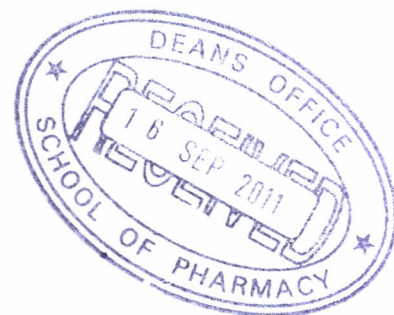


**RHAMNACEAE FAMILY AS A SOURCE OF HERBAL AND CONVENTIONAL  
MEDICINES.**

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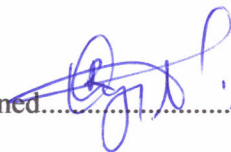
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**A dissertation submitted in partial fulfilment for the award of degree of Bachelor of  
Pharmacy, University.**

**September 2011**

## DECLARATION

The work herein is my original work and has not in any way been duplicated from any other source.

Signed.....

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## **DEDICATION**

To God for giving me the power strength and determination to keep going even when things seemed hard.

To my loving fiancé, Thomas kombo Ngala, who gave me hope and was always there with me through the sleepless nights.

To my loving mum who always believed in me when everyone else did not. Thanks for making me achieve my dreams.

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My sincere gratitude to them whose invaluable support has facilitated the timely and thorough completion of this project.

First to the Lord almighty for giving me the intelligence and good health to enable me piece up this project.

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To my supervisor, Dr. Ambrose K. Gatuma, whose stewardship and counsel guided me through this project.

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## ABSTRACT

Worldwide interest in natural products as preventive and therapeutic agents has led to a greater appreciation of the rich heritage of traditional systems of medicine. Majority of drugs owe their origin to plants, either as modification products of major plant constituents or the actual constituents. Most of the plants modern uses are related to their traditional uses. This then has necessitated intensive studies on plants all over the world, on their pharmacological and other activities as well as isolating their constituents and characterizing them and also studying of their major adverse effects and how they can be reversed. In some cases there has been synthetic modification of these natural products and their production in large-scale for use as conventional products.

This work entails a compilation of information on the recent scientific work done on plants in the Rhamnaceae family. The literature information herein has been obtained from scientific journals detailing recent scientific discoveries about their constituents and activity. There is a lot of work showing plants potential in management of infections such as bacterial, fungal and protozoal.

It is thus important that all the scientific work done be followed up in an effort to avail better drugs in future, especially for the neglected diseases such as trypanosomiasis whose only treatment involves the use of very toxic agents such as arsenicals and also for resistant gram negative bacterial strains. Work needs to be done to modify these natural compounds so as to increase their potency, reduce their toxicity as well as devising methods of large scale production of such compounds in a sustainable and affordable manner.

## ABBREVIATIONS

WHO;	World Health Organisation
CAT;	Catalase
GSH;	Glutathione
SOD;	Superoxide dismutase
MDR-TB;	Multi drug resistant tuberculosis
DNA;	Deoxyribonucleic acid
Na <sup>+</sup> ;	Sodium
Cl <sup>-</sup> ;	Chloride
HAD;	Hydroxyanthracene derivatives
LDL;	Low density lipoproteins
ALT;	Alanine aminotransferase
AST;	Aspartate aminotransferase
ALP;	Alkaline phosphatase



## CHAPTER ONE

### 1.1 INTRODUCTION

Rhamnaceae family, the Buckthorn family, is a large family of flowering plants, mostly trees, shrubs and some vines.

The family contains 50-60 genera and approximately 850-900 species. They have a wide distribution, but are more common in the subtropical and tropical regions. The earliest fossil evidence of Rhamnaceae is Eocene.

The simple leaves can be either alternate or spiralling, or opposite. Stipules are present. These leaves are modified into spines in many genera, in some (e.g. *Paliurus spina-christi* and *Colletia cruciata*) *spectacularly so*. *Colletia* stands out by having two axillary buds instead of one, one developing into a thorn, the other one into a shoot. The flowers are radially symmetrical. There are five (sometimes four) separate sepals and five (sometimes four or none) petals. The petals may be white, yellowish, greenish, pink or blue, and are small and inconspicuous though in some (e.g. *Ceanothus*) the dense clusters of flowers are conspicuous.



**FIGURE 1:** *Ceanothus cuneatas*

The five or four stamens are isomerous with the petals (i.e. on stamen opposite each petal). The ovary is superior with two or three ovules.

The fruits are mostly berries fleshy drupes or nuts. Some are adapted to wind carriage, but most are dispersed by mammals and birds.

Chinese jujube is the fruit of the jujube tree (*Ziziphus zizyphus*) and is a major fruit in China.



**FIGURE 2:** *Ziziphus zizyphus*

Economic uses of the Rhamnaceae family are chiefly as ornamental plants (e.g. American genus *Ceanothus* which has several showy ornamental species) and as a source of many brilliant green and yellow dyes. The wood of *Rhamnus* was also the most favoured species to make charcoal for use in gunpowder before the development of the modern propellants. The plants in this field also have various uses in the medical field due to the various active constituents that they have.

## **1.2 LITERATURE REVIEW**

### **1.2.1 Traditional uses**

In all countries of the world there exists traditional knowledge related to the health of humans and animals. The importance of traditional medicine as a source of primary health care was first officially recognised by the world health organisation (WHO) in the Primary Health Declaration of Alma Ata (1978) and has been globally addressed

since 1976 by the Traditional Medicine Programme of the WHO. That programme defined traditional medicine as: ‘the sum total of all the knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing.’

It is estimated by the WHO that 70-90 of Africa’s rural population still relies on traditional medium to meet partially or totally its health needs. A large number of people in Kenya irrespective of their social status, ethnic group or religion regularly use complementary medicines. WHO has described traditional medicine as one of the surest means to achieve total health coverage of the world’s population.

