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Ethnobotanical Uses of *Sansevieria* Thunb. (Asparagaceae) in Coast Province of Kenya

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Research

Abstract

Sansevieria Thunb. is a genus with diverse ethnobotanical uses in its geographical range. The current study reports on findings from an ethnobotanical study carried out on the genus *Sansevieria* in Coast Province of Kenya. Collating of ethnobotanical uses of *Sansevieria* from existing literature has been complicated by the fact that the ethnobotany of the genus is poorly documented with most species misidentified due to the nomenclatural confusion and the unresolved taxonomy of the genus *Sansevieria*. The aim of the current study was to correctly identify various *Sansevieria* species from their natural habitats and type localities where possible, to observe the plants *in situ*, and to document ethnobotanical uses of different *Sansevieria* species that occur in Coast Province of Kenya. Indigenous knowledge on the use of the plants by the local communities was captured by interviewing people residing in the study area. Purposive sampling and snow ball sampling were employed in the selection of informants. Direct observation, open ended, informal, and semi structured interviews covering questions on local names of species, plant uses, mode of administration, and the specific plant parts used were carried out with thirty respondents. Responses were documented for ethnobotanical uses of 9 *Sansevieria* species: *S. conspicua* N.E.Br., *S. dumetescens* L.E. Newton, *S. fischeri* (Baker) Marais, *S. kirkii* Baker, *S. nitida* Chahin., *S. perrotii* Warb., *S. powellii* N.E.Br., *S. raffillii* N.E.Br., and *S. volkensii* Gürke. A total of four broad use categories were identified from the study: medicinal use, horticultural use, food additives, and materials. Materials category was the most prevalent category with 49% of the total responses, followed by Medicinal category that accounted for 27%, the Horticultural use category that accounted for 21%, and the Food additives category that accounted for 3% of the total responses. The current study contributes to documentation of the ethnobotany of genus *Sansevieria* species in Coast Province of Kenya and provides a basis for a broader inquiry on the ethnobotany of genus *Sansevieria* based on wider sampling.

Introduction

The genus *Sansevieria* is well known worldwide for its range of xerophytic perennial plants that occur in dry tropical and subtropical parts of the world. About 70 species are known with a distribution range from Africa to south east Asia and the islands of the Indian Ocean (Alfani *et al.* 1989, Purseglove 1972). Mbugua and Moore (1996) suggested East Africa to be the center of diversity for the genus *Sansevieria*. Mbugua (2007) recognized 35 species of *Sansevieria* occurring in Kenya in the revision of family Dracaenaceae for flora of tropical Africa (Mwachala & Mbugua 2007). More recently, three new species have been described in Kenya (Newton 2009, 2010), further increasing the number of Kenyan *Sansevieria* species and

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raising the total number of *Sansevieria* taxa with type localities in Kenya to twenty: *S. ascendens* L.E. Newton, *S. ballyi* L.E. Newton, *S. bella* L.E. Newton, *S. caulescens* N.E. Br., *S. conspicua* N.E. Br., *S. dooneri* N.E. Br., *S. dumetescens* L.E. Newton, *S. francisii* Chahin., *S. frequens* Chahin., *S. gracilis* N.E. Br., *Sansevieria* x *itumea* (Mbugua) Jankalski, *S. nitida* Chahin., *S. parva* N.E. Br., *S. patens* N.E. Br., *S. pinguicula* P.R.O. Bally, *S. powellii* N.E. Br., *S. powysii* L.E. Newton, *S. raffillii* N.E. Br., *S. robusta* N.E. Br. (currently a synonym of *S. perrotii* Warb.), and *S. suffruticosa* N.E. Br. The genus is currently treated under family Asparagaceae (APG 2009). The genus is widely known by various common names: mother in law's tongue, bow string hemp, snake plant, zebra lily, leopard lily, devil's tongue, and good luck plant (Agnew 1974, Cutak 1966, Everett 1982, Koller & Rost 1988, Kwembeya & Takawira 1998, Pfennig 1979, Takawira-Nyenya 2006, Turrill 1959).

Ethnobotanical data on the genus *Sansevieria* have been documented in various locations in East Africa. Bally (1937) reported on the use of *Sansevieria kirkii* Baker roots for treatment of foot sores. In studies carried out in Nakuru and Maragua districts of Kenya by Khalumba *et al.* (2005), they identified five use categories, namely medicine (33% of the reports), fibers (24%), soil conservation (22%), fodder (18%), and other uses (14%) for four species, *Sansevieria ehrenbergii* Schweinf. ex Baker, *S. parva*, *S. raffillii*, and *S. suffruticosa*. Chhabra *et al.* (1987) mentioned the use of *Sansevieria bagamoyensis* N.E.Br. for treatment of convulsive fever in Tanzania. Watt & Breyer-Brandwijk (1962) listed the use of *Sansevieria hyacinthoides* (L.) Druce in the treatment of toothache and earache and the use of the rhizome decoction of *S. kirkii* as a purgative, both reported from East Africa. Kiringe (2006) reported on the use of *Sansevieria volkensii* Gürke for the treatment of sexually transmitted diseases such as gonorrhea. Owuor & Kisangau (2006) included the use of *Sansevieria parva* N.E.Br. leaf sap for treatment of snake bite wounds and *S. kirkii* extracts for treatment of snakebite wounds in Kenya. In spite of these reported uses, the documentation of ethnobotanical uses of genus *Sansevieria* is incomplete. Khalumba *et al.* (2005) acknowledged the deficiency of data and published documentation on the ethnobotany of the genus *Sansevieria* in Kenya despite the many species that occur there.

