



Saponins: Part-3

Course Code: 0521511

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Learning Outcomes

At the end of the lecture students will be able to

- ❖ **Outline botanical name, family name, chemical constituents, medicinal uses, side effects , herb-drug interactions of**
 - ❖ **Glycyrrhiza (Licorice)**
 - ❖ **Quillaja**
 - ❖ **Centella**

GLYCYRRHIZA (LICORICE)

- The **genus Glycyrrhiza** consists of about 30 species
- Herbaceous **perennial** plant (lives >2 yrs), grows to 1 metre in height
- Native to Asia, Europe, North and South America, and Australia
 - *Glycyrrhiza glabra*
 - *Glycyrrhiza uralensis*
 - *Glycyrrhiza inflata*
- **Family:** Fabaceae
- Licorice root has distinctive **sweet taste** (due to glycyrrhizic acid)
- Named as “**Sweet Root**” by Greek physicist Pedanius Dioscorides
- Glycyrrhiza spp. are named after the Greek words
 - “**glycys**” means **sweet**
 - “**rhize**” means **roots**



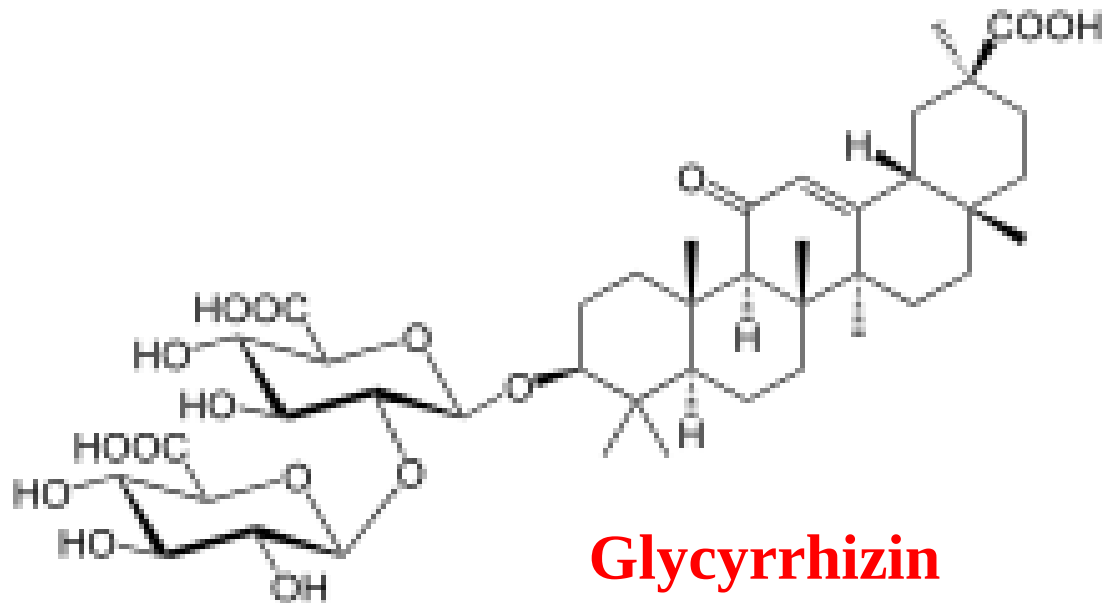
Licorice plant



Licorice root

Constituents of Glycyrrhiza

- Various **polyphenols** and **saponins** are reported to be responsible for the pharmacological activity of licorice.
- **Glycyrrhizin** (**oleanane triterpenoid saponins**) is the **major** secondary metabolite in licorice
- **Glycyrrhizin** on hydrolysis yields
 - **18 β -glycyrrhetinic** or glycyrrhetic acid (**derived from β -amyrin**)
 - 2 molecules of **glucuronic acid**.
- **Yellow color** of licorice root is due to **flavonoid** and **coumarin** glycoside constituents



Uses of Licorice

1. Glycyrrhiza is used in food and beverage industry, cosmetic products, as well as to flavor cigarettes
2. **Demulcent** in the treatment of sore throats, **expectorant** for cough.
3. Treatment of **inflammatory conditions** and **rheumatoid arthritis**
4. **Addison's disease** (**is a rare, chronic endocrine system disorder in which the adrenal glands do not produce sufficient steroid hormones (glucocorticoids and mineralocorticoids)**)
5. Prophylaxis and treatment of **peptic ulcer** and **dyspepsia**.
6. Recently, it has shown **antiviral** and **anti-tumor** effect in mice.
7. Treatment of liver diseases and **liver protection**.

