

Ethnobotany. Lecture 31

Alexey Shipunov

Minot State University

April 20, 2015



Outline

Pharmacognosy

- Plant remedies for respiratory system

- Plant remedies for nervous system; stimulants



Pharmacognosy

Plant remedies for respiratory system



Ipecac, *Cephaelis* (Psychotria) spp., Rubiaceae, Central America

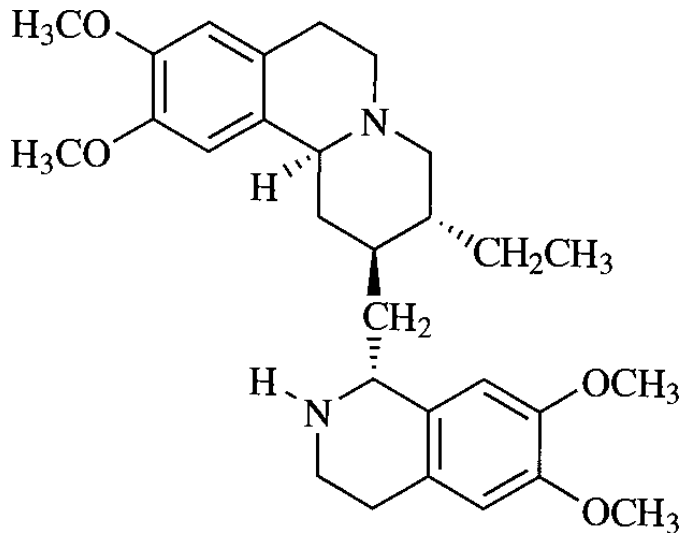
- ▶ *Ipecacuanhae radix*
- ▶ loquinoline alkaloids as emetine
- ▶ Has both mucolytic and emetic effects (frequently used as anti-toxic)



Ipecac



Emetine



Cough

- ▶ Normally a symptom of other diseases
- ▶ Suppression of brain nervous centers will reduce the cough

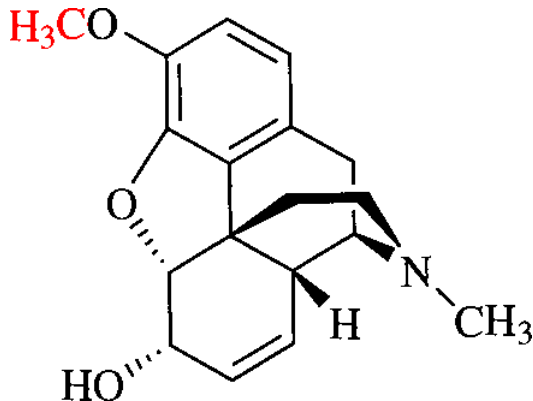


Opium poppy, *Papaver somniferum*, Papaveraceae, Asia

- ▶ Contain alkaloids codeine and morphine
- ▶ Codeine is toxic in large doses because of respiratory depression effect
- ▶ Morphine causes strong addiction and painful withdrawal syndrome
- ▶ Opioids mimic endogenous opioids: endorphins, enkephalins, dynorphins neurotransmitters



Codeine and morphine



Pharmacognosy

Plant remedies for nervous system; stimulants

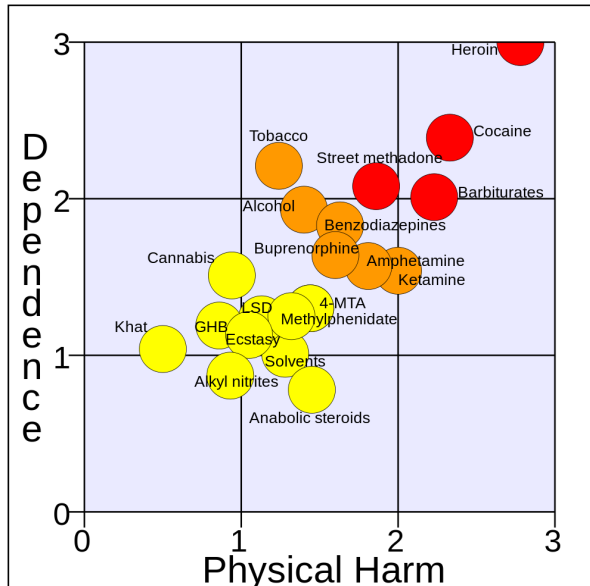


Stimulants and narcotics

- ▶ Most of them substitute natural synaptic neurotransmitters
- ▶ Withdrawal syndrome is due to flexibility of our biosynthesis



From Nutt et al. (2007) in "Lancet"