Collating of ethnobotanical uses of *Sansevieria* from existing literature has been complicated by the fact that the ethnobotany of the genus is poorly recorded (Khalumba *et al*. 2005), and where documented, some species are identified using different synonyms due to nomenclatural confusion and the unresolved taxonomy of the genus *Sansevieria*. Correct taxonomy and identification of a plant species is key to unlocking its ethnobotany, economic and pharmacological importance, and eventual exploitation of the plants for commercial purposes. The aim of the current study was to correctly identify various *Sansevieria* species that occur in Coast Province of Kenya based on observations of the plants *in situ*, to interview the local people on the uses of *Sansevieria* species in their habitats, and to capture indigenous knowledge on the genus *Sansevieria*'s economic and cultural value in the study area.

Kenya has about 42 different tribes with different cultures and beliefs, and these differences contribute to a rich diversity of knowledge and practices (Jeruto *et al.* 2008). Different tribes use different local names for the various *Sansevieria* species in Kenya. Capturing the uses of plant species from various ethnic groups is therefore a significant contribution to the documentation of indigenous knowledge on the use of plant resources in Kenya.

The study area, the people

Coast Province of Kenya (Figure 1) currently includes six counties: Kilifi, Kwale, Lamu, Mombasa, Taita-Taveta and Tana River. The areas visited during the study were mostly in the Taita-Taveta and Kilifi counties. Taita-Taveta County lies about 200 km northwest of Mombasa and 360 km south east of Nairobi. The population of Taita-Taveta County is estimated to be 250,000 people (2009 Census). Taita-Taveta County covers an area of 16,975 km^2, about 62% of which is within Tsavo National Park. About 5,876 km^2 of the area is occupied by ranches and sisal estates, and water bodies which cover less than 100 km^2. Taita-Taveta County has approximately 25 ranches with the main land use being cattle grazing. The Coast Province is also home to three operating sisal estates in Taita-Taveta County, namely Taita Sisal Estate, Voi Sisal Estate, and Taveta Sisal Estate. Many ranches in the area are also utilized for wildlife tourism and conserva-

Figure 1. Coast Province of Kenya.

tion, for example the Taita Hills forest which holds unique biodiversity and many endemic plant and animal species. Main occupations of the people include subsistence and smallholder farming of maize and cashew nuts among other crops (Giyethe pers. comm.) Off-farm income-generating activities include charcoal sale and employment in the tourism industry in Mombasa and Taita-Taveta, in the Tsavo National Park, or in the sisal estate industry.

Kilifi County is bordered to the south by Mombasa, to the north by Malindi, Tana River, and Lamu Counties, and to the west by Taita-Taveta and the Indian Ocean to the east. The County covers an area of about 12,000 km^2 that includes about 109 km^2 occupied by water. The population of Kilifi is estimated to be 720,000 with the majority from the Mijikenda, a loose grouping of 9 tribes from the area whose Bantu languages are closely related to Swahili (the main language used in Kenya). The Giriama and Digo subgroups are the largest tribes. Kilifi is a small town 60 km north of Mombasa of around 10,000 people. The two primary forms of economic activity in Kilifi County are agriculture and tourism. The tourism is concentrated around Malindi and to a lesser extent Kilifi. About 85% of the population is involved in subsistence and smallholder farming, but since the population density is high in relation to the agricultural potential, Coast Province of Kenya is one of the poorest in terms of per capita income. Only 4% of the population is employed for wages.

The selection of Coast Province as the study area was motivated by prior knowledge of the rich diversity of *Sansevieria* species in the area including many of type localities cited in the *Sansevieria* monograph (Brown 1915).

Methods

Ethnobotanical data were collected in the field as part of a taxonomic study conducted in August and September 2007. A non-probabilistic, purposive sampling approach was used for selecting informants (Guest *et al.* 2006). Bryan (2004) describes purposive sampling as essentially strategic, where a researcher samples on the basis of wanting to interview people relevant to specific research questions. We targeted groups of the local people living in the vicinity of *Sansevieria* type localities (Brown 1915).

Snowball sampling was used, whereby informants told researchers about specific plants found in their area and then led the research team to other informants who knew more about the use of plants. Direct observations and open-ended and semi-structured interviews using a standardized set of questions were used, modified from Cunningham (2001), Martin (1995), and Cotton (1996). Prior informed consent was obtained from the informants before the interviews. Local plant names and samples already collected were sometimes used as prompts at the beginning of the interview in order for the informants to understand which plants were in question. Informants were shown specimens of *Sansevieria* and asked if they recognized the plant. In some cases informants took the research team to more localities where the species were occurring in the area. One of the co-authors served as a translator from Swahili to English and vice-versa.

Responses to questions covering aspects on local names, uses, mode of preparation, and methods of administration (in case of medicines) were recorded. Each time a plant was mentioned as "used" the report was recorded as "one use-report." Data were collected from independent events where an event is defined as the process of interviewing one informant on one occasion on their knowledge of the use of any *Sansevieria* using methods modified from Phillips & Gentry (1993). Demographic data of respondents such as age and gender were also recorded. All plant specimens were identified using Brown (1915), Mbugua (2007), Newton (2009, 2010), and voucher specimens deposited at the East African herbarium (EA) in Kenya.

Use categories

Ethnobotanical data recorded from interviews with 30 informants were classified into categories according to the Economic Data Collection Standard (Cook 1995) for the purpose of illustrating and summarizing the data. For each category the data were quantified by adding up the individual reports on use of each plant species.

