Wild and semi-wild edible plants used by the communities of Acholi sub-region, Northern Uganda

Alfred Nyero, Innocent Achaye, Walter Odongo, Godwin Anywar and Geoffrey Maxwell Malinga

Research

Abstract

Background: In the Acholi sub-region, consumption of wild edible plants is still an integral part of the food culture, particularly during times of food shortage. However, much of indigenous traditional knowledge has not been documented due to the history of prolonged civil war in the area. We conducted an ethnobotanical survey to document the wild plants utilized by the Acholi communities in northern Uganda.

Methods: Data was collected using semi-structured questionnaires administered to 1,353 respondents between November 2017 and February 2018 and 65 focus group discussions.

Results: Seventy-three edible plants from 39 families were identified to species level while three species were unidentified. *Vitex doniana* (0.72), *Aframomum alboviolaceum*. (0.70), *Saba comorensis* (0.45), *Hibiscus surattensis* (0.42), and *Borassus aethiopum* (0.39) had the highest relative frequencies of citation. Fabaceae (7) and Euphorbiaceae (5) had the highest number of plant species. Most of the edible plants were herbs (34%) and trees (31%). Fruits were the major parts consumed (57%), followed by leaves (37%). Only 34% of species were cooked before eating, while 60% were eaten raw. Sixty-seven percent of the species were harvested during the rainy season and 22% in the dry season.

Conclusion: There is a rich diversity of wild edible plants in the Acholi sub-region. Conservation and domestication of these plants will provide a buffer crop and enhance the food security of the locals in the face of recurrent droughts and climate change.

Keywords: Wild edible plants, Indigenous knowledge Ethnobotany, Food security.

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Background

In many developing countries across sub-Saharan Africa, gathering and consumption of wild and semi-wild edible plants is still an integral part of the food culture especially in times of food scarcity (Martins *et al.* 2011). Wild and semi-wild edible plants grow or

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are produced with no formal cultivation or human intervention (Sujarwo *et al.* 2016). Whereas wild edible plants grow in natural habitats, semi-wild plants grow in disturbed soils such as farmlands, roadsides or around human settlements. The plant species, particularly the leafy vegetables grow quickly and become harvestable within a short time. They are free and usually easy to access by the local communities (Agea *et al.* 2011; Bigirimana *et al.* 2016) especially at the onset of the rainy season. Besides being a food source, wild and semi-wild edible plants also contribute to household incomes (Acipa *et al.* 2013; Ebert 2014), have medicinal properties (Anywar *et al.* 2014a 2014b; Madziga *et al.* 2010) and are nutritious (Anywar *et al.,* 2017). Despite their importance, there is still limited research on indigenous knowledge, exploitation and consumption of these plants (Phillips *et al.* 2014; Singh 2011). This knowledge gap is partly due to neglect arising from dependence of the local people on relief food and changing perception on these food plants, as they are considered as food for the poor (Acipa *et al.* 2013; Odhav *et al.* 2007; Phillips *et al.* 2014).

In Uganda, several wild and semi-wild edible plant species have been reportedly gathered either for household consumption or for sale in different parts of the country (Agea *et al.* 2011; Acipa *et al.* 2013; Musinguzi *et al.* 2006; Tabuti *et al*. 2004; Tabuti 2007). Among the Luo-speaking people of Siaya district in western Kenya, 69 species of edible plants were reportedly gathered from the wild (Johns and Kokwaro, 1991). The Luo people of Siaya district belong to the same ethnic group as the Acholi in the present study area in northern Uganda. Both the Acholi and Siaya share many common attributes such as ancestry, culture and language (Campbell, 2006)

The Acholi sub-region experienced armed conflict for nearly two decades from around 1985 to 2005 (Durick 2013) between the Lord's resistance army and the Uganda peoples' defense forces. This conflict changed the traditional way of life in several ways including increased consumption of western-style relief foods, overexploitation of natural resources leading to their decline. Mass displacement of the people in internally displaced people's camps led to the erosion and weakening of the Acholi traditional cultural practices such as transfer of knowledge by elders to the young at the fireplace and during family daily chores (Durick 2013). Besides, many of the elderly people who might have been knowledgeable on such plant species died during the insurgency. Such knowledge needs to be documented before it is completely lost. The majority of people in the Acholi sub-region (44%) live in poverty (UBOS 2014); hence they do not have adequate food supply. Furthermore, this sub-region comprises mostly of savanna grassland ecosystems which are reported to contain many plant resources including edible ones (Langlands 1974; Tabuti 2007). There is need to identify alternative food sources that can provide better coping strategies in the face of recurrent droughts and climate variability. This can be done through a comprehensive inventory on the wild and semi-wild edible plants in the Acholi sub-region which is still lacking. Previous studies by Oryema *et al.* (2013) in six sub-counties of Gulu district in the Acholi sub-region inventoried only wild fruits. Another study by Loki and Ndyomugyenyi (2016) established the diversity and nutritional values of some wild edible leaves used by the Acholi people. The aim of this study was to inventory wild edible plants gathered and consumed by the Acholi people that can be targeted for conservation, domestication and value addition.