Cannabis, *Cannabis sativa*, Cannabaceae, South Asia

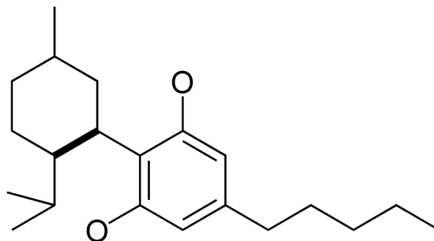
- ▶ Annual or perennial herb
- ▶ Leaves contain unique family of terpeno-phenolic compounds called cannabinoids (some psychoactive like THC, tetrahydrocannabinol; some are not like CBD, cannabidiols)
- ▶ THC is known to activate protein-coupled cannabinoid receptors 1 and 2 (CB₁, CB₂)
- ▶ Cannabinoids mimic endocannabinoids which acts as retro-neurotransmitters which go backward in synapse and terminate release of “normal” neurotransmitters



Cannabis



CBD, cannabidiol



Coca, *Erythroxylon coca*, Erythroxylaceae, South America



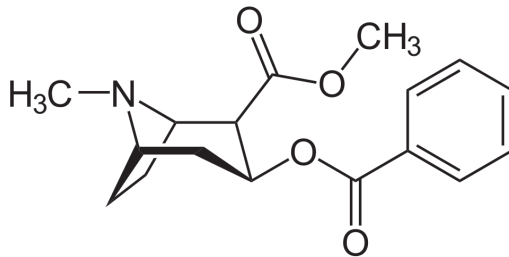
- ▶ Andean evergreen shrub
- ▶ Contains cocaine, anesthetic and strong stimulant narcotic
- ▶ Cocaine blocks the dopamine transporter protein



Coca



Cocaine



Peyote cactus, *Lophophora williamsii*, Cactaceae, Mexico

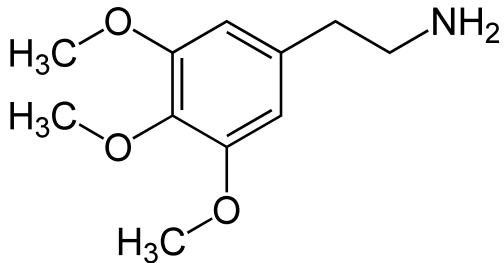
- ▶ Cactus plant containing mescaline, LSD/psilocybin group hallucinogen narcotic
- ▶ Agonist of serotonin 5-HT_{2A} receptor



Lophophora



Mescaline



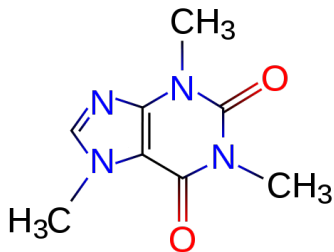
Cola, *Cola acuminata*, Malvaceae, West Africa

- ▶ *Colae semen*
- ▶ Tropical tree, seeds contain caffeine and kolanins
- ▶ Caffeine is antagonist of adenosine inhibitory receptors and natural insecticide

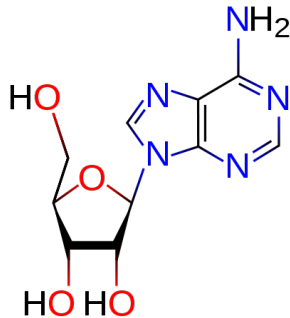


Cola





Caffeine



Adenosine

Caffeinated spiders make wrong webs



Tea, *Camellia sinensis*, Theaceae, East Asia

- ▶ Small evergreen shrub
- ▶ Native to China, cultivated there from 2500 BC



Tea



Tea facts

- ▶ Young leaves and buds are mostly used
- ▶ There are fermented (black, pu-ehr, up to 3% of caffeine!) and non-fermented (green) teas
- ▶ All contain caffeine and small amounts of theobromine and theophylline



Coffee, *Coffea arabica*, Rubiaceae, East Africa

- ▶ Small evergreen tree with regular growth
- ▶ Native to Ethiopia, was a local Yemen culture until XVIII century



Coffee



Coffee facts

- ▶ Seeds contain up to 2.5% of caffeine
- ▶ Most of aromatic compounds (caffeol) are activated when frying



Cocoa, *Theobroma cacao*, Malvaceae, South America

- ▶ Evergreen small tree with cauliflory
- ▶ Cocoa beans are large fruits which go to cocoa, chocolate and oil production