Results

Thirty respondents (Table 1) were interviewed about uses of *Sansevieria* species. Half of the respondents were below 30 years old. There were no respondents in the age group 46-90. Nine *Sansevieria* species were identified as having uses (Table 2). *Sansevieria fischeri* was the most mentioned (Table 2, Figure 2).

Ethnotaxonomy

Almost all the respondents interviewed knew at least one local name for each *Sansevieria* species that occurred in

Table 1. Ethnobotanical respondents' gender and age groups in Coast Province of Kenya.

Age group (years old)	Male	Female	Total
15 or younger	4	6	10
16-30	4	1	5
31-45	9	5	14
46-90	0	0	0
over 90	1	0	1
Total	18	12	30

Table 2. Ethnobotanical uses and use categories of *Sansevieria* from interviews conducted with 30 informants in Coast Province of Kenya. Each row represents one respondent. Parts used are leaf (L), rhizome (R), or entire plant (E). Voucher specimens are deposited at the East African Herbarium, Kenya. Use categories: Materials (M), Medicinal use (O), Horticultural uses (H), and Food additives (F). Parts used are leaf (L), rhizome (R), or entire plant (E). Voucher specimens are deposited at the East African Herbarium, Kenya. Specimens already collected in the area were sometimes shown to the informants as interview prompts; hence for some voucher specimens numbers are repeated.

***Sansevieria* species**	**Vouchers (Takawira Nyenya & Wabuyele #s)**	**Part used**	**Use categories and uses**											**Use**	**Respondents**	**Locality**	**Coordinates and altitude**
			M						**O**	**H**			**F**				
			Processed fiber	**Unprocessed fiber**	**Crafts**	**Brushes**	**Play**	**Trapping animals**	**Medicinal**	**Ornamental**	**Live fencing**	**Soil conservation**	**Culinary**				
S. conspicua N.E.Br	K34	L	X											Making rope for tying goats	29	6.2 km from Kaloneni along Malindi Sala gate of the Tsavo National Park, Kilifi County	03 11 17.0 S 39 48 40.1 E 100 m
S. dumetescens L.E. Newton	K33	E								X				Collected from the wild and cultivated around the homestead as ornamental	28	3.7 km east of Kakoneni, Malindi along Road to Tsavo National Park, Kilifi County	03 10 51.9 S 39 53 24.7 E 70 m
S. fischeri (Baker) Marais	K9	L	X											Making fiber for rope	4	4 km south of Voi, along Mwatate Road.	03 30 34.4 S 38 20 46.1 E 960 m
		L				X								Making brushes			
		L	X											Making fiber for rope	5	Turnoff to Sechu Primary School, Mwatate.	03 29 45.8S 38 18 20.2 E 960m
		L		X										Tying firewood			
		L		X										Tying firewood	6		
		L							X					Treating abdominal pains	7		
	K14	E								X				Ornamental	9	13 km after Mwatate on road to Mombasa, Taita.	03 30 11.6 S 38 15 03.0 E 960 m
		L	X											Making thatching rope	15	Landi Village, Taita.	03 29 00.9 S 38 26 35.0 E 770m
		L							X					Treating wounds inflicted by *Sansevieria* tips	16	Torienyi Village, Mengo sublocation Kishamba.	03 27 06.0 S 38 28 42.4 E 770 m

Sansevieria species	Vouchers (Takawira Nyenya & Wabuyele #s)	Part used	Use categories and uses											Use	Respondents	Locality	Coordinates and altitude
			M						O	H			F				
			Processed fiber	Unprocessed fiber	Crafts	Brushes	Play	Trapping animals	Medicinal	Ornamental	Live fencing	Soil conservation	Culinary				
S. fischeri (cont.)	K14	L	X											Making fiber for rope	16	Torienyi Village, Mengo sublocation Kishamba.	03 27 06.0 S 38 28 42.4 E 770 m
		L				X								Making brushes	17		
S. kirkii Baker	K51	R							X					Cut rhizome pieces added to a glass of water for treating malaria	30	Along Kaloneni Mariakani Road, 8.6 km before Mariakani, Kilifi County	03 44 18.0 S 39 41 43.9 E 140 m
S. nitida Chahin.	K3	L							X					Treating ear infections	3	4 km south of Voi, along Mwatate Road.	03 30 34.4 S 38 20 46.1 E 960 m
	K13	L	X											Various uses	8	13 km after Mwatate on road to Mombasa, Taita.	03 30 11.6 S 38 15 03.0 E 960 m
		L			X									Weaving crafts / tying roof poles			
	K15	E								X				Ornamental	10		03 29 00.9 S 38 26 35.0 E 770 m
	K22	L						X						Making rope used in dik dik traps	19	Ndara village, Taita.	03 29 35.3S 38 40 56.6 E
	K23	L			X									String woven in crafts	20		
	K22	L					X							Making childrens' play sandals	22	Sagala sublocation, Voi.	03 30 00.7 S 38 41 18.7 E 530 m
		L							X					Leaf sap treats cuts and open wounds	24	Kajire	03 30 00.7 S 38 41 18.7 E 530 m
		L R											X	Tender white leaf base with sliced rhizome pieces cooked in soups / meat dishes	25	Wagala, near Bachuma station along Voi - Mombasa Road.	03 36 20.6 S 38 49 56.1 E 440 m

