

**THE IMPORTANCE OF SCROPHULARIACEAE FAMILY AS A SOURCE OF
HERBAL AND CONVENTIONAL MEDICINES.**



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DECLARATION

This research project is my original idea and has been submitted for evaluation, research and examination with my approval and to the best of my knowledge has not been presented elsewhere for project work.

Sign..........

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This project has been submitted with my approval as the University Supervisor

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DEDICATION

To my parents for moulding me to the person I am today.

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Special thanks to my project supervisor Dr.Gatuma for his constant guidance and correction that proved useful to my work.

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ABBREVIATIONS

WHO- World Health Organization

CNS- Central Nervous System

GMPs- Good Manufacturing Practices

ABSTRACT

This project was based on extensive exploration of Scrophulariaceae family as an important source of traditional and conventional medicines using literature survey, internet and journals.

A brief survey of the various sub-families was done, and then the various species of medicinal importance were considered.

Both the traditional, modern uses and research findings, where applicable, were considered, together with the chemical constituents responsible for their effects.

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CHAPTER ONE

1.1 INTRODUCTION

The exploitation of plants for medicines has a long and honourable history since at one time all drugs were obtained from natural sources. Herbal medicines is currently enjoying a revival in popularity and is of course the primary form of medicine in many parts of the world. Herbal medicines are effective and potent medicines requiring evaluation by specific methods in order to be used to their full effect. Standardization of herbs is important for comparing herbal therapy with conventional medicine.

Over the past two decades, there has been a tremendous increase in use of herbal medicine; however there is still a significant lack of research data in this field. Since 1999, WHO has published four volumes of WHO monographs. These provide WHO guidelines on GMPs for herbal medicines which provide general technical guidance on obtaining medicinal plant materials of good quality for the production of herbal medicines in the overall context of quality assurance and control of herbal medicines.

Natural products are the basis of many drugs used in modern medicine thus they serve as templates for their development. Even if the potency of some of these compounds is not sufficient to justify their development as pharmaceuticals their effects on the body must be considered because of the sheer volume of their ingestion. Plants also supply efficient treatment of some conditions when conventional medicine has little to offer.

The WHO estimates that 70-90% of Africa's rural population still relies on traditional medicine to meet health needs. Herbal medicine is recognized by WHO as an essential component of primary health care. A large no of people in Kenya irrespective of social status, ethnic group or religion regularly uses complementary medicine. It is estimated that 33% of drugs produced in the developed countries come from higher plants. This is a clear indication that plants play a

important role in production of conventional medicines. Hence the need to explore further plants as sources of active ingredients.

In developing countries, accessibility and affordability is the driving force for increased use of traditional medicines. These medicines have been recognized as a valuable source of products and treatment of healthcare. It often provides leads for the development and commercialization of new pharmaceutical products. This research project involves extensive exploration of Scrophulariaceae family as an important source of traditional and conventional medicines using literature survey, internet and journals.

Factors to justify promotion of herbal medicine in Kenya

- Traditional medicine is easily accessible and affordable
- It offers a gentler means of managing chronic diseases like Diabetes and Hypertension
- The drug components act synergistically lower doses are then used hence reduced toxicity
- It is of growing economic importance hence act as a source of income
- Low level of technology needed in their preparation
- Its broadly accepted hence its promotion will improve the quality of medical care

Limitations of herbal medicine

- The complex nature of the preparations
- Over dosage which could lead to serious side effects
- Under dosage which could lead to resistance
- Instability of preparations especially water extracts
- Extinction of plants which are sources of the herbal medicine
- Some therapeutic claims are vague with no scientific basis
- The lack of legal control in practice of traditional medicine
- Lack of standardization hence there is no control of the medicament

These limitations highlight the need for standardization of these drugs in order to

- To improve their general acceptability
- To allay the skepticism
- To avoid dangers of toxicity, side effects and over dosage
- To ensure a certain minimum level of hygiene in their preparations
- To ensure good agricultural practices, good extraction practices, good manufacturing practices, good laboratory practices and good clinical practices are observed.

