

# Survey on Indigenous Food Plants of Kaya Kauma and Kaya Tsolokero in Kilifi County Kenya

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**Abstract:** An ethnobotanical study was carried out in the sacred forests of Kaya Kauma in Kilifi county and Kaya Tsolokero in Junju location in Kenya between 21st January 2015 to 22nd February 2016. Ethnobotanical data on the knowledge of useful Indigenous Food Plants among the dwelling population in the villages around Kaya Kauma and Kaya Tsolokero were obtained from the using semi-structured questionnaire and interviews of the population in the homesteads around both the forests. The Food Plants included vegetables, fruit or any sort of food if they yield to the society. Results based on a questionnaire survey in 18 villages around Kaya Kauma and 9 villages around Kaya Tsolokero are presented by different stratum of Gender, Age, Tribes, Education level, Relationship to the village, Marital status. Usage of plant as food out of the population interviewed around Kaya Kauma and the total fruit plants mentioned by the villagers dwelling around the forest was 18 belonging to 9 different families. The total vegetable plants which were mentioned by the population around Kaya Kauma were 23 belonging to 12 different families. Other Food Plants mentioned by the community was 36. Out of the population interviewed around Kaya Tsolokero out of the Food Plants mentioned by the community, total fruit plants mentioned by the community was 46 belonging to 19 different families, total vegetable plants mentioned was 20 which belonged to 13 different families and other Food Plants mentioned by the community was 23. Out of the dwelling tribes around Kaya Kauma, Mkauma emerged as the most popular tribe and Mjibana as the most popular tribe around Kaya Tsolokero. The 18 adjoining villages to Kaya Kauma were interviewed for the survey and 9 adjoining villages were interviewed adjacent to Kaya Tsolokero.

**Key words:** Sacred forest, indigenous food, Kaya Kauma, Kaya Tsolokero, ethnobotanical species.

## 1. Introduction

Plant resources provide vital materials for survival to humanity. Plant products are irreplaceable for humans and they serve in fulfilling economic, medicinal, forage, constructional, apiary and more importantly medicinal applications to man that are considered to be the most important components of diet for good health [1]. They also preserve cultural heritage, biological information and indigenous knowledge on their utility [2]. The traditional African people have used plants as food and feed and as a medicine for generations. Synthetic chemicals and petroleum derivatives can replace many plant-derived medicines, fibres, and dyes; metal, brick, and concrete can replace wood; but there is no substitute for plant-derived foods. Almost all human foods are

plants or organisms that eat plants [3].

The human diets are based on fewer plant species yet there are over 350,000 plant species with 80,000 edible for humans. Out of these only 150 plant species are actively cultivated and 30 of these plants produce 95% of human calories and proteins [4].

Traditional useful plants (food, medicine, construction, recreation, and aesthetics) are still available in the wild and most are threatened by genetic erosion and loss of traditional knowledge on how to use them [5]. Many traditional cultivars have disappeared and are not known to present generation [5]. The custodian on indigenous knowledge is also old and highly disregarded by the youth, hence the danger of complete loss of this knowledge.

The coastal forests of Kenya are rich in biodiversity of flora and fauna [6], account for more than 50% of Kenya's rare trees [7], harbour wild germplasm of food

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and medicine and exhibits a very high level of biodiversity endemism and rarity in a significant number of biological groups [8].

As a part of this system and remnants of once much more extensive forest on the Kenya coast, the coastal sacred forests, Kayas, display high biodiversity values in terms of diversity, endemism and rarity. The latest estimates show that Kayas constitute about 5% of the remaining coastal closed forest cover of Kenya estimated to be about 67,000 ha, with high biodiversity values of 7 out of the 20 sites with the highest conservation status (National Museums of Kenya Publication).

The forests are inhabited as sacred places and were homes to the Mijikenda community, a dominant ethnic community in the coastal region of Kenya.

They are nine (Giriama, Digo, Chonyi, Jibana, Kauma, Ribe, Rabai, Duruma, and Kambe) distinct groups (Mijikenda means “nine tribes”) speaking closely related Bantu dialects sharing about 71% of their vocabulary [11].

