

11 - дәріс. Табиғи циклды қосылыстардың классификациясы.

Дәріскер: доцент Ескалиева Б.К.

Терпенді қосылыстарға құрамы негізгі изопрен (C_5H_8) буынынан тұратын қосылыстарды айтамыз. Бұл үлкен табиғи қосылыстар класын былай ажыратады:

Монотерпендер	немесе	терпендер	$(C_{10}H_{16})$
Сесквитерпендер			$(C_{15}H_{24})$
Дитерпендер			$(C_{20}H_{32})$
Тритерпендер			$(C_{30}H_{48})$
Тетратерпендер			$(C_{40}H_{64})$
Политерпендер			$(C_{10}H_{16})_n$

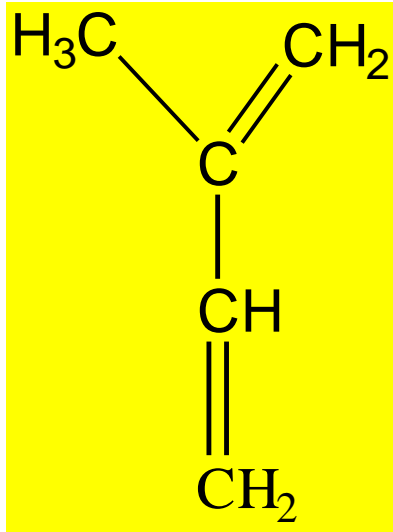
Монотерпендер және сесквитерпендер эфир майларының құрамына кіреді.

Дитерпендер смолалардың құрамына кіреді; сонымен қатар күрделі табиғи заттар – хлорофилл, К витаминінің тобына кіреді.

Тритерпендер – стериндер және тритерпендер агликондарының гликозидтері болып табылады (сапониндер).

Тетратерпендер – каротиноидтар және А витаминінің құрамы болып табылады.

Политерпендер – каучуктер.

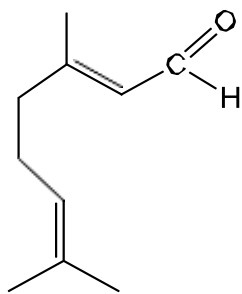


Изопрен

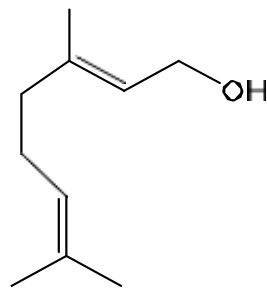
Егер құрылысы тек көмірсутектерден тұрса оларды – терпендер дейді; ал олардың оттекті туындыларын терпеноидтар деп атайды.