1.2 LITERATURE REVIEW

1.2.1 CLASSIFICATION

Scrophulariaceae family is a family of 220 genera and about 3000 species. The name was also derived from European species of *Scrophularia*, the common figwort. The plants were used to treat haemorrhoids, which were known as “figs”. Figworts were also used to treat scrofula, a form of tuberculosis carried in the milk of infected cows. It is also known as the figwort family. It is classified in the plant kingdom as follows;-

Kingdom-Plant

Division-Angiospermae

Class-Dicotyledonae

Sub class-Sympetalae

Order-Tubiflorae

Sub order-Solanineae

Family-Scrophulariaceae

The genera found in this family are; *Verbascum* (306spp), *Calceolaria* (400spp), *Linaria* (180spp), *Antirrhinum* (42spp), *Scrophularia* (300spp), *Penstemon* (250spp), *Mimulus* (100spp), *Gratiola* (20spp), *Veronica* (300spp), *Isoplexis* (4spp), *Bartsia* (30spp), *Euphrasia* (200spp), *Pedicularis* (500spp), *Digitalis* (20-30spp), *Melapyrum* (35spp), *Odontitis* (30spp), *Chaenorrhium* (20spp) and *Bacopa* (100spp).

It is a family of flowering plants which are annual or perennial herbs or under shrubs with bilateral or rarely radial symmetry, a few trees and some semi parasites like Indian paint brush and owl's clover (*castilleja*), lousewort (*Pedicularis*), and bird's peak (*cordylanthus*). Its characterized by bisexual flowers with tubular corollas that are bilaterally symmetrical and have four stamens in most, two of which are shorter than the other two. The pistil is superior and usually two celled. Its geographical distribution is cosmopolitan majority being found in the temperate areas including tropical mountains. The major constituents are steroidal and

triterpenoid saponins, cyanogenetic glycosides, aucubin glycosides, naphthoquinones and anthraquinones, auronos and iridoid alkaloids.

1.2.2 MEDICINAL USES

Some of the medicinal plants found in this family include figworts, black root, culvers root, heptandra, verbascum, scrophularia and mulleins. These plants have been used traditionally for many years for various ailments and some have found use in conventional medicine.

Verbascum thapsus (mullein leaves)



Verbascum thapsus commonly referred to as mullein. Other names include witches candle, velvet plant, lungwort and candle because of its woolly appearance. It originates from Europe, Northern Africa and Asia.

Its dry leaves are crushed and applied for different types of purposes including hemorrhoids, diarrhea, cough, bronchitis, asthma, migraines, frostbite, nervousness, bruises, stress, insomnia, treatment of lung bleeding, reducing symptoms of pneumonia, soothing inflammatory conditions of the trachea, treating bronchial congestion, soothe the skin and relieve the inflammatory conditions associated with burn, relieving constipation, as a demulcent and cardiac stimulant.

Mullein is also used for treatment of tinnitus, for this purpose one to two teaspoons of dried leaves per cup of boiling water is used. This is boiled for ten minutes and the leaves are strained.

One teaspoon contains approximately 0.5g of the drug. The dosage reported to relief from tinnitus seems to be 3 to 4g per day. A side effect associated with mullein is skin irritation of skin when in contact with the living plant.

In Nepal its local name is yugisingh, the whole plant, roots, flowers or seeds are used to treat various ailments infection, edema, burns, stomachache and overbleeding.

It constitutes saponins, glycosides resin, sulphur, hesperidine verbacoside, potassium, iron, magnesium, tannins, choline, carotene and mucilage.

Rehmannia glutinosa



Radix rehmanniae constitutes the dried roots and rhizomes of *Rehmannia glutinosa*. Some of its vernacular names include Akayajio, rehmannia and shu di.

This species is indigenous to China but it is cultivated in Japan and Korea.