In Kenya, the richness of biodiversity in the Kaya forests was recognized in the 1980s [12] and the sacred forests are prominent on hills and other strategic sites blend culture and nature. Traditional restrictions were placed on access and the utilization of natural forest resources resulting to the kayas preserving and sustaining biodiversity. Kaya forest patches are small in size, ranging in area from 10 ha to 400 hectares.

To date, over 50 Kayas have been identified in Kwale, Msambweni, Kinango, Kaloleni, Mombasa, Kilifi and Malindi.

Information documented indicated that rules to protect the site included a ban on cutting of live trees, dead wood may be collected in limited amounts on some sites by women for domestic use taking only as much as they can carry in their arms without use of a

rope, grazing is forbidden due to the risk of disturbing ritual objects hidden in the forest and livestock

straying into the kaya is at risk of capture and slaughter that wildlife including large snakes was to be unmolested as it might represent spirit beings [8].

There is vast documentation of usefulness of plant biodiversity in Kenya such as the “Useful trees and shrubs for Kenya [13], Traditional Food Plants of Kenya [14,15] There is documentation in medicinal plants as in the “Traditional medicines in Africa, Medicinal trees of Bukusuland [16] and many others”. To date most research on useful plants focused on documenting medicinal plants and their role in community healthy [17]. Information documented on indigenous food is so far general and not specific to the Coastal Kaya forests. This is the reason why a survey was conducted to determine the status of food plants.

To familiarize with the villagers and respondents situations, needs, and responsibilities gradual interrogation leads to the output of prevalent knowledge. However this information is limited, so identifying some time-efficient research methods is essential. Different dimensions of learning and knowledge of the population can be recognized by levels of interrogation to the population level of learning and two more key dimensions Financial Performance and Knowledge Performance [17]. In the present study, emphasis is given to the theoretical framework of social phenomenology, specifically on social phenomenology of which is based on understanding the action of individuals in the social world, having as reference to the relationships among subjects in everyday experiences. Group disparities in health have been documented for several decades. The determinants of disparities occur at multiple levels, from the molecular to the societal, and interact with one another in ways not yet fully understood, they represent a challenge to researchers attempting to capture their complexity [12].

## 2. Materials and Methods

### 2.1 Site Description

Kaya Kauma, a primary Kaya of the Kauma community, is located in Jaribuni area in Kilifi County. The geographical position of this forest is 3°37.821S and 39°44.189E at an altitude of 120 m above the sea level. The size of this forest is 100 ha in area and it exhibits a deciduous pattern of vegetation, sloping down in the north to “Ndzovuni” river. The forest exhibits a rich soil content of iron-ore deposit with the top layer of soil changing its colour to black owing to the iron gravels. Iron ore mining is a major threat to this forest with deep pits spread all round and disposing the bare ground to gully erosion. Kaya Tsolokero (Junju) is secondary Kaya of the Jibana Community. The area of the forest is 35 hectares, geographical position is 3°50.802E and 39°44.645S with a vegetation exhibiting an evergreen pattern of very thick forest with variety of floral diversity. There is still a Kaya village inside the forest with dwelling population.

#### 2.1.1 Study Approach

A survey on useful ethnobotanical food plant species around Kaya Kauma and Kaya Tsolokero was undertaken. A semi-structured questionnaire was used to conduct a demographic survey on the population and the useful plants around the villages adjacent to Kayas. Useful ethnobotanical food plant species prevalent around both Kaya forests were taken into account with the help of interrogation of the respondents (179 respondents in Kaya Kauma and 103

