International Journal of Medicinal Plant Research ISSN: 2169-303X Vol. 1 (6), pp. 063-074, November, 2012. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Ethnobotanical studies of *Strychnos henningsii* in five (Gilg.) natural habitats in Kenya

Kuria M. W.*, Njenga P. K. and Ngumi V. W.

Department of Botany, Jomo Kenyatta University of Agriculture and Technology, Kenya.

Received 20 August, 2012; Accepted 30 November, 2012

Strychnos henningsii **(Gilg.), Loganiaceae common names: Muteta (Kikuyu/Kamba), Muchimbi (Meru), is an indigenous and threatened plant species in Kenya. The wide-scale use of this species resulted to its over-exploitation by the traditional medicinal practioners, hotels and restaurants owner and the local people. It is used in the preparation of milk soups and fatty-meat among Kikuyu, Maasai and Kamba people. In African traditional medicine *S. henningsii* has been used for treatment of various diseases including rheumatism, syphilis, gastrointestinal disorders (purgative) and snakebites. In addition to over-exploitation, the species has a slow growth rate, seed production is erratic and seed germination is poor. The study revealed that *S. henningsii* is a threatened species in the areas of study. Most respondents obtained the plant with difficulties and among the key difficulties encountered were scarcity and long distance walking. There is therefore a danger of genetic erosion. Therefore this study endeavors to undertake the ethnobotanical survey on the traditional knowledge of this species from different regions of Kenya. This information will be useful in designing the strategies for conservation and sustainable use of this plant.**

Key words: Conservation, ethnobotany, *Strychnos henningsii,* sustainable use, threatened.

INTRODUCTION

Strychnos henningsii (Gilg.) belongs to the family Loganiaceae. The common names are Red bitter berry (English) (Gachathi 2007), Henning's Strychnos (Maundu and Tengäs, 2005). The local names include Muteta (Kikuyu Kamba), Maset (Kipsigis), Entuyesi (Maasai), Mutambi (Mbeere), Muchimbi (Meru), Kapkamkam (Pokot), Nchipilikwa (Samburu), Hadesa (Somali), Turukukwa (Tugen) and Yapoliss (Turkana) (Maundu and Tengäs, 2005).

It varies in size from a shrub or small erect tree, much-branched tree of about 2 to 15 m tall with green-reddish stem. The bark is pale grey and smooth in young trees but becomes dark brown and somewhat flaky in order specimens. The twigs have pale ashy or straw-colored and waxy skin splitting lengthwise. Lenticels are few and inconspicuous. Leaves are opposite, subsessile or ovate, 2.5 to 6.5 cm long and 0.8 to 4.5 cm wide. They have entire margin and acuminate leaf tips. The leaves are strongly three to five nerved from base cuneate or rarely subcordate at base; a characteristic feature in Strychnos species (Ben-Erik Van wyk et al., 1997). Floral cymes is borne on flat clusters in the leaf axils, 2 to 2.5 mm long and 4 mm wide when open, scented, yellowish-green in color turning orange with age. The ovary is globose with a short style. The fruit is up to 1.9 cm long and 6 to 11 cm wide, oblong or roundish with one to two seeds (coffee-like) red, brown or orange when ripe (Beentje, 1994; Gachathi, 2007; Maundu and Tengäs, 2005).

S.henningsii commonly occurs in the dry and moist forests, wooded hillsides, thickets, on rocky hills, coastal forests and stream banks. It is native in Angola, Mozambique, South Africa, Swaziland, Tanzania and Uganda. In Kenya it is widely distributed in Nairobi, Kakamega, and in the Central Province. It is often associated with dry Podocarpus and Olea forests, hillsides, thickets and Combretum bushland (Maundu and Tengäs, 2005).

In East Africa, *S. henningsii* is used in the preparation of fatty-meat and milk soups (Chapman et al., 1997). Roots, stem and bark are boiled in soup for fitness, painful joints and the general body pains among the Kikuyu, Maasai and Kamba communities (Palgrave,

*Corresponding author. E-mail: wahukuria@yahoo.com.

1988; Beentje, 1994; Maundu et al., 1999; Gachathi, 2007). The soup is claimed to be an aphrodisiac and is used as a remedy for colic, to relieve nausea and treat syphilis (Palgrave, 1988).

In the African traditional medicine, it is used for the treatment of various ailments including rheumatism, gastrointestinal complications and possibly of value in dysmenorrhoea (Hutchings, 1989; Watt and Breyer, 1962; Pujol, 1993; Hutchings, 1996). The roots bark and green fruits of Strychnos species are used as a remedy for snakebites (Tits et al., 1991; Ben-Erik Van wyk et al., 1997). The bark decoction is employed as a remedy for rheumatism and arthritis (Palgrave, 1988; Beentje, 1994). The ground bark is a mouth antiseptic and applied onto wounds in cattle and horses to hasten healing (Gachathi, 2007). The fruits and the bark contain a poisonous bitter alkaloids; the bark is used in traditional medicine as a purgative (Palgrave, 1988; Noad and Birnie, 1989). Some alkaloids have been used in anesthesiology due to their muscle relaxing effects (Bruneton, 1995). Mbeere people use the fruits to flavor their beer (Maundu et al., 1999; Gachathi, 2007). *S. henningsii* has a potential in the development of new antinociceptive and antispasmodic drugs (Tits et al., 1991).