The traditional uses include as an antispasmodic, diuretic, emmenagogue, treatment of burns, diarrhea, dysentery, metorrhagia and impotence. Its use from pharmacopoeias and well established documents include internally for the treatment of fever, diabetes, hypertension, skin eruptions and maculations, sore throat, hypermenorrhea and polymenorrhea. It is also used as a tonic to stimulate the immune system.

These observed effects are attributed to its major chemical constituents the iridoid monoterpenes including catalpol, ajugoland aucubin, retimanniosides A to D, monometilloses, melittosides, verbascoside and jionosides. This drug comes as a dosage form of dried roots and rhizomes for infusions and decoctions.

Rhizoma picrorhizae

Rhizoma picrorhizae consists of dried rhizome with root of *Neopicrorhiza scrophulariiflora*, *Picrorhiza kurroa* and *Picrorhiza scrophulariiflora*. Some of its vernacular names include balakadu len, rohini, kutaki and kuru. It is distributed in the Himalayas from Kashmir to Sikkim.

It is traditionally used to treat anaemia, asthma, diarrhea, dyspepsia, fever, headaches, obesity, malaria and stomachaches. Its use from pharmacopoeias and well-established documents is orally to treat fever, immune disorders and skin diseases. Studies have also shown the role of the rhizome in treatment of bronchial asthma and viral hepatitis.

From experimental pharmacology it has been established to have antiallergic, antidiabetic, diuretic and immune stimulating effects.

These effects are attributed to its chemical constituents iridoid alkaloids, kuktosides, picrosides and aucubin, cucurbitacin B, D, E, F, I and R, triterpenes and simple phenols like apocynin. Dosage forms available are in form of the crude drugs, extracts, tablets and tinctures.

Bacopa monnieri



Bacopa monnieri also known as *Herpestis monnieri*, water hyssop is a creeping perennial herb which grows in marshy places and has a light purple flower and big leaves.

It is cultivated in south India.

It is traditionally used as a brain tonic to enhance memory development, learning and concentration. Also as a cardiac tonic, diuretic, aperiant, treatment of asthma, hoarseness, insanity, epilepsy, antianxiety and antiperiodic.

This is attributed to the active ingredients, saponins bacosides A and B, alkaloids bratimine and herpestine, Acid A, stigmastanol, monnierin, betulinic acid and beta sitosterol.

Scoparia dulcis



Scoparia dulcis traditionally known as aguan nkyene in Ghana, pipybras in Liberia and kari in Sierra Leone has been used widely for medicinal purposes in West Africa.

The leaves are placed in warm water and drunk when cool or rubbed on skin to relieve feverish headaches. For sore throats lime is cut covered with powdered then sucked. The entire plant is used as an ague and emetic. Other uses which have not been cited include facilitation of confinement, as a diuretic ,purgative, for relieving fever, treatment of gonorrhoea, earache and conjunctivitis.

Linaria vulgaris

Linaria vulgaris commonly referred to as yellow toadflax.

It is a plant native to Europe and Asia but is now widely naturalized in North America.

It has a long history of herbal use. It acts mainly on the liver and was once employed as a diuretic in treatment of edema. The whole plant has agents that counteract inflammation, cause tissue to contract, cleanse boils, sores, wounds etc purify and cleanse the blood induce urination, promote the well being of the liver and increases the secretion of bile, promote healing of disorders and diseases of the eye and are powerful purgatives or laxatives causing severe evacuation. It is gathered just when coming into flower and can be used fresh or dried.

The plant is especially valued for its strongly laxative and diuretic activities .It is employed internally in the treatment of edema, jaundice, liver diseases, gall bladder complaints and skin problems .Externally it is applied to hemorrhoids, skin eruptions, sores and malignant ulcers.

The plant should be used with caution. It should preferably only be prescribed by a practitioner and should not be given to pregnant women. Dosage is critical, since the plant might be slightly toxic .The fresh plant or an ointment made from the flowers has been applied to piles and skin eruptions. The juice of the plant is a good remedy for inflamed eyes and cleaning ulcerous sores. A homeopathic remedy is made from the plant, and is used in the treatment of diarrhea and cystitis.