Cocoa

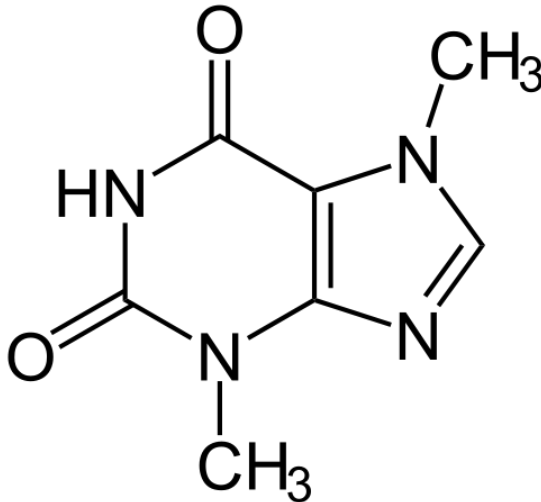


Cocoa facts

- ▶ Fermented and fried seeds contain 2% of theobromine
- ▶ Phosphodiesterase inhibitor which raises intracellular cAMP
- ▶ 43% of world cocoa come from Côte d'Ivoire



Theobromine



Yerba mate, *Ilex paraguariensis*, Aquifoliaceae, South America

- ▶ Evergreen shrub from semi-deserts of South America
- ▶ Leaves contain up to 2% of caffeine
- ▶ Anti-cancer and cancer effects were both stated



Mate



Yerba mate



Guarana, *Paullinia cupana*, Sapindaceae, South America

- ▶ Tropical shrub with pinnate leaves; seed powder is used as a drink
- ▶ Extremely high in caffeine (up to 6%), actually caffeine old name was “guaranine”



Guarana



Khat, *Catha edulis*, Celastraceae, East Africa

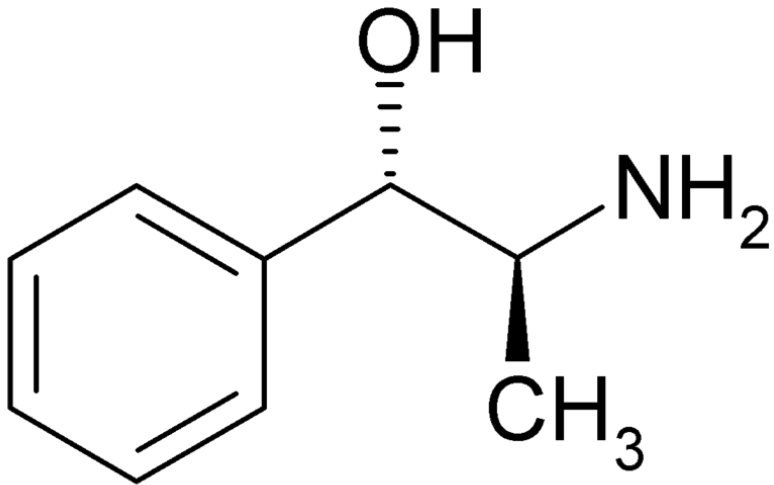
- ▶ Evergreen shrub ecologically similar to coffee
- ▶ Leaves contain cathine (pseudonorephedrine), agonist of noardrenaline receptors, which mild psychoactive effects



Khat



Cathine



Areca nut, *Areca catechu*, Palmae, Southeast Asia

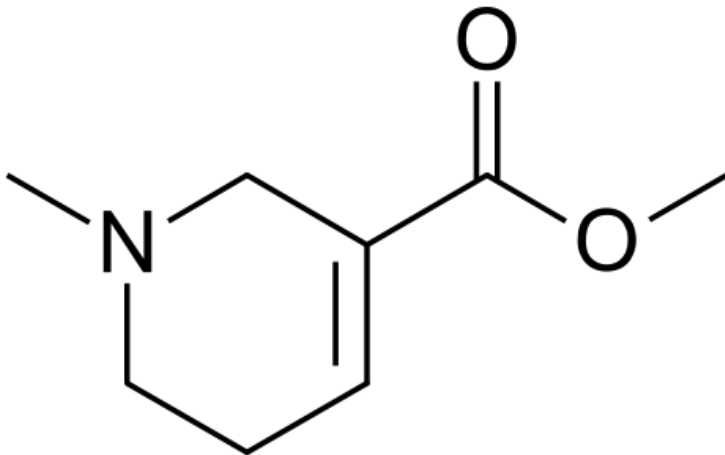
- ▶ Nuts are chewed with betle pepper (*Piper betle*, Piperaceae) leaves and slaked lime (Ca(OH)_2)
- ▶ Chemical reaction will free arecoline alkaloid (similar to nicotine), agonist of acetylcholine receptors



Areca nut vendor (Hainan, China)