It is estimated that 33% of drugs produced in the developed countries are from higher plants.25% of these owe their origins to the tropical rain forests of Africa, Asia and South America.

Various communities all over the country use some plants in the Rhamnacea family as herbal medicines. These communities exploit the various active principles that are present in the various parts of the plant. The major parts used include the barks, leaves and the fruits of the plants.

### **1.2.2 Preparation of drugs**

These parts are prepared skilfully by medicine men (i.e. herbalist) so as to carefully extract the active principles without destroying them. Various methods are used by the herbalists in the preparation of these drugs. The methods include;

- Boiling especially roots and barks. The resulting decoction is then used either internally or externally.
- Soaking which is done either in warm or cold water. The leaves are generally pounded before being soaked. Cold water is preferred for root or stem drugs.
- Burning the plant or just its useful parts. The plants are dried before burning. This method is especially practised for small herbs and leaves.
- Pounding which generally preceded all other methods like boiling, soaking or burning depending on the plant part being dealt with. In some cases however

the plant or its parts may be pounded and applied directly to the infections. Such preparations are widely used externally for complaints such as boils, wounds and other skin diseases. Pounded stuff is frequently mixed with some kind of cream particularly ghee or covered with some kind of bandage.

- Chewing (of barks and leaves) is considered as a first aid technique and is frequently used as a quick treatment for snake bites, mouth diseases or stomach problems.
- Heating or roasting of particularly succulent plants especially their leaves is a common method of preparing drugs or materials used as poultices and should be externally applied such as on sprained joints, back aches, chest pains and other joint disorders.

### **1.2.3 Methods of application**

There are many methods used in the application of the drugs most of which depend largely on the particular disease to be treated and also on the method by which the drug has been prepared.

### **1.2.4 Chemical constituents of plant parts**

A variety of chemical constituents from plant sources have been studied for their medicinal values. Some of these chemical constituents which are biologically active include;

**Fats and oils:** Fixed oils can be of two kinds, i.e. fixed oils which does not distil at the temperature of boiling water and is made up of fatty acids linked onto a glycerol backbone and essential oils which are volatile and usually odorous liquids due to the scents of flowers or other plant parts from which they are derived. Essential oils are nitrogenous compounds. Fats and oils regulate intestinal movements (i.e. prevent or control violent contractions) and thus aid the orderly flow of food through the bowel. They may also be as condiments with food and to relieve colicky pains. Fats and oils also have the power to hinder bacterial growth and may therefore be used in treatment of wounds and infections. Oils which are less well absorbed may be of value as vermifuges.

**Glycosides:** These are compounds made of hexose sugars mainly glucose. Example, tannins, which are glycosides of gallic or protocatechuic acids. They have the ability to precipitate mucus and also constricting blood vessels. Such astringent property of the tannins gives them medicinal value of preventing diarrhoea and controlling haemorrhages. They may also be applied on wounds as a protective coating. Glycosides are the most abundant of active principles in plants particularly in trees and shrubs where they are mainly found in the bark. They are extracted by boiling the bark in water or soaking it in cold water.

**Alkaloids:** Exist in plants as salts of various organic acids and amine bases. The salts are colourless crystalline compounds. Although the main active alkaloids are among the most potent vegetable poisons, a good number of them can be taken in fairly large amounts without any danger. The less toxic alkaloids such as caffeine and sapartine would normally increase the renal secretion either by increasing the blood flow through the kidney or by other direct actions and are thus used as diuretics and in dropsy. Alkaloids have a bitter taste.

**Toxalbumins:** These are poisonous proteins which are irritant in nature and mainly found in the seeds of plants. They can induce inflammation of mucous membranes such as those of the eye and nose and can cause violent vomiting and purging when swallowed since they are not digested. Toxalbumins may be applied on ulcers, congested eyes to induce an inflammatory reaction followed by healing.

**Benzoquinones:** For example, alkylbenzoquinones such as maesaquinone and embelin have anthelmintic action.

**Anthraquinone cathartics:** The purgative anthraquinone drugs owe their activity to complex mixtures of the 1, 8-dihydroxy derivatives of anthrols, their glycosides and free anthraquinones. The relative proportions of the mixture, which greatly influence the pharmacological activity, depend not only on the time of collection, age of plant (For example, the anthraquinone constituents in frangula and cascara can be stored in the bark for upto a year or two before they are consumed for treatment. The aging process reduces the degree of irritability, due to changes in the glycoside and anthraquinone chemical properties.), drying conditions and geographical source, but also on genetic factors.

## **1.3 OBJECTIVES**

### **1.3.1 BROAD OBJECTIVE**

1. To identify the various uses of the plants in Rhamnaceae family as sources of herbal and conventional medicines.

### **1.3.2 SPECIFIC OBJECTIVE**

1. To determine the various active principles in the various species and their mechanism of actions in treatment of various disease conditions.
2. To identify the various preparations of the said plants available in the Kenyan market.
3. To identify some of the constraints and challenges associated with preparations from plants in this family.
4. To identify various measures and strategies for enhancing the preparation of medicinal products so as to meet the safety and efficacy requirements.

## **1.4 COMMENTS**

Despite the fact that there exists close to 900 species in this family, only a few have been studied for their medicinal values. In Kenya for example, only about twenty species have been studied for their use in conventional and herbal medicine. The table below gives some examples of the said species and their various uses especially in herbal medicine. The table also indicates the various parts of the plant that is of medicinal importance.

