

BP105T INTRODUCTION TO PHARMACOGNOSY

UNIT V — PHYTO-THERAPEUTIC AGENTS

20 Drugs • 11 Categories • Biological Source, Major Constituents and Uses
Adaptogens • Hepatoprotectives • Cardiovascular • Antidiabetics • Anti-inflammatory • CNS
Antimicrobial • Gastrointestinal • Dermatological • Women's Health • Respiratory

B.Pharm — Semester I

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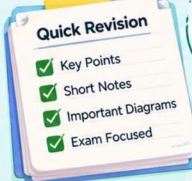
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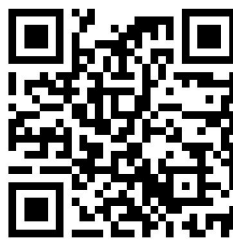
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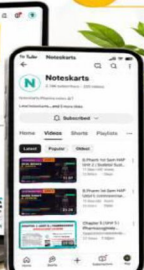
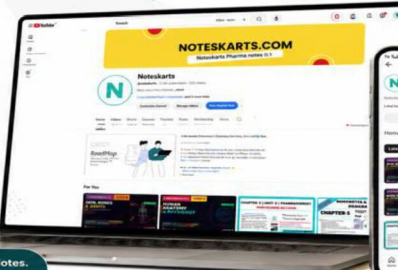
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Introduction to Phyto-Therapeutic Agents

A **phyto-therapeutic agent** is a **medicinal substance obtained from plants** and used for a specific therapeutic purpose.

For each agent, three important points are studied:

- **Biological source** – The plant from which it is obtained.
- **Major constituents** – The important chemical compounds present.
- **Uses** – Its main **medicinal and therapeutic applications**.



Figure 1 — The eleven therapeutic categories of phyto-therapeutic agents covered in this unit.

1. Adaptogens and Immunomodulators

- **Adaptogens** help the body resist physical, chemical, and biological stress non-specifically, without disturbing normal physiological function; **immunomodulators** adjust (usually enhance) immune system activity.

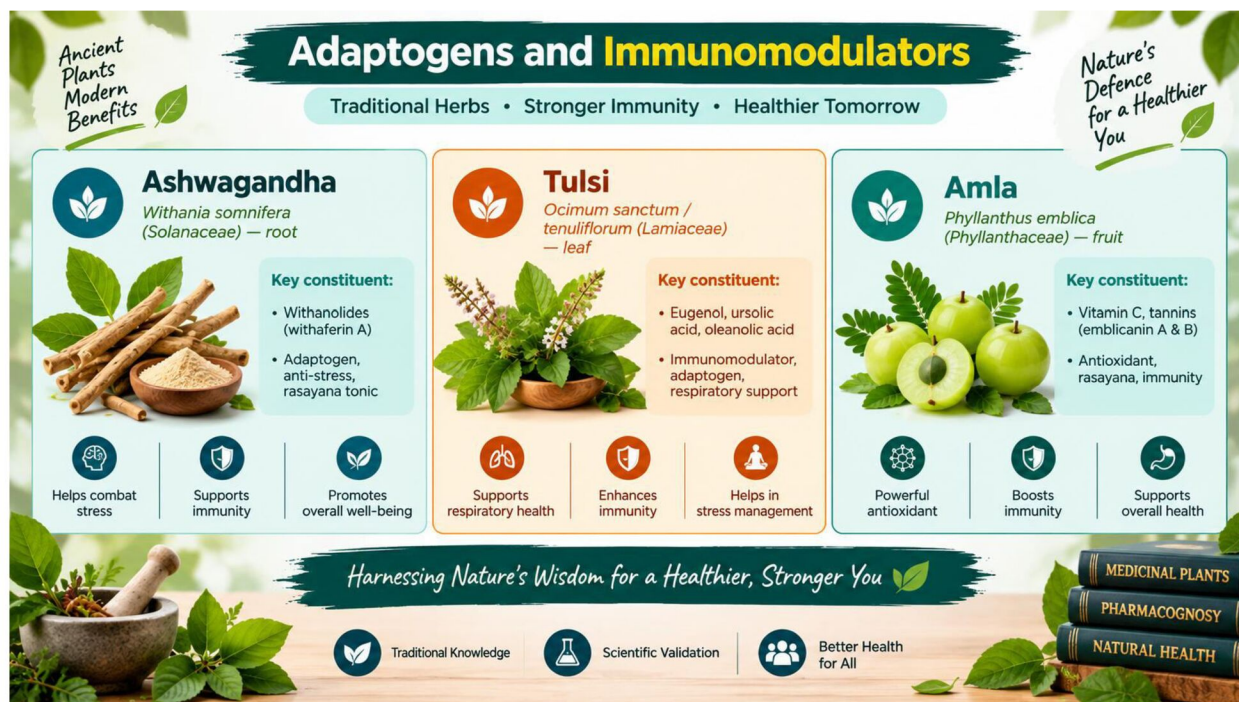


Figure 1.1 — Ashwagandha, Tulsi, and Amla — biological source, key constituent, and use.