Materials and Methods

Study area

The Acholi sub-region is in northern Uganda (Fig. 1). The region comprises the seven districts of Agago, Amuru, Gulu, Kitgum, Lamwo, Nwoya and Pader with a population of 1478641 people distributed in 65 sub-counties, 291 parishes and 2599 villages (UBOS 2014). The altitude ranges between 600 and 2600 m asl. The average rainfall is approximately 1450 mm per annum and rainy seasons are from late March to the end of November, peaking twice in a year (Angwech *et al.* 2015; JICA 2012). The community comprises mainly of the Acholi and Langi speaking people who are subsistence farmers growing cereals such as maize, sorghum, upland rice and millet; legumes like groundnuts, cowpeas; and tubers such as sweet potatoes and cassava (JICA 2012). They also rear livestock such as goats, sheep, pigs and cattle. The region has ferruginous soils with a high percentage of sandy texture (Langlands 1974), and therefore susceptible to erosion. The vegetation of the area is savannah grassland with dotted bushland and the common trees include; *Acacia hockii* De Wild., *Ficus sycomorus* L., *Combretum apiculatum* Sond., *Vitex doniana* Sweet, *Albizia gummifera* (J.F. Gmel.) C.A. Sm., *Phoenix reclinata* Jacq. and *Borassus aethiopum* Mart. The common grasses include *Imperata cylindrica* L., *Pennisetum purpureum* Schumach., and *Digitaria erantha* Steud.