Sansevieria species	Vouchers (Takawira Nyenya & Wabuyele #s)	Part used	Use categories and uses											Use	Respondents	Locality	Coordinates and altitude
			M						O	H			F				
			Processed fiber	Unprocessed fiber	Crafts	Brushes	Play	Trapping animals	Medicinal	Ornamental	Live fencing	Soil conservation	Culinary				
S. nitida (cont.)	K22	R							X					Cut rhizome pieces added to a glass of water for treating malaria	26	Wagala, near Bachuma station along Voi - Mombasa Road.	03 36 20.6 S 38 49 56.1 E 430 m
S. perrotii Warb.	K21	L	X											Thatching rope	13	Landi Village, Taita.	03 29 00.9 S 38 26 35.0 E 770m
		L		X										Tying firewood			
		E								X				Ornamental	18	Ndara village, Taita.	03 29 35.3S 38 40 56.6 E
		L	X											Making fiber for rope			
S. powellii N.E.Br.	K28	E									X			Live boundary fences between homesteads	21	Sagala sublocation, Voi.	03 30 00.7 S 38 41 18.7 E 530 m
	K30	E									X			Grown as live fencing and as a hedge to demarcate boundaries between homesteads	27	Jilore Village.	03 12 02.8 S 39 55 20.1 E 1000 m
		E										X		Planted to control soil erosion			
S. raffillii N.E.Br		E								X				Ornamental	14	Landi Village, Taita.	03 29 00.9 S 38 26 35.0 E 770m
S. volkensii Gürke	K8	L	X											Making rope for construction	1	4 km south of Voi, along Mwatate Road.	03 25 10.0 S 38 31 43.8 E 630 m
		L							X					Treating ear infections	2		
	K19	L							X					Treating ear infections	11	Landi Village, Taita.	03 29 00.9 S 38 26 35.0 E 770m
		R							X					Treating abdonimal pains	12		
	K24	L							X					Leaf sap treats cuts and open wounds	23	Kajire	03 30 00.7 S 38 41 18.7 E 530 m

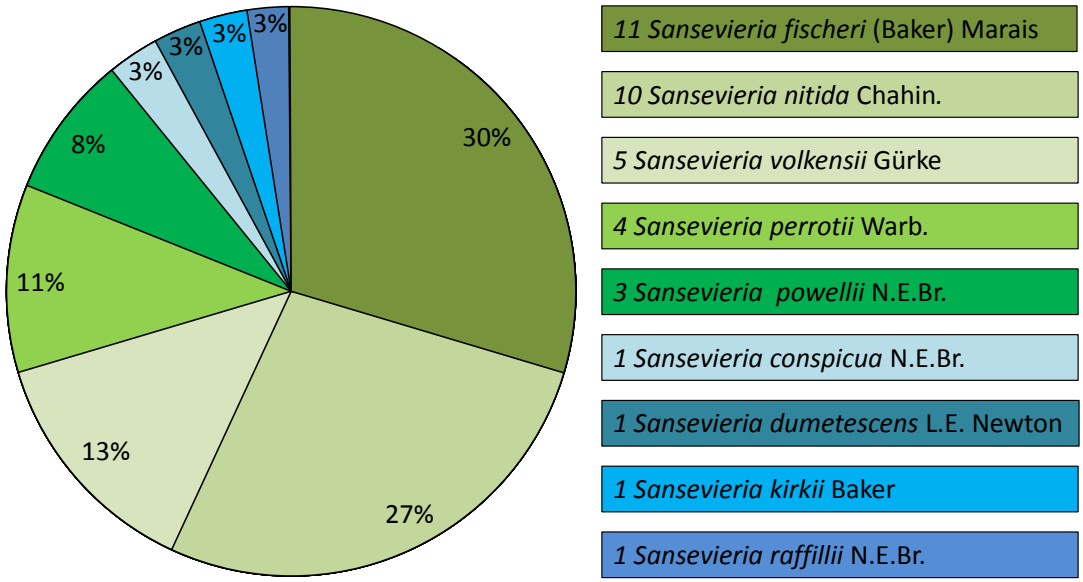

Figure 2. Percentage and number of times different *Sansevieria* species were reported in interviews with 30 respondents in Coast Province of Kenya. Data from Table 2 and are further sorted in Appendix 1.

their area, and respondents were able to identify different species and describe the distinguishing features between them in cases where more than one species occurred in their area. Table 3 presents the local names for *Sansevieria* that were reported and the languages spoken by the respondents. Some of the names had no apparent meaning while some common names had indications to the characteristic features of the *Sansevieria* species named. Names related to the latter included "**makonge akenyeji**", a Taita common name that was mentioned for *S. fischeri* meaning "traditional sisal" and "**shambalala-handini**" meaning "small **shambalala**" with **shambalala** being the Kisagala common name given for *S. powellii*. Common names were recorded for 4 local languages spoken in Coast Province (Kigiriama, Kisagala, Kimaasai, and Kitaita) as well as Kiswahili, a language used in the entire country. The common names "**makonge**" and "**madango**" were indiscriminately used for many *Sansevieria* species and were also used for the introduced species *Agave sisalana* Perrine.

Table 3. Some local names for *Sansevieria* species and the associated languages as recorded from the informants in the Coast Province of Kenya.

Sansevieria species	Common name used in folk taxonomy (language)
S. conspicua N.E.Br.	**Konge** (Giriama)
S. *fischeri* (Baker) Marais	**Madango** (Taita)
	Nona (Taita)
S. nitida Chahin.	**Chongwa** (Giriama)
	Madango (Taita)
	Makonge (Taita)
	Nona (Taita)
	Oldopai (Maasai)
	Shambalala (Kisagala)
S. perrotii Warb.	**Konge** (sing.), **makonge** (pl.) (Taita)
	Ngonge (Kisagala)
S. powellii N.E.Br.	**Ngonge** (Kisagala)
S. raffillii N.E.Br.	**Madango** (Taita)
S. volkensii Gürke	**Dango** (sing.), **madango** (pl.) (Taita)
Sansevieria spp.	**Konge** (Swahili)
	Nkonje (Giriyama)

Plant parts used

The leaf was the main plant part used and was cited 25 times, which accounted for 67% of the uses reported. Use of entire plants (8 citations, 22%) and rhizomes (4 citations, 11%) were also reported.