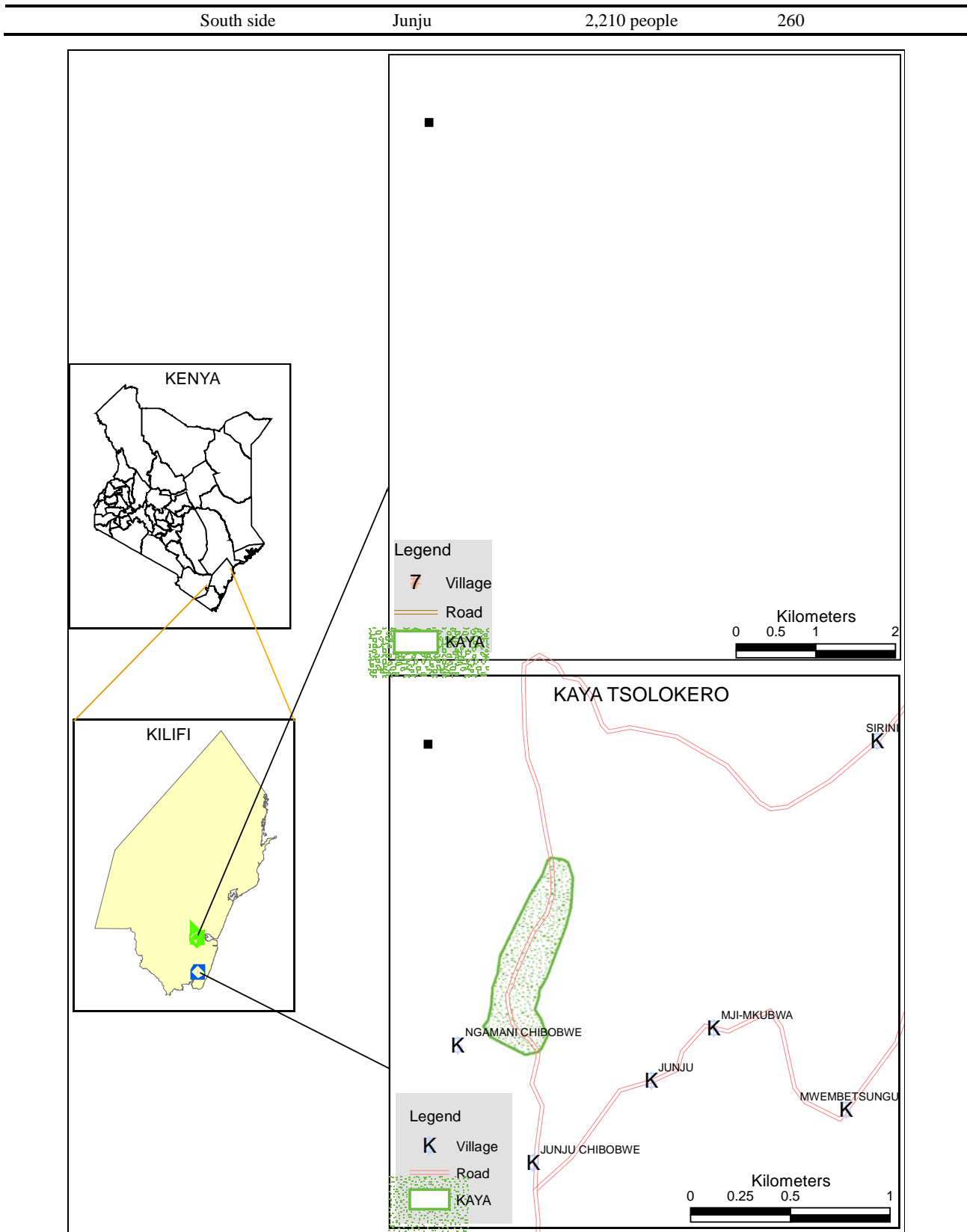
respondents from Kaya Tsolokero). Firstly the number of adjoining villages around two Kayas in all the four geographical directions was recorded from the area chief of Kauma and Junju location respectively. It was noted that 18 villages are surrounding Kaya Kauma from all the direction and 9 villages surround Kaya Tsolokero respectively (Fig. 1). Recent data on the number of population prevalent in each village were also recorded from the Chief’s office (Table 1). Semi-structured questionnaires were circulated in these villages to obtain the list of plants that are useful for food, parts used, habit of growth, frequency of usage whether low, moderate and high use. Other aspects recorded include commercialization aspects, efforts on domestication, usage by tribes, knowledge by different age groups (adult age over 35 years and youth age group of between 18-34 years), knowledge by gender and education level.