Монотерпендер (C₁₀) екі изопрен буыны бар

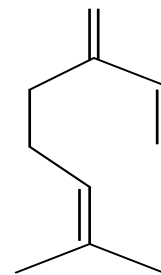
Ациклды монотерпендер



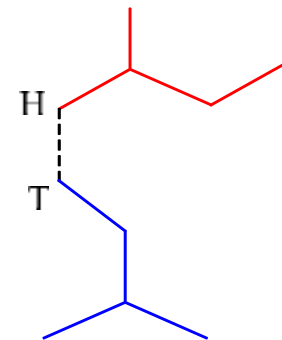
Цитраль



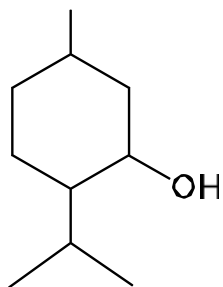
Гераниол



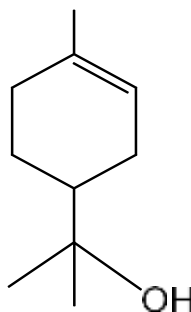
Мирцен



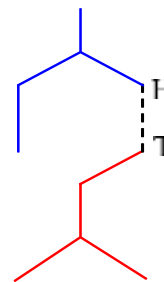
Моноциклды монотерпендер



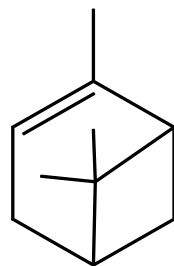
Ментол



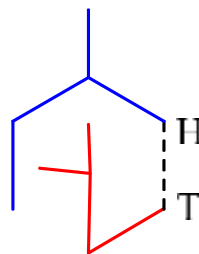
α -Терпинол



Бициклды монотерпендер

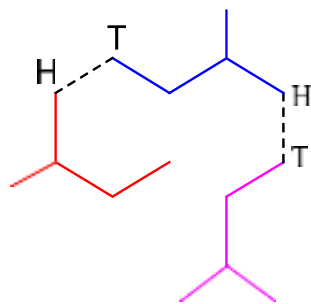
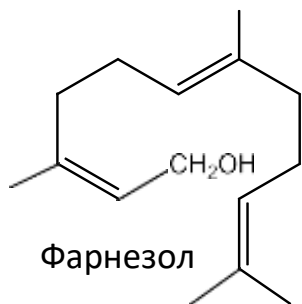


α -Пинен

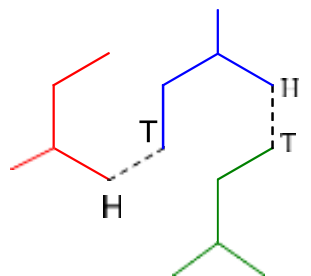
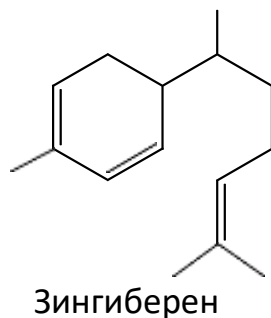


Сесквитерпендер (C₁₅) үш изопрен буыны бар

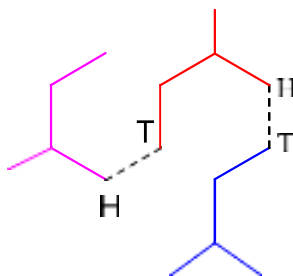
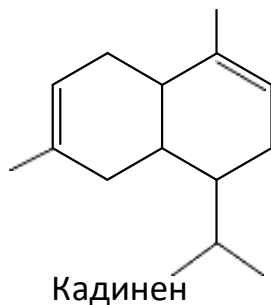
Ациклды
сесквитерпендер



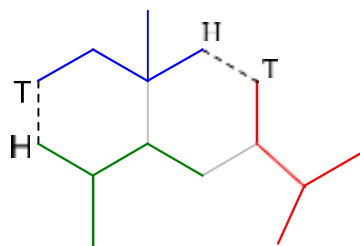
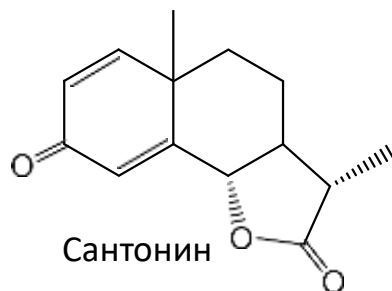
Моноциклды
сесквитерпендер



Бициклды
сесквитерпендер

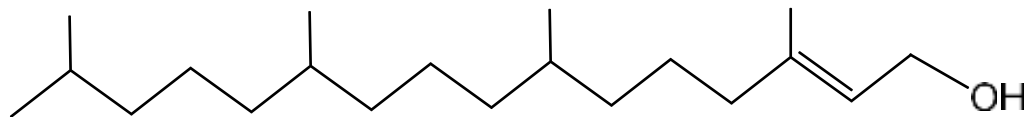


Трициклды
сесквитерпендер

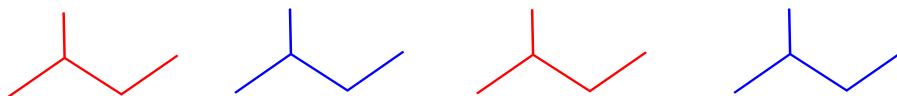


Дитерпендер (C₂₀) төрт изопрен буынынан тұрады

Ациклды
дитерпендер



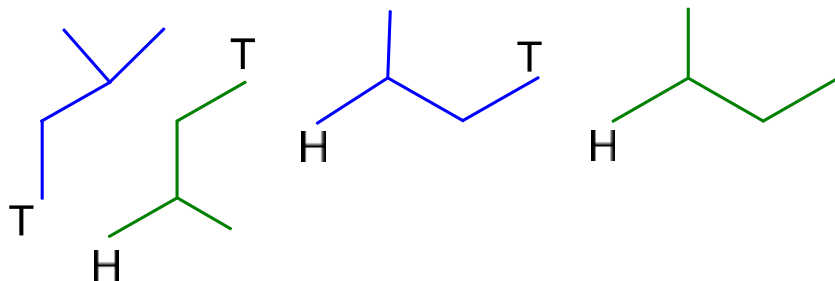
Фитол



Моноциклды
дитерпендер

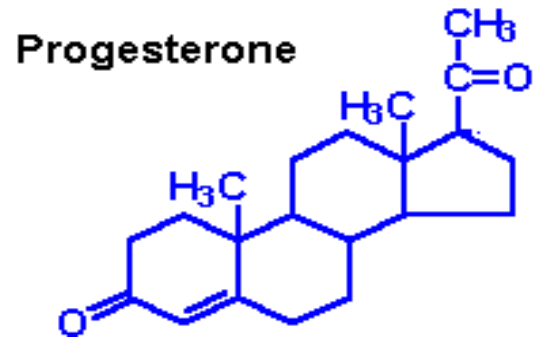
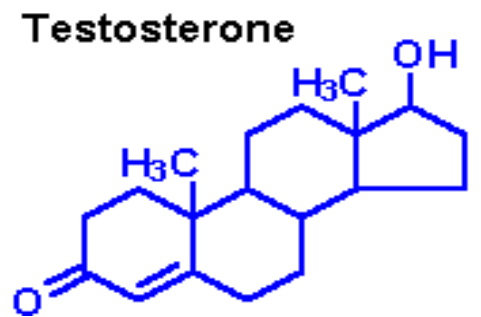
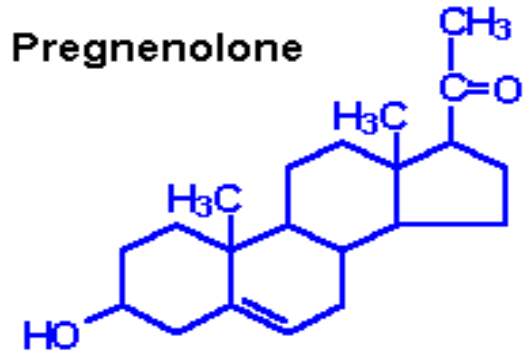
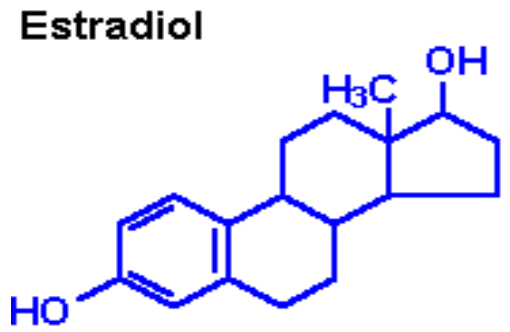
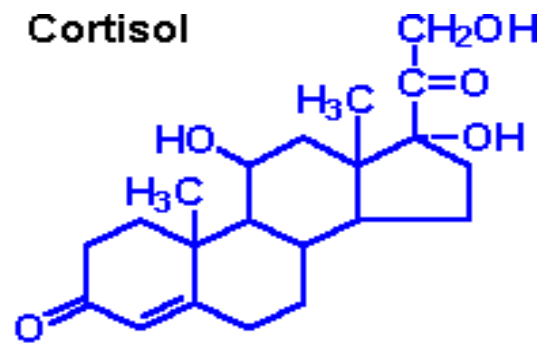
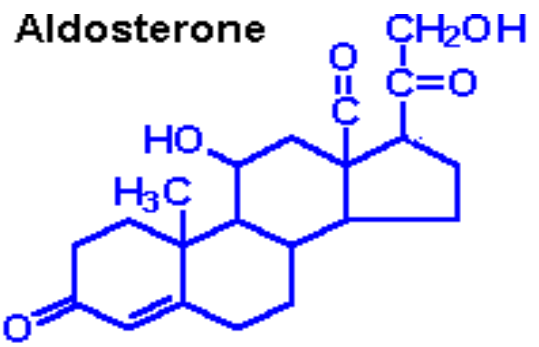


Витамин А



Тритерпендер (C_{30}) алты изопрен буынынан тұрады. Тетрациклды (стериндер, стероидтар) және пентациклды. Гликозидтенген түрлері Сапониндер.

Стероидты гармондар

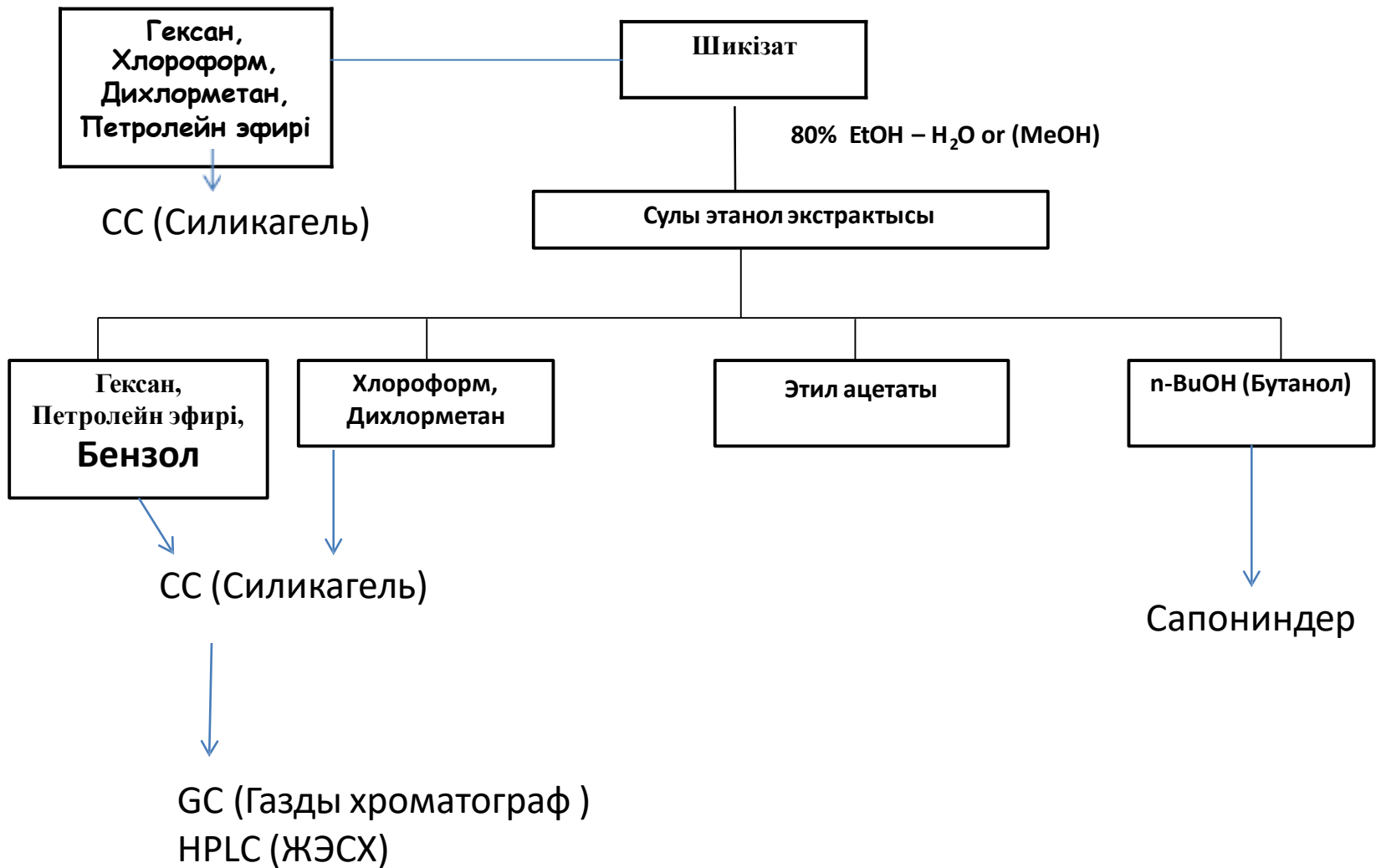


Methods of Extraction of Medicinal Plants

- ✓ maceration
- ✓ infusion
- ✓ percolation
- ✓ digestion
- ✓ decoction
- ✓ hot continuous extraction (Soxhlet)
- ✓ aqueous-alcoholic extraction by fermentation
- ✓ counter-current extraction,
- ✓ microwave-assisted extraction,
- ✓ ultrasound extraction (sonication),
- ✓ supercritical fluid extraction,
- ✓ phytonic extraction (with hydrofluorocarbon solvents).





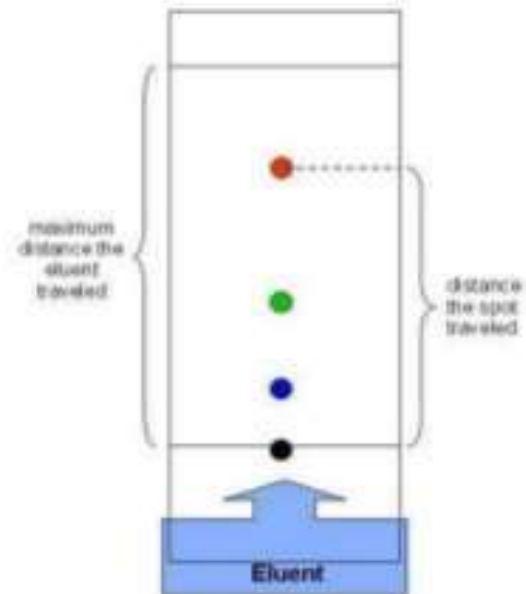


Thin layer chromatography (TLC)

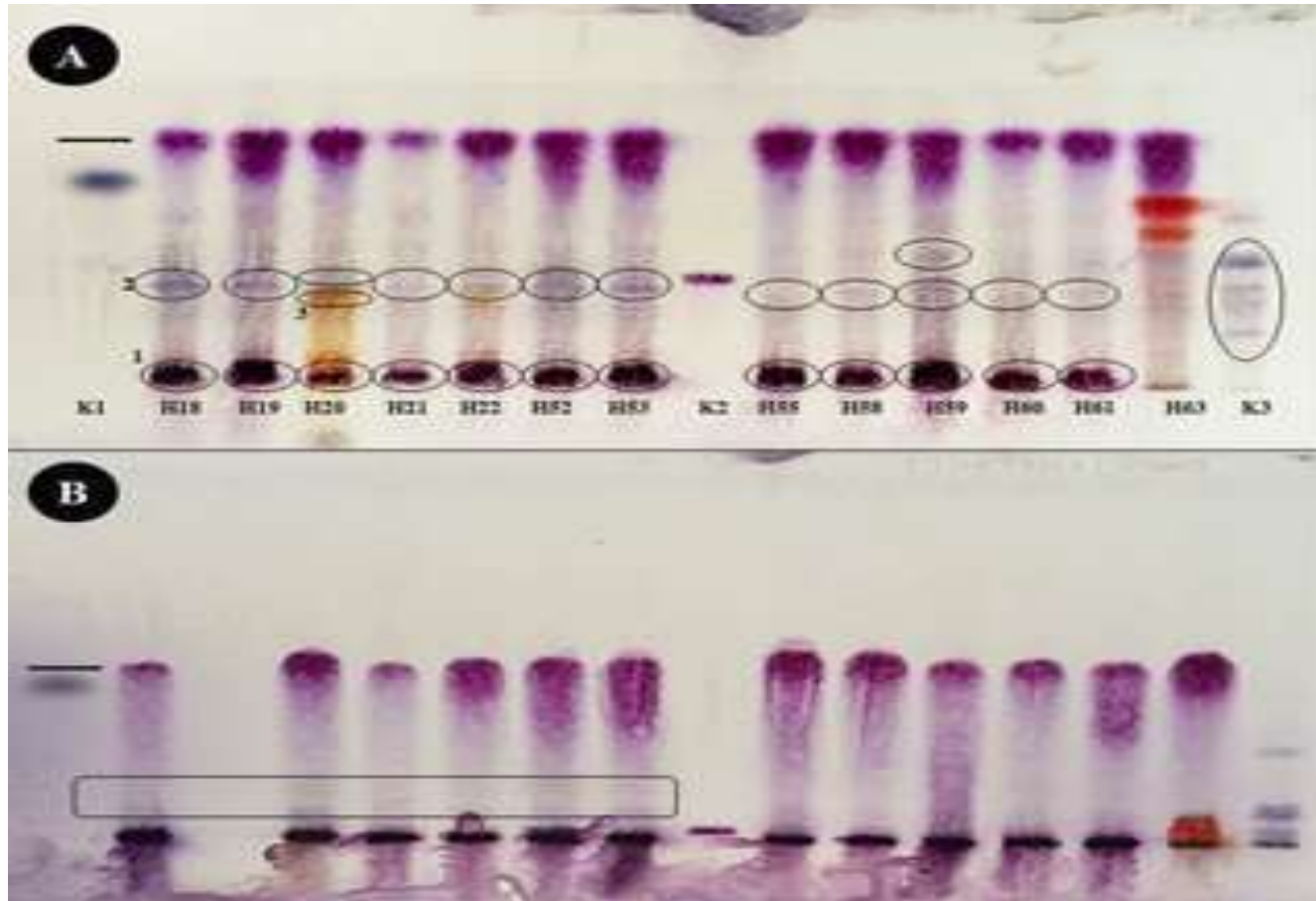
- Similar to paper chromatography
- Thin layer of a solid is painted onto an inert support, such as glass

Common solids:

- Alumina (Al_2O_3)
- Silica (SiO_2)



The Use of Anisaldehyde Sulfuric Acid as an Alternative Spray Reagent in TLC Analysis Reveals Three Classes of Compounds in the Genus *Usnea* Adans. (Parmeliaceae, lichenized Ascomycota)



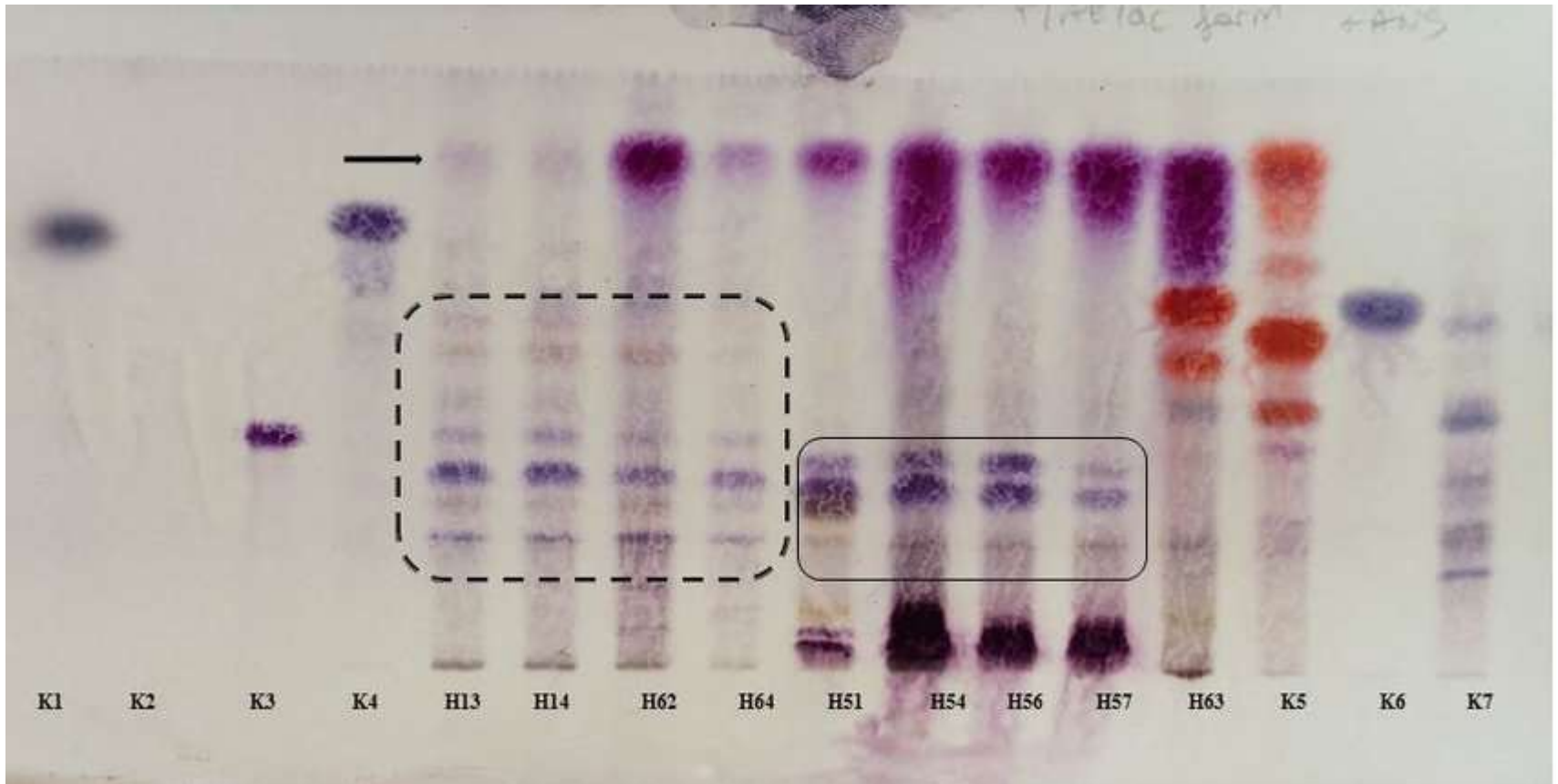
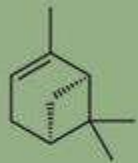
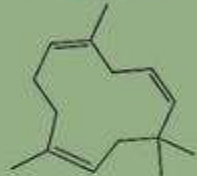


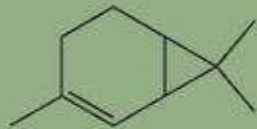
Figure 3: Detection of terpenes and steroids: TLC analysis in the solvent-spray reagent system G-ANS of *U. moreliana* (dashed square) and *U. malmei* (H54)/*U. papillata* (H51, H56, H57) (solid square) with two distinct chemical patterns: a) unidentified triterpenes in *U. moreliana* and b) steroids in *U. malmei*/*U. papillata* (as already showed in Figure 2). The controls were the following: K1=linalool, K2=eucalyptol (monoterpenes); K3=hopane-triol, K4=lanosterol, K5=zeorin (triterpenes, extracted from *Evernia prunastri*); K6=cholesterol; K7=ergosterol and related compounds (steroids). H63 = *U. longissima* with zeorin. Arrows on the top indicates the presence of usnic acid.



PINENE
(Pines)



CARYOPHYLLENE
(Peppercorns)



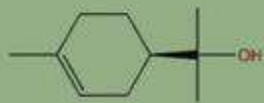
CARENE
(Cedar,
Rosemary)



LIMONENE
(Citrus Lemon)



LINALOOL
(Mints,
Lavender)



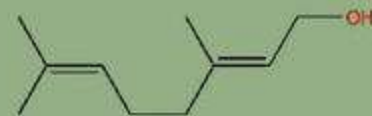
TERPINEOLS
(Junipers,
Orange Peel)



NEROL
(Lemongrass)



HUMULENE
(Hops)



GERANIOL
(Roses,
Wine Grapes)



MYRCENE
(Myrtles &
Cannabis)

2 isoprene units

MONOTERPENES & their SMELLS

ACYCLIC

α-Ocimene
Used in perfumes to add a fruity, lime flavour.

β-Ocimene
Used in perfumes to add a fruity, lime flavour.

α-Myrcene
Not found in nature, and not used in industry. But it exists!

β-Myrcene
Quite unstable in air; used in the production of aroma compounds.

Geraniol
Used in DEET-free mosquito repellent products.

Citronellal
Found in lemon-scented gum & kaffir limes. Repels mosquitoes.

Citronellol
Found in lemongrass. Repels mosquitoes and attracts mites.

Linalool
Group of compounds produced by the mint family (and citruses)

Citral A
Found in Australian lemon myrtle. Used in cosmetics.

Halomon
Produced by red algae. Might be a good anti-cancer drug.

MONOCYCLIC

S-Limonene
Pleasant smell of pine trees & turpentine. Added to perfumes.

R-Limonene
Found in orange peel. Used in many household products.

Phellandrene
Eucalyptus aroma. Smells like koala bears (!)

α-Terpinene
Cardamom aroma. (Also found in marjoram oils.)

Menthol
Strong, cooling, mint-like aroma. Very mildly anaesthetic.

S-Carvone
Caraway aroma. Chiral enantiomer.

R-Carvone
Spear-mint aroma. Chiral enantiomer.

Safranal
Saffron aroma. Anti-depressant and anti-oxidant.

Terpineol
Pure pine aroma. Gives lapsang souchong tea its distinctive taste.

Thymol
Thyme aroma. Kills fungi.

Carvacrol
Oregano aroma. Pungent taste; kills bacteria.

Umbellulone
Causes headaches. Produced by Californian "headache trees".

Piperitone
Peppermint aroma. Can be converted easily into menthol.

Pulegone
Found in pennyroyal. Smells like spearmint. Causes abortions.

Rose oxide
Typical rose aroma found in roses and German wine grapes.

BICYCLIC

Sabinene
Contributes to the spiciness of black pepper.

Camphene
Explosive 19th-century lamp fuel with a turpentine smell.

Eucalyptol
Eucalyptus aroma. Smells like koala bears (!)

Thujene
Gives Summer Savory its pungent flavour.

Thujone
Smells like menthol. Found in cypress trees and in absinthe (the alcoholic drink). Causes muscle spasms and convulsions.

Pinene
Bronchodilator, anti-inflammatory, and broad-spectrum antibiotic.

Nepetalactone
Active ingredient in catnip. Gets cats extremely high.

Ascaridole
Poisonous, explosive compound with a funny-looking structure.

Borneol
Active ingredient in Chinese moxibustion therapy: 冰片.

Verbenone
Spanish verbena aroma. Signature fragrance of L'Occitane.

Camphor
Camphor laurel tree aroma. Repels insects and is used in sweets.

Ethyl fenchol
Smells pleasant, like damp soil. Made by Actinobacteria in lakes.

TRICYCLIC

Cyclosantene
Rare. Has a musty odour.

3 isoprene units

SESQUITERPENES & their SMELLS

ACYCLIC

Farnesene
Apple aroma. Alarm pheromone used by termites and aphids.

Farnesol
Smells like violets. Kills mites.

Nerolidol
Smells like fresh bark.

MONOCYCLIC

Zingiberene
Ginger aroma and flavour.

Humulene
Hops aroma. Gives beer its "hoppy" taste.

Bisabolane
Fragrant. Currently being tested as an alternative to diesel.

Bisabolene
Balsamic aroma.

Elemol
Gives Filipino "pill tree" resin its spicy-citrus aroma.

BICYCLIC

Caryophyllene
Clove aroma, clove flavour.

Guaiol
Pigment in blue mushrooms and guaiacum flowers. Rose-like smell.

Vetivazulene
Gives South Indian vetiver its earthy smell. Soothes & relaxes.

Cadinene
Juniper aroma.

Caryophyllene
Most abundant in cannabis and in West African pepper. Earthy.

Cuparane
Gives Japanese liverwort its characteristic aroma.

Laurane
Found in marine red algae.

Oppositane
Found in the Zimbabwean evergreen tree, *Teclea nobilis*.

Mutisianthol
Moderate anti-tumor activity. Found in Mutisia flowers.

Thapsane
Active ingredient in "villous deadly carrot". Makes you sick.

Lepidozanes
Group of compounds found in liverworts.

Chioscyphane
Group of compounds found in liverworts.

Pinguisanes
Group of compounds found in liverworts.

Herbertanes
Group of compounds found in liverworts.

Botrydial
Toxic to plants. Produced by *Botrytis cinerea* fungus.

TRICYCLIC

Longifolene
Found in pine resin lapsang souchong

Copaene
First isolated in C. Attracts Mediterranean

Patchouliol
Gives patchouli its scent. Used widely

Norpatchouliol
Gives patchouli its scent. Used widely

Santalol
Sandalwood aroma. Hindu, Buddhist

TETRACYCLIC

Cortisol
Human stress hormone. Increases blood

Progesterone
Prepares the female system for pregnancy

Oestrogen
Promotes female characteristics (like

Testosterone
Increases muscle mass. Increases body hair

11-Ketotestosterone
Testosterone for