Its valued timber is dark gray, heavy, hard, durable and termite resistant. Wood is used for fencing and making hut poles and tool handles by Maasai community (Maundu and Tengäs, 2005; Gachathi, 2007). The species is important in protecting soils from water erosion in highland areas. Its physical attributes, shiny foliage, pleasant shade and fragrant flowers make it a suitable choice for gardening (ICRAF, 1992).

In promotion of conservation agenda, it is important to understand how local community use and manage natural resources. Traditional healers provide considerable information about the use of many plants or plant parts (Survase and Raut, 2011). Studies in ethnobiology and traditional ecological knowledge are known to serve as a significant bridge between conservation and local communities (Njoroge et al., 2010). These studies help in understanding how local communities relate to their environment and pave away for their active involvement in natural resource conservation (Duchelle, 2007). Empowerment of local communities to conserve and sustainably use biodiversity is increasingly becoming an important policy shift as most of the local people in rural areas depend on natural resources for their livelihoods (Bagine, 2006).

Ethnobotanical studies reveal how human beings have utilized plants for a wide diversity of primary survival and aesthetic purposes. It is a science that covers historical as well as present usage of plants (Nyazema, 1996). Ethnobotanical studies are often significant in revealing the importance plants species especially for the discovery of crude drugs (Cox and Blicks, 1996; Flaster, 1996). Such survey also reveal the process of domestication which is a major evolutionary force bringing about different forms of plants through human solution (Casas et al., 1996). Ethnobotanical studies are also a source of suitable information regarding useful plants that can be targeted for domestication. Domestication of important medicinal plants in East Africa has been seen as a way of increasing income and availability of the products to the healers and other resource users (Dery and Otsyina, 2000).

The use and commercialization of traditional medicinal plants has been found to be an important livelihood strategy in developing countries where rural people are economically vulnerable (Shackleton et al., 2009) hence improving income and living standards (Sunderland and Ndoye, 2004). Traditional medicines form a central component in health care systems in developing countries where 80% of the population has been reported to depend on traditional medical systems (http:www.who.int/; Gupta et al., 2010; Survase and Raut, 2011). Studies have been undertaken to try to document and describe the traditional herbal products used by traditional societies and also to validate their use (Light et al., 2005). The use of herbal medicines is on the increase even in developed countries because of their natural origin (Jacobson et al., 2009).

Global demand for herbal medicines is not only large, but also steadily growing (Marles, 1996; Srivastava, 2000; Light et al., 2005). In Kenya 90% of the population has used medicinal plants at least once for the various health conditions (Chirchir, 2006). In Central Kenya, the rural poor are turn into traditional plants remedies to solve medical problems as the prices of biomedicine have escalated to unaffordable levels. In some cases, the medical facilities are inaccessible with only one or two governmental hospital per district. This has caused and is still causing some valuable indigenous plants species to become threatened or even extinct (Williams et al., 2000; Shingu, 2005). *S. henningsii* offers a recent example of such species being over exploited and in fact it has been report as disappearing in Mwingi areas in Kenya (Musila et al., 2004; Schmeltzer, 2008).

As demand for medicinal plants continue to accelerate, species preservation is perceived to depend on sustainable methods and cultivation (Njoroge, 2010). Cultivation of medicinal plants species may be the only solution for their rapid conservation (Lange, 1998). In Asia, more and more medicinal plants are being depleted some becoming endangered hence cultivation is being viewed as a viable alternative source of these resources despite the challenges in *ex-situ* management strategies (Bisht et al., 2006; Sher et al., 2010).

In view of the rapid loss of natural habitats, traditional community life, cultural diversity and knowledge of medicinal plants, documentation of African medicinal plants is an urgent matter (Wyk et al., 2002). The documentation of medicinal plants prioritized by the local people as well as their understanding of possible diversity loss ands strategies of conservation are some aspects in

ethnobotanical studies (Bisht et al., 2006). Further the extent to which important medicinal plants are cultivated is often unclear, even in regions where large amounts of medicinal plants are being commercialized (Bussmann et al., 2008). This study explored the traditional knowledge of *S. henningsi* among the local people in five natural habitats in Kenya. This study will provide information necessary for sustainable use, conservation methods as well as domestication processes for this important plant species.

MATERIALS AND METHODS

Research design

Survey and naturalistic design were used because of their descriptive nature that aid in learning respondent's perception, attitude, beliefs, values, behavior, opinions, likes and dislikes, habits and desires on *S. henningsii*. In particular, the baseline survey was appropriate because of variables of assessment such as awareness and availability of *S. henningsii*, sources, uses, parts of plants used, extract and processing of *S. henningsii* among different communities in Kenya.

Target population, sampling, sample size and measurements

The target population for the study was household providers. Stratification sampling was used in selection of respondents. This was based on the study areas where five of them were purposefully selected namely, Narok, Nyeri, Kajiado, Meru and Kiambu. A total of 105 respondents were interviewed. The questionnaires were proportionately allocated where 31 were interviewed from Kajiado, 23, 23, 19 and 13 from Narok, Nyeri, Meru and Kiambu, respectively. A structured questionnaire was used in data collection. The variables assessed were household characteristics such gender, location, age, marital status, family size, education level of children in household, economic status, land size and land use management. The other variables assessed included awareness and availability of *S. henningsii,* sources and availability of the species, trading in *S. henningsii,* uses of the plant, extraction of the species and difficulties experienced in access of *S. henningsii.*

Methods of statistical data analysis

Descriptive statistics such as frequencies, percentages, cross tabulation and exploration were undertaken to identify pattern of data for inferential analysis. Chi-square test was used to check association among variables such as location and gender, location and age, gender and age, location and uses of *S. henningsii,* among others. Kruskal-Wallis test was used to compare qualitative independent variables such as location and land use, location and species use, gender and parts of the plants used, location and extraction methods among others. One way analysis of variance was used to compare land sizes among locations. Least significant difference (LSD) was used for mean comparisons of land sizes among locations. Statistical significant differences were declared at 5%.

