THE CHEMISTRY OF NATURAL PRODUCTS

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A large number of organic compounds are found in nature, particularly in the plant and animal world. Since these compounds were not produced synthetically substances obtained from natural resources become known as **Natural products.**

These naturally occurring compounds have found with application in modern society. The most widely used of all natural products is ethanol. The stimulant most widely used in modern society is an alkaloid called caffeine, which is extracted by hot water from tea leaves or ground coffee beans.

In this programme our main attention will be focused on the plant metabolites. These metabolites can be divided in to two major groups.

1). Primary matabolites

2). Secondary metabolites

Primary Matabolites are common to most of the living things. Generally they are macro molecules (e.g. carbohydrates, proteins and lipids).

The secondary metabolites are relatively small in size and their molecular weights are lower. Some of these secondary metabolites have biological activities such as,

antibiotic

antiviral

anticancer

antitumor

antimalarial

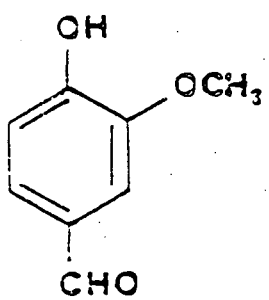
antileukaemic

anti-inflammatory

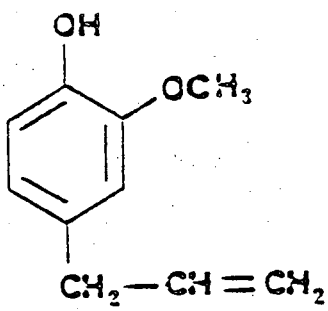
insecticidal

These secondary matabolites can be used in classification of plants in chemotaxonomy. Sometimes we find that given compounds are specific for one family or species or it may be a feature of a given genera. These compounds are called chemotaxonomic markers. We can use these markers to show similarities in plant families or species. These secondary plant matabolites may be

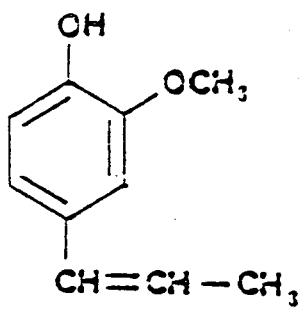
1). Phenolic compounds



Vanillin
(Vanilla bean)

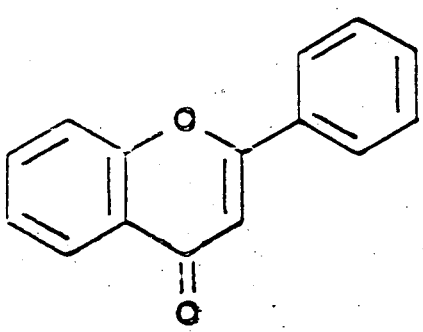


Eugenol
(Oil of cloves)

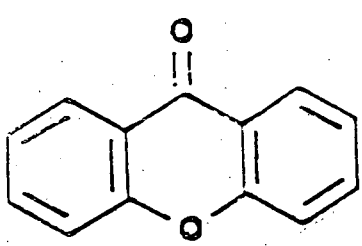


Isoeuginol
(Oil of nutmeg)

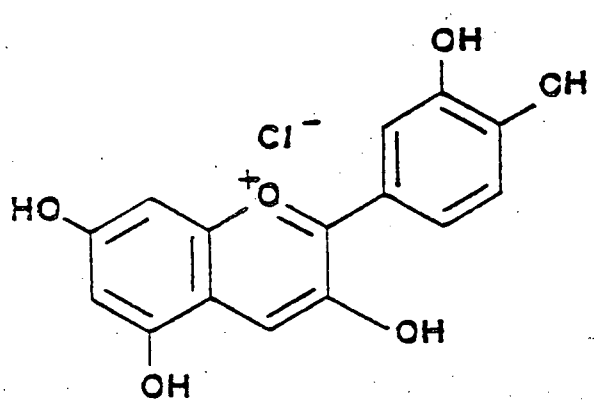
2). Oxygen-heterocyclic compounds



Flavone-

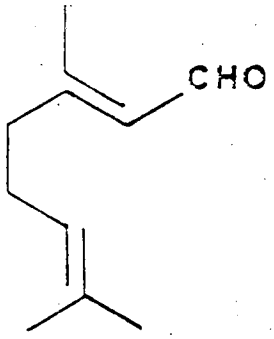


Xanthone

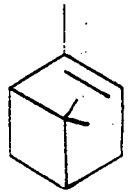


Cyanidin chloride

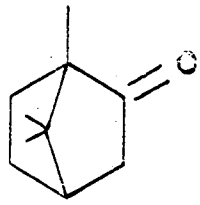
3). **Terpenoids**



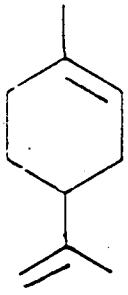
Citral
(Lemon grass oil)