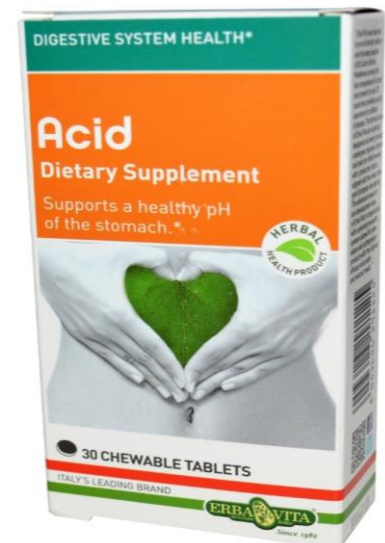
Mechanism of Actions

Anti-inflammatory Action

- Glycyrrhizin is metabolized to glycyrrhetinic acid
- Glycyrrhetinic acid inhibits **11- β -hydroxysteroid dehydrogenases** involved in the metabolism of **corticosteroids**.
 - Causes **hypermineralocorticoidism** with sodium retention and potassium loss, edema, increased blood pressure
- Glycyrrhizin **inhibits reactive oxygen species (ROS)** generation by neutrophils which are potent mediator of tissue inflammation
- Also found to inhibit **phospholipase A₂**

Side Effects and Cautions

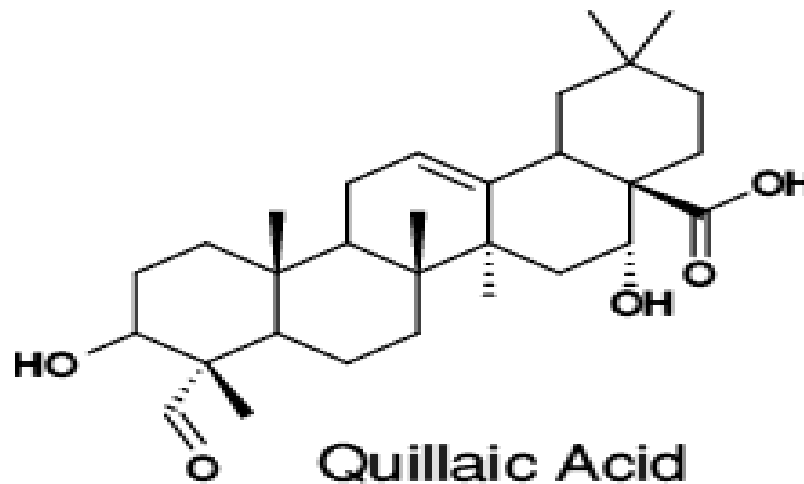
- In large amount, licorice might cause
 - Hypertension, water retention, hypokalemia
 - Avoid licorice extracts for patients with heart disease
 - **Alteration of enzyme activities of P450 isoforms**
 - **Modulation of P-glycoprotein (drug transporter protein)**
 - Leads to potential **herb-drug interactions** of licorice



QUILLAJA BARK (Soapbark tree)



- It is the dried inner **bark** of *Quillaja saponaria* and other species of Quillaia/Quillaja.
- Family: **Quillajaceae**
- **Quillaic acid** is the major aglycone of the widely studied saponins
- Other constituents include tannins, polyphenols, and calcium oxalate



Uses of Soapbark

- Soapbark is famous for the medicinal and commercial use
- **Inner bark** is abundant source of saponins (**quillaia** saponin).
- The inner bark is dried, powdered, and used as an emulsifier and foaming agent in cosmetics, shampoos, cream, beer, soft drinks, and even fire extinguishers.
- In foods, quillaia is used in frozen dairy desserts, candy, baked goods, gelatins, and puddings.
- Soapbark saponins are **poisonous when consumed at greater concentrations** than the amount added to commercial products.

Uses of Soapbark

- Despite safety concerns, people take quillaia for **cough, bronchitis,** and **other breathing problems.**
- Quillaia extract is **applied directly to the skin** to treat **skin sores, athlete's foot,** and **itchy scalp.**
- Used in **shampoos for dandruff**
- Used in **hair tonic preparations** for thinning hair.
- Used as **adjuvant** in **veterinary vaccines**
- In South America, quillaia bark is used to wash clothes.

QUILLAIA Side Effects & Safety

- Quillaia contains high amounts of **tannins** which can cause **stomach and intestinal disturbances**.
 - Don't use in stomach or intestinal disorder.
- It can also irritate and damage the lining of the mouth and throat.
- Quillaia also contains chemicals called **oxalates** that **can lower blood calcium levels** and **cause kidney stones**.
- Quillaia use can also cause diarrhea, serious breathing problems, convulsions, coma, red blood cell destruction, liver and kidney failure.
- **Pregnancy and breast-feeding:** Quillaia might be **UNSAFE** for both mother and infant. Avoid use.