Data was coded and entered into statistical package for social scientists (SPSS V18) which was used in data analysis. The results were presented in tables, bar graphs and pie charts.

RESULTS

Background information on respondents

The explanatory variable assessed on background information of the respondents included; gender, location, age, marital status, family size, education level of the children in household, economic status, land size and land use management. This area therefore provides the findings in relation to the defined variables as prescribed as follows.

Location, gender and age category

Kajiado had the highest number of respondents followed by Nyeri/ Narok with the least number in Kiambu (Figure 1).

Of the respondents 81 and 19% were male and female respectfully. This was not significantly associated (χ^2 = 5.763; d.f. = 4; p = 0.218) with location, implying that both male and female respondents were proportionately represented in the study areas. The respondents aged 36 to 45 were most interviewed followed by 46 to 55 years (Table 1). There was significant associations ($p<0.05$) and differences between study area and age category (Table 2) where Narok had the highest (57%) proportion of respondents in the age category of 36 to 45 where as Kiambu had (53%) in the age category 46 to 55 years. In contrast, Meru had the least of respondents (6%) in the category of 26 to 35 years (Table 2).

Economic activities

Majority (70%) of the respondents were self employed as compared to one percent who was informal employment (Figure 2). This significantly varied ($p<0.05$) among the study location where there was more informal employment in Meru and Nyeri whereas more of self employment in Narok, Kajiado and Kiambu (Table 3).

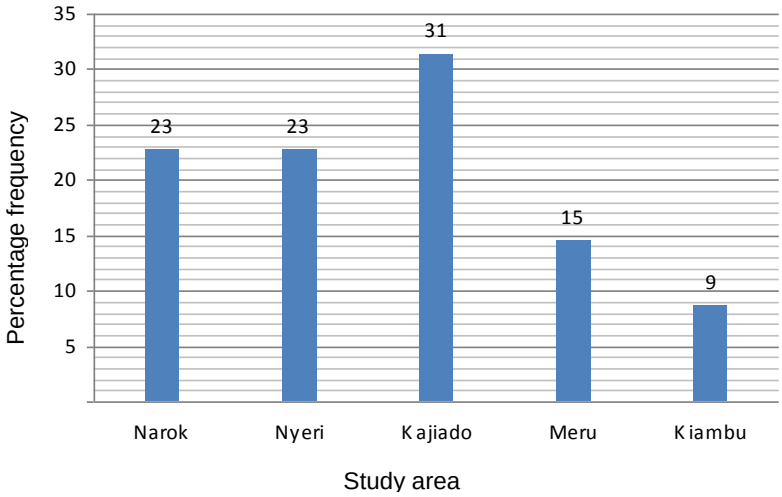

Figure 1. Percentage frequency distribution of respondents per study location.

Table 1. Age category of respondents in five study areas/ locations.

Age category	Frequency (n)	Percentage frequency
26-35years	30	14
36-45 years	94	43
46-55yesrs	79	36
>55 years	16	7
Total	219	100.0

Table 2. Comparison between age category and study areas.

Study area	Percentage frequency and mean rank on age category in years and study area/location					
	26-35	36-45	46-55	>55	Total (n)	Mean rank
Narok	20	57	22	0	49	83.76
Nyeri	22	12	22	5	50	114.6
Kajiado	7	44	37	12	6	119.80
Meru	6	50	34	9	32	115.2
Kiambu	10	37	53	0	19	115.79

Chi square test: χ^2=26.919;d.f.=12;p =0.008; Kruskal Wallis test: χ^2 =12.343;d.f. =4; p =0.015.

Ethnobotany of *S. heningsii*

Ethnobotany of *S. heningsii* focused on the awareness of the tree, place of growth, sources of the plant, uses, parts of the plant used, quantity used, processing of the plant products for use, accessibility of the plant and difficulties experienced when dealing with the plant.

Availability and awareness of *S. heningsii*

One hundred percent of the respondents knew *S. heningsii* in all study locations. However majority of the respondents did not grow the tree on their lands (Figure 3). This was significantly ($p < 0.05$) associated and varied among study locations (Table 4). Majority of the farmers in Kajiado (82%) and Kiambu (100%) did not grow *S. henningsii* on their land as compared to in Narok (59%) who grew *S. henningsii* on their farms (Table 4).