Arecoline

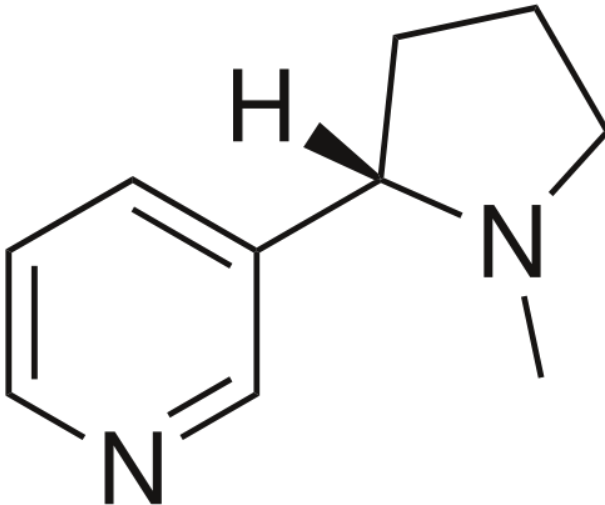


Tobacco, *Nicotiana tabacum*, Solanaceae, Central America

- ▶ Perennial herb with large glanduliferous leaves
- ▶ Contain alkaloid nicotine binding to acetylcholine receptors and (among other effects) increases the level of brain dopamine
- ▶ Nicotine is also a well-known natural insecticide



Nicotine



Kava, *Piper methysticum*, Piperaceae, Pacific

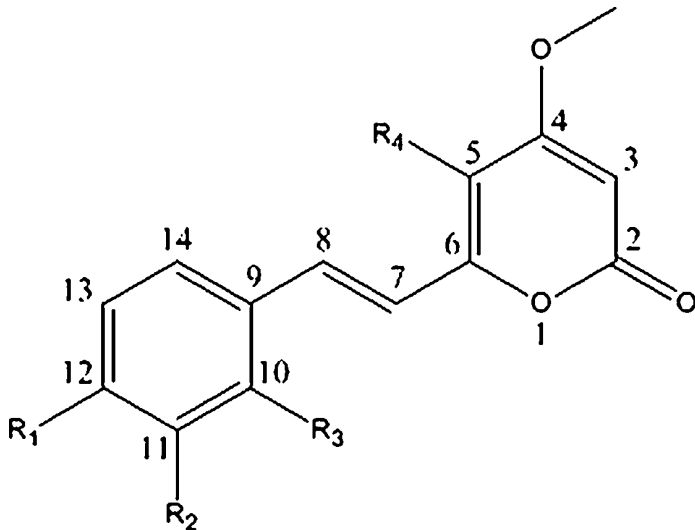
- ▶ Small shrub, roots are used to prepare sedative drink
- ▶ Active components are kavactones, stimulate inhibitory γ -aminobutyric GABA receptors



Kava



Kavactone



Hibiscus tea, *Hibiscus sabdariffa*, Malvaceae, Mediterranean

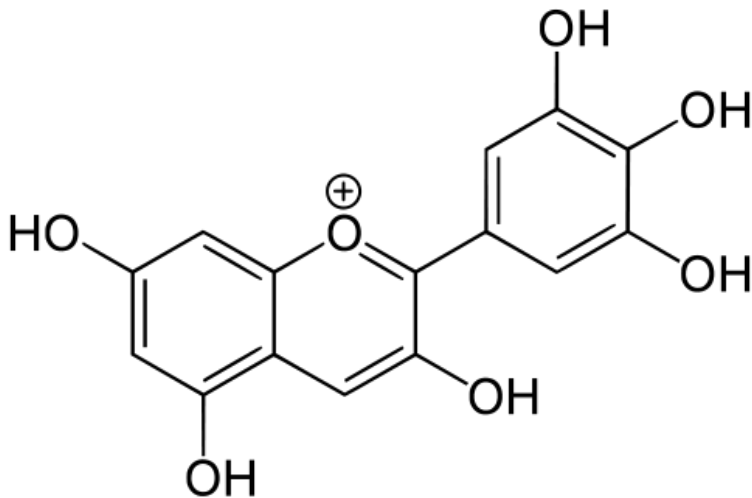
- ▶ Flower calyces (sepals) are dried and boiled
- ▶ Contain flavonoids (e.g., anthocyanin deplhinidin) and organic acids with multiple medicinal effects, e.g., lowering blood pressure



Hibiscus tea plant



Delphinidin anthocyanide



Rooibos tea, *Aspalathus linearis*, Leguminosae, South Africa

- ▶ Small shrub of Cape province
- ▶ Leaves contain high level of antioxidants such as aspalathin and nothofagin, fermented similarly to tea or yerba mate



Rooibos



Boldo, *Peumus boldus*, Monimiaceae, South America



- ▶ Andean evergreen shrub
- ▶ Contains alkaloid boldine and multiple essential oils (e.g., with anthelmintic effect)
- ▶ Used as a tea in many South American countries, typically mixed with mate



Summary

- ▶ Most of stimulants / narcotics are analogs of neurotransmitters



For Further Reading



A. Shipunov.

Ethnobotany [Electronic resource].

2011—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_310



Heinrich et al. 2012.

Fundamentals of Pharmacognosy and Phytotherapy.

Churchill Livingstone, Edinburgh.