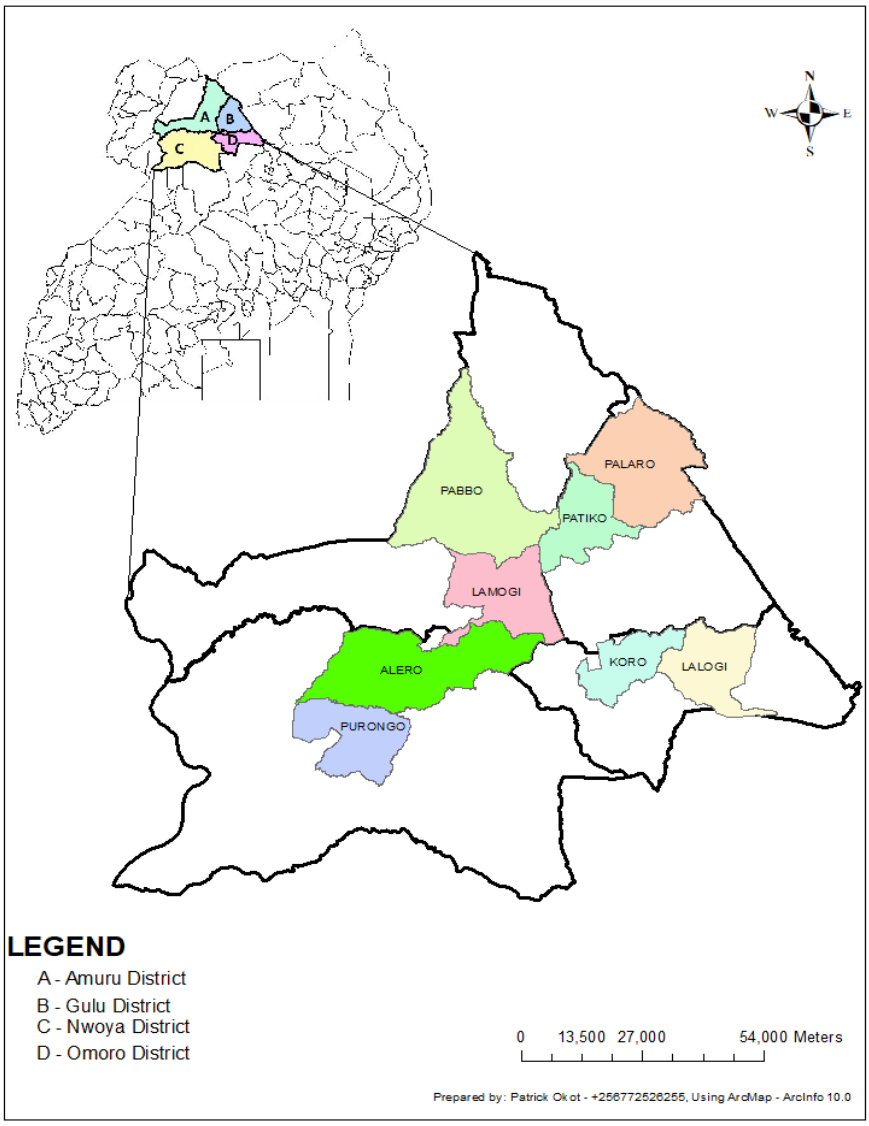

Fig. 1. Location of the sampled districts and sub-counties in Acholi sub-region, northern Uganda.

Data collection

Demographic and socio-economic data were collected using semi-structured questionnaires. The questionnaires were administered to 1,353 respondents between November 2017 and February 2018. Prior to conducting the study, written informed consent/assent was obtained from all the respondents. The questionnaires were pretested before the actual data collection.

The respondents were selected through a multi-stage sampling technique from two sub-counties in each of the four districts (eight in total). We determined the sample size using the Krejcie and Morgan (1970) table, based on the aggregated population for the four districts of Amuru, Gulu, Nwoya and Omoro (UBOS 2014). The respondents comprised of both males and females from each selected household. For the respondents below 18 years of age assent was obtained through their parents or guardians. Each respondent was asked to list the local (Acholi) names of woild edible and semi-wild edible plants, plant growth forms, habitat where found, mode of consumption and preparation, parts consumed, method of harvest and season/time of gathering. To corroborate the information gathered during interviews, we conducted 65 focus group discussions, one in each sub-county with 7-10 participants. We undertook field excursions with the assistance of one respondent and a local guide. Voucher specimens of the mentioned plant species were collected by a taxonomist, following standard plant collection procedures, and deposited at the Makerere University Herbarium (MHU) for identification. For each species, we obtained the acceptable scientific and family name from the

catalog of life (http://www.catalogueoflife.org/) and the APGIV (Chase *et al.* 2016), respectively, whereas the global conservation status was obtained from the International Union for the Conservation of Nature (IUCN) Red List of Threatened species (https://www.iucnredlist.org/).

Socio-economic characteristics of respondents

A total of 779 (57.6%) females and 574 (42.4%) males were interviewed. Most respondents were 18-36 years (46.6%) followed by those above 36 years (35.7%). The respondents had varying levels of education; 0.1% had no formal education, 84.8% had primary level education, 11.8% secondary level and only 3.3% tertiary level. Most respondents were of the Catholic faith (64.2%) followed by the Anglicans (22.1%). The respondents comprised 80.9% peasant farmers, followed by students (11.7%) and traders (1.5%).

Data analysis

We used descriptive statistics such as frequency and percentages to analyze ethnobotanical data. For each species, we determined the relative frequency of citation (RFC) whose value ranged from 0 and 1, as the ratio of respondents who mentioned a species to the total number of respondents in the study (Tardío & Pardo-de-Santayana, 2008). Additionally, we computed the RFC for each use category and season of harvest.

Results

Wild edible plants consumed

In total, 73 indigenous plant species belonging to 39 different families were reported as edible. Three of the plants could not be identified to species level (Table 1). The families with the highest numbers of species were Fabaceae (7), Euphorbiaceae (5), Cucurbitaceae and Dioscoreaceae (4); and Moraceae, Solanaceae, Verbenaceae (3). The remaining families were represented by either one or two species each. These edible species are consumed in multiple forms, e.g., as sauces, staples, snacks, condiments, seasonings or spices. The five plant species with the highest RFC are *V. doniana*, *Aframomum alboviolaceum* (Ridl.) K. Schum. *Saba comorensis*., *Hibiscus surattensis* L. and *B. aethiopum* (Table. 1).