#### 2.2 Data Collection

The prevalent local language was used as a media of communication apart from the prevalent language “Kiswahili” to get the maximum information from the respondents. Various enumerators from the two sites that were local residents were trained to interview the respondents with the help of a local guide to conduct this survey. The villages that were chosen for the survey

**Table 1 Villages surveyed around Kaya Kauma and Kaya Tsolokero with respective population.**

Kaya forest	Direction of village around forest	Name of the village	Population	
			(report of 2016)	No. of household
Kaya Kauma	East side	Jaribuni	800 people	68
	West side	Merere	445 people	61
		Mitangani	1,016 people	123
	North side	Muhoni	277 people	40
	South side	Jeza	657 people	91
Kaya Tsolokero		Mitangani	1,016 people	123
	East side	Sirini	3,840 people	310
	West side	Chidongo	1,985 people	210
	North side	Kolewa	4,893 people	530



**Fig. 1** Map of the villages surrounding Kaya Kauma and Kaya Tsolokero where the population survey was conducted.

Note: Villages around Kaya Kauma: Jaribuni, Jeza, Majengo, Makalangani, Morere, Mbaoni/Mwabao, Mbonga, Mbudzi, Mhoni,

Mitangani, Miyani, Mtepeni, Mtunga, Muroka, Mwanda Mikuluni, Mwapula, Sihu and Zunguluka; Villages around Kaya Tsolokero: Kolewa, Sirini, Mwembetsungu, Mji-Mkubwa, Junju, Junju Chibobwe, Ngamani Chibobwe and Chidongo.

were around the forest in the radius of 5 to 8 km so that maximum knowledge of the Kaya flora could be captured. The Kaya elders, local herbalist, local leaders and a sample of adults and youth were randomly selected for interviews. The questionnaire focused on the general personal data of key informants, description of uses, habits and distribution of Food Plants.

### 2.2.1 Data Analysis

The data collected based on the description given by the communities were analyzed using SPSS Software. The evaluated and the results were manipulated to obtain general information on the prevalent knowledge on the Food Plants in the population. Food Plants were noted according to strata of the population such as gender, age and tribe to acquire the gap of knowledge of the flora, and then listed the frequency of usage commercialized Food Plants and categorization based on its usage such as fruits and vegetables. The data would identify new knowledge, opportunity gaps and give recommendations.

## 3. Results and Discussion

The survey showed six (6) Mijikenda sub-tribes living around Kaya Kauma with the Kauma as the dominant group and five (5) sub-tribes living around Kaya Tsolokero with the Jibana community as the dominant.

Fruits and vegetables were the most commonly used Food Plants in the communities around both the Kaya forests. A total of 41 species of fruits were stated from the communities around Kaya Tsolokero and 16 species of fruit were stated by the communities around Kaya Kauma (Table 1). The 27 species of vegetables were stated by the communities around Kaya Kauma and 31 species of vegetables were stated by the communities around Kaya Tsolokero (Table 2).

The two Kayas do not seem to have the same fruits

as one being a wet moist forest and the other is a dry forest.

The major vegetable families around Kaya Kauma were Apocyanaceae, Asteraceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Malpighiaceae, Malvaceae, Dioscoreaceae, Moringaceae and Solanaceae. Fabaceae family leads with the most popularized vegetable as *Vigna uguiculata* (Cow peas); *Omocarpum kirkii* (Chitwadzi) and *Senna siaemae* (Mchilifi). Moringaceae family also imparts a popular vegetable as *Moringa oleifera* (Mdzungi). *Cajanus cajan* (Mbalazi) a pulse. *Dialium orientale* (Mapepeta) of the family fabaceae and *Dioscorea dumetorum* (Mriga) of the family Dioscoreaceae.