**TABLE 2: Table showing various plants in the *Rhamnaceae* family used as herbal medicines.**

<b>PLANT NAME</b>	<b>COMMUNITIES THAT UTILISE THE PLANT</b>	<b>PART OF PLANT USED</b>	<b>CONDITON</b>
<i>Berchenia discolor</i>	Turkana, Baringo, Kamba	Bark is drunk as tea or boiled in various foods or soups.	Yellow jaundice and stomach disorders
<i>Helinus mystacinus</i>	Luhya	The roots can be boiled in water or both the leaves and roots can be chewed whole.	Stomach aches and headaches
<i>Rhamnus staddo</i>	Elgon	Roots can be boiled in water or milk.	Cure for venereal diseases, urination and barren conditions in women
<i>Rhamnus prinoides</i>	Elgon and Kakamega	Bark and roots	Gonorrhoea and rheumatism. Also used as a blood purifier and in the treatment of pneumonia.
<i>Scutia myrtina</i>	Kikuyu, Luo, Luhya, kamba	Bark decoction	Used to decrease or eliminate intestinal worms. Has a drying effect in the mouth and is

			therefore used as an astringent Can also be used as an ointment locally applied to increase parturition of the child placenta.
<i>Zizyphus abyssinica</i>	Kamba,luhya,luo,kamba	Roots are dried and powdered	As an abortifacient and also in treatment of asthma Can also be used together with the <i>Rhynchosia</i> species in treatment of stomach aches
<i>Zizyphus mauritiana</i>	Taita, Kambe	Roots	Indigestion
<i>Zizyphus mucronata</i>	Luo, Kamba, Duruma, Kambe	Bark	Used for snake bite treatment, rheumatism and snake bites Also used as an emetic chest troubles, coughs and pains of any sort Poultice of the leaf is used in boils carbuncles and other septic swellings
<i>Helinus orate</i>	Zulu	Leaves	Hysteria



<i>Rhamnus holstii</i>	Maasai	Roots	Gonorrhoea
<i>Rhamnus zeyheri</i>	Kakamega	Leaves	By mouth in management of pains and soreness in the back and as an enema for rectal ulceration in kids
<i>Ziziphus abyssinica</i>	Kamba		Tonsillitis and pneumonia
<i>Ziziphus helvola</i>	Turkana, Magadi		Used in women with menstrual troubles
<i>Ziziphus zeyheri</i>		Roots	Diarrhoea and dysenteries

#### 1.4.1 Use in conventional medicine

Various active ingredients have been extracted, using high-through put mechanistic methods, and are being used as drugs in the present day medicine. Some of these ingredients are as recorded in the table below.

**TABLE 3: Important plant-based ingredients of medicaments.**

Ingredient	Plant species	Application
Anthraquinolones	<i>Rhamnus purshiana</i> , <i>Rhamnus frangula</i>	Laxative

Alkaloids	<i>Ceonathus velutinus</i> , <i>Ziziphus mucronata</i>	Increasing blood flow, diuretics
Glycosides; Tannins	<i>Ziziphus zizyphus</i>	Constricting blood vessels
Emodin	<i>Rhamnus frangula</i>	
Resins	<i>Rhamnus frangula</i>	Emetic

## CHAPTER TWO

### 2.1 *Rhamnus purshiana*

Common names: Bearberry

Buckthorn

Cascara

Sacred bark

Purshiana bark



FIGURE 3: *Rhamnus purshiana*

#### 2.1.1 Location and description of plant

Found in moist places, in the understory of coniferous forests, along roadsides.

*Cascara sagrada* is a small deciduous tree or large deciduous shrub with thinly fissured bark; grows 15-25 feet high, and its reddish-brown bark is often covered with gray lichen. The alternate, dark green, elliptic to oblong-ovate, wavy-edged, leaves are finely and irregularly toothed or nearly entire. They are rounded at the base and may be obtuse or acute at the apex. Clusters of small, greenish, bell-shaped, flowers grow in finely hairy umbels on leaf axils, producing eventually juicy, black or purplish black, pea-sized drupes (berries).

### 2.1.2 Medicinal properties

The active constituents of cascara are the anthraquinones. They are inactive in the gastrointestinal tract until they reach the colon; there they produce a soft or formed stool within about six to eight hours and cause vigorous peristalsis.

Other active compounds include anthraquinone glycosides, (emodin, frangulin, iso-emodin, aloe-emodin, and chrysophanol), rhein, aloin, malic acid, tannic acid, cascarosides A, B, C, and D, and hydroxy anthracene derivatives (HAD).

Aged/dried bark contains 7-10% of total hydroxyanthracene derivatives of which 60-70% are cascaroside A ( $C_{27}H_{32}O_{14}$ ).

**Antitumor activity:** Cascara's anticancer activities may arise from its emodin and aloe-emodin content. Emodin is a tyrosine kinase inhibitor. It appears to exert antitumor properties possibly by inhibiting tumor cell proliferation, inducing cell cycle arrest, apoptosis and tumor cell death. *In vitro* studies show that aloe-emodin induces p53 and p21 expression resulting in cell cycle arrest in the G1 phase. However, more studies are needed to confirm this effect.

Emodin has been shown to have highly selective activities against src-Her-2/neu and ras-oncogenes. In addition, emodin has been shown to increase the repair of DNA damaged human cells and has demonstrated *in vitro* to reduce the invasiveness of human cancer cells. Emodin may also have immunosuppressive, vasorelaxant, antioxidant and hepatoprotective activities.

**Antiviral activity:** Aloe-emodin, a constituent in cascara and aloe, has been reported to have antiviral activity *in vitro*. Another constituent, emodin, has been reported in studies to possess anti-inflammatory, antibiotic, and antineoplastic properties.

**Laxative effects:** It is the free anthraquinone and hydroxy anthracene derivative (HAD), which give cascara sagrada its laxative action. These compounds promote more peristalsis in the large intestine and at the same time, trigger a nerve center, which facilitates bowel movement. The active constituents of cascara are absorbed through the small intestine, enter the circulation and stimulate the autonomic nervous system to create peristalsis. Cascara also contains small amounts of bitter anthracene and aloin compounds which account for the cathartic action.

The chemical components of cascara also stimulate the organs of the digestive tract including the gallbladder, pancreas and stomach, which results in increased digestive fluids. The laxative effect of cascara appears to be via induction of the synthesis of nitric oxide.