The highest number of the edible wild plant species were recorded in Omoro (73) and Amuru (72) followed by Nwoya (67) and Gulu (66) districts. These edible plants mostly grow in wooded grassland or bushland (51%) followed by forested habitat (26%), in cultivated land/and disturbed soils (19%), and in swamps/wetland habitats (4%).

Growth forms of wild and semi-wild edible plants

The growth forms of the wild edible plant species included grasses, creepers/climbers, herbs, shrubs, and trees. The herbs were the most important life forms of the edible species (34%), followed by trees (31%) and creepers/climbers (22%) while shrubs and grasses contributed only 10% and 3% of all the identified species, respectively.

Edible plant parts used, use category and mode of preparation as food

The plant parts consumed included fruits, leaves, roots, seeds, and stem. Fruits were the dominant edible parts (57%), followed by leaves (37%). Most wild food plants were eaten raw (60%), boiled or cooked (34%) and a few of them (6%) could be eaten as both raw or cooked. Most of the fruits were eaten raw, e.g., *Annona senegalensis* Pers., *Carissa spinarum* L., *Searsia pyroides* (Burch.) Moffett. Meikle, *Saba comorensis* (Boier.) Pichon, *Bridelia scleroneura* Mull. Arg., *Hoslundia opposita* Vahl. and *Syzygium cumini* (L.) Skeels, while some were made into juice such as *S. comorensis and Tamarindus indica* L. Also, roots from *Pergularia daemia* (Forssk) Chiov. and *I. cylindrica* were eaten raw. According to the respondents, fruits had the most important use value of wild edible plants (RFC = 0.62) followed by leaves (RFC = 0.30), roots (RFC = 0.08), seeds (RFC = 0.07), and stem (RFC = 0.01).

Time of gathering and consumption of wild edible plant species

The time of gathering and consumption of wild edible plants depended on the species. The majority of the wild edible plants were gathered and consumed during the rainy seasons in April to May and July to November during which most of the plants flower and fruit (Table 1). Examples of edible plants gathered and consumed during the rainy season included *S. comorensis*, *B. aethiopum*, *Amaranthus dubius* Mart. ex Thell., *Cleome gynandra* L, *S. cumini*, *Dioscorea cayennensis* Lam. and *Vitellaria paradoxa* C.F. Gaertn. Notable examples of edible plants harvested during the dry season (December to March) included *T. indica, V. doniana, B. aegyptiaca* and *A. alboviolaceum*. Some of the edible species, notably *V. paradoxa* and *T. indica* are collected and preserved in dry condition to be used during periods of scarcity. The wild edible plant species were more important in the rainy season (RFC=0.67) than either in the dry season (RFC = 0.30) or throughout the year (RFC = 0.03).

Table 1. Wild and semi-wild food plant species and their attributes from the four districts of Acholi sub-region, Uganda.

Family, scientific name & voucher number	Local name (Acholi language)	RFC	District of citation	GF	Habitat	Part eaten	Harvest method	HS	Form eaten	IUCN status
Acanthaceae										
Asystasia gangetica (L.) T. Anderson NA 64	Ladyelcol	0.05	All	V	Fo	Lf	Pl	Wet	Ck	
Amaranthus dubius Mart. ex Thell. NA16	Obuga	0.38	All	H	DS	Lf	Pl	Wet	Rw	NE
Searsia pyroides (Burch.) Moffett. Meikle NA38	Awaca waca	0.12	All	T	Bu	Fr	Pl	Dry	Rw	NE
Anacardiaceae										
Sclerocarya birea (A. Rich) Hochst NA21	Titimu	0.03	GNO	T	Bu	Fr	Pl	Wet	Rw	NE
Lannea edulis (Sond.) Engl. NA63	Ayweja	0.01	AGO	H	Bu	Fr	Pl	Wet	Rw	NE
Annonaceae										
Annona senegalensis Pers. NA28	Obolo	0.27	All	T	Bu	Fr	Pl	Wet	Rw	NE
Asparagaceae										
Asparagus africanus Lam. NA15	Ogudu	0	N	H	Bu	Fr	Pl	Wet	Rw	NE
Apocynaceae										
Carissa spinarum L. NA62	Acuga	0.09	All	S	Bu	Fr	Pl	Wet	Rw	NE
Saba comorensis (Bojer.) Pichon NA 42	Fomo	0.45	All	V	Fo	Fr	Pl	Wet	Rw	NE
Pergularia daemia (Forssk) Chiov. NA57	Lurono	0.05	All	V	Fo	Rt	Dg	All	Rw	NE
Arecaceae										
Phoenix reclinata Jacq. NA60	Otit	0.17	All	T	Fo	Fr	Pl	Dry	Rw	NE
Borassus aethiopum Mart. NA59	Tugu	0.39	All	T	Bu	Fr	Co	Dry	Rw	LC
Asteraceae										
Crassocephalum rubens var. *sarcobasis (*Bojer ex DC.) C. Jeffrey & Beentje NA44	Lapuku	0.01	AGO	H	DS	Lf	Pl	Wet	Ck	NE
Balanitaceae										
Balanites aegyptiaca (L.) Delile NA46	Too	0.05	All	T	Bu	Fr/Lf	Pi	Dry	Rw	NE
Cleomaceae										
Cleome gynandra L NA22	Akeyo	0.38	All	H	DS	Lf	Pl	Wet	Ck	NE
Capparaceae										
Maerua angolensis DC. NA 65	Odwee	0.03	GNO	S	Bu	Lf	Pl	Dry	Ck	NE
Convolvulaceae										
Ipomoea eriocarpa R. Br. NA31	Padowiakuri	0.03	All	V	DS	Lf	Pl	Wet	Ck	NE
Cucurbitaceae										
Cucurbita maxima Duchesne NA64	Okono	0.17	All	V	DS	Fr/Lf	Pl	Wet	Ck	NE
Coccinia adoensis (A. Rich.) Cogn. NA61	Acicilo	0.01	G	V	DS	Fr	Pl	Wet	Rw	NE