The popular vegetables around Kaya Tsolokero were reported from the family Euphorbiaceae with 2 main vegetables as *Manihot esculanta* (Cassava); *Bridelia cathartica* (Mbunduki). The 3 plants reported from the family Solanaceae as *Capsicum annum* (Bell pepper; Mpilipili); *Solanum sps* (Mnavu); *Lycopersicon esculentum* (Tomato); *Solanum lycopersicum* (Cherry tomato). The 4 popular vegetables were recorded from the family Malvaceae as *Nesogordonia holtzii* (Mtobwe); *Corchorus olitarius* (Vombo); *Corchorus tridens* (Chikosho) and *Abelmoschus esculentus* (Lady's finger-Mbenda).

### 3.1 Cultivation of Indigenous Fruits and Vegetables

Out of the popular commercialised vegetables around Kaya Tsolokero *Bridelia cathartica*; *Nesogordonia holtzii*; *Corchorus tridens*; *Corchorus olitarius*; *Abelmoschus esculentus*; *Vigna uguiculata*; *Omocarpum kirkii* were indigenous to the place whereas *Manihot esculanta*; *Capsicum annum*; *Lycopersicon esculentum*; *Solanum nigrum*; *Cajanus cajan*; *Dalium orientale* and *Dioscorea dumetorum* were exotic to the place. Around Kaya Kauma *Omocarpum kirkii*; *Launea cornuta*; *Cyphostemma adenocaulis*; *Dioscorea dumetorum*; *Asystasia gangetica*; *Vigna uguiculata*;

*Haplocoelum inoploeum*; *Huteria zeylznica*; *Sesamum indicum* were indigenous to the place whereas *Acoidocarpus zanzibaricus*; *Moringa oliefera*; *Senna saemae*; *Ipomea sps* were exotic to the place.

**Table 1 Edible fruits of Kaya Kauma and Kaya Tsolokero.**

Scientific name	Local name	Family	Kaya Kauma	Kaya Tsolokero
<i>Ipomea batatus</i>	Mriazi	Convolvulaceae	+	+
<i>Solanecio angulatus</i>	Mdzipo	Compositae	+	-
<i>Vangueriamadagascarensis</i>	Mviru	Rubiaceae	+	-
<i>Thespesia danis</i>	Mhoe	Malvaceae	+	-
<i>Mangifera indica</i>	Mwembe	Anacardiaceae	+	-
<i>Heisia crinata</i>	Mfyofyo	Rubiaceae	+	-
<i>Citrillus lanatus</i>	Matikiti	Cucurbitaceae	+	-
<i>Landolfia kirkii</i>	Mtongazi/Mtorya	Apocynaceae	+	+
<i>Anacardium occidentale</i>	Mubibo/Mkanju/Mkorosho	Anacardiaceae	+	+
<i>Opuntia elator</i>	Mcactus	Cactaceae	+	-
<i>Manilkara mochasia</i>	Mn'ago	Sapotaceae	+	-
<i>Dialium orientale</i>	Mpepeta	Fabaceae	-	+
<i>Chytranthus obliquinervis</i>	Muhukuhu	Sapindaceae	-	+
<i>Pavetta perifoliar</i>	Mumangi/Mumangitsaka	Rubiaceae	-	+
<i>Ziziphus mauritiana</i>	Mkunazi	Rhamnaceae	+	+
<i>Pavetta pervifoliar</i>	Mbangimangi	Rubiaceae	-	+
<i>Dialium orientale</i>	Mtumbwi	Fabaceae	-	+
<i>Carissa tetramera</i>	Mdowe	Apocynaceae	-	+
<i>Tetracera litoralis</i>	Makuha	Dilleniaceae	-	+
<i>Strychnos madagascarensis</i>	Mkwakwa	Loganiaceae	-	+
<i>Cucurbita pepo</i>	Mahango(Pumpkin)	Cucurbitaceae	-	+
<i>Tamarindus indica</i>	Mkwaju	Fabaceae	-	+
<i>Musa basjoo</i>	Mgomba(Banana)	Musaceae	-	+
<i>Artocarpus heterophyllus</i>	Mfenesi(Jackfruit)	Moraceae	-	+
<i>Capsicum annum</i>	Mpilipili(Bell Pepper)	Solanaceae	-	+
<i>Persea americana</i>	Avacado	Lauraceae	-	+
<i>Nesogordonia holtzii</i>	Mtobwe	Malvaceae	-	+
<i>Solanum lycopersicum</i>	Mtindi(Cherry Tomatoes)	Solanaceae	-	+
<i>Citrus limon</i>	Mukapu/Mlimau	Rutaceae	+	+
<i>Citrus reticulata</i>	Orange	Rutaceae	-	+
<i>Citrus macropetra</i>	Mdanzi(Bitter lime)	Rutaceae	-	+
<i>Citrus sps</i>	Mchenza(Soft peel orange)	Rutaceae	-	+
<i>Cajanus cajan</i>	Mbalazi/Mbaazi	Fabaceae	-	+
<i>Suregada zanzibariensis</i>	Mdimu tsaka(Forest lime)	Euphorbiaceae	-	+
<i>Manihot esculanta</i>	Mpea(Cassava)	Euphorbiaceae	-	+
<i>Saba commorensis</i>	Mungo	Apocyanaceae	-	+
<i>Cocos nucifera</i>	Mnazi	Arecaceae	-	+
<i>Zanthoxylum holtzianum</i>	Mjafari/Mdungu	Rutaceae	+	-
<i>Cyphostemma sps</i>	Muchryaloma	Lamiaceae	-	+
<i>Annona squamosa</i>	Mtomoko	Annonaceae	-	+