QUILLAIA - DRUG Interactions

- Medications taken by mouth (Oral drugs) interacts with QUILLAIA
- **Tannins** (present in Quillaia) can **adsorb substances in the stomach and intestines**
 - ❑ Decrease the absorption and effectiveness of oral medications.
- **Take quillaia at least one hour after oral medications.**
- **Example:** Taking quillaia along with metformin (orally) **decreases the absorption and effectiveness of metformin for lowering blood sugar.**

CENTELLA (Gotu Kola)

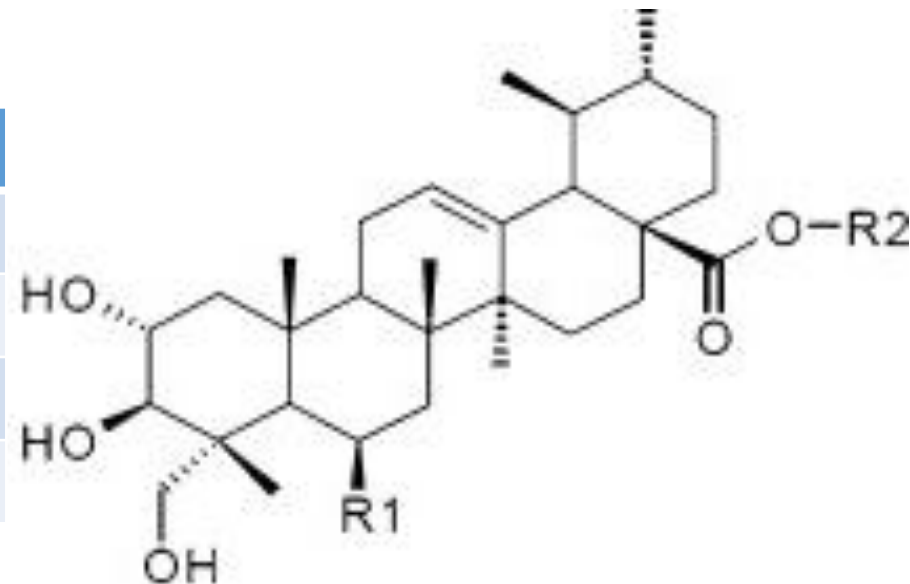
- ❖ The **aerial parts** of *Centella asiatica*
- ❖ **Family:** Umbelliferae or **Apiaceae**
- ❖ Grows in tropical swampy areas and wetlands in Asia.
 - ❖ It is found in India, Pakistan and Africa.



Chemical Constituents of Centella

- ❖ Contains **triterpenoid saponins** –
 - ❖ **Asiaticoside** (aglycone - **asiatic acid**)
 - ❖ **Madecassoside** (aglycone - **madasiatic acid**)
- ❖ Also contains small amounts of **volatile oil** (chiefly **α -humulene**)
- ❖ Responsible for **antibacterial activity**.
- ❖ In addition, it contains **flavonoids** like **quercetin**, and **phytosterols**.

Name	R1	R2
Asiatic acid	H	H
Madecassic acid	OH	H
Asiaticoside	H	Glu-Glu-Rha
Madecassoside	OH	Glu-Glu-Rha

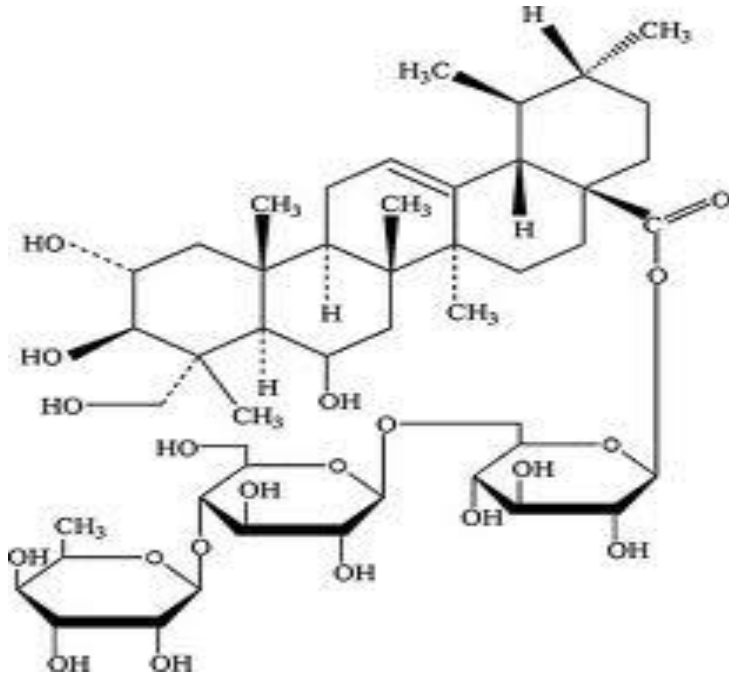


Uses of Centella

1. **Anti-rheumatic** and lowers back pain.
2. Dermatological agent for **wound-healing** and cosmetic preparations.
3. Asiatic and madecassic acids and asiaticoside and madecassoside **stimulate and regulate the production of collagen, essential for wound healing.**
4. Facilitate the **regeneration of axons of the nerves** that border the wound.
5. Aqueous extract (infusion) of leaves can **increase cognitive abilities**, learning, memory while **alleviating anxiety.**
6. It protects the stomach wall (**ulcer**) **by increasing the secretion of mucus.**
7. Peripheral vasodilator.



Centella سرة الأرض



Asiaticoside (Centelloside)



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