Sources

The results showed that 98% of the respondents across

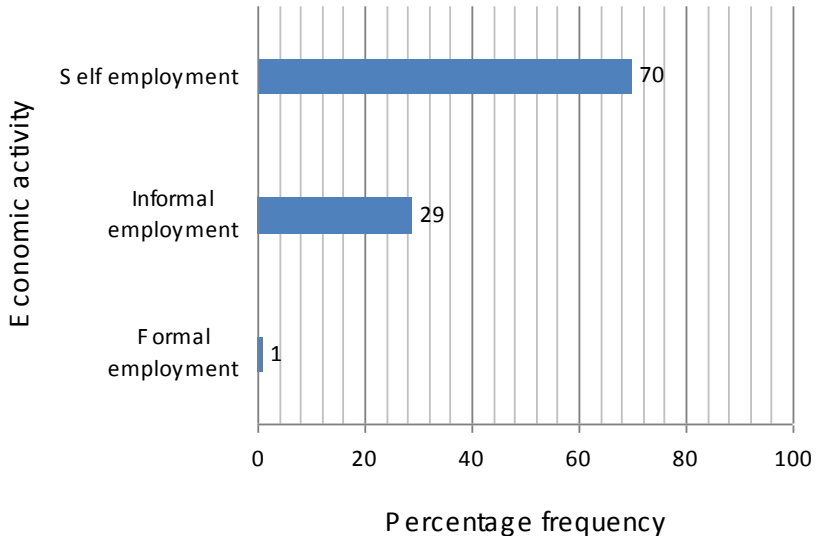

Figure 2. Other activities engaged apart from farming.

Table 3. Other types of economic activities apart from farming among study locations.

Study area	Percentage frequency and mean rank on economic activities among study locations				
	Formal employment	Informal employment	Self employment	Total(n)	Mean rank
Narok	0	4	96	49	137.63
Nyeri	2	64	34	50	70.72
Kajiado	0	10	90	68	130.99
Meru	3	68	29	31	65
Kiambu	5	5	90	19	129.0

Chi square test: χ^2=9.418;d.f=8;p=0.000; Kruskal Wallis test: χ^2 =84.976;d.f=4; p=0.000.

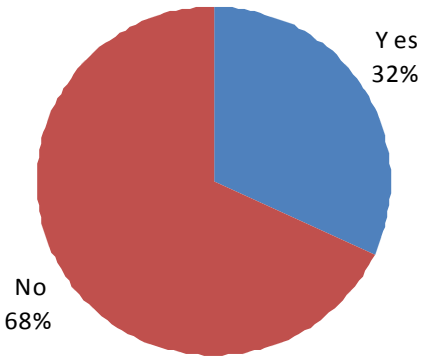

Figure 3. Percentage frequency of *S. henningsii* growing on farmer's land.

all study locations obtained *S. henningsii* from forests as compared to two percent from suppliers. This was significantly (p<0.05) associated and varied among the study locations (Table 5).

Availability

Generally high proportion of respondents obtained the plant materials with a lot of difficulties (Figure 4). This was significantly (p < 0.05) associated and varied among the study locations. For instance, majority (69%) of respondents from Nyeri obtained the plant easily as compared to 77 and 88% of respondents from Meru and Kiambu who obtained the plant with difficulty respectfully (Table 6). In Nyeri majority of the respondents were near the forest (Kabiru-ini forest) whereas in Meru the natural forest is very far and in Kiambu the plant occurs in the protected areas of the natural forests.

Trading on *S. henningsii*

Majority (64%) of the respondents across the study locations were not trading on *S. henningsii* as compared to 36% who did so. This was significantly (p<0.05) associated and varied among the study locations (Table 7). For instance 100% of respondents in Nyeri and Meru

Table 4. Associations and comparisons of growth of *S. henningsii* on farmers land among study locations.

Study areas	Percentage frequency on growth of *S. henningsii* and mean rank			
	Yes	No	Total (n)	Mean rank
Narok	59	41	42	71.37
Nyeri	41	59	46	89.3
Kajiado	18	82	0	11.94
Meru	23	77	31	107. 76
Kiambu	0	100	18	130.0

Chi square test: χ^2=31.592;d.f=4;p=0.000; Kruskal Wallis test: χ^2 =31.431;d.f=4; p=0.000. Sources and availability of *S. henningsii.*

Table 5. Associations and comparison sources of *S. henningsii* among the study locations.

Study areas	Percentage frequency on sources of *S.henningsii* and mean rank			
	Forests	Suppliers	Total (n)	Mean rank
Narok	100	0	49	94.5
Nyeri	98	2	42	96.8
Kajiado	98	2	53	96.3
Meru	100	0	32	94.5
Kiambu	88	12	18	106.5

Chi square test: χ^2=10.262;d.f=4;p=0.036; Kruskal Wallis test: χ^2 =10.209;d.f=3; p=0.037.