Penstemon fruticosus

Penstemon fruticosus commonly referred to as shrubby penstemon is a plant that grows in rocky, open or wooded places in North America. It was used by medicinal purposes by several native tribes. The Iroquois used a compound decoction as a wash by women who were bothered by milk flow. The Okanagan-Colville Indians made a tea of plant tops taken for flu, colds, headaches and internal disorders.

They also used it for sores and itchy scalp and to bathe the skin for acne and pimples. Raw roots were placed on the tooth for severe headaches. The Thompson Indians used the whole plant to make bathing water for rheumatism. A decoction of leaves was used as eyewash for sore, red eyes. They made a decoction of stems, flowers and leaves were taken for kidney trouble and sore back and a decoction of the whole plant for ulcers.

Castilleja miniata

Castilleja miniata also known as scarlet paintbrush is a plant that grows in meadows and slopes of Northern America.

The Gitksan Indians of British Columbia made a decoction of leaves taken for coughs and taken as a purgative and diuretic. They also used the decoction for bleeding, lame back, stiff lungs and sore eyes.

Mimulus guttatus

Mimulus guttatus commonly referred to as yellow monkey flower is a plant growing in parts of North America and Mexico.

The plant has agents that cause tissue to contract and was used for healing wounds and fresh cuts. A decoction of leaves and stems was used by the Kawaiisu as a herbal steam bath for chest and back soreness. The Shoshoni used a poultice of the crushed leaves applied to wounds, and rope burns.

Scrophularia ningpoensis

Scrophularia ningpoensis commonly known as Ningpo figwort is a plant growing in Zhejiang province in China. It dried root was used traditionally as a heart tonic, antipyretic, antibacterial, antifungal, antiphlogistic, diuretic, febrifuge, haemolytic, hypoglycaemic as well as a vasodilator.

Veronica anagallis

Veronica anagallis commonly referred to as water speedwell.

The plant grows along ditches and in slowly moving streams, or in other wet places, frequently in shallow water, but largely above surface.

It is native to Europe but is now widely distributed in the United States of America.

Traditionally the leaves and the roots are used as appetizers and have agents that gradually restore health and that induce urination. The leaves have been used in treatment of scurvy and impurity of blood. The plant is bruised and applied externally as a poultice on burns, ulcers and whitlows.

Veronica wormskjoldii

Veronica wormskjoldii commonly referred to as alpine speedwell.

The plant grows in moist meadows, stream banks, bogs and open slopes in Montana state in USA.

These plants are astringent and are believed to flush toxins from the system by increasing urine flow. It was used to treat urinary, blood and skin disorders, to clear stones from the kidneys and to clear mucus from the digestive and urinary tracts.

Leptandra virginica

The black root *Leptandra virginica* was used by the American Indians as a powerful laxative and emetic. The Seneca Indians induced vomiting by drinking tea made from the plants dried root. Chippewas used the root as blood cleanser.

It is believed it increases blood flow of bile from the liver. Herbalists use it in the treatment of liver disorders and for chronic indigestion and other conditions thought to arise from liver dysfunction .other uses include treatment of flatulence and bloating, eases discomfort of hemorrhoids and rectal prolapse, skin problems if poor liver function is a factor.

Heptandra

The fresh root of heptandra is a violent cathartic but its dried root is milder.

Its constituent heptandrine excites the liver gently and promotes secretion of bile without irritating the bowels and purging. It is also a tonic for the stomach hence useful in diarrhea and chronic dysentery. The dried root is used in treatment of leprosy when combination n with cream of tartar.

Euphrasia pectinata

Euphrasia pectinata was used to treat conjunctivitis, eye fatigue, stress, cough and hoarseness.

It contains the following constituents iridoid glucosides,a lignin glucoside, flavanoids,tannins and phenolic acids.

Digitalis purpurea

Digitalis also known as the purple foxglove leaves consists of the dried leaves of *Digitalis purpurea*.