1.1 Ashwagandha

- **Biological Source:** Dried roots (sometimes leaves) of *Withania somnifera*.
- **Family:** Solanaceae
- **Other Names:** Indian ginseng, Winter cherry

Major Constituents

- **Withanolides** – steroidal lactones
 - **Withaferin-A**
 - **Withanolide-D**
- **Alkaloids:** Isopelletierine, Anaferine
- **Saponins:** Sitoindosides

Uses

- **Rasayana:** Rejuvenating Ayurvedic tonic
- **Adaptogen:** Helps the body manage stress
- May support sleep and reduce anxiety
- Studied for anti-inflammatory and antioxidant effects

- **Withaferin-A** has also been studied for potential anticancer activity

Safety

- Use caution during pregnancy
- Caution in hyperthyroidism
- May increase the effects of sedative medicines

1.2 Tulsi (Holy Basil)

1.2 Tulsi (Holy Basil)

- **Biological Source:** Leaves of *Ocimum sanctum* (syn. *Ocimum tenuiflorum*)
- **Family:** Lamiaceae

Major Constituents

- **Volatile oil:** Rich in Eugenol
- **Triterpenoids:** Ursolic acid, Oleanolic acid
- **Flavonoids**

Uses

- Acts as an immunomodulator and adaptogen
- Provides respiratory support in cough and cold
- Traditionally used for mild asthma
- Used in Ayurveda as a daily tonic herb
- Considered a sacred plant in Hindu tradition

Safety

- Generally well tolerated
- High, prolonged doses may have a mild antiplatelet effect.

1.3 Amla (Indian Gooseberry)

- **Biological Source:** Fruit of *Phyllanthus emblica* (syn. *Emblica officinalis*)
- **Family:** Phyllanthaceae

Major Constituents

- **Vitamin C** – present in high amounts
- **Hydrolysable tannins:** Emblicanin A and B
- **Gallic acid**

Uses

- Acts as a **potent antioxidant**
- Used as a classical **Rasayana** in Ayurveda
- Major ingredient of **Chyawanprash**
- Traditionally used to support **immunity**
- Helps support **digestion**
- Traditionally associated with **hair and skin health**

Safety

- Generally **well tolerated** as a food
- Large doses may occasionally cause **mild gastrointestinal upset**.

2. Hepatoprotectives

Hepatoprotective drugs protect liver cells from chemical or biological damage, or support liver regeneration after injury.

2.1 Milk Thistle

- **Biological Source:** Fruits (achenes) of *Silybum marianum*
- **Family:** Asteraceae

Major Constituents

- **Silymarin** – mixture of flavonolignans
 - **Silybin (Silibinin)** – principal and most active component
 - **Silychristin**
 - **Silydianin**

Uses

- **Mainly used as a hepatoprotective**
- **Traditionally/studied for liver conditions such as:**
 - **Alcohol-related liver disease**

- **Drug-induced liver injury**
- **Viral hepatitis**
- *Amanita* mushroom poisoning
- **Provides antioxidant effects**
- **Helps stabilise hepatocyte cell membranes**
- **Also studied for possible galactagogue activity**

Safety

- **Generally well tolerated**
- **Rare allergic reactions may occur in people sensitive to the Asteraceae (daisy) family**

2.2 Kutki

- **Biological Source:** Dried **rhizome and root** of *Picrorhiza kurroa*
- **Family:** **Plantaginaceae**

Major Constituents

- **Iridoid glycosides:**
 - **Picroside I**
 - **Picroside II**
- Together known as **Kutkin / Picroliv**

Uses

- Mainly used as a **hepatoprotective**
- Also shows:
 - **Antioxidant** activity
 - **Anti-inflammatory** activity
 - **Immunomodulatory** activity
- It is an **endangered Himalayan medicinal plant**, so **sustainable sourcing** is important.

Safety & Sourcing

- **High doses** may have a **purgative effect**
- **Cultivated material** is preferred over wild-collected material to support **conservation and sustainable sourcing**.