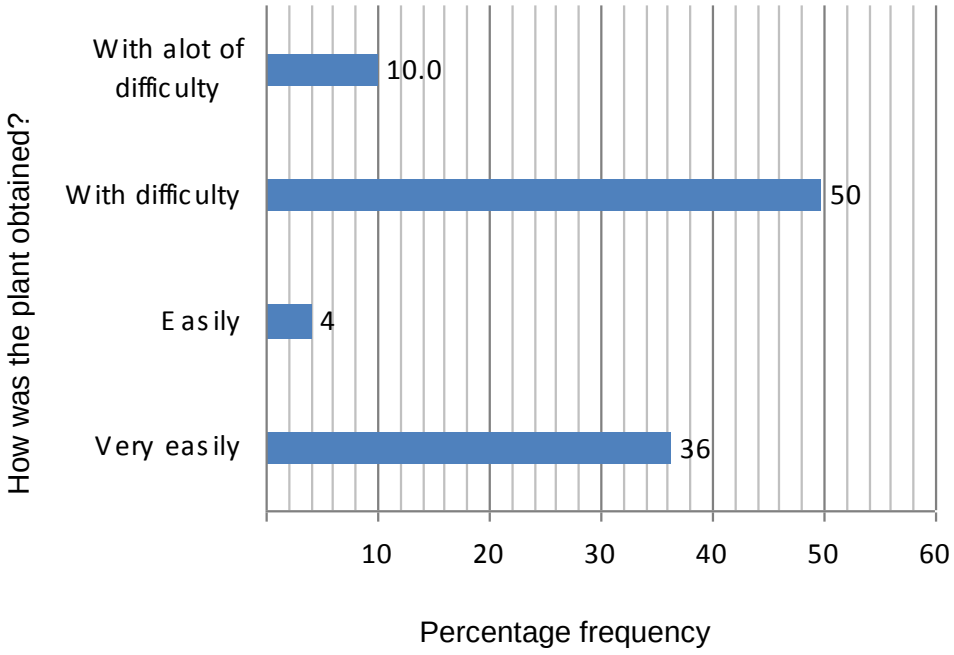

Figure 4. Frequency on how *S. henningsii* was obtained.

were not selling the species as compared to 42 and 58% who were selling in Narok and Kajiado (Table 7). Of those who were selling, they traded in roots and bark at kshs. 20 per piece or teaspoon.

Table 6. Associations and comparison sources on how *S. henningsii* was obtained among the study locations.

Study areas	Percentage frequency on how *S.henningsii* was obtained and mean rank					
	Very easily	Easily	With difficulty	With a lot of difficulty	Total (n)	Mean rank
Narok	52	4	22	22	46	92.11
Nyeri	69	0	21	4	45	68.58
Kajiado	21	8	64	7	61	109.74
Meru	17	0	77	7	30	118.47
Kiambu	0	0	88	12	17	137.00

Chi square test: χ^2=69.062;d.f=12;p=0.000; Kruskal Wallis test: χ^2=31.587;d.f=4;p=0.000.

Table 7. Trading on *S. henningsii* among the study locations.

Study areas	Percentage frequency trading on *S. henningsii* and mean rank			
	Yes	No	Total (n)	Mean rank
Narok	42	58	12	30.67
Nyeri	0	100	13	44
Kajiado	58	42	31	25.42
Meru	0	100	8	44
Kiambu	-	-	-	-

Chi square test: χ^2=18.544;d.f=3;p=0.000; Kruskal Wallis test: χ^2=31.431;d.f=4;p=0.000.

Table 8. Overall uses of *S. henningsii* in five study locations.

Uses of *S. henningsii*	Frequency (n)	Percentage frequency
Treating stomach	43	13.1
Treating headache	53	16.2
Treating common cold	56	17.1
Source of energy	7	2.1
Soup	35	10.7
Malaria treatment	56	17.1
Blood cleanser	2	0.6
Joint pain treatment	51	15.5
Deworming children	22	6.7
Appetizer	1	0.3
Chest pain	2	0.6
Total	328	100.0

Uses of *S. henningsii*

Ninety percent of the respondents across all the study location knew the uses of *S. henningsii* as compared to two percent who did not know. This was consistent with study locations where 100% of the respondents from Meru, Narok and Kajiado knew the uses of the plant as compared to 93 and 95% from Nyeri and Kiambu respectfully. They identified the following uses of the plant (Table 8).

Consequently, comparing the uses of the plant among the study locations, there were significant differences ($p < 0.05$) on the uses of the plant. For instance in Narok the plant was mainly used for treating malaria whereas in Nyeri for making soup, Kajiado for treating, Meru for de-worming children and in Kiambu for treating stomach (Table 9).

On the other hand, cross tabulating between age bracket and use of *S. henningsii*, there was no significant difference ($p = 0.910$) implying that the use of the plant was not in any way influenced by the age bracket of the respondents in all study locations.

Table 9. Uses of *S. henningsii* among study locations.

Uses of *S. henningsii*	Study locations and % frequency on uses of plant					
	Narok	Nyeri	Kajiado	Meru	Kiambu	Total (n)
Treating stomach	11	14	29	10	26	37
Treating headache	2	0	11	3	16	12
Treating common cold	18	5	5	3	21	18
Source of energy	2	2	0	0	0	2
Making soup	13	33	16	7	0	32
Malaria treatment	42	5	22	7	16	40
Blood cleanser	2	2	0	0	0	2
Joint pain treatment	7	35	18	16	16	37
Deworming children	2	0	0	55	5	19
Mean rank	95.89	109.6	81.90	148.81	78.95	

Kruskall-Wallis test: χ^2=32.601;d.f=4;p=0.000.

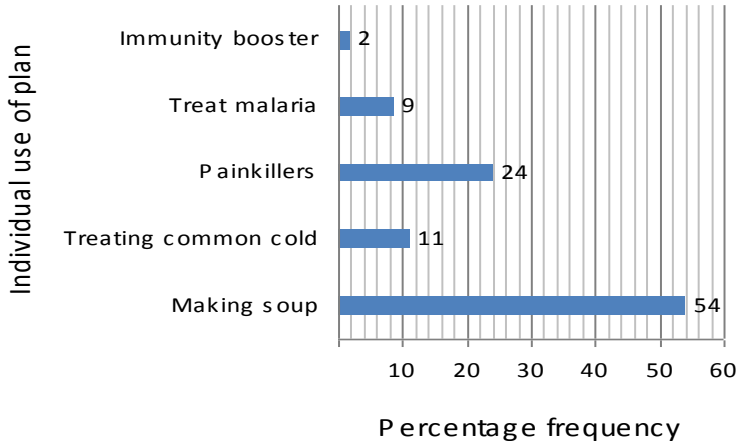

Figure 5. Individual use of *S. henningsii* among the study locations

Individual use of *S. henningsii*

The results showed that 99% used *S .henningsii* as compared to one percent who did not. The common use was making soup (Figure 5). Comparing the uses in Figure 5 among the study locations, the study revealed that there were no significant differences on the five uses. This implies that both of these uses were dominantly used in Narok, Nyeri, Kajiado Meru and Kiambu.