It is a biennial or perennial herb which is very common in the UK and most of Europe, including Mediterranean regions of Italy and is naturalized in North America.

It is source of cardiac glycosides. This plant however is now classified under plantaginaceae family

			<p>-Spat into eyes as a remedy for ophthalmia</p> <p>-A decoction of leaves is used as a wash for the umbilical cord for a baby whose has not healed properly</p>
<i>Buchnera nutii</i>	Misisi	Swahili(Kenya)	-reported but no specific use stated
<i>Craterostigma plantagineum</i>	Anyoung-bar	Luo(Kenya)	-Treatment of toothache, leaves are chewed and retained in the mouth for some minutes
<i>Cycnium adonese</i>	Mashilitsa	Luhya(Kenya)	-A decoction is made from leaves is given to newly hatched chicks to open their eyes when they are gummed up
<i>Cycnium herzfeldianum</i>	Chawe	Pare(Tanzania)	<p>-leaves are used as styptic</p> <p>-leaves are crushed or pounded and the juice squeezed onto a bleeding wound to stop it</p>
<i>Cycnium tubulosum</i>	Muhangati	Ngoni(Tanzania)	<p>-Roots are used as an abortifacient ,boiled or crushed root decoction is drunk as may be necessary</p> <p>-The whole plant is used to cure stomachache especially in babies and</p>

			children
<i>Cycnium veronicifolium</i>	Sila	Shamba(Tanzania)	-Roots are used for the treatment of pneumonia and for abortion,the fresh roots are boiled and soaked in water and the infusion drunk
<i>Ghikaena speciosa</i>	Kenyora	Dorobo (Kenya)	-plant is used as a ritual medicine
<i>Lindernia insularis</i>	Mudogo	Digo(Kenya)	-ash from leaves is rubbed into incisions on the skin of the abdomen to relieve hernia
<i>Pseudosopubia hildebrandtii</i>	Likidamperoi	Samburu(Kenya)	-Ritual protection medicine
<i>Striga hermonthica</i>	Kayongo	Luo(Kenya)	-leaves for treatment of thrush
	Oluyongo	Luhya(Kenya)	-fresh leaves pounded and soaked into water as a preparation -Whole plant burnt and ash licked for tuberculosis
<i>Striga pubiflora</i>	Mpagi	Yao	-Roots are boiled or chewed for treatment of stomach troubles

1.2.3 RESEARCH FINDINGS

TABLE 2

TABLE SHOWING RESEARCH CARRIED OUT ON SOME PLANTS AND THEIR FINDINGS

PLANT	RESEARCH FINDINGS
<i>Scoparia dulcis</i>	<p>- This plant has also been studied for antimalarial activity, the ethylene acetate extract of the whole plant gave an IC50 of 19.5ug/ml on <i>Plasmodium falciparum</i> (Ngemenya et al 2004).</p> <p>-This activity was attributed to the different chemical compounds from several classes they include flavonoids, terpenoids, phenylpropanoids, benzenoids, alkaloids and saponins.</p> <p>-<i>Scoparia dulcis</i> is incorporated into a substance known as Diasulia which is an mixture of ten plants at a concentration of 40mg/ml, the ethanolic extract of diasulia shows anti hyperlipidimic , antiperoxidase activity and antidiabetic activity in alloxan induced hyperglycemia in rats.</p>
<i>Bacopa monnieri</i>	<p>-The BES5 plant extract has been standardized with optimal concentrations of bacosides to provide significant effect.</p>

