel-Rafei MK, El Bakary NM, Thabet NM. Withania somnifera (Ashwagandha) root extract counteract acute and chronic impact of γ-radiation on liver and spleen of rats. Human & Experimental Toxicology. 2022 May 26;41:09603271221106344.

HOW TO CITE: Yadav Priyanka, Herwade Bhakti, Shedbale Sindhutai, A Comprehensive Review of Commonly Available Anticancer Plants, Int. J. of Pharm. Sci., 2025, Vol 3, Issue 5, 2976-2996. https://doi.org/10.5281/zenodo.15454752