The onset of action is based on unsubstantiated reports; orally administered cascara laxatives usually produce a bowel movement within 6-8 hours, although the effect may not occur for 24 hours. Following oral administration, the anthraquinone glycosides are purported to be poorly absorbed until they are hydrolyzed by colonic bacteria; then moderate absorption of cascara occurs.

Metabolism occurs at intestinal wall, to an unknown extent. Readily transformed to corresponding glucuronide and sulfate derivatives. The colon and jejunum also exert an anthraquinone-conjugating activity. At least a part of these compounds undergo extra-hepatic metabolism. Following oral administration and hydrolysis by colonic bacteria, the anthraquinones are partially eliminated renally.

**Selected combination products:**

- Bassoran® cascara (sweet cascara and magnesium oxide)
- Bicholax® cascara elixir (cascara, licorice, light magnesium oxide, coriander oil, anise oil, ethanol, saccharin sodium, glycerol, water)
- Cascara Sagrada Whole Herb Active (cascara sagrada bark, cascaroside A)
- Evac®
- Casylium
- Concentrated Milk of Magnesia (Cascara equivalent to 1mL of aromatic fluid extract per teaspoon of milk of magnesia)
- Kondremul® with Cascara (220mg per teaspoon of mineral oil)
- Nature's Remedy® Natural Vegetable Laxative Tablets (150mg cascara sagrada and 100mg aloe in tablet)
- Parke-Davis® Zand® cleansing laxative with cascara sagrada.

In veterinary practice, Cascara Sagrada is also much used and is probably the best mild purgative remedy for dogs with chronic constipation, as the dose does not require to be increased by repetition and the tone of the bowels is improved by the drug.

## 2.2 *Rhamnus carthatica*

Common name; Highway thorn

Waythorn

Hartsthorn



FIGURE 4; *Rhamnus carthatic*

### 2.2.1 Description

The main stem is erect, the bark smooth, of a blackish-brown colour, on the twigs ash-coloured. The smaller branches generally terminate in a stout thorn or spine, hence the ordinary name of Buckthorn, and the older names by which the shrub has been known: Highwaythorn and Waythorn. The leaves grow in small bunches on footstalks, mostly opposite towards the base of the young shoots; though more generally alternate towards the apex. They are egg shaped and toothed on the edges, the younger ones with a kind of soft down. In the axils of the more closely arranged leaves, developed from the wood of the preceding year, are dense branches of small greenish-yellow flowers, about one-fifth inch

across, which are followed by globular berries about the size of a pea, black and shining when ripe, and each containing four hard, dark-brown seeds.

### **2.2.2 Parts used**

The *berries* are the part used medicinally, collected when ripe and from which an acrid, nauseous, bitter juice is obtained by expression. From this juice, with the addition of sugar and aromatics, syrup of Buckthorn (*Succus Rhamni*) is prepared.

### **2.2.3 Medicinal action and uses**

The berries are cathartic, depurative, diuretic, laxative and violently purgative. About 8 - 15 of the mature fruits, chewed before breakfast, are a strong and effective laxative for adults, they should not be used by children. An infusion of the immature fruits is gentler in its action. It should be used with caution because it can cause brisk, watery purging with nausea, dryness of throat, thirst and tormnia. These effects are partly removed by giving the juice (*Rhamni succus*) in the form of a syrup which formerly enjoyed much reputation as a hydragogue in gout rheumatism and dropsy; at present it is seldom employed in practice but is occasionally employed as an adjunct to other cathartic and diuretic mixtures.

Buckthorn berry juice contains Rhamnocathartin (which is yellow and uncrystallizable), Rhamnin, a peculiar tannic acid, sugar, glycosides, ascorbic acid, mineral salts and gum.

Other active constituents include organic acids and ascorbic acid.

Studies have been done using small doses of a tincture in seventy six percent alcohol as a stimulant to the vegetative process, for its influence on the digestive tract and in diseases of the nose, throat and lungs. The fruits can be used for edema, stomach ulcers, gout, rheumatism, chronic skin diseases and inflammatory diseases of the oral mucosa.

### 2.3 *Rhamnus frangula*

Common names; Black Dogwood

Alder Dogwood

Alder Buckthorn

Black Alder



FIGURE 4: *Rhamnus frangula*

#### 2.3.1 Description

It is generally about the same size as the Common Buckthorn, but is distinguished from it by its less bushy and more tree-like habit, by the absence of thorns on its branches and by its larger and entire, not toothed, feather-veined leaves, which are all arranged alternately on the stem, none opposite to one another. Their fruit, which is ripe in September, is not unlike that of the Common Buckthorn, but the berry has only two, or at most three, roundish, angular seeds, instead of four. Bees are likewise constant visitors of the flowers of this species, and



goats eat the leaves voraciously. It grows as a rule in leaf-mould in woods comparatively free from lime.

The bark and leaves of the Alder Buckthorn yield a yellow dye much used in Russia; when mixed with salts of iron it turns black. The berries, when unripe, afford a good green colour, readily taken by woollen stuffs; when ripe, they give various shades of blue and grey.

After removal of the bark from the stem and branches, the wood of this shrub is used for making charcoal, yielding a very light, inflammable kind, and being on that account preferred to that of almost any other tree by gunpowder makers, who name it 'Black Dogwood.'

### 2.3.2 Parts used

Dried bark.

### 2.3.3 Medicinal action and uses

The chemical constituents of Frangula Bark, especially those to which the laxative properties are due, are but imperfectly known. A yellow, crystalline glucoside, Frangulin has been isolated from it. Emodin ( $C_{15}H_{10}O_5$  m.p 256-257 °C), both di-glycosides and mono-glycosides, is present in old bark; this principle is also present in rhubarb root; it is allied to Chrysophane, and is said to result from the glucosic fermentation of Frangulin or Frangulic acid, and to its presence the drug owes its purgative action.

