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INTRODUCTION

In Yemen, the study of the desert plants and their environment has not received sufficient attention. However, Draz (1956) reported "The existing cover in Yemen is the result of climatic and edaphic factors as well as of human and grazing factors". The original vegetative cover has been greatly modified or destroyed long ago through extensive uncontrolled grazing and cultivation of land. The increase of unpalatable plants such as *Euphorbia* spp., *Salvadora persica*, Asclepiadaceae spp.; etc. is a direct result of overgrazing.

Shams (1978) working on ecological survey of Sanaa-Taiz area was able to classify the plant cover of the area in relation to land form into: 1) vegetation of table land, 2) vegetation of rocky hill countries and ridges, 3) vegetation of slopes of mountains and 4) vegetation of wadies. The vegetation of various geomorphological units was subdivided into communities.

The same author; Shams (1982) in his ecological notes on Saaa area reported that Sanaa area comprises three principal ecosystems: 1) The main plain ecosystem 2) mountain ecosystem and 3) Wadies ecosystem. The vegetation of each ecosystem comprises various community types ranging from six in the third ecosystem to eight in the first one. Shams *et al.* (1986) and Shams and Ahmed (1986) demonstrated the effect of habitat conditions on metabolic contents with special to organic, fatty and amino acids of *Euphorbia ammak* growing naturally in rocky and withered habitats of Y.A.R.

Al-Hubaushi and Muller-Hohenstein (1984) classified the plant cover of Yemen into zonal and azonal vegetation. The former includes plant formations (e.g. forest, woodland, shrubland, grassland etc.) which represent the normal development on places where water is available for plant growth according to climatic conditions and topograhy. Meanwhile the azonal vegetation includes plant formations which have a much better water supply. A plant formation zonal or azonal may consist of many plant communities because of variations in soil characteristics in the same natural region.

The vegetation cover of Yemen is rich, the number of the known species is about 2000 species mainly distributed on the different natural regions.

Following Al-Hubaushi and Muller Hohenstein (1984) these regions are: 1- Tihama region, 2- Tihama foothill region, 3- Lower escarpment region, 4- Higher escarpment region, 5- Highland and highmountains rgion and 6- Eastern semi-desert region.

The vegetation of the Yemen as in other parts of the world is greatly affected by human activities. Draz (1956) stated that over-grazing in the range has been practised for many centuries resulting in denudation of the land in some areas where the plant cover is exterminated, while in other areas which have been less severely overgrazed the unpalatable plants have greatly increased and replaced the other forage grasses which once existed.

In Egypt, extensive studies have been carried out on the water relations of xerophytes including those of Migahid (1954 and 1962), Migahid and Shafei (1953 and 1956), Hammouda (1954), Abd El-Rahman and Batanouny (1959 and 1964), Abd El-Rahman *et al.* (1971 and 1976), El-Ghonemy (1976), Batanouny and Batanouny (1968 and 1969), Batanouny and Ezzat (1971) Shalaby *et al.* (1982), Girgis *et al.* (1979), Hassan (1979) Shams *et al.* (1983), Salama (1989), Abd El-Fattah (1990), Olama *et al.* (1991) .. etc.

Due to increasing interest in natural chemical compounds and the world tendency to develop drought resistant crops containing special chemical compounds for growing in desert regions, some information have been cited about the relationships between the chemical composition of plants and their adjustment to their habitats. Girgis *et al.* (1979) demonstrated the relation between ions accumulation and osmotic adjustment. Ahmed and Girgis (1979) showed that the osmotic adjustment of xerophytes depends on, to a large extent, the accumulation of organic intermediates, while electrolytes are the main osmotically active constituents of halophytes. They demonstrated that species invading saline and xeric habitats tend to behave like xerophytes in xeric habitats and to halophytes in slaine habitats.

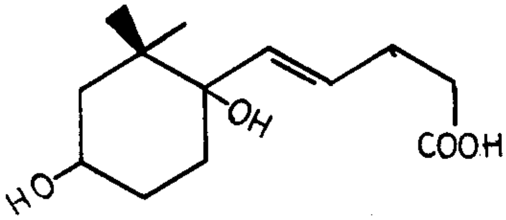
Malik and Srivastava (1982) stated that plants have several mechanisms to tolerate drought conditions. One of these is the presence of hydrophilic substances in the protoplasm e.g. proteins of high molecular weight and some carbohydrates (e.g. alginic acid). Further, compounds of low molecular weight e.g. polyhydric alcohols act as hydrophylic compounds. Sugars are usually increased under droungt conditions in such plants since their presence in solutions directly lowers the water potential of cell sap. This helps the plant to conserve water and save the protolasm from desiccation. In general drought tolerant plants have small cells, high nucleic acid contents, low starch and very high amount of soluble sugars.