Parts of *S. henningsii* used

In this study the parts of *S. henningsii* used were stem and roots or their bark ground into powder. The leaves were not commonly used (Figure 6). These varied significantly ($p<0.05$) among the study locations where roots were mainly used in Narok, Kajiado and Kiambu and stem in Nyeri and Meru (Table 10). Of these plant parts used 98% used mature ones as compared to two percent who used any. Consequently, 100% used small portion to taste.

Extraction/processing of *S. henningsii*

The study revealed that majority (72%) of the respondents processed their plant parts through boiling in water (Table 11).

Comparing the processing methods of the plant extracts, there was a significant differences ($p<0.05$) among the study locations (Table 12). Nyeri, Kajiado, Meru and Kiambu mainly boiled the plant parts in water whereas Narok graded the bark and then boiled in water. Oral consumption was recommended against diseases like cold, cough, rheumatism, joint pains, fever diarrhea etc. Drugs were prescribed in small doses to taste either from parts of *S. henningsii* only or in combination with plant parts from other plant species. These combinations are more effective in curing diseases or enhancing the

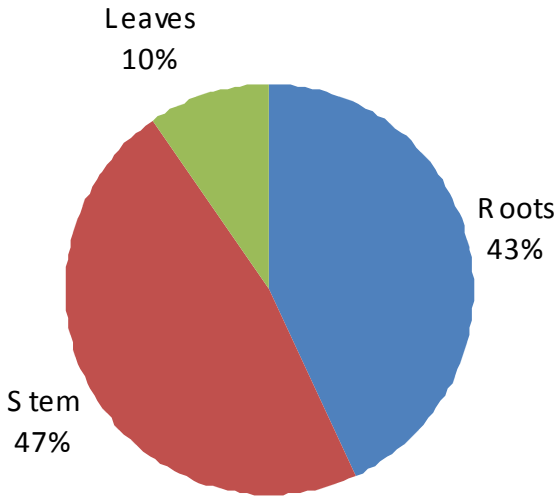

Figure 6. Parts *S. henningsii* of used among the study locations.

Table 10. Plant parts used among the study locations.

Study location	Percentage use of plant parts among the study locations				
	Roots	stem	Leaves	Total (n)	Mean rank
Narok	90	6	4	48	80.56
Nyeri	18	82	0	49	153.71
Kajiado	88	12	0	65	80.92
Meru	25	72	3	32	147.97
Kiambu	95	5	0	19	73,53

Chi-square test: χ^2=110.608;d.f=8;p=0.000; Kruskal-Wallis test: χ^2=94.418;d.f=4;p=0.000.

Table 11. Methods used for processing *S. henningsii* plant parts across study locations.

Methods of extraction	Frequency (n)	Percentage frequency
Boiling in water	138	72
Grade the bark then boil in water	47	25
Put the scrapings in water and let stand for 5 min	5	2.5
Dry the leaves, crush them and boil	1	0.5
Total	191	100.0

Table 12. Associations and comparison on processing of *S. henningsii* plant parts among the study locations.

Study areas	Percentage frequency on processing methods and mean rank					
	Boiling in water	Grade the bark then boil in water	Put the scrapings in water and let stand for 5 minutes	Dry the leaves, crush them and boil	Total (n)	Mean rank
Narok	31	56	11	2	45	136.76
Nyeri	96	4	0	0	47	73.44
Kajiado	73	27	0	0	51	94.89
Meru	86	14	0	0	29	82.26
Kiambu	89	11	0	0	19	79.24

Chi square test: χ^2=63.664;d.f=12;p=0.000; Kruskal Wallis test: χ^2=59.968;d.f=4;p=0.000.

Table 13. Mixing of *S. henningsii* plant parts with other things.

Mixed with	Frequency (n)	Percentage frequency
Tea	3	15.0
Soup	7	35.0
Honey	9	45.0
Milk	1	5.0
Total	20	100.0

Table 14. Difficulties experienced with *S. henningsii* plant.

Difficulties experienced	Frequency (n)	Percentage frequency
Scarcity	72	29
Long distance	86	35
Bad weather	9	4
Insecurity	21	9
Ignorance	4	2
Deforestation	13	5
Expensive buying	30	12
Confusing it with other trees	7	3
Identifying	5	2
Total	247	100.0

Table 15. Suggested solutions to identified difficulties.

Suggested solution	Frequency (n)	Percentage frequency
Establish tree nurseries	56	23
Train locals on tree conservations and use	79	32
Design better methods of harvesting	1	0.4
Plant it locally	81	33
Processing the medicine from the plant and sell it in shops	1	0.4
Afforestation	12	5
Protect and safeguard	5	2.4
Proper harvesting	12	5
Total	247	100.0

immunity of the patient (Survase and Raut, 2011).

Mixing of *S. henningsii* plant parts with other things

The results showed that 67% mixed *S. henningsii* plant parts with other things as compared to 33% who did not. They mainly mixed with honey, soup tea and other plant (Table 13).

Difficulties experienced with *S. henningsii* plant

The key difficulties identified in relation to *S. henningsii* were scarcity and long distance walking (Table 14). These were much related because with scarcity of the plant it would be expected that individuals searching for it have to walk long distances.