Cucumis ficifolius A.Rich. NA45	Okwee	0.07	All	V	DS	Fr/Sd	Co	Dry	Rw/Ck	NE
Telfairia pedata (Sm.) Hook. NA 66	Kula kula	0.02	ANG	V	Fo	Sd	Co	Wet	Ck	NE
Dioscoreaceae										
Dioscorea schimperiana Hochst. ex Kunth NA17	Aboce	0.17	All	V	Fo	Rt	Dg	Dry	Ck	NE
Dioscorea bulbifera L. NA51	Oogo	0.1	All	V	Fo	Rt	Pl	Dry	Ck	NE
Dioscorea oppositifolia L. NA10	Mwodo	0.17	All	V	Bu	Rt	Dg	Dry	Ck	NE
Dioscorea cayennensis Lam. NA12	Obato	0.33	All	V	Bu	Rt	Dg	Dry	Ck	NE
Ebenaceae										
Diospyros mespiliformis Hochst. ex. A. DC NA23	Cumu	0.04	AG	T	Fo	Fr	Pl	Wet	Rw	NE
Euphorbiaceae										
Acalypha bipartita Müll. Arg. NA4	Ayuyu bunga	0	O	Sh	Fo	Lf	Pl	Wet	Ck	NE
Acalypha rhomboidea Raf. NA14	Ayuyuu	0.18	All	H	DS	Lf	Pl	Wet	Ck	NE
Fabaceae										
Senna obtusifolia (L.) Irwin & Barneby. NA29	Oyado	0.33	All	H	DS	Lf	Pl	Wet	Ck	NE
Crotalaria brevidens Benth. NA 67	Lalaa	0.12	All	H	DS	Lf	Pl	Wet	Ck	NE
Vigna membranacea A. Rich NA27	Boo Ayom	0.27	All	V	Bu	Lf	Pl	Wet	Ck	NE
Eriosema shirense Baker f. NA 69	Lalekadyel	0.01	All	H	Bu	Rt	Dg	Dry	Rw	
Crotalaria ochroleuca G.Don. NA36	Lawija	0.03	All	H	Bu	Lf	Pl	Wet	Ck	
Phaseolus lunatus L. NA1	Abangabanga	0.03	All	V	Fo	Sd	Pl	Wet	Ck	NE
Bauhinia thonningii Schum. NA40	Ogali	0.03	All	T	Bu	Fr	Pl	Dry	Rw	NE
Tamarindus indica L. NA6	Cwaa	0.26	All	T	Bu	Fr	Pl	Dry	Rw	LC
Lamiaceae										
Hoslundia opposita Vahl. NA24	Tutuu	0.04	All	H	Bu	Fr	Pl	Wet	Rw	NE
Hyptis spicigera Lam. NA48	Lamola	0.08	All	H	DS	Sd	Pl	Wet	Ck	NE
Vitex doniana Sweet NA11	Oywelo	0.72	All	T	Bu	Fr	Co	Dry	Rw	LC
Vitex mediensis Oliv NA8	Oywelo gwok	0	O	S	Bu	Fr	Pl	Wet	Rw	NE
Loganiaceae										
Strychnos innocua Delile NA53	Lalingkwalo	0.16	All	T	Bu	Fr	Pl	Wet	Rw	NE
Melatomataceae										
Heterotis rotundifolia (Sm.) Jacq.-Fél. NA56	Odwanga/Cun bit	0.28	All	H	Rv	Lf	Pl	Dry	Ck	NE
Malvaceae										
Hibiscus cannabinus L NA 68	Lagoroto	0.1	All	H	Bu	Lf	Pl	Wet	Ck	
Hibiscus surattensis L.NA37	Gwanya	0.42	All	H	Rv	Lf	Pl	Dry	Ck	NE
Moraceae										
Ficus sycomorus L. NA26	Olam	0.2	All	T	Bu	Fr	Co	Dry	Rw	NE
Ficus mucuso Welw. ex Ficalho NA50	Oduru	0.26	All	T	Bu	Fr	Pl	Wet	Rw	