It has been known that leaves of plants subjected to water stress often show a decrease in starch content (Lundegardh, 1914) which is said to be accompanied by an increase in soluble sugar content (Levitt, 1956). However, the sugar content does not increase in all species (Wadleigh and Ayers, 1945). Kozlowski (1964) reported that increasing water stress, over a period of time, reduces starch, sugars and carbohydrates in bean and tomato plants.

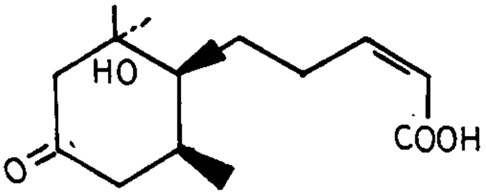
Mothes (1955), Chen *et al.* (1964) and Kudrev (1967) reported that water stress induced characteristic changes in level of free proline and glutamic acid and amides, where the amount of proline increased greatly and appeared to function as storage compound in stressed plants for carbon and nitrogen when both starch and proline synthesis are inhibited. In stressed Bermuda grass shoots enough $C^{14}O_2$ was fixed to labelled free proline that turned over very slowly. The C^{14} glutamic acid labelling data clearly show that stressed shoots readily accumulated much more proline, newly synthesized from glutamic acid than do control shoots. The slow turnover of labelled proline may reflect inhibition catabolism (Bernett and Naylar, 1966).

The effect of habitat conditions on primary and secondary metabolic products was demonstrated by Shalaby *et al.* (1978), Shams *et al.* (1983), Baraka (1990) and Salama (1989). Shams (1989) in a comparative study of the fatty acids of *Tamarix nilotica* and *Senecio desfontainei* in different habitats showed that habitat conditions may affect the distribution of fatty acids. McNair (1929) related the fats and oil to taxonomy and climate concluding that the oil stored by tropical plants have higher melting point than those of plants growing in temperate conditons.

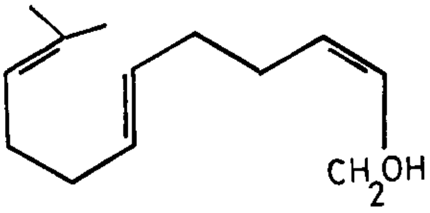
It is well known that plants which resist drounght have been broadly divided into two groups: those which conserve water and those which have increased ability to absorb water. Levitt (1956) indicated that the latter mechanism is largely physiological while the former is biochemical. Thus one way of conserving water is to reduce the time when the leaf stomata are open or to only open the stomata at night. He added that the hromone abscisic acid causes stomatal closure and there is circumstational evidence that drought resistant plants contain larger amount of this hormone. Loveys and Kriedmann (1974) stated that in the control of stomatal closure, abscisic acid can be replaced by at least three related oxygenated sesquterpens e.g. Farnesol, xanthoxin and phaseic acid.



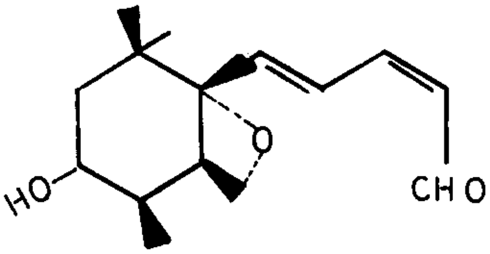
Abscisic acid



Phaseic acid



Farnesol



Xanthin

In particular phaseic acid and farnesol have been shown to produce stomatal closure in *Vitis vinifera* (Loveys and Kriedemann, 1974) and *Sorghum* spp. (Wellburn *et al.*, 1974).

Following Harborne (1988) chemical adaptation can operate at different levels in metabolism. It may affect enzymes and produce amino acid substitution or alter the balance of isoenzymes. It may affect intermediary metabolism or it may affect secondary metabolism.

Harbone (1988) stated that biochemical adaptation in plants involves various changes in the basic biochemistry of cells. These include:

1- The development of new metabolic pathways (e.g. Photosynthetic adaptation).

2- The accumulation of low molecular weight metabolites.

3- Change in hormone level.