	<p>-Bacosides have to been found to responsible for improving vital neurotransmitters which are responsible for memorization and information processing and also modulates expression of certain enzymes which occur in the reactive and generation of oxygen species in the brain.</p> <p>--Hence this extract has been found to be important for warding off dementia and age related memory loss. It is sold as memory pills and memory booster vitamins.</p>
<i>Verbascum Thapsus</i>	<p>-A study was done and it was found to have anti influenza viral activity which was attributed to its phenyl ethanoid and lignan glycosides. Anti herpes activity was also reported.</p> <p>-The phytochemicals responsible for anti influenza activity could be different from those of anti herpes activity. Also the amount of active constituents present in plants depends on the geographical distribution, season of collection, climate and ecological condition of collection date.</p>
<i>Rehmannia glutinosa</i>	<p>-From experimental pharmacology it has been established to have antibacterial, antidiarrhoeal, antihepatotoxic, anti-inflammatory, antitumour, and antiulcer and hematological activities.</p>

	<p>-These observed effects are attributed to its major chemical constituents the iridoid monoterpenes including catalpol,ajugoland aucubin,retimanniosides A to D,monometilloses,melittosides,verbascoside and jionosides.This drug comes as a dosage form of dried roots and rhizomes for infusions and decoctions.</p>
<p><i>Rhizoma picrorhizae</i></p>	<p>-From experimental pharmacology it has been established to have antiallergic, antidiabetic diuretic and immune stimulating effects.</p> <p>-These effects are attributed to its chemical constituents iridoid alkaloids kuktosides,picrosides and aucubin,cucurbitacin B,D,E,F,I and R,triterpenes and simple phenols like apocynin</p>
<p><i>Russelia equisetiformis</i></p>	<p>-Antimicrobial; Antimicrobial effect of a methanolic extract was noted on <i>Staphylococcus aureus</i>, <i>Salmonella typhi</i> and <i>Pseudomonas aeruginosa</i>.The effect was attributed to triterpenes in the extract.</p> <p>-Antinociceptive; Results of study of whole plant extracts of this confirmed it's traditional in the treatment of inflammation and pain.</p> <p>-CNS Depressant activity; Study of crude methanol extracts in mice showed CNS</p>

depressant activities.

Hair-Growth Promoting Effect; Topical application of the methanol extract of the whole plant on a known diameter of the shaved area of the back of albino wistar rats produced a significant increase in the rate of hair growth. The hair growth promoting potential is attributed to the presence of triterpenes and flavonoids in the plant extract.

Membrane Stabilizing Activity; Study showed the aqueous –ethanol extract possess membrane stabilizing activity in a concentration dependent manner as evidenced by significant changes of membrane stabilization of RBC exposed to heat stress induced hemolysis.

1.2.4 PHYTOCHEMISTRY

As a result of recent in the plant kingdom as a potential source of new drugs, strategies for the fractionation of plant extracts based on biological activity rather than on a particular class of compound, have been developed. The chemical examination follows after the isolation of the active fraction.

The phytochemical investigation of a plant may thus involve the following: authentication and extraction of plant material, separation and isolation of constituents of interest, characterization of the isolated compounds, and investigation of the biosynthetic pathways to particular compounds and quantitative evaluations. parallel to this may be the pharmacological assessment of the separated components.

The roots of plants of this family contains volatile oils, tannic acid, gum, resin, a crystalline principle, a saccharine principle resembling mannite and a glucoside resembling senegin.

Both the crystalline principle and impure resin obtained by precipitating with water. A tincture of the root have been called heptadrin and is said to be the active principle. the properties are extracted by both water and alcohol. An ester of p-methoxycinnamic acid, a phytosterol and some dimethoxycinnamic acid are also obtained.

From the phytochemistry, it shows that the constituents can be extracted and made into suitable dosage forms or provide lead compounds.

1.2.5 SPECIFIC STUDIES

Antimicrobial and anti oxidant activities of various extracts of *Verbascum antiochium*

This plant is endemic to Turkey.

Extracts are obtained by increased polarity and direct methanol extraction were tested by the agar well diffusion against various gram positive, gram negative bacteria and fungus.

The methanol-water extract exhibited a larger inhibition against both gram positive and gram negative bacteria than the other extract. *Haemophilus influenza* was found to be the most sensitive among the bacteria tested.

Anti microbial activity of leaf callus of *Bacopa monnieri*

The aim of this study was to ensure that the anti microbial effect of the plant and to assess whether tissue culture of the plant will retain some activity or not.