**Table 2** Edible vegetables of Kaya Kauma and Kaya Tsolokero.

Scientific name	Local name	Family	Kaya Kauma	Kaya Tsolokero
<i>Omocarpum kirkii</i>	Chitwadzi	Fabaceae	+	-
<i>Acoilocarpus zanzibaricus</i>	Mboho	Malpighiaceae	+	-
<i>Moringa oliefera</i>	Mzungi	Moringaceae	+	-
<i>Launea cornuta</i>	Mtsunga	Asteraceae	+	-
<i>Senna saemae</i>	Mchilifi	Fabaceae	+	-
<i>Cyphostemma adenocaula</i>	Mwanjere	Vitaceae	+	-
<i>Ipomea sps</i>	Chiramba	Convolvulaceae	+	-
<i>Dioscorea dumetorum</i>	Mriga	Dioscoreaceae	+	+
<i>Asystasia gangetica</i>	Vongonya/Tsalakushe	Acantheceae	+	+
<i>Vigna uguiculata</i>	Mkunde	Fabaceae	+	-
<i>Leucas glabrata</i>	Nyadzua	Lamiaceae	+	-
<i>Deinbollia borbonica</i>	Mtsimbi	Sapindaceae	+	-
<i>Solanum nigrum</i>	Mnavu	Solanaceae	+	+
<i>Huteria zeylznica</i>	Mudzungi	Apocynaceae	+	-
<i>Sesamum indicum</i>	Ufuha	Pedaliaceae	+	-
<i>Albizia adianthifolia</i>	Tsafwe	Fabaceae	+	+
<i>Manihot esculata</i>	Mvumbamanga/Mpea/Manga	Euphorbiaceae	+	+
<i>Amaranthus sps</i>	Kiswenya	Amarantheceae	-	+
<i>Agaricus bisporus</i>	vyoga	Cindaria	-	+
<i>Cucumis maxima</i>	Mahango	Cucurbitaceae	-	+
<i>Albizia anthelmintica</i>	Mpojo/Muporojo	Fabaceae	-	+
<i>Ipomea batatus</i>	Myogbwe(Sweet Potato)	Convolvulaceae	+	+
<i>Brassica oleraceae</i>	Msukuma(Kale)	Brassicaceae	-	+
<i>Corchorus olitarius</i>	Vombo	Malvaceae	-	+
<i>Corchorus tridens</i>	Chikosho	Malvaceae	-	+
<i>Curcuma longa</i>	Chilungo(spice)	Zingiberaceae	-	+
<i>Terminalia zambesiaca</i>	Mkunguni	Combretaceae	-	+
<i>Senna occidentalis</i>	Mtsalafu	Fabaceae	-	+
<i>Lycopersicon esculentum</i>	Mtomato	Solanaceae	-	+
<i>Zingiber officinale</i>	Mtangawizi	Zingiberaceae	-	+
<i>Bridelia cathartica</i>	Mubunduki	Euphorbiaceae	-	+
<i>Haplocoelum inoploeum</i>	Mfungohema	Sapindaceae	-	+

30% of the vegetables stated exhibited herbaceous habit, 35% as Climbers, 4% as Shrubs and 10% as Trees in Habit.