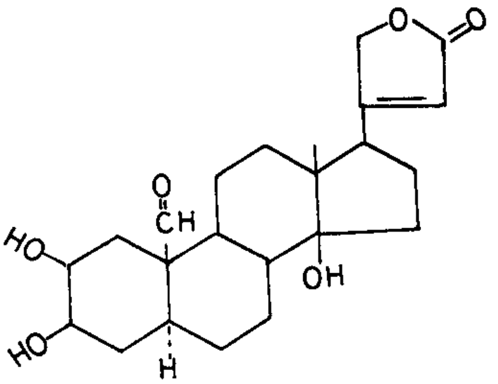
4- Synthesis of special protein.

5- Detoxification mechanism (e.g. the chelating of heavy metals with organic acids or special polypeptide). Here one may add the biotransformation or internal transformation of some toxic compounds into the corresponding non toxic one or vice versa due to changes in the environmental factors or due to stage of growth, e.g., some glycosides especially cardinolides (e.g. digotoxine into digoxine).

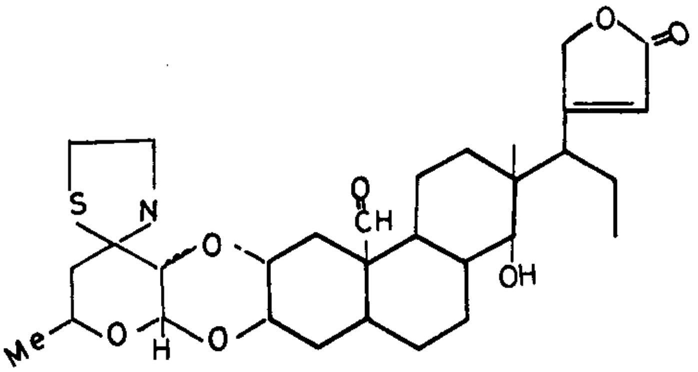
Studies on the phytochemistry of some members of the family Asclepiadaceae were carried by several workers.

Tsukamoto *et al.* (1985) stated that many of the glycosides from Asclepiadaceae plants have D. and or L cymaroses in the sugar chain. The optimal resolution was achieved by HPLC using samples derived from *Cynanchum caudatum*. Tsukamoto *et al.* (1986) were able to make further studies on glycosides with a noval sugar chain containing a pair of optically isomeric sugars, D. and L. cymarose from *Cynanchum wildfloridi*. Yoshimmura *et al.* (1985) isolated and studied the structure of five new glycosides from *Dregea volubillis* L.(Benth). The structure of five glycosides, Cyntratoside from the chinese drug "Pai-wei" *Cynanchum atratum* Bunge was elucidated by

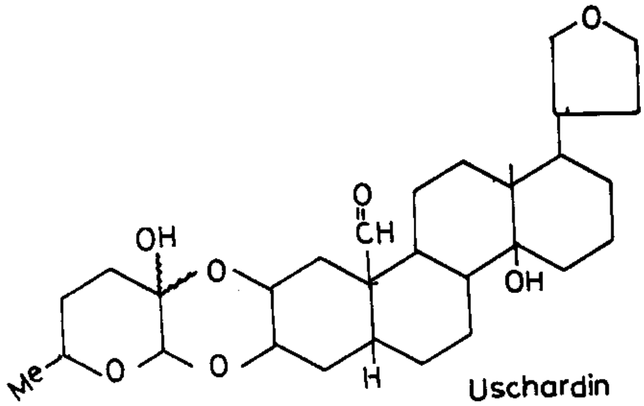
Zhung-xin Zhang *et al.* (1985). Nakagawa *et al.* (1983) stated that five glaucosides were isolated from dried roots of *Cynanchum glaucescens*. They consisted of a high oxygenated aglycone with a noval skelton and unique sugar chains. Seiber *et al.* (1982) stated that cardinolide analyses were presented for a range of speices in the Asclepiadaceae including some known to be toxic to vertebrates and certain insects. Relative high contents were found in leaves and latex of five species including *Calotropis procera* and *Asclepias curassavica*. Both these speices contained calotropagenine and its derivatives calactine, calotropin and calotoxin in leaves and especially latex. Cardinolides containing the spiro N,S ring at 3' (such as uschardin, uscharin and rougcharin) were principally found in latex. Marks *et al.* (1975) stated that the cytotoxic extracts of the roots of *Parquetina nigrescens* yielded three cardinolides: Cymarin, strophanthidinine and strophanthidin glycosides. Other compounds isolated included alkanols, phytosterols and triterpens. Seiber *et al.* (1978) stated that milk weed cardinolides which have been fully characterized include those first isolated from *Calotropis procera* (Calotropagenin). These compounds, since isolated from *Asclepias curassavica* (Eriocarpin and Eriocarpin diacetate), are the most part glycosides of calotropagenin. He added that uscharin, uschardin and the isomeric pair calactin and calotropin which differ in stereochemistry at C-2' and C-3',are examples; their structure have recently been revised to those shown here;