Suggested solutions to the identified difficulties

The key suggestions were training of locals on tree conservation strategies and sustainable use, establishment of tree nurseries to enhance planting locally (Table 15).

This would provide an alternative source of the plant and thus reduce the pressure exerted on the few

individuals remaining in the wild habitat.

DISCUSSION

It is clear from the study that the age between 36 to 55 years were the active group and hence the respondents were readily available for the interview. In Narok and Kajiado majority respondents were involved with trading in herbal medicines and in soup making. In other areas the respondents were mainly gathered from slaughtering houses or from butcheries and hence they were either self employed or in informal employment. Majority of the respondents did not grow the plant in their farms and thus obtained the plant materials from the forests. They obtained the plant materials with a lot of difficulties. The key identified difficulties were scarcity and long distance walking. This confirmed the decline of the plant species that the herbal practitioners used to collect within the vicinity of their homesteads only few years ago but now move for long distances to collect the same kind of plants. The results conformed to the study on Conservation Status and Use of Medicinal Plants by Traditional Medical Practitioners in Machakos District**,** Kenya (Musila et al., 2004).

S. henningsii was *id*entified as having become rare or threatened in Machakos due to over-exploitation (Musila et al., 2004). Majority of there respondents did not trade on the plants. In Narok and Kajiado the majority of the respondents were the Maasai community who are deep rooted in traditional medicinal practices. In Kiambu and Meru hospitals and other health facilities are readily available to the people and thus majorities do not rely on herbal medicines. Majority of these respondents did not trade on the plants. In Narok and Kajiado the majority of the respondents were the Maasai community who are deep rooted in traditional medicinal practices. *S. henningsii* had varied uses among the respondents from different study areas and the most common use was in making soup.

Different types of preparations made from medicinally important plants include decoction, juice, powder and oils (Survase and Raut, 2011). The roots and the stems are the most frequently used plant parts by the traditional healers as was the case in this study (Survase and Raut, 2011). Oral consumption was recommended against diseases like cold, cough, rheumatism, joint pains, fever diarrhea etc. Drugs were prescribed in small doses to taste either from parts of *S. henningsii* only or in combination with plant parts from other plant species. These combinations are more effective in curing diseases or enhancing the immunity of the patient (Survase and Raut, 2011; (Musila et al., 2004; Schmeltzer, 2008).

Conclusions

The study shows clearly that *S. henningsii* is heavily exploited in all the study areas due to its high demand for its medicinal properties. This calls for an urgent need for its conservations. Most respondents suggested ways of conserving the plant including training locals on tree conservations and sustainable use, planting it locally and establish tree nurseries.

ACKNOWLEDGEMENTS

We wish to thank the Research Production and Extension in Jomo Kenyatta University of Agriculture and Technology for supporting this work. Thanks also to Vincent Oeba, the Biometrician Kenya Forestry Research Institution for data analysis and interpretation. We are grateful to Joyce Liti and Patrick Njenga our technicians for their assistance in data collection in the field.

REFERENCES

Bagine R (2006). Natural resource for sustainable development: Empowering local communities' biodiversity conservation. Proceedings of National Museums of Kenya first Scientific Conference, 15th-17th Nov.18-20.

Beentje H.J. (1994). Kenya Trees, Shrub and Lianas. National Museums of Kenya, Nairobi, Pg 465.

Bisht AK, Bhatt A, Rawal RS, Dhar U (2006) Prioritization and conservation of Himalaya medicinal plants: *Angelica glauca* (edge) as a case study. Ethnobotany research and *Applications* 4: 011-023.

Bruneton J (1995). Phamacognosy, phytochemistry medicinal plants. Intercept. Hampshire.

Bussmann RW, Sharon D, Ly L (2008). From garden to market? The cultivation of native and introduced medicinal species in Cajamarca, Peru and implications for habitat conservation. Ethnobotany research and Applications 6: 351-361.

Casas A, Vazquez MD, Viveros JL, Caballero J (1996). Plant Management among the Nahua and the Mixtec in Balsas river basin, Mexico: An Ethnobotanical Approach to the study of plant domestication. Human Ecology 24: 455-478.

Chapman L, Johns T, Mahunnah RLA (1997). Sapon-like *in vitro* characteristic of extracts from selected non-nutrient wild plant food additive used by the Maasai in meat and milk based soups. Ecology of Food and Nutrition 36 (1): 1-22.

Chirchir J, Mungai G, Kariuku P (2006). Indigenous Knowledge and conservation of natural Resources: Resources Medicinal plants utilization in East Africa. Proceedings of National Museums of Kenya first Scientific Conference, 15th-17th Nov.106-111.