- Diglycosides;
  - i. glucofrangulin A (emodin -6-o- $\alpha$ -L-rhamnosyl-8-o- $\beta$ -D-glucoside)
  - ii. glucofrangulin  $\beta$  (emodin-6-o- $\beta$ -D-apiosyl-8-o- $\beta$ -D-glucoside)
  
- Monoglycosides;
  - i. frangulin A (emodin-6-o- $\alpha$ -L-rhamnoside)
  - ii. Frangulin B : emodin -6-o- $\beta$ -D-apioside
  - iii. Frangulin C: emodin-6-o- $\beta$ -D-xyloside

Possibly other glucosides are also present and contribute to the laxative action, but the evidence in favour of this assumption is not conclusive. Two resins, resinous bitter matter and a little tannic acid are likewise present in the bark. It is therefore used as a tonic, laxative or a cathartic.

Other active constituents include small quantities of dianthrone and aglycones.

It is believed to be a powerful stimulant cathartic agent. Emodin-9-anthrone is the most important metabolite produced by the bacteria of the large intestines. Main mode of action includes increase in colonic motility leading to reduced transit time. It also influences secretion processes by two concomitant mechanisms, this is;

- Inhibition of absorption of water and electrolyte ( $\text{Na}^+$ ,  $\text{Cl}^-$ ) into the colonic epithelial cells
- Increases leakiness of tight junctions and stimulation of secretion of water and electrolyte into the lumen of the colon (secretagogue effect), resulting into enhanced concentrations of fluid and electrolyte.

An alcoholic extract of *Rhamnus frangula bark* also has some antifungal effects. They are believed to completely prevent the germination of spores from *Aspergillus fumigatus*, *Penicillium digitatum* and *Fusarium oxysporium* in the agar.

Hot glycerine extracts are virucidal and therefore inactivate the virus. Other pharmacological effects include antibacterial activity (emodin induces a dose dependent DNA damage and inhibition of the growth of *Helicobacter pylori*). It also has anti-inflammatory and anti-cancer effects.

Dried seasoned bark from one to two years old alone should be used, as the freshly stripped bark acts as an irritant poison on the gastro-intestinal canal. The action of the bark becomes gradually less violent when kept for a length of time and more like that of rhubarb.

It is used as a gentle purgative in cases of chronic constipation and is principally given in the form of the fluid extract, in small doses, repeated three or four times daily, a decoction of 1 OZ. of the bark in 1 quart of water boiled down to a pint, may also be taken in tablespoonful doses.

## 2.4 *Ziziphus mucronata*

Common name; Buffalo thorn



FIGURE 6; *Ziziphus mucronata*

### 2.4.1 Description

*Ziziphus mucronata* is a small to medium-sized tree, 3-10(-20) m high; with a spreading canopy. The main stem is green and hairy when young; year old branches often zigzag; the bark is reddish brown or roughly mottled grey, cracked into small rectangular blocks, revealing a red and stringy under-surface. Young stems are reddish brown.

Leaves are simple, alternate; ovate or broadly ovate; vary enormously in size from tree to tree, 30-90 x 20-50 mm, tapering or often mucronate apex, base strongly asymmetrical, cordate to rounded on one side; margin finely serrated, often badly eaten by insects, glossy green above, slightly hairy and paler below; 3- to 5-veined from the base; veins covered with fine hairs when young; petiole up to 20 mm long; stipules, when present, take the form of small thorns at the nodes, one straight and one hooked. Leaves turn golden yellow in autumn. Flowers are borne in dense clusters in leaf axils; green to yellow;  $\pm$  4mm in diameter; inconspicuous. The fruit is a smooth, shiny, leathery, spherical drupe, 12-20 mm in diameter, reddish-brown or deep red when ripe, slightly sweet, the pulp is dry. The fruit sometimes stays on the plant long after the leaves have fallen. The seeds are usually solitary, elliptic and compressed.

#### 2.4.2 Parts used

Roots, barks.

#### 2.4.3 Medicinal action and uses

*Z. mucronata* has anti-sickling effect due to its anthocyanin content. It can therefore be used in anaemia. Anthocyanins' anti-inflammatory ability has been shown to help dampen allergic reactions. They also have the potential to inhibit some human tumour cells. Another beneficial effect of the anthocyanins is their anti-oxidant effect and can therefore be used to prevent oxidation of LDL during the progression of arteriosclerosis. Anthocyanins help improve eyesight.

Extracts from the bark have some antibacterial activity against both gram negative and gram positive bacteria. This broad antibacterial activity can be exploited in the treatment of infections with *Escherichia coli*, *Proteus vulgaris*, *Staphylococcus aureus* and *Bacillus subtilis*. The broad spectrum of activity of this plant is due to the ability of the extracts from the bark to prevent the active mechanism of resistance in gram negative bacteria which tend to restrict the penetration of antimicrobials due to the presence of multi-drug resistant pumps and also a complex cell wall.

Extracts from the roots have been shown to have some antifungal activity. They are active against *Trichophyton metagrophytes*, *Trichophyton rubrum*, *Aspergillus fumigates* and *Microsporum canis*. These extracts can be useful in antiseptic and disinfectant formulations (Harami M. Adamu et al).

Extracts from the roots and barks have some antihelmintic effect and can be used against tapeworm infestation.

A decoction of the glutinous roots is commonly administered as a painkiller for all sorts of pains as well as dysentery. A concoction of the bark and the leaves is used for respiratory ailments and other septic swellings of the skin. Pastes of the root and leaves can be applied to treat boils, swollen glands, wounds and sores. Steam baths from the bark are used to purify and improve the complexion. In East Africa, roots are used for treating snake bites. All of the above can be attributed to the peptide alkaloids and antifungal properties isolated from the bark and leaves.