Methanolic extracts of the leaf callus of *Bacopa* at concentrations of 0.25,0.05,0.03mg/disc was investigated for antimicrobial activity by modified Kirby –Bauer diffusion method using ciprofloxacin and griseofulvin as antibacterial and antifungal reference standards respectively.

The findings of this study revealed that extract possessed a dose dependent antimicrobial activity against all the tested bacterial and fungal spp indicated by the zones of inhibition of microbial growth. The antimicrobial effect of the plant callus under investigation was comparable to those of the reference standards.

Preliminary phytochemical studies revealed presence of alkaloids, aminoacids, phenolic compounds, terpenoids, steroids, proteins, saponins, coumarins, ascorbic acid and tannins as the major phytoconstituents.

TABLE 3

DISTRIBUTION OF POTENTIALLY USEFUL PLANTS OF THE SCROPHULARIACEAE FAMILY IN KENYA

PLANT	REGION FOUND IN KENYA
<i>Russelia equisetiformis</i>	Nairobi city park(Nairobi)
<i>Alectra sessiflora</i>	Mt.Elgon,koiwa in Kericho,Mbololo forest in Taita
<i>Veronica anagallis</i>	Mt.kulal,Elgeyo,Cherangani,Maasai
<i>Scoparia dulcis</i>	Shimba hills ,Vanga and Mkongani forest in Kwale,Arabuko Sokoke in Kilifi
<i>Veronica glandulosa</i>	Teleki valley,Aberdares,Mt.Kenya
<i>Striga pubiflora</i>	Lamu,Lunga Lunga in Kwale
<i>Veronica absynnica</i>	Trans-Nzoia,Muguga forest in Kiambu
<i>Verbascum brevipedicellatum</i>	Sotik,Kericho,Maasai
<i>Striga asiatica</i>	Nakuru

CHAPTER TWO

2.1 DISCUSSION

From the literature review, about forty species were studied. This by no means is exhaustive for the family as many as yet undiscovered medicinal uses many members in this family still remain to be explored.

For the traditional uses, it can obviously be seen that the same plants are used for different diseases in different communities and sometimes even within the same community. This is an indication of the trial and error aspects of traditional medicine.

Nevertheless, some plants used in traditional medicine, especially Chinese and Asian medicine in general, have found extensive usage in modern medicine as purified plant extracts e.g *Radix rehmanniae* comes as a dosage form of dried roots and rhizomes for infusions and decoctions, *Rhizoma picrorhizae* is available as dosage forms in form of crude drugs, extracts, tablets and tinctures. This was made possible by WHO publishing monographs which provide guidelines on GMPs for herbal medicines which provide general technical guidance on obtaining medicinal plant materials of good quality for the production of herbal medicines in the overall context of quality assurance and control of herbal medicines. In these cases the traditional uses are the same as the modern uses.

In some cases, studies of the plant have yielded different pharmacological actions for the concerned plants other than the traditional uses .In some of these cases, no basis for the traditional uses of these plants has been found. This is an indication of the erratic use of some of these plants in traditional medicine.

Still, some of the plants with extensive use in traditional medicine have not yet been found useful in modern medicine. These plants however should not be dismissed .Additional studies should be done on them for possible activity.

Development of resistance by microbes against known antibiotics is a huge concern in the medical field, thus searching for new antimicrobial compounds is a never-ending process. From the results obtained in the antimicrobial activity of *Bacopa monnieri* it seems it's a promising plant in this context. However, further tests against other strains of bacteria and fungi are needed. In addition, the active ingredients should be isolated and their mechanisms of actions should be enlightened for further studies.

Some plants of this family are found in Kenya and they are a source of potentially useful medicines e.g. *Russelia equisetiformis* has shown promising results from the research findings shown. These plants can therefore provide a source of medicines for conventional use. But there is the issue of local extinction of the available plants and the declining supplies. This issue can be addressed with commercial cultivation of indigenous medicinal plants so as to address biodiversity and market sustainability issues.