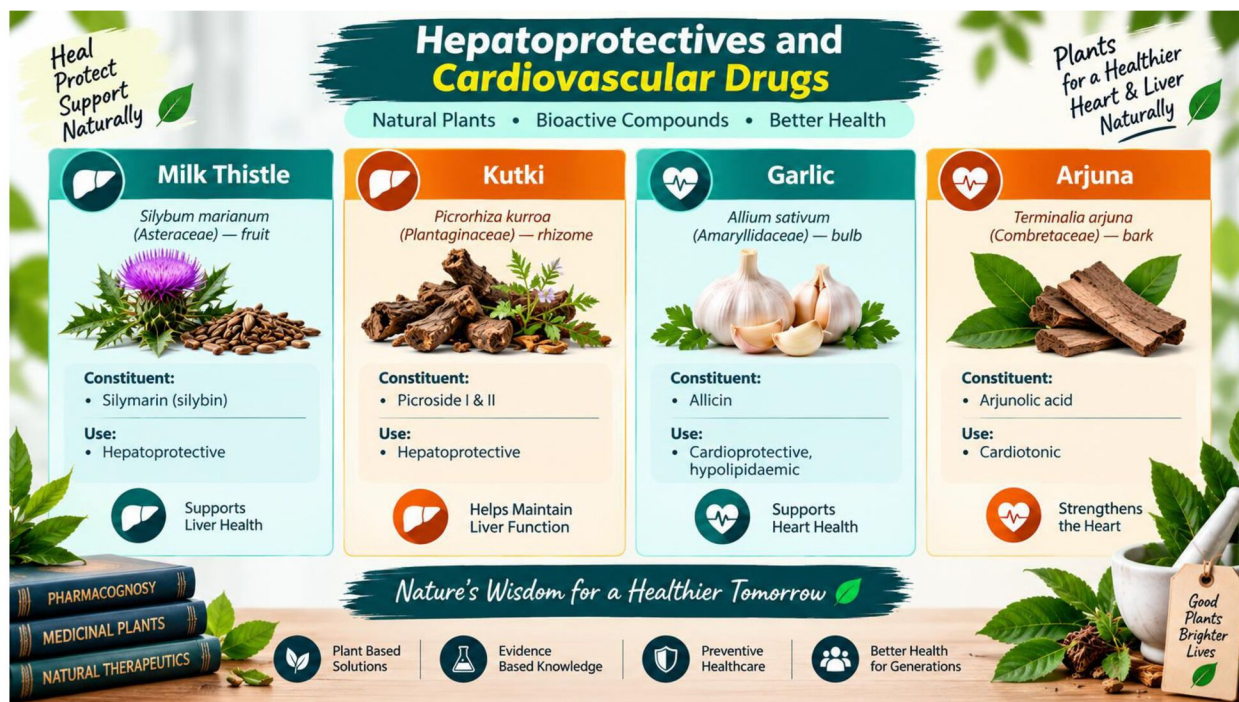


Figure 2.1 — Milk thistle, Kutki, Garlic, and Arjuna — biological source, key constituent, and use.

3. Cardiovascular Drugs

This category covers phyto-therapeutic agents used to support heart function or manage cardiovascular risk factors.

3.1 Garlic

- **Biological Source:** Bulb of *Allium sativum*
- **Family:** Amaryllidaceae (*Alliaceae* in older classifications)

Major Constituents

- **Alliin** – odourless precursor present in intact garlic
- **Allicin** – formed when garlic is crushed
 - Produced by the enzyme **alliinase**
- Other organosulfur compounds:
 - **Ajoene**
 - **Diallyl disulfide**

Uses

- **Hypolipidaemic:** May modestly lower **LDL cholesterol**
- **Mild antihypertensive** effect
- **Antiplatelet:** May reduce platelet aggregation
- **Antimicrobial** activity
- **Important point:** Allicin is **not present in ready-formed form** in intact garlic; it is produced when the tissue is damaged or crushed.

Safety

- May **increase bleeding risk** with anticoagulant or antiplatelet medicines
- Use caution **before surgery**

3.2 Arjuna

- **Biological Source:** Stem bark of *Terminalia arjuna*
- **Family:** Combretaceae
- Traditionally used in Ayurveda as a **cardiac tonic**

Major Constituents

- **Triterpenoid saponins:**
 - Arjunolic acid
 - Arjunic acid
- **Flavonoids**
- **Tannins**
- **Coenzyme Q10**

Uses

- **Cardiotonic:** Supports cardiac muscle function
- Traditionally used for **angina** and **mild heart failure**
- Also studied for:
 - **Antihypertensive** activity
 - **Hypolipidaemic** activity
 - **Antioxidant** activity

Safety

- Generally **well tolerated**
- May have an **additive effect** when combined with cardiac or antihypertensive medicines.