## 2.5 *Berchemia discolor*

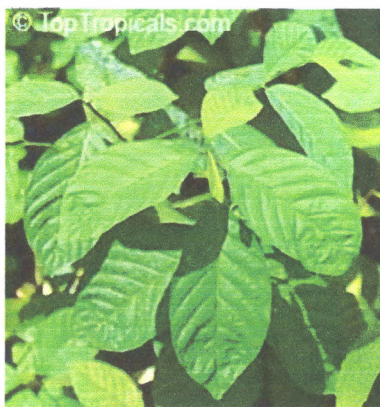


Fig. 7; *Berchemia discolor*

### 2.5.1 Description

A shrub or a tree 3-20 m high; with a straight bole; rough, dark grey bark that flakes longitudinally; dense, rounded crown; slash yellow; young branches conspicuously lenticellate; branchlets glabrous to densely pubescent with short, spreading, whitish hairs. Leaves alternate or sub-opposite, entirely or obscurely crenate, shiny above, dull and glaucous below, broadly elliptic, ovate or obovate-elliptic lanceolate, 2-9 x 2-5 cm, obtuse or acute at the apex, rounded or cuneate at the base; leaf stalks glabrous or pubescent, 1-1.8 cm long. Flowers small, solitary, thick, oblong or ellipsoid, 4-5 mm in diameter, greenish when young, turning yellowish after ripening. Fruit datelike, yellow, up to 20 x 8 mm with 1-2 flat seeds in sweet, edible flesh.

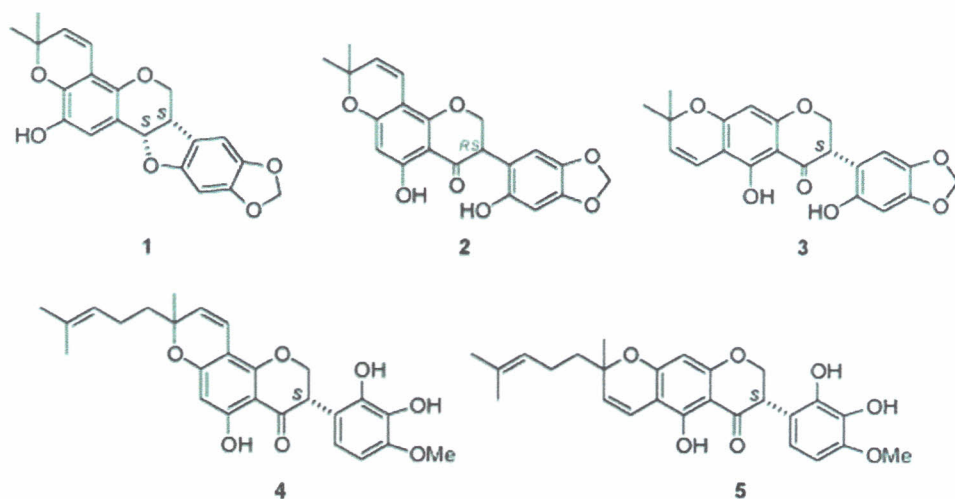
### 2.5.2 Parts of plant used

Roots, leaves and stem barks.

### 2.5.3 Medicinal uses

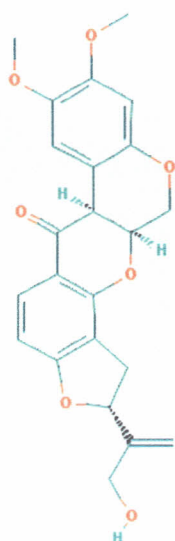
Extracts of *Berchemia discolor* are active against MDR-TB. They can therefore be important sources of mycobactericidal compounds against multidrug-resistant.

Five prenylated flavanoids have been isolated from the roots of *Berchemia discolor*. The five whose structures are given below exhibit cytotoxic activity against a small panel of human cancer cells (Qiuwen Mi et al).



Additional active ingredients in the roots include; nitidulin, Amorphigenin, Dabinol which have anti-proliferative and anti-cancer effects in many cell types. Nitidulin is active against human hormone-dependent prostate cancer.

Amorphigenin is a rotenoid whose structure is shown below:



Amorphigenin

It has the potential to inhibit osteoclast differentiation. Osteoclasts are important in bone remodelling; they constantly dissolve and get rid of old and damaged bones making way for osteoblasts to make new ones. Decrease in bone mass resulting from imbalance between bone resorption and bone formation can be caused by various hormones and cytokines which often lead to bone diseases such as autoimmune arthritis, periodontitis, and postmenopausal

osteoporosis and bone tumours. Extracts from *B. Discolour* can therefore be used as treatment option for bone erosion by inflammation.

Acetone and hexane extracts of the leaves and barks have some antifungal activity. They have been shown to be active against *Candida albicans*, *C. Neoformans* and *C. Krusei*. They can therefore be exploited in the management these fungal infections. Extracts from the bark and the leaves have also been shown to have some anti-bacterial activity and are effective against *Staphylococcus aureus*.

## 2.6 *Scutia myrtina*

Common names; Cat thorn

Siphingo



Fig. 8; *scutia myrtina*

### 2.6.1 Description

Evergreen shrub, upto 11m high, bark pale green and spines are often present. Leaves are opposite hairless leathery, short- stalked; blade is oval entire and blunt (15-30cm. Long, 1-2.5 cm. Broad).

Spines are irregularly arranged, single, straight (5-7 cm long) or hooked. Flowers are small, greenish, dioecious. Male flowers are sessile, female; 2-3 together at the twig ends. Petals are green with purple –red tips, ovary is superior and two celled. Fruit is somewhat fleshy spherical, one seeded in a cup shaped calyx is pale yellow in colour and is edible.

### 2.6.2 Parts used

Barks, roots and leaves

### 2.6.3 Medicinal action and uses

The active ingredients that have been isolated from extracts of the bark include; scutianthraquinones A, B, C (anthrone-anthraquinones), D (bisanthrone-anthraquinone) and a known anthraquinone : aloesaponarin. These compounds show some moderate antiplasmodial activity against chloroquine resistant *Plasmodium falciparum*.