Cox AP, Balicks JM (1996). Ethnobotanical Research and Traditional Health Care in Developing countries. Plants, People and Culture PgsW.H. Freeman & Co. (Cited like

this in most publications)
Dery BB, Otsyina R (2000). Indigenous knowledge and prioritization of medicinal trees for domestication in the Shinyanga region of Tanzania. Proceedings of a workshop held in Arusha, Tanzania 1999. Edited by Temu AB, Lund G; William RE; Kowero GS; Klein K; Malande Y; Kone I. The African Academy of Science Pgs: 57-77.
Duchelle (2007). Observation on natural resource use and conservation by the Shuar in Ecudor's Cordillera del Condor. Ethnobotany Research & Application 5:005-023.
Flaster T (1996). Ethnobotanical approaches to the discovery of bioactive compounds. Progress in new crops: Proceedings of the Third National Symposium Pgs 561-565. ASHS Press, Alexandria.
Gachathi M (2007). Kikuyu Botanical dictionary. A guide to plant names uses and culture values. 2nd Ed Tropical Botany. Pgs 143, 212.
Gupta A, Mishra AK, Bansal P, Kumar S, Sannd R, Gupta V, Goyal BM, Singh AK, Kumar A, (2010). Antileprotic potential of ethnomedicine herbs; A review. Drug Intervention Today 2 (3): 191- 193.
Hutchings A (1989). A survey and analysis of traditional medicinal plants as used by the Zulu, Xhosa and Sotho. Bothalia. 19: 111–123.
Hutchings A (1996). Zulu medicinal plants. Natural University Press. Pietermaritzburgs
ICRAF (1992). A selection of useful tress and Shrubs for Kenya. Notes on their identification, propagation and management for use by farmers and pastoral communities. ICRAF.
Jacobson I, Johnson AK, Greidẻn B, Hägg S (2009). Spontaneously reported adverse reactions in association with complementary and alternative medicine substances in Sweden. Phamacoepideomiology and drugs safety 18: 1039-1047.
Lange D (1998). Europe's medicinal and Aromatic plants: Their use, trade and conservation. In Traffic, Species in Danger Reports. Cambridge UK. 77 PP
Light ME, Sparg SG, Stratford GT, Van Staden J (2005). Riding the wave. South Africa's contribution to Ethnopharmacological research over the last 25 years. *Journal of* Ethnopharmacology 100: 127-130.
Marles RJ (1996). Prairie medicinal and aromatic plants. Conference- odds, Alberta. March 3rd-5th
Maundu P, Tengäs T (2005). Useful Trees and Shrubs of Kenya. Technical handbook No. 35. Nairobi, Kenya: World Agroforestry center-Eastern and Central Africa regional Programme (ICRAF-ECA). Pp 400.
Maundu PM, Ngugi GW, Kabuye CHS (1999). Traditional food plants of Kenya. Kenya Resource Centre for Indigenous Knowledge (KENRIK), National Museums of Kenya, Nairobi, Pg 216.
MusilaW, Kisangau DP, Muema J (2004). Conservation Status and Use of Medicinal plants byTraditional Medicinal Practioners In Machakos district ,Kenya; Traditional aspects of health and wellness. Proceedings of Inter-Institutional Consortium for indigenous knowledge, transforming the academy, Pennsyvania Pg 27-29.
Njoroge GN, Kaibui IM, Njenga PK, Odhiambo PO (2010) Utilization of priority traditional medicinal plants and local people knowledge on their conservation status in arid lands of Kenya (Mwingi District) Journal of Ethnobiology and Ethnomedicine 6:22
Noad TC, Birnie A. (1989) Tree of Kenya. P. 135. (Citation ok, it's a small book)
Nyazema ZN (1996) Ethnobotany and Traditional Medicine Practice in Zimbabwe. *The Zimbabwe Science News* 4(104-109).
Palgrave KC (1988): Trees of South Africa 5th Ed, Struik publishers, Cape Town Pg 765-766.
Pujol J (1993**)** Naturafrica-the herbalists' handbook. Jean Pujol Natural Healer; Foundation, Durban
Schmeltzer GH (2008) Plant Resource of Tropical Africa (11); Medicinal Plants 1. PROTA Foundation Backhuys, CTA Wageningen, Netherlands Pgs 570-571.
Shackleton CM, Parkin F, Chauke MI, Downsborough L, Olsen A, Brill G, Weidman C (2009) Conservation, commercialization and Confusion: Harvesting of Ischyrolepis in a coastal forest, South Africa. Environment, Development and Sustainability 11:229-240
Sher H, Hussein F, Sher H (2010) *Ex-situ* management study of some high value medicinal plant species in Swat, Pakistan. Ethnobotany research and Applications 8: 017-024.
Shingu GK (2005) Ownership and sustainability issues of botanical medicines. Ethnobotany, Research and Applications 3:17-23.
Srivastava R (2000) Studying the information uses of medicinal plants stakeholders' in Europe. Traffic dispatches 15: 5.
Sunderland T, Ndoye O (2004) Forest products, Livelihoods and conservation: Case study of non-timber forest products systems Vol. 2 Africa. Center for International Forestry Research (CIFOR), Bogor, Indonesia
Survase SA, Raut SD (2011) Ethnobotanical studies of some tree medicinal plants in Marathwada, Maharashtra. Journal of Ecobiotachnology 3(2): 17-21.
Tits M, Damas J, Qurtin-Leclercq J, Angenot (1991) From Ethnobotanical uses of *Strychnos henningsii* to antinflammatories, analgesics and antispasmodics. Journal of Ethnopharmacology 34 (2-3): 261-267.
Traditional Medicine: Key facts {http:www.who.int/.}Website)
Van Wyk B, Bosch Van O, Nigel G (1997) Medicinal plants of South Africa. 2nd ed. Pretoria South Africa. Pgs 244-245
Watt MP, Breyer NG (1962) Medicinal and Poisonous plants of Southern and Eastern Africa. Livingstone,

Edinburgh.
Williams VL, Balkwill K, Witkowski ETF (2000) Unraveling the commercial markets for medicinal plants and plant parts in the Witwaterstrstrand, South Africa. Economic Botany 54:310-327.