Even with increasing knowledge, there is still much debate around the pro's and con's of medicinal plant cultivation. These are;

- 1) Potential loss of cultural and indigenous values associated with harvesting of medicinal plants.
- 2) Potentially reduced production of secondary metabolites (the active ingredients in most medicinal plants) in farmed plants compared to wild stocks.
- 3) Genetic contamination of local species populations through cultivation with plants from alternative genetic stocks.

2.2 CONCLUSION

Medicinal plants have been a major source of cure for human diseases since time in memorial. Today a quarter of the world's population depends on traditional medicines. Side effects of conventional medicine, efficacy of plant derived drugs and growing interest in natural products has increased scientific interest in medicinal plants. Herbal medicines have been used since the dawn of civilization to maintain health and treat diseases.

The WHO estimates that about three quarters of the world's population currently use herbs and other forms of traditional medicine to treat their diseases. Even as we commence the new century with its exciting prospect of gene therapy, herbal medicines remain of the common forms of therapy available to the world population.

For the issue of commercial cultivation of indigenous medicinal plants, the key conclusion is a combined strategy and a set of interventions is required if the aim is to address sustainability and biodiversity issues in the supply of scarce high value medicinal plants at abroad scale. This combined strategy should include cultivation of scarce high value medicinal plants, wild stock management and enrichment planting of plantations and croplands with locally sourced seedlings.

Generally, Scrophulariaceae family is a family of plants with tremendous potential in as far medicinal applications are concerned .Some of these have been discovered while others are yet to be discovered and extensive research is still required if this potential is to be harnessed.

REFERENCES

- 1.) Trease and Evans Pharmacognosy 15th Edition Elsevier Limited(2002)
- 2.) WHO monographs on selected medicinal plants volume 3(2007)
- 3.) WHO monographs on selected medicinal plants volume 4(2009)
- 4.) Medicinal plants of East Africa 3rd Edition by John.O.Kokwaro.Kenya Literature Bureau, Nairobi.
- 5.) Edible Wild plants of Sub-Saharan Africa by Charles Peters, Eileen O'brien and Robert Drummond
- 6.) Medicinal plants of South West by Claudia Calvan, Veronica Gutierrez and Michelle Toman.
- 7.) Burkill, H.M, 2000.The useful plants of Tropical West Africa.2nd Edition.Volume 5, S-Z Addenda. Royal Botanic Gardens, Kew, Richmond, United Kingdom 686pp.
- 8.) EAwe et al/ International journal of phytotherapy and phytopharmacology /2008- Apr;vol 15 (issue 4) :pp 301-5
- 9.) New natural products and plant drugs with pharmacological ,biological or therapeutic activity by H.Wagner and P.Wolf Springer-verlay Berlin Heidelberg New York (1977)
- 10.) Hepper,F.N, 1960.New and noteworthy Scrophulariaceae in Africa.Kew Bulletin 14:402-416
- 11.) Frederick O.Oladeinde.PhD/African Healing Wisdom:From Tradition to Current Research
- 12.) Kolawol O T et al/ Nigerian journal of physiological sciences/2007 Jun-Dec;vol 22(issue1-2):pp 59-63
- 13.) Awe O et al/Nigerian journal of natural products: volume 2(2009)
- 14.) Awe O E et al/ Journal of natural products, volume 2 (2009):03-09
- 15.) Commercializing medicinal plants a southern African guide. Edited by Nicci Diedrichs(2006)
- 16.) Journal of medicinal food ISSN:1557-7600
- 17.) Flora of Tropical East Africa by S.A Ghazanfar,F.N Hepper and D.philcox(2008)
- 18.) www.plant-life.org
- 19.) www.prota.org
- 20.) www.science-pal.com

- 21.) www.indiamart.com
- 22.) www.scholarsresearchlibrary.com
- 23.) www.imperialpharmajournal.com
- 24.) www.memorybite.com