The roots of *Scutia myrtina* have perylenequinones; scutiaquinones A and B, which have antihelminthic activity and cyclopeptide alkaloids with moderate antimicrobial activity.

Ethanol extract of *Scutia myrtina* have been shown to be hepatoprotective. The hepatoprotective effects of *Scutia myrtina* is due to its antioxidant and free radical scavenging effects. The extracts have been shown to significantly decrease the activity of serum enzymes (AST and ALT), ALP, bilirubin, and lipid peroxidation, while it significantly increases the levels of protein, uric acid, GSH, Vitamin C, Vitamin E, SOD and CAT.

*Scutia myrtina* also contains alkaloids, carbohydrates, anthraquinone glycosides, saponins, tannins, flavonoids and fixed oils. The anthraquinone glycosides are responsible for the laxative effect of the plant. *S. Myrtina* potentiates the effect of acetylcholine on smooth muscles especially smooth muscles of the intestines. This effect leads to an increase in the contraction of the smooth muscles of the intestines thus leading to an increase in gut motility and hence its laxative effect.

Leaves are used in ointments applied locally to hasten parturition. The roots are used to relieve backaches and chest pains.



It is also believed to have some anti-carcinogenic effects but the main mechanism of action is not well established. Their anti-proliferative activity can be employed in management of human ovarian cancers and liver lesions.

## 2.7 *Ziziphus zizyphus*

Common name; jujube



Fig. 9; *Ziziphus zizyphus*

### 2.7.1 Description

A bushy shrub or small tree up to 15 m high with drooping branches and hairy zigzagging twigs with small paired spines at leaf bases (occasionally absent). Leaves alternate, simple, elliptic-ovate to oblong-elliptic, 2–9 cm long and 1.5–5 cm wide, entire or slightly crenate, glossy above, densely white haired below with 3 conspicuous longitudinal veins and 8–15 mm long leaf stalks. Inflorescence from leaf corners. The yellowish to reddish or blackish fruit is globose to ovoid, up to 6 × 4 cm when cultivated, smaller on wild trees, with glossy smooth or rough skin and white, juicy, weakly acid to sweet flesh.

### **2.7.2 Parts used**

The fruit is eaten fresh, used to make drinks, candy or syrup or preserved by drying. Other parts used include roots, leaves and the seeds.

### **2.7.3 Medicinal uses and actions.**

Jujube fruit contains a number of vitamins and minerals, such as calcium, potassium, iron, copper and phosphorus. This nutritious fruit also contains vitamins A and C, as well as niacin, riboflavin and thiamine. It also contains calories. The fruit can therefore be used to help strengthen the stomach and improve digestive functions. It can also be used to improve muscular strength and to increase stamina.

The dried fruit contains triterpenoids and alkaloids and is considered to purify the blood and aid in digestion. It can also be used in a range of conditions such as chronic fatigue, loss of appetite, diarrhoea, pharyngitis, bronchitis, anaemia irritability and hysteria. The fruit, being mucilaginous, is very soothing to the throat and decoctions of jujube have often been used in pharmacy to treat sore throats.

The seeds contain saponins, triterpenes, flavonoids and alkaloids. The seeds are hypnotic, narcotic, sedative and tonic. It can therefore be used in treatment of palpitations, insomnia, nervous exhaustion, night sweats and excessive perspiration.

A decoction of the root can be used in dyspepsia and to reduce fever. It can therefore be used in treating such eruptive fevers of children as smallpox, measles, and chicken pox.

The leaves are astringent and febrifuge and are believed to promote hair growth. They are also anti-obese and can therefore be employed to help in weight reduction in obese patients. . Ziziphin, a compound in the leaves of the jujube, suppresses the ability to perceive sweet taste in humans.

Jujube is also used for various skin conditions including dry and itchy skin, purpura and eye diseases. The bark is used to make an eye wash for inflamed eyes. The plant may help prevent impairment of hippocampal memory. The plant can also be as an expectorant, emollient, calmative, diuretic and to improve the immune system.

## 2.8 *Zizyphus oenoplia*

Common names; Jackal jujube



Fig. 5; *Zizyphus oenoplia*

### 2.8.1 Description

It is a spreading, sometimes climbing, thorny shrub growing to 1.5 m in height. The leaves are simple, alternate, ovate-lanceolate, acute and oblique. The flowers are green, in subsessile axillary cymes. The fruit is a globose drupe, black and shiny when ripe, containing a single seed.

#### Parts used

Stem bark, leaves and roots

#### Medicinal action and uses

The plant produces cyclopeptide alkaloids, known as ziziphines A, B, C, D and E, Abyssinine B and A. It also contains about twelve percent tannins, flavonoids, phenolic compounds, saponins, amphibine (B and F) and mauritine D.

The roots are astringent, bitter, antihelmintic, digestive, and antiseptic. They are useful for treating hyperacidity, ascaris infection, abdominal pain, and healing of wounds. The flavonoid content of the roots has some anti-ulcerogenic activity. Extracts from the roots of this plant can therefore be used in treating of gastric and duodenal ulcers which can be precipitated by agents such as stress, smoking, ingestion of non-steroidal anti-inflammatory agents such as indomethacin and infection by *Helicobacter pylori*. Main mechanism of action of its anti-ulcer effect is believed to be due to;

- Decrease in gastric secretions
- Increase in the pH of the stomach
- Increase in prostaglandin synthesis which has a protective action on the mucosa

The barks and leaves have some antibacterial activity and can therefore be used in *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa* infections.

*Z. oenoplia* is angiogenic and is believed to facilitate wound closure by facilitating proliferation of capillaries which bring oxygen and micronutrients to growing tissues and remove catabolic waste products. The roots contain alkaloids, carbohydrates, starches, mucilages, tannins, saponins, proteins and amino acids, tannins, steroids, and sterols. Its angiogenic activity is thought to be due to a combination of any of the said ingredients (exact mechanism of action is not well known).