#### 4. Knowledge Based on Tribes

Kauma form the largest community living adjacent to the Kaya Kauma accounting for 75% population and the remaining 25% is composed of eight Mijikenda communities. Jibanas formed the largest population dwelling around Kaya Tsolokero. Mkauma emerged as the highest population 91% of the population residing around Kaya Kauma stating fruit and vegetable plant. Mgiriama, Dzakaa, Mdigo, Mchyoni and Mkambe comprised the rest 8%

population. Mkauma mentioned 69% of the total fruit plants in Kaya Tsolokero and 65% of the total vegetables plants out of the total population. The 9 fruits stated by the community were high in consumption of usage leading with *Thespsia dannis* (Mhoe) and *Adansonia digitate* (Mbuyu). *Cyphostemma adenocaula* (Mwanjere) is the most commonly used vegetable in the population.

It was evident that the inhabitants have knowledge of their fruits and vegetable plants. The knowledge was highest on fruit plants in both the Kaya Forests.

Commercialisation was highest on fruit plants compared to vegetables. There is an increasingly important role of Food Plants in forest regeneration, community developments, species diversity and ecosystem-level processes, particularly in the tropics [9-10]. Numerous areas within this landscape are considered to be sacred by the indigenous people of the region, who interact with these sites in ways potentially beneficial to conservation. Our previous remote sensing study indicated that sacred sites are found in habitats with greater species richness, diversity, and endemism than randomly selected non-sacred sites [10].

## 5. Commercialization of Indigenous Fruits and Vegetables

The communities around the two Kayas sell some of the vegetables and fruits. On the basis of commercialisation 87% of fruits and 60% of the mentioned vegetables were commercialised in the population around Kaya Tsolokero. The most commonly sold fruit was *Dalium orientale* (Mpepeta) of the family Fabaceae and the vegetable was *Omocarpum kirkii* (Chitwadzi) of the family Fabaceae.

The most commonly mentioned vegetable around Kaya Tsolokero was *Ipomea batatus leaves* (Bwere) and as a tuber of the family Convolvulaceae. *Manihot esculanta* (Mpea/Cassava) was also commonly stated as usage of leaves as well as tuber. The communities around Kaya Tsolokero mentioned 74% of the total fruit and 55% of the total vegetables were mentioned by the population majorly belonging to Mjibana, Mchyoni and Mgiriana community and some from Mduruma and Mkauma community. Stated by the population, the most mentioned fruit by the population around Kaya Tsolokero was *Dalium orientale* (Mpepeta). The 18 fruits stated by the communities around Kaya Tsolokero was high in use by the population e.g. *Tamarindus indica* (Mkwaju). Up to seven (7) vegetables were mentioned by 51% of the

population. These were *Bridelia cathartica*, *Nesogordonia holtzii*, *Corchorus tridens*, *Corchorus olitarius*, *Abelmoschus esculentus*, *Vigna uguiculata*, *Omocarpum kirkii* etc. Vegetables stated by the community was high in use by the population e.g. *Conchorus olitarius* (Vombo) include the 42%.

Most commonly stated fruit plant by the population of the villages is around Kaya Kauma Mhoe (*Thespesia danis*) of the family Malvaceae. Most commonly mentioned vegetable by the population around Kaya Kauma is Mkunde (*Vigna uguiculata*), up to 59% of the mentioned vegetables that were commercialised as *Moringa oleifera*, *Cajanus cajan*, *Dioscorea dumetorum* etc. up to 63% of mentioned fruits that were commercialised as *Solanecio angulatus*, *Vangueria madagascarensis*, *Thespesia danis*, *Landolphia kirkii* etc.

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