Use categories

Four main categories were identified (Materials, Medicinal use, Horticultural use, and Food additives) based upon 11 reported use types (Figure 3). The Materials category was the most common response (49%), followed by Medicinal use (27%), Horticultural use (21%), and Food additives use (3%) categories respectively. Each of the cat-

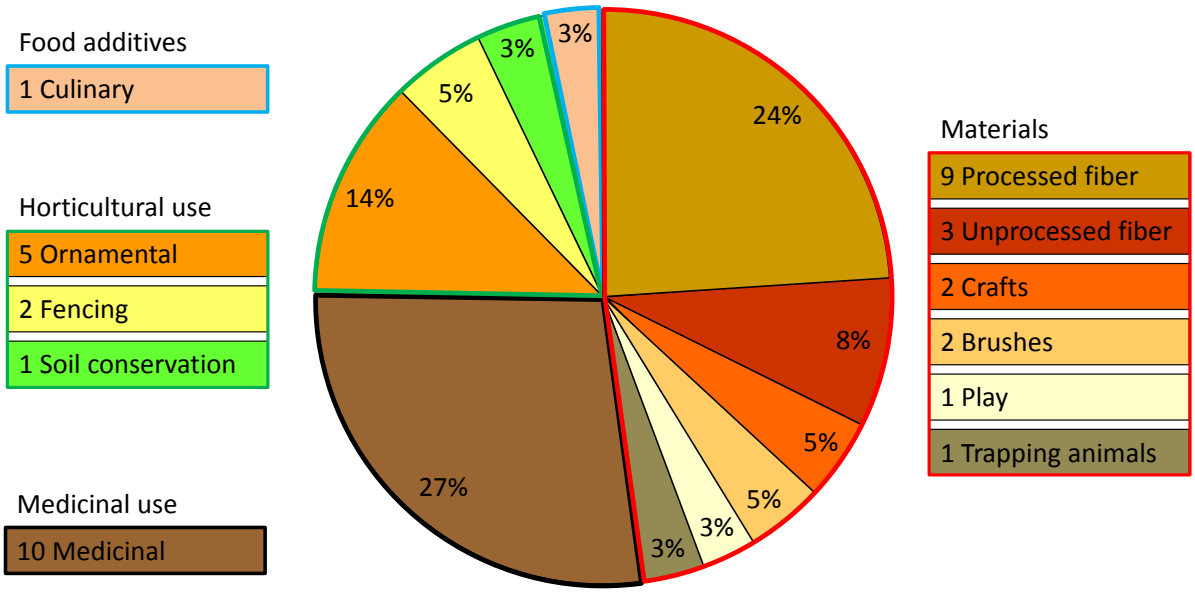

Figure 3. Percentage and number of uses in use categories (Materials, Medicinal use, Horticultural use, and Food additives) for *Sansevieria* species reported in interviews with 30 respondents in Coast Province of Kenya. Data from Table 2, and are further sorted in Appendix 1.

egories and the use reports as reported by the informants are briefly described below.

Materials

This category included reports on uses of *Sansevieria* leaves for: processed rope, unprocessed fiber, crafts, brushes, trapping animals, and as material for play.

The processed fiber uses included making rope or string of various thicknesses. This use-report formed the second largest group with nine reports. *Sansevieria fischeri* was the species mostly reported (four reports) for this use-report.

The most common technique reported for extracting fiber was to use two sticks with the leaf in between. The sticks were continually moved up and down until the fiber separated from the rest of the leaf tissue. One informant reported a different method of fiber extraction that included soaking the leaves in water over a period of 3 to 5 days and scraping off the leaf tissue after the maceration, leaving just the fiber. The extracted fiber was intertwined to a desired thickness by dividing the fiber strands into three parts and then rolling them by laying the fibers on one's foot or thigh and moving one's hand backwards and forwards to make a twisted rope of desired thickness. Processed fiber was reportedly extracted for the purpose of making rope used in thatching huts, weaving, and in various forms of construction. It was also used for filling mattresses. Four reports were on the use of unprocessed leaves as simple ropes for tying firewood and in thatching huts.

Two reports were on the use of *Sansevieria* for making brushes. Brushes made from the thick cylindrical leaves of *S. fischeri* were used for various purposes: painting, sweeping, or cleaning. A brush was made by hitting one end of the leaf with a stone to make the bristles (Figure 4). The informant reported that she added sand or detergents to the bristles and used the brush for cleaning her kitchen utensils and the inside of bottles or other containers too narrow for inserting the hand for cleaning purposes.

Craft uses included weaving baskets, hats, and table and door mats. Only two reports were given for this use, both for *S. nitida*.

A single report was given on the use of *S. nitida* for setting traps for small animals such as dik dik (*Madoqua* sp.). The informant explained how they mounted nets made from *S. nitida* fibers to the ground by means of sticks in the area where dik dik had previously been seen. One of the hunters startled the animal, usually out of its sleep, so that it would run headlong into the net, while the other hunters stood by on the sides with sticks, waiting to drive the animal toward the net in the event that it attempted to run in a different direction. Similar traps were said to be used for other small animals.

One informant reported on the use of *S. nitida* by children for making miniature sandals during play. Sandal production was demonstrated by drawing an outline of a sandal on a broad, variegated, flat leaf of *S. nitida* which was then cut into a sandal sole shape and parts of the leaves shredded longitudinally to make the upper part of the sandal (Figure 5).