4. Antidiabetics

Plant-derived **antidiabetic drugs** help control blood glucose through different mechanisms:

4.1 Gymnema

- **Biological Source:** Leaves of *Gymnema sylvestre*
- **Family:** Apocynaceae (*Asclepiadaceae* in older classifications)
- **Common Name:** Gurmar – “sugar destroyer”

Major Constituents

- **Gymnemic acids** – oleanane-type triterpenoid saponins
- **Gymnemasaponins**

Uses

- Mainly used as an **antidiabetic herb**
- May help reduce **blood glucose** and **HbA1c**
- May support **pancreatic β -cell function**
- **Key feature:** Chewing the leaves can temporarily **reduce or abolish the taste of sweetness**.

Safety

- May enhance the effect of **insulin and other hypoglycaemic medicines**
- **Blood glucose monitoring** is advised when used with antidiabetic drugs.

4.2 Fenugreek

- **Biological source:** seeds of **Trigonella foenum-graecum**, family **Fabaceae**.
- **Major constituents:** the alkaloid **trigonelline**; the unusual amino acid **4-hydroxyisoleucine**; steroidal saponins; a high proportion of mucilage/galactomannan fibre.
- **Uses:** antidiabetic (4-hydroxyisoleucine enhances glucose-dependent insulin secretion); hypolipidaemic; also traditionally used as a galactagogue and digestive aid; the mucilage content also slows gastric emptying and carbohydrate absorption.
- **Safety note:** may potentiate hypoglycaemic drugs; a harmless maple-syrup-like body odour is a common, well-recognised effect.

Antidiabetics and Anti-inflammatory / Analgesic Drugs
Nature's Compounds • Scientific Evidence • Better Health

Plants Relieve Pain, Reduce Inflammation, Improve Lives *Traditional Knowledge, Modern Healing*

Operculina	Paregoric	Turmeric	Boswellia
 <i>Operculina turpethum</i> (Convolvulaceae) — root	 <i>Papaver somniferum</i> (Papaveraceae) — latex	 <i>Curcuma longa</i> (Zingiberaceae) — rhizome	 <i>Boswellia serrata</i> (Burseraceae) — oleo-gum resin
Constituent Turpethin and related resin glycosides	Constituent Morphine and related opioid alkaloids	Constituent Curcumin	Constituent Boswellic acids (especially AKBA)
Pharmacological action Hypoglycaemic (antidiabetic)	Pharmacological action Potent analgesic, antitussive, and antidiarrhoeal	Pharmacological action Anti-inflammatory, antioxidant	Pharmacological action Anti-inflammatory (5-lipoxygenase inhibition)
Uses Traditional use in diabetes; helps in lowering blood glucose levels.	Uses Traditionally used for relief in diarrhoea, cough and pain.	Uses Used in inflammatory conditions like arthritis and other painful disorders.	Uses Useful in osteoarthritis, rheumatoid arthritis and other inflammatory conditions.

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From Plants To Better Health

Figure 4.1 — Gymnema, Fenugreek, Turmeric, and Boswellia — biological source, key constituent, and use.

5. Anti-Inflammatory and Analgesic Drugs

These plant-derived drugs are mainly used to **reduce inflammation and pain** through different mechanisms.

5.1 Turmeric

- **Biological Source:** Rhizome of *Curcuma longa*
- **Family:** Zingiberaceae

Major Constituents

- **Curcumin** – principal active constituent
- Other curcuminoids:
 - **Demethoxycurcumin**
 - **Bisdemethoxycurcumin**
- **Volatile oil:** Turmerone

Uses

- **Anti-inflammatory:** Acts on multiple inflammatory pathways, including **NF-κB**
- **Antioxidant**
- Supports **wound healing**
- Widely used in **Ayurveda**
- Commonly used as a **spice and natural colourant**
- Curcumin is extensively studied for potential **anti-inflammatory and anticancer** effects
- **Important point:** Curcumin has **poor oral bioavailability**, which limits its clinical usefulness.

Safety

- High supplemental doses may **increase bleeding risk**
- Use caution **before surgery**
- Avoid or use cautiously in **gallstone disease**

5.2 Boswellia

- **Biological Source:** Oleo-gum-resin of *Boswellia serrata*
- **Family:** Burseraceae
- **Other Names:** Indian frankincense, Salai guggul

Major Constituents

- **Boswellic acids** – pentacyclic triterpenoid acids
- **AKBA** (*3-O-acetyl-11-keto-β-boswellic acid*) – an important active constituent

Uses

- **Anti-inflammatory**
- Inhibits **5-lipoxygenase (5-LOX)** through a non-redox mechanism
- Reduces **leukotriene synthesis**
- Used/studied in:
 - **Osteoarthritis**
 - **Rheumatoid arthritis**
 - **Inflammatory bowel disease**

Key Point

Boswellia acts differently from NSAIDs: it primarily inhibits the **5-LOX pathway**, whereas NSAIDs mainly inhibit **cyclooxygenase (COX)** enzymes.