Ficus sur Forssk. NA19	Kibuur	0.06	All	T	Bu	Fr	Pl	Wet	Rw	NE
Musaceae										
Ensete ventricosum (Welw.) Cheesman. NA41	Lateme	0.12	All	H	Bu	Fr	Pl	Dry	Rw	NE
Myrtaceae										
Syzygium cumini (L.) Skeels NA20	Kano	0.38	All	T	Fo	Fr	Co	Wet	Rw	NE
Nymphaeace										
Nymphaea nouchali Burm.f. NA54	Keyo	0	AO	H	Wa	Fr	Pl	All	Rw	NE
Olacaceae										
Ximenia caffra Sond. NA49	Alimo	0.13	All	T	Bu	Fr	Pl	Wet	Rw	NE
Passifloraceae										
Passiflora edulis Sims. NA32	Matunda	0.15	All	V	Fo	Fr	Co	Wet	Rw	NE
Pedaliaceae										
Ceratotheca sesamoides Endl. NA7	Otigo nyim	0.03	All	H	Bu	Lf	Pl	Wet	Ck	NE
Phyllanthaceae										
Bridelia scleroneura Mull. Arg. NA52	Larwece	0.25	All	T	Bu	Fr	Pl	Dry	Rw	NE
Phyllanthus muellerianus (Kuntze) Exell NA47	Oketkeny	0.22	ANO	Sh	Fo	Fr	Pl	Wet	Rw	NE
Margaritaria discoidea (Bail.) Webster NA25	Vino	0.07	All	Sh	Fo	Fr	Pl	Wet	Rw	NE
Poaceae										
Imperata cylindrica (L.) Raeusch. NA9	Obiya	0.02	ANO	H	Bu	St	Dg	Dry	Rw	NE
Rhamnaceae										
Ziziphus abyssinica Hochst. ex A. Rich. NA30	Lango	0.08	ANO	T	Bu	Fr	Co	Wet	Rw	NE
Rubiaceae										
Sarcocephalus latifolius (Sm) NA3	Oculup	0.06	AGO	T	Bu	Fr	Pl	Wet	Rw	NE
Vangueria madagascariensis J.F. Gmelin NA58	Odayo	0.02	AO	T	Fo	Fr	Pl	Wet	Rw	NE
Sapindaceae										
Allophylus abyssinicus (Hochst.) Radlk. NA34	Odyaka	0.04	AGO	T	Fo	Fr	Pl	Wet	Rw	NE
Sapotaceae										
Vitellaria paradoxa C.F. Gaertn. NA13	Yaa	0.28	All	T	Bu	Ft/Sd	Co	Wet	Rw/ Ck	VU
Solanaceae										
Capsicum annuum L. NA18	Kalara	0.21	All	H	Fo	Fr/Lf	Pl	Wet	Rw/ Ck	LC
Solanum americanum Mill. NA39	Ocuga	0.04	All	H	DS	Fr/Lf	Pl	Wet	Rw/ Ck	NE
Physalis minima L. NA33	Kongogwal	0.2	All	H	DS	Fr	Pl	Wet	Raw	NE
Tiliaceae										
Corchorus trilocularis L NA43	Otigo lum	0.18	All	H	Bu	Lf	Pl	Wet	Ck	NE
Grewia mollis Juss.NA55	