Figure 4. *Sansevieria fischeri* (Baker) Marais leaves used as brushes in Coast Province of Kenya. A stone is used to gently crush the end of the leaf until the fibers (for bristles) are separated from the soft leaf tissue. A detergent or sand is added to the bristles before it is used for cleaning. The upper end shows a brush under preparation, the lower end shows a previously made brush. (Photo by B. Stedje)

Figure 5. *Sansevieria nitida* Chahin. sandals made by children for play in Coast Province of Kenya. (Photo by B. Stedje)

Medicinal use

The medicinal use category included reports on a variety of treatments. *Sansevieria volkensii* was most often reported. Information given on medical uses included three reports on the use of *Sansevieria* for treatment of ear infections. The most frequently described application method used for treating ear infections was to heat a leaf over a flame or live hot embers and then to squeeze out the sap of the heated leaf into the infected ear. One informant specified *S. volkensii* as the species mostly used for treatment of ear infections in their area, but also added that all the **madango** (*Sansevieria*) were generally used in the same way for treating ear infections.

Sansevieria fischeri was reported once for the treatment of abdominal pains by adding the leaf or rhizome cut into small pieces to drinking water. The same species was also reported once for treating wounds inflicted by the sharp tips of the same plant's leaf. This report was given in Landi village where large *S. fischeri* populations occurred in thick clusters covering wide areas and over rocky outcrops, increasing the risk of people suffering wounds from the species' spiny leaf tips while walking through the area. An illustration on how sap was expressed from the leaf straight onto a freshly inflicted wound by wringing the leaf is shown in Figure 6.

The use of *S. kirkii* and *S. nitida* in treatment of malaria was reported once for each species. When using the latter species, the rhizome was cut into small pieces and added to a glass of boiled water and the mixture cooled and given to a malaria patient. The report was given by a Maasai man who emphasized the importance of this medicinal use in their ethnic group's semi-nomadic way of life and the central role played by traditional medicine over modern medicines in their life. The second report on the treatment of malaria was on the use of *S. kirkii*. The mode of preparation of the medicine differed from the report given for *S. nitida*. The leaf of *S. kirkii* was put in a fire for about three minutes and the sap squeezed into a container. One teaspoon of the sap was added to a glass of water and the mixture given to the patient.

Horticultural uses

This category is comprised of reports on ornamental use, fencing, and soil conservation. This includes growth of *Sansevieria* around homesteads as ornamentals and for decorative purposes. Five different species were reported for this category.

Sansevieria powellii was reported twice as being used for fencing. The plants were planted or alternatively used as live fencing in their natural habitat. One of the informants pointed out that the sharp ends of the leaves and the numerous leaves distichously arranged along the stem made the species ideal for fencing. The species was also planted for marking boundaries between homesteads.

Only one report was recorded for use of *Sansevieria* in soil conservation. *Sansevieria powelli* was reportedly planted on gullies and steep slopes to control soil erosion. One informant mentioned that the growth habit of all members of genus *Sansevieria*, forming colonies and the occurrence of vegetative propagation through rhizomes that form a thick network below ground, makes them efficient in holding soil particles together.

Food additives

There was only one report on the use of *Sansevieria* in cooking. The cream-colored tender base of leaves and rhizome of *S. nitida* were reported to be chopped and added to soups and meat dishes by the Maasai people (Figure 7). The parts were added to well-cooked and tender meat stock.

Discussion

In the current study we refrained from making comparisons about species preference between contributions by groups in the sample (e.g., males and females, or different age groups) because for concrete conclusions to be drawn a larger sample would be required. However, while a sample size of 30 informants could be deemed small, Warren (2001) states that a minimum number required for a qualitative interview study to be published can be between 20 and 30 with sample size able to support convincing conclusions varying from situation to situation. In the current study, the sample size, obtained through purposive sampling as we carried out field work for the study guided by the recorded type and specimen localities, provided preliminary data that can be used as a basis for a more in-depth study.

More male respondents (18) were interviewed than women (12). This could have been partly coincidental and partly due to the fact that more men were encountered during the field studies as most interviews were carried out around the localities of the species. This is in contrast to encountering women, who mostly could have been at their homesteads at the times of the interviews. Other studies, for example Zobolo & Mkabela (2006), have reported on women and girls as the main custodians of indigenous plant knowledge in South Africa. A total of 10 informants below or equal to the age of 15 were interviewed showing that indigenous knowledge is still passed on to the younger generation.

Several of the local names of *Sansevieria* species given by the respondents were related to the use of *Sansevieria* for making rope. The common name **madango** was re-

Figure 6. Informant demonstrating how sap is squeezed straight from the leaf of *Sansevieria fischeri* (Baker) Marais onto a wound, in Coast Province of Kenya. (Photo by B. Stedje)

Figure 7. Maasai men showing two *Sansevieria* species; *S. volkensii* Gürke (L) and *S. nitida* Chahin (R), with the one to the right indicating the specific plants of *S. nitida* used for culinary purposes in soup and meat dishes in Coast Province of Kenya. (Photo by B. Stedje)

ported by a number of informants as meaning "rope." This name was also said to be locally used for *A. sisalana* because of the common use of *Sansevieria* and *A. sisalana* for making rope. Common names recorded in Giriama, Taita, Kisagala, and Maasai for different species indicate that people of these tribes are able to discriminate between species of *Sansevieria* and that these species play a role in their daily lives. The name **mkonge** is used to describe various *Sansevieria* species (Table 3) but also *Balanites aegyptiaca* (L.) Delile, a useful timber tree, and *A. sisalana*. There is need to relate common names from different ethnic groups to the correct scientific species as they are identified by people from the ethnic groups (of the plants) *in situ*.