In India the root is used in Ayurvedic medicine. Extracts can be used in mouthwash for sore throats, for dysentery, and for inflammation of the uterus.

## Chapter three

### 3.1 Adverse effects and contraindications

Special care should be taken in patients taking preparations of *Rhamnus frangula* especially if the patient is on the following drugs;

- i. Cardiac glycosides
- ii. Antiarrhythmic medicinal products
- iii. Medicinal products inducing QT-prolongation
- iv. Diuretics
- v. Adrenocorticosteroids

This is so because long term use of such preparations has the ability to decrease  $K^+$  levels thus potentiating the action of cardiac glycosides and the rest. One should consult the doctor before taking *frangula* concomitantly.

Most of the plants discussed with laxative effects are contraindicated in faecal impaction and undiagnosed acute or persistent gastrointestinal complaints such as abdominal pain, nausea and vomiting, inflammatory bowel disease, crohns disease, intestinal obstruction and ulcerative colitis. Overdosage leads to severe diarrhoea with consequent loss of fluid and electrolyte.

Extracts from these plants are safe in pregnancy however use in lactating mothers is not recommended as there are insufficient data on the excretion of the metabolites in breast milk.

*Rhamnus* species is associated with an inflammatory condition known as melanosis; a condition in which the mucous membrane of the colon is pigmented with melanin.

When taken by mouth, cascara can commonly cause mild abdominal discomfort, colic, and cramps. Long-term use may lead to potassium depletion, albuminuria (albumin in the urine above a specified level indicating potential kidney damage), hematuria, disturbed heart function, muscle weakness, finger clubbing (enlargement), and cachexia. It is purported that

the bark of cascara must be aged for one year or heat-treated to remove harsh constituents, which may produce severe vomiting, intestinal cramping, and/or spasms.

In some cases, chronic use may also cause pseudomelanosis coli. Pseudomelanosis coli (pigment spots in the lining of the large intestine) is believed to be harmless, usually reverses with discontinuation.

They should be avoided in individuals with a known allergy or hypersensitivity to cascara or the Rhamnaceae family. Cascara sagrada exposure has resulted in occupational asthma and rhinitis. Symptoms of allergy may include contact urticaria ("hives") or rash.

*Ziziphus* species is relatively safe compared to the other plants in this family. There is not enough documentation on the adverse effects.

### **3.2 CONSTRAINTS AND CHALLENGES**

The major challenge I encountered while compiling this research work was lack of adequate reference material within the University libraries in terms of journals and textbooks. Most of my reference material was from the internet and books obtained from the National museum.

Lack of cooperation from the attendants in the various herbal shops that I visited with the aim of finding out the available preparations in the Kenyan market. Most of the attendants were also not well informed on the major components of the products that they were selling.

### **3.3 RECOMMENDATIONS**

1. Kenya should have a National Drug policy incorporating herbal medicines so as to improve the health of people and to protect them from quacks.
2. Safety, efficacy and quality of the medicines should be established controlled and maintained.

3. Financial grants and sponsorship should be given to scholars so as to encourage more research work on plants with medicinal uses. This will facilitate proper and accurate identification of the active ingredients so as to minimise any side effects.
4. There should be a National Advisory committee which is interdisciplinary comprising of Herbalists, pharmacists, medical practitioners, nurses, legal personnel, conservationists, economists and planners.
5. Setting up of herbal schools so as to educate the herbalist on the correct methods of extracting, storing, preparing and routes of administration of the active drug. This will help in minimising the chances of contamination during extraction.

## References

1. Kokwaro J.O., 1993 Medicinal plants of East Africa, second edition, University of Nairobi
2. Kokwaro J.O., Medicinal plants of East Africa, third edition, University of Nairobi
3. John Mitchell Watt, Maria Gerdina, Breyer Brand Wijk, The medicinal plants of Eastern and Sothern Africa, pg 882
4. Marshall C. Johnston, E. Milne, Flora of Tropical East Africa
5. Dr. Y. Nayudamna et al, The wealth of India: A dictionary of Indian raw materials and industrial products
6. H. J. Beentje, Kenyan Trees Shrubs and lianes National Museums of Kenya pg 722
7. William Charles Evans, Trease and Evans' Pharmacognosy, fourteenth edition, pg 43-44
8. Michael Heinrich, J. Burnes, J. Gibbons and E. Williamson, October 2003, Fundamentals of pharmacognosy and phytotherapy
9. <http://en.wikipedia.org/wiki/file:tree986.jpg>
10. <http://www.plantzafrica.com/>
11. Kokwaro J. O., Timothy Johns, Luo biological dictionary ,pg 102
12. Journal of complementary and integrative medicine: vol. 8 iss. 1, Article 8
13. Albrecht J. Ed 1993: Tree seed handbook of Kenya.GTZ forestry seed centre Muguga, Nairobi, Kenya.
14. ICRAF 1992: A selection of useful trees and shrubs for Kenya.
15. Journal of Ethnopharmacology vol 33 issues 1-2 pgs 143-157



16. Qiuwen Mi, John M. Pezzuto, Roman R. Fransworth, Mansukli C. Wani, A. Douglas Kinghorn and Steven M. Swanson: Journal of Natural Products 2009 vol 3 pg 573-580.
17. [www.yourmedicinalplants.com/jujube](http://www.yourmedicinalplants.com/jujube)
18. Asian Journal of Pharmaceutical and Clinical research vol. 4 iss 1, 2011
19. <http://scholarsresearchlibrary.com/archive.html>
20. Harami M. Adamu, O j Abaye, Nne U. Iboke and Samuel Emgba Kafu: Natural Product Radiance, vol 5, 2006 pg 357-360
21. Journal of Medicinal Plants Research vol 5, pg 3791-3795