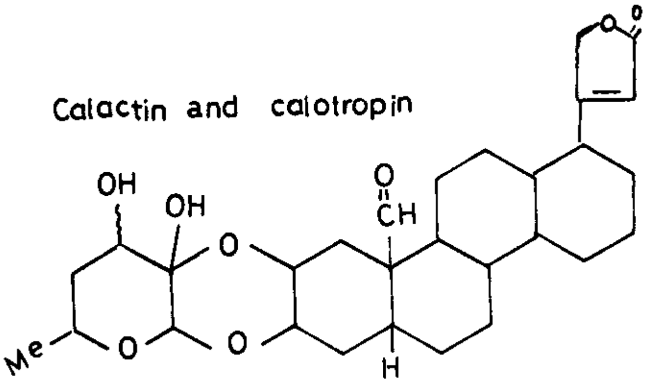
Calotropagenin



Uscharin



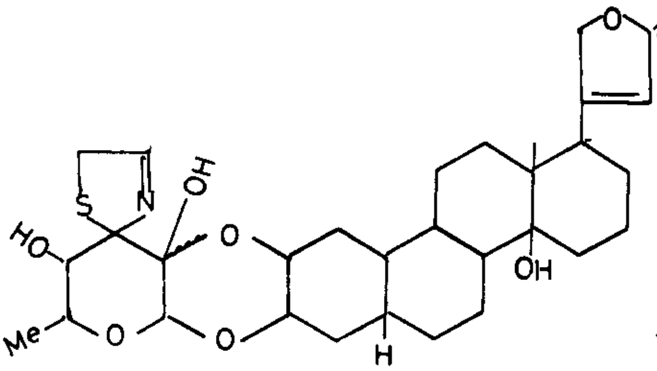
Uschardin



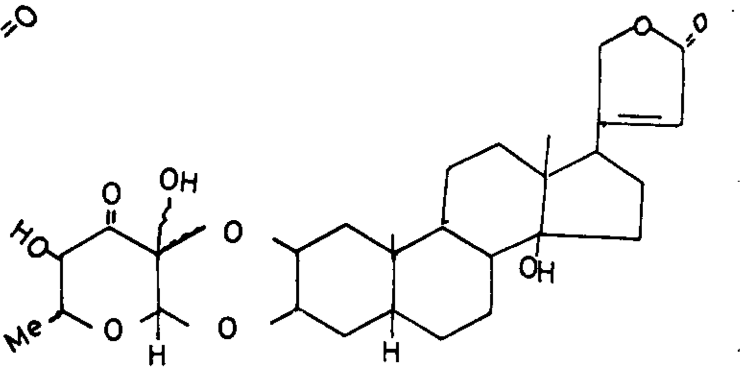
Calactin and calotropin

Also they added that *Asclepias eriocarpa* and *A. labriforms* contain three new cardinolides, the structures of which have been partially assigned by their spectral properties and comparison with the known cardinolides of *Asclepias curassavica*. They include labriformine (C$_{31}$,

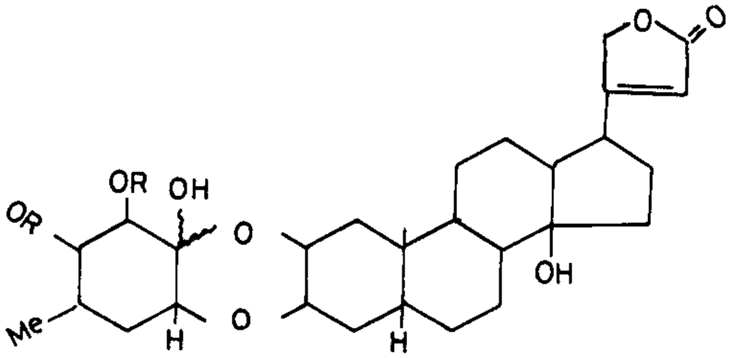
$H_{39}O_{10}NS$), labriformidine (C_{29} H_{36} O_{11}), and eriocarpin.



Labriformin



Labriformidin



Eriocarpin

An attempt was made to isolate and elucidate the structure of the glycosides namely cardinolides, saponins and tannins of *Kanahia laniflora*. In addition carbohydrate fractions, nitrogenous compounds and organic acids were determined seasonaly. The amino and fatty acids of leaves stems and roots of *K. laniflora* collected from rocky and coarse wadi sediment habitats were investigated.