Two major sisal industries are found in Coast Province of Kenya with the sisal reported as mainly for export. The sisal from *A. sisalana* is used for making sacks for export. There could be a possible competition between rope from *Sansevieria* and that from sisal by the local communities as reported for *Sansevieria* species in a similar study in Zimbabwe (Takawira-Nyenya 2012, Takawira-Nyenya & Stedje 2011).

Limitations of the *Economic Botany Data Collection Standard* (Cook 1995) have been highlighted before by Barfod (1997). While an attempt was made to force all of the ethnobotanical uses into categories based on the Biodiversity Information Standards (TDWG) standard, this tended to cause misfits for certain uses that could not exactly fit into the categories outlined in this standard, thereby overshadowing some of the ethnobotanical uses that the genus *Sansevieria* is well known for.

Many studies have reported on the economic importance of *Sansevieria* worldwide in horticulture where various species are grown in pots and in gardens as ornamentals (Koller & Rost 1988, Takawira-Nyenya 2006, Takawira-Nyenya & Stedje 2011). Our studies report on the cultivation of five *Sansevieria* species, *S. fischeri*, *S. raffillii*, *S. perrotii*, *S. dumetescens*, and *S. nitida*, around homesteads for ornamental purposes. Cultivation of various species of *Sansevieria* was also reported elsewhere in Kenya (Khalumba *et al*. 2005), in Zimbabwe (Takawira-Nyenya & Stedje 2011), and South Africa (Zobolo & Mkabela 2006). Additional knowledge of species of *Sansevieria* that can be successfully cultivated as ornamentals reported here widens the knowledge on the range of genetic resources that can be potentially exploited commercially.

Medicinal plants are of significance in conservation due to the cultural, livelihood, or economic roles they play in many people's lives (Hamilton 2004). Ethnomedicines play important roles in the lives of most rural communities due to their relatively low cost compared to clinical treatments. Most informants mentioned the use of *Sansevieria* species for treatment of earache. This treatment has been reported elsewhere in Africa, for example in South Africa and Zimbabwe (Takawira-Nyenya & Stedje 2011) and other parts of the world.

The treatment of ear infections using *Sansevieria* species was the most common medicinal use reported in this study. Our findings on the use of various *Sansevieria* species for medicinal purposes in the current study confirm the importance of the genus *Sansevieria* in traditional medicine reported elsewhere in the healthcare system of the people of Kenya. Anti-inflammatory property of leaves of *Sansevieria liberica* Gérôme & Labroy have been tested to ascertain the toxicity and phytochemical profiles of the leaf extracts, and results showed that leaves of *S. liberica* possess anti-inflammatory effects which may be due to its bioactive constituents. Further purification of these constituents may result in the development of anti-inflammatory agents (Chinasa *et al.* 2011).

Our findings on the use of *Sansevieria* species for treatment of ear infections in Coast Province are consistent with reports on use of *Sansevieria* species for treatment of ear infections reported internationally in India (Mohan *et al.* 2008), in Kenya, (Khalumba *et al.* 2005), in South Africa (Van Wyk *et al.* 2008, Zobolo & Mkabela 2006), and in Zimbabwe (Gelfand *et al.* 1985, Takawira-Nyenya 2012, Takawira-Nyenya & Stedje 2011). Morgan (1981) reported the use of *S. ehrenbergii* sap for treatment of cuts by applying the sap in the same way as reported in the current study. Uses of *Sansevieria* species for treatment of open wounds was reported by Khalumba *et al.* (2005), Dargol & Gurung (1991), and Takawira-Nyenya (2012) with differences only in the particular species used.

We report in this study the use of *S. nitida* and *S. kirkii* for treating malaria. Use of *S. liberica* for treatment of malaria has been reported before by Hermans *et al.* (2004) who made an inventory of medicinal plants used against malaria in Benin. Lack of precision and standardization in the quantities and dosage of medicine were common in this study as has been widely discussed (Giday *et al.* 2003, Jeruto *et al.* 2008, Muthee *et al.* 2011).

Sansevieria fischeri and *S. perrotii* have been reported here for tying firewood and for use in thatching without prior extraction of fiber. This included shredding the green outer tissue of the leaf and tying the strands end to end for use in tying firewood and during thatching without prior extraction of fiber. Similar results were reported in Takawira-Nyenya & Stedje (2011) and elsewhere in Kenya by Ngugi (2007) whereby informants reported using the unprocessed fiber in place of nails when thatching.

Our findings on the use of *Sansevieria* leaves for making fiber are in accordance with other studies (Khalumba *et al.* 2005, Morgan 1981, Takawira-Nyenya 2006, 2012, Takawira-Nyenya & Stedje 2011, Van Wyk & Gericke 2000). While methods of fiber extraction and the species reported in these studies may differ, the concept of inter-

twining the extracted fiber to make rope of desired thickness is the same. Use of *Sansevieria* for weaving crafts has been reported in other studies (Khalumba *et al.* 2005, Takawira-Nyenya & Stedje 2011) and is consistent with our findings.

Reports on direct ingestion of *Sansevieria* are not common in the literature. Addition of *Sansevieria* leaf sap to fresh milk to speed up the souring process was reported in Kenya and application of leaf sap to maternal breasts for stimulation of milk production has been reported among the Bushmen in Namibia (Takawira-Nyenya 2012). The current study documented the use of *S. nitida* leaf and rhizome as a food additive chopped and added to soup and meat dishes by the Maasai people. No other uses of *Sansevieria* for purely culinary purposes were known to us prior to this study although the use of *Sansevieria* in drinks or soups for medicinal purposes has been reported before (Johns *et al.* 1994, Kiringe 2006, Takawira-Nyenya & Stedje 2011).