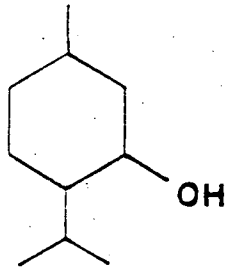
α-Pinene
(Pine tree)



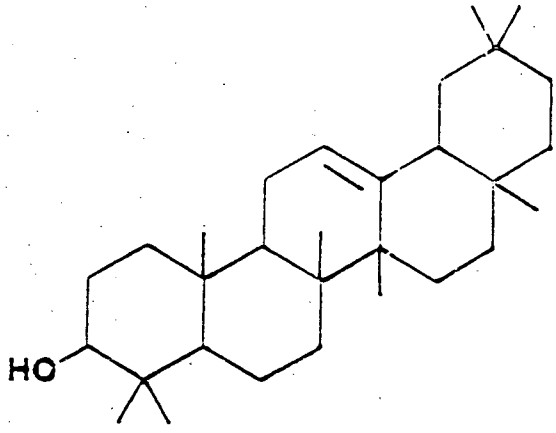
Camphor
(Camphor tree)



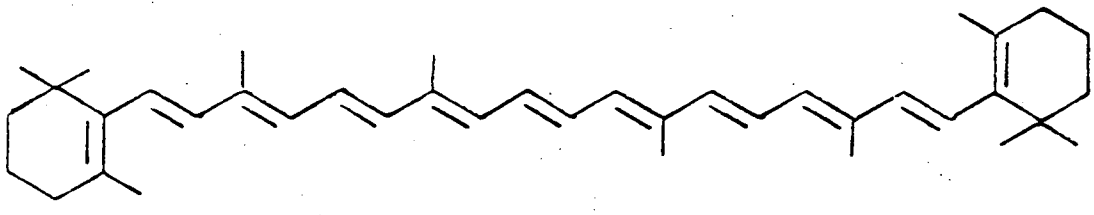
Limonene
(Citrus)



Menthol
(Peppermint)

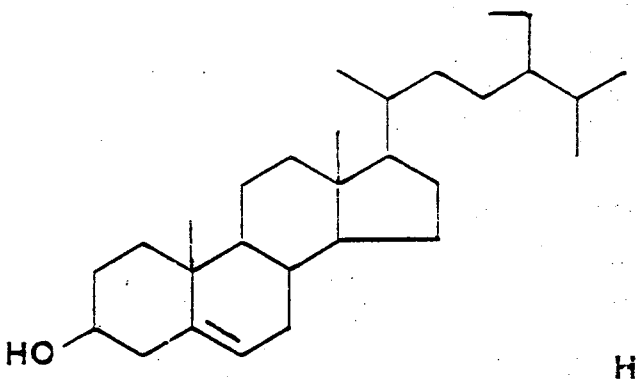


β-Amyrin

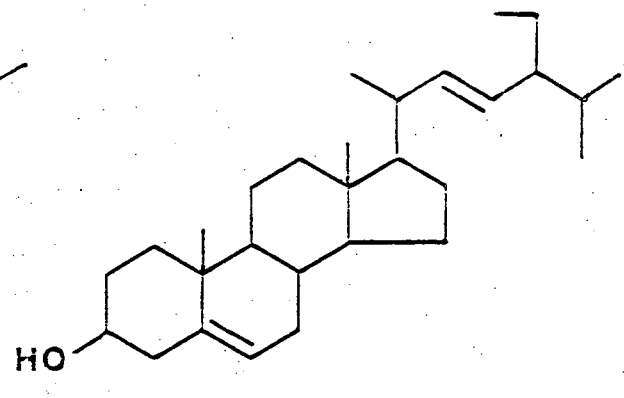


β-Carotene (Carrots)

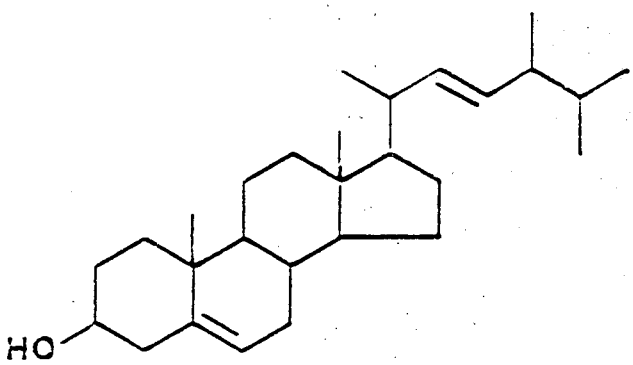
4). **Steroids**



Sitosterol

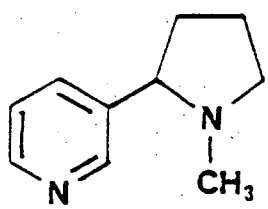


Stigmasterol
(Soya bean oil)

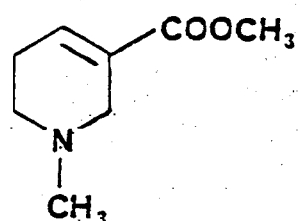


Ergosterol
(Yeast)

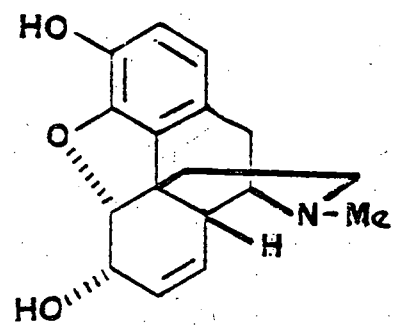
5). **Alkaloids**



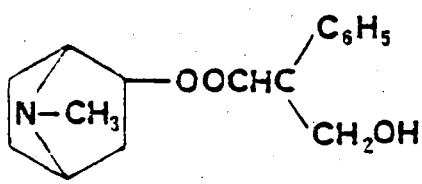
Nicotine
(Tobacco plant)



Arecoline
(Arecanut)

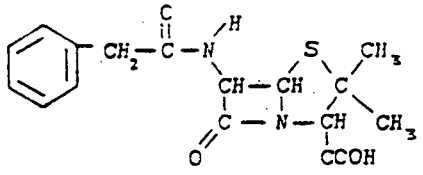
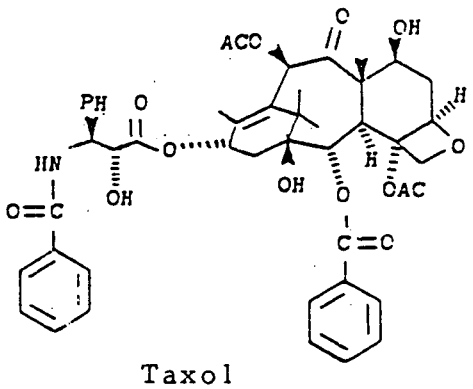
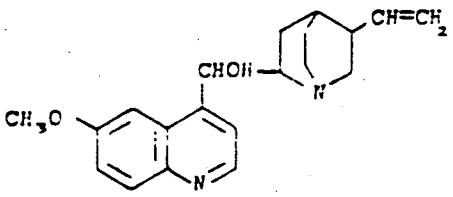
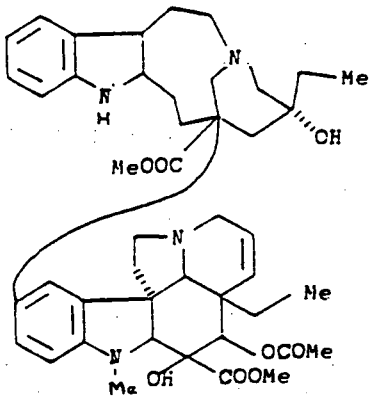
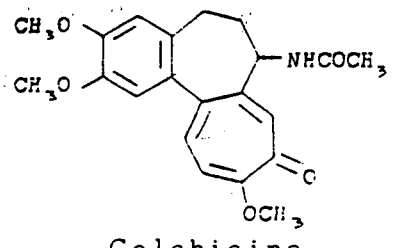


Morphine
(Opium)



Atropine
(Atropa belledonna)

SOME BIOLOGICALLY ACTIVE NATURAL PRODUCTS

ACTIVITY	SOURCE	COMPOUND
Antibiotic	*Penicillium notatum*	 Penicillin
Anticancer	*Taxus brevifolia*	 Taxol
Antimalarial	*Cinchona* species	 Quinine
Antileukaemic	*Catharanthus roseus*	 Vincaleukoblastine
Anti-inflammatory	*Colchicine autumnale*	 Colchicine

Plants are capable of making complex molecules from small molecules or atoms. Chlorophyll or modified chlorophyll containing plants are capable of making carbohydrates by CO_2 fixation. This process is called photosynthesis.

$$n\,CO_2 + n\,H_2O \xrightarrow[\text{Sunlight}]{h\nu} \underset{\text{Carbohydrate}}{(CH_2O)_n} + n\,O_2$$

These photosynthesised carbohydrates contain aldoses and Ketoses. They can undergo polymerization to give polysaccharides such as cellulose. Plant cell walls are mainly made of polysaccharides and they are primary metabolites. For each of these processes, plants need specific enzymes. Carbohydrates can undergo small changes and can give glycerol.

BIOSYNTHETIC PATHWAYS OF NATURAL PRODUCTS IN PLANTS