Safety

- Generally **well tolerated**
- High doses may occasionally cause **mild gastrointestinal upset**.

6. CNS Drugs

Plant-derived **CNS drugs** are used to support **memory, cognition, relaxation, and nervous system function**.

6.1 Brahmi

- **Biological Source:** Whole plant of *Bacopa monnieri*
- **Family:** **Plantaginaceae** (*Scrophulariaceae* in older classifications)
- **Common Name:** Brahmi

Major Constituents

- **Bacoside A**
- **Bacoside B**
- Both are **triterpenoid saponins**

Uses

- **Nootropic:** Supports memory and cognitive function
- **Medhya Rasayana:** Traditionally used to promote **mental performance**
- May improve:
 - **Memory acquisition**
 - **Verbal learning**
 - **Delayed recall**
- Used as an **anxiolytic** and **nerve tonic**
- Also studied for **antiepileptic** and **antioxidant** effects

Safety

- May occasionally cause **mild gastrointestinal upset**
- **Correct species identification** is important for consistent therapeutic effects.

	Bacopa monnieri (“Jala-Brahmi”)	Centella asiatica (“Mandukaparni”)
Family	Plantaginaceae	Apiaceae
Key constituents	Bacosides A & B	Asiaticoside, madecassoside

	Bacopa monnieri ("Jala-Brahmi")	Centella asiatica ("Mandukaparni")
Main traditional use	Memory, epilepsy, insanity	General rejuvenative, skin healing

7. Antimicrobial and Antiviral Drugs

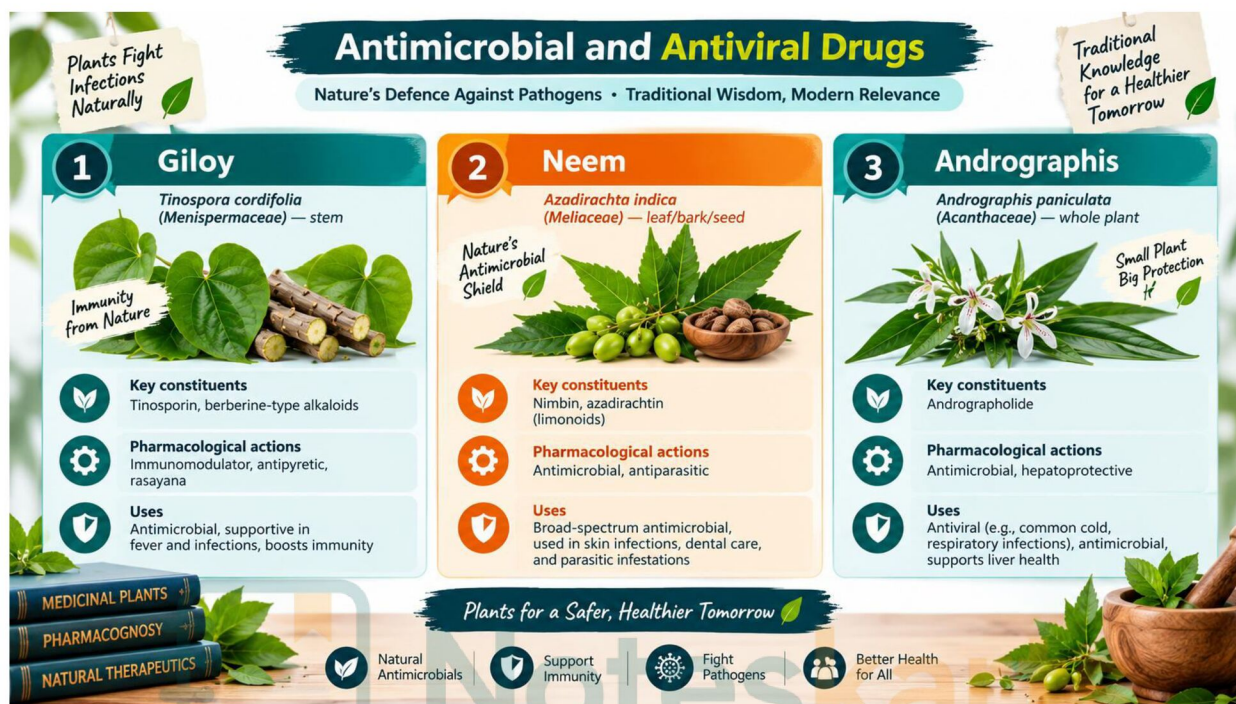


Figure 7.1 — Giloy, Neem, and Andrographis — biological source, key constituent, and use.

7.1 Giloy

- **Biological Source:** Stem of *Tinospora cordifolia*
- **Family:** Menispermaceae
- **Other Names:** Guduchi
- Considered an important **Ayurvedic Rasayana**

Major Constituents

- **Alkaloids** and berberine-related bases
- **Diterpenoid lactones:** Tinosporide, Tinosporin
- **Glycosides:** Giloin
- **Polysaccharides**

Uses

- **Immunomodulator**
- **Antipyretic:** Traditionally used for **fever**
- Used as a **general tonic** during fever and convalescence
- Studied for **hepatoprotective** and **antioxidant** effects
- Also investigated as an adjunct in **COVID-19-related research**

Safety

- Its **immunostimulant effect** may be a concern in **autoimmune conditions**
- Use caution with **immunosuppressant medicines**

7.2 Neem

- **Biological Source:** Leaves, bark, and seeds of *Azadirachta indica*
- **Family:** Meliaceae
- Neem is also associated with a well-known **biopiracy/patent dispute**.

Major Constituents

- **Limonoids**
 - **Nimbin**
 - **Azadirachtin** – especially abundant in seeds
- **Azadirachtin** is responsible for strong **insecticidal and antifeedant** activity.

Uses

- **Antimicrobial**
- **Antiparasitic**
- Traditionally used for:
 - **Skin conditions**
 - **Dental hygiene**
 - Neem twigs as a traditional **toothbrush**
- Used as a **natural insect repellent**
- **Azadirachtin-based preparations** are used as **biopesticides**

Safety

- Avoid internal use during **pregnancy**
- **Neem seed oil can be toxic if swallowed**, particularly in **infants and young children**.

7.3 Andrographis

- **Biological Source:** Whole plant, mainly leaves, of *Andrographis paniculata*
- **Family:** Acanthaceae
- **Common Name:** King of Bitters

Major Constituent

- **Andrographolide** – principal bioactive **diterpenoid lactone**

Uses

- **Antimicrobial** and **antiviral**
- Studied for **respiratory infections**, including the common cold
- Also investigated in **COVID-19-related research**
- **Hepatoprotective**
- **Anti-inflammatory**

- Extremely **bitter in taste**, giving rise to the name “King of Bitters”

Safety

- Very high doses may cause **gastrointestinal upset**
- Use caution when combined with **antihypertensive** or **antiplatelet medicines**.

8. Gastrointestinal Drugs

Plant-derived gastrointestinal drugs are mainly used to **improve bowel function, regulate stool consistency, and support digestive health**.

8.1 Psyllium

- Biological Source:** Seed husk (**epidermis**) of *Plantago ovata*
- Family:** Plantaginaceae
- Other Name:** Isabgol

Major Constituent

- Mucilage** – a highly water-absorbing **polysaccharide**
- Mainly concentrated in the **seed coat**

Uses

- Bulk-forming laxative**
 - Absorbs water and **swells greatly**
 - Increases **stool bulk and softness**
 - Helps relieve **constipation**
- May help manage **mild diarrhoea** by absorbing excess water
- At higher doses, may help **modestly reduce LDL cholesterol**

Key Pharmacognosy Point

- Psyllium's swelling property can be demonstrated by the **Swelling Index test**.
- More water absorption** → **greater swelling** → **increased stool bulk**.

Safety

- Must always be taken with **adequate water**
- Taking it with insufficient water may cause **oesophageal or intestinal obstruction**.

9. Dermatological Agents

Plant-derived dermatological drugs are mainly used for **skin protection, soothing, moisturising, and wound healing**.

9.1 Aloe

- **Biological Source:** Mucilaginous **gel** from the leaf parenchyma of *Aloe barbadensis* (syn. *Aloe vera*)
- **Family:** **Asphodelaceae** (*Liliaceae* in older classifications)

Major Constituents

Aloe Gel:

- **Polysaccharides**, mainly **acemannan**
- **High water content**

Aloe Latex/Exudate:

- **Anthraquinone glycosides**
 - **Aloin (Barbaloin)**
 - **Aloe-emodin**

Uses

Gel:

- Used topically for **burns and wounds**
- **Soothing** and **moisturising**
- Supports **mild wound healing**
- Used in various **skin conditions**

Latex/Exudate:

- Acts as a **stimulant laxative**
- Its anthraquinone mechanism is similar to **senna**

Imp Pharmacognosy Point

One plant → two different drugs:

Aloe gel → Dermatological use

Aloe latex → Stimulant laxative

The **plant part used** therefore determines the drug's **constituents and pharmacological action**.

Safety

- Long-term or high-dose use of **aloe latex/aloin** may cause **electrolyte imbalance**
- **Latex fraction should be avoided during pregnancy.**

10. Drugs Used in Women's Health

These plant-derived drugs are traditionally used for **menstrual health, reproductive support, and lactation**.

10.1 Chasteberry

- **Biological Source:** Dried ripe fruits of *Vitex agnus-castus*
- **Family:** **Lamiaceae** (*Verbenaceae* in older classifications)
- **Other Names:** Chaste tree, Monk's pepper

Major Constituents

- **Casticin** – important marker compound used for standardisation
- **Diterpenoids**
- **Essential oil**

Uses

- Used for **Premenstrual Syndrome (PMS)**
- Helps manage **cyclical breast pain (mastalgia)**
- Used for **menstrual irregularities**
- May act partly through a **dopaminergic effect**, which can reduce **prolactin secretion**

Safety

- Generally **not recommended during pregnancy**
- Use caution with **hormonal medicines or contraceptives**
- Professional advice is recommended when combining it with hormonal therapy.

10.2 Shatavari

- **Biological Source:** Tuberous roots of *Asparagus racemosus*
- **Family:** **Asparagaceae** (*Liliaceae* in older classifications)

Major Constituents

- **Steroidal saponins** called **Shatavarins**
 - Shatavarin I
 - Shatavarin II
 - Shatavarin III
 - Shatavarin IV

Uses

- Classical Ayurvedic **Rasayana** for the **female reproductive system**
- **Galactagogue:** Traditionally used to promote **lactation**
- Used as a **reproductive tonic**
- Used as an **adaptogen**
- Also studied for **antioxidant** and mild **oestrogenic** activity

Safety

- Generally **well tolerated**
- Use caution in **oestrogen-sensitive conditions** because of its potential mild oestrogenic activity.

11. Respiratory Drugs

11.1 Vasaka

- **Biological source:** leaves (and sometimes root) of **Adhatoda vasica** (syn. *Justicia adhatoda*), family **Acanthaceae**; also called Malabar nut.
- **Major constituents:** quinazoline alkaloids **vasicine** and **vasicinone**, along with related minor alkaloids (vasicinolone, vasicol).
- **Uses:** bronchodilator and expectorant — used for cough, cold, bronchitis, and asthma; vasicine is the structural basis for the semi-synthetic drug **bromhexine** (and its active metabolite ambroxol), both still widely used mucolytic/expectorant allopathic drugs — a clear example of the Unit I theme of natural leads giving rise to modern semi-synthetic medicines.
- **Safety note:** high doses may cause mild gastrointestinal upset; a long history of traditional and clinical use supports its overall safety profile at normal doses.

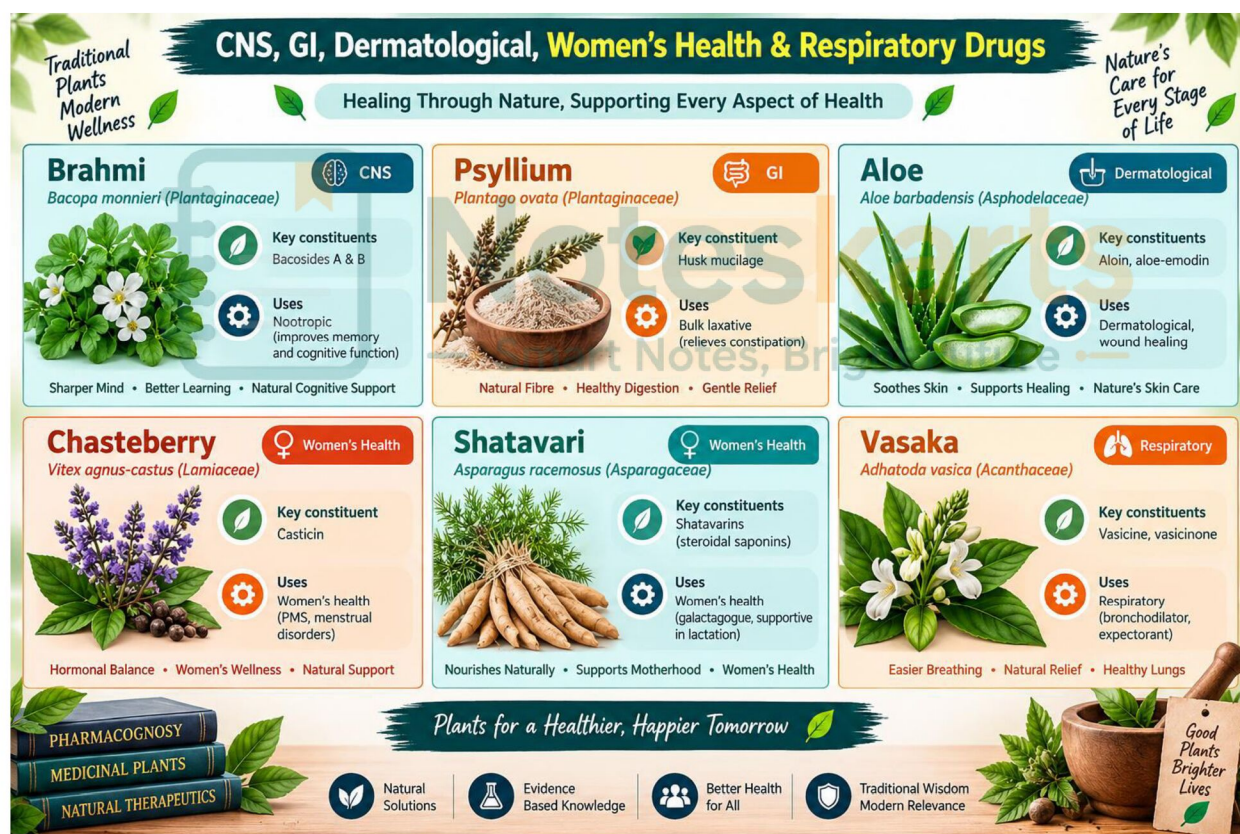


Figure 11.1 — Brahmi, Psyllium, Aloe, Chasteberry, Shatavari, and Vasaka — biological source, key constituent, and use.

Master Summary Table — All 20 Phyto-Therapeutic Agents

A single consolidated reference across every drug covered in this unit — useful for a final revision pass before moving on to detailed pharmacological study in later semesters.

Drug	Botanical source (Family)	Part used	Key constituent	Main use
Ashwagandha	Withania somnifera (Solanaceae)	Root	Withanolides	Adaptogen
Tulsi	Ocimum sanctum (Lamiaceae)	Leaf	Eugenol	Immunomodulator
Amla	Phyllanthus emblica (Phyllanthaceae)	Fruit	Vitamin C, emblicanins	Antioxidant
Milk thistle	Silybum marianum (Asteraceae)	Fruit	Silymarin	Hepatoprotective
Kutki	Picrorhiza kurroa (Plantaginaceae)	Rhizome/root	Picroside I & II	Hepatoprotective
Garlic	Allium sativum (Amaryllidaceae)	Bulb	Allicin	Cardioprotective
Arjuna	Terminalia arjuna (Combretaceae)	Bark	Arjunolic acid	Cardiotonic
Gymnema	Gymnema sylvestre (Apocynaceae)	Leaf	Gymnemic acids	Antidiabetic
Fenugreek	Trigonella foenum-graecum (Fabaceae)	Seed	Trigonelline, 4-OH-isoleucine	Antidiabetic
Turmeric	Curcuma longa (Zingiberaceae)	Rhizome	Curcumin	Anti-inflammatory
Boswellia	Boswellia serrata (Burseraceae)	Gum resin	Boswellic acids (AKBA)	Anti-inflammatory
Brahmi	Bacopa monnieri (Plantaginaceae)	Whole plant	Bacosides A & B	Nootropic (CNS)
Giloy	Tinospora cordifolia (Menispermaceae)	Stem	Tinosporin, alkaloids	Immunomodulator
Neem	Azadirachta indica (Meliaceae)	Leaf/bark/seed	Nimbin, azadirachtin	Antimicrobial
Andrographis	Andrographis paniculata (Acanthaceae)	Whole plant	Andrographolide	Antimicrobial
Psyllium	Plantago ovata (Plantaginaceae)	Seed husk	Mucilage	Bulk laxative
Aloe	Aloe barbadensis (Asphodelaceae)	Leaf gel/exudate	Aloin, acemannan	Dermatological/laxative

Drug	Botanical source (Family)	Part used	Key constituent	Main use
Chasteberry	Vitex agnus-castus (Lamiaceae)	Fruit	Casticin	Women's health (PMS)
Shatavari	Asparagus racemosus (Asparagaceae)	Root	Shatavarins	Women's health (galactagogue)
Vasaka	Adhatoda vasica (Acanthaceae)	Leaf	Vasicine, vasicinone	Respiratory (bronchodilator)



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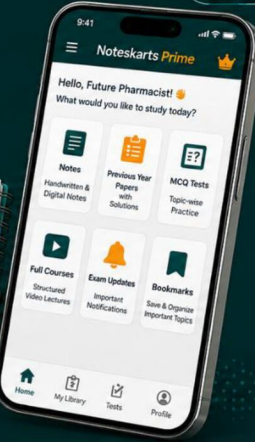


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