Use of *Sansevieria* species for making sandals used for play reflected creativity in an environment where children have no access to modern and sophisticated tools for play. *Sansevieria nitida* was probably the preferred species for this use due to the broad, flat shape of the leaves and the large surface area compared to the other species. We report for the first time the use of *S. nitida* by children for making miniature sandals, with the sandals probably serving a dual purpose of being a play tool and practical providing protection from the tropical heat.

The two reports on the uses of *S. fischeri* for making brushes are in accordance with Pandey & Gupta (2003) reporting on the use of fiber-yielding plant species of India for making brushes. No other reports of *Sansevieria* being used for making brushes were known to us prior to this study.

The documentation of ethnobotanical uses involving the whole plant meant that the plants could be conserved both *in situ*, in the case of live fencing involving plants in their natural habitats, and *ex situ*, in cases where plants were collected from their natural habitats for cultivation in home gardens as ornamentals. Muthee *et al.* (2011) reported on harvesting of medicinal plants by the people in the Loitoktok district of Kenya from natural vegetation, home gardens, roadsides, farmlands, and live fences implying that live fences served as readily accessible sources of medicine.

The part of a *Sansevieria* plant that is harvested has a bearing on sustainable utilization, management, and conservation of the resource (Kakudidi *et al.* 2000, Takawira-Nyenya & Stedje 2011). Our study showed that use of leaves was the most prevalent. These results concur with findings of Khalumba *et al.* (2005) who found that most of the respondents (83%) used leaves. They also reported that the prevalent use of leaves was detrimental to the survival of single leaf species like *S. raffillii*. However, Giday *et al.* (2003) and Srithi *et al.* (2009) found that harvesting of leaves was generally more sustainable for most plants than harvesting of underground parts. No threats to the survival of the *Sansevieria* species related to the harvesting of plant parts were reported in our study. An observation of numerous *S. powelli* plants that had been cut and arranged in a row for fencing purposes however raised conservation concerns, as harvesting of each plant had involved cutting the entire part of the plant above ground, leaving just the rhizome below the ground. Further studies into how rampant such practices are in the area and how detrimental they are to the existence of the species could shed light on the threats to its existence.

The use of *Sansevieria* species in soil conservation is consistent with observations of Khalumba *et al.* (2005) who found that 22% of their respondents reported this purpose. Their study also included use of *Sansevieria* species as live fencing, ornamentals, rehabilitation of degraded sites, and stabilization of river banks. The growth habit of the genus *Sansevieria*, forming colonies and vegetative propagation through rhizomes that form a thick network below ground, makes them ideal for holding soil particles together. Newton (2004) also reported on the use of *S. perrotii* in controlling soil erosion elsewhere in Kenya. While the cultivation of *Sansevieria* plants in the current study was mainly for ornamental use and soil erosion control, these uses also indirectly result in the propagation and conservation of *Sansevieria* species. Propagation of *Sansevieria* species for dual purposes of soil conservation and species conservation has been reported before in Zimbabwe by Sangarwe (2005) who described the importance of such an ecosystem approach as a strategy for integrated management of land, water, and living resources, thereby promoting conservation and sustainable use of natural resources.

Conclusion and Recommendations

This study documented ethnobotanical knowledge of nine species of *Sansevieria* in Coast Province of Kenya. The range of reported uses for the genus *Sansevieria* in Kenya has been broadened. The results complement ethnobotanical studies carried out by Khalumba *et al.* (2005). The purposive sampling approach employed in this study allowed us to overcome time constraints and to generate preliminary results for future work. It is hoped that this study, together with the work of Khalumba *et al.* (2005), will form basis for in-depth studies on the genus *Sansevieria* in Kenya. Future studies on the conservation of *Sansevieria* species should focus on the sustainability of harvesting methods and their impact on the conservation of respective *Sansevieria* species.

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Appendix 1. Data extracted from Table 2 to produce Figures 2 and 3. Number of responses for different ethnobotanical uses reported for each of the species recorded from interviews with 30 informants in Coast Province of Kenya.

Uses as reported by informants	**Total number of uses per species**									
	S. conspicua N.E.Br.	*S. dumetescens* L.E. Newton	*S. fischeri* (Baker) Marais	*S. kirkii* Baker	*S. nitida* Chahin.	*S. perrotii* Warb.	*S. powellii* N.E.Br.	*S. raffillii* N.E.Br.	*S. volkensii* Gürke	**Total**
Medicinal use	0	0	2	1	3	0	0	0	4	**10**
Processed fiber	1	0	4	0	1	2	0	0	1	**9**
Ornamentals	0	1	1	0	1	1	0	1	0	**5**
Unprocessed fiber	0	0	2	0	0	1	0	0	0	**3**
Crafts	0	0	0	0	2	0	0	0	0	**2**
Fencing	0	0	0	0	0	0	2	0	0	**2**
Making Brushes	0	0	2	0	0	0	0	0	0	**2**
Culinary use	0	0	0	0	1	0	0	0	0	**1**
Play	0	0	0	0	1	0	0	0	0	**1**
Soil conservation	0	0	0	0	0	0	1	0	0	**1**
Trapping animals	0	0	0	0	1	0	0	0	0	**1**
Total	**1**	**1**	**11**	**1**	**10**	**4**	**3**	**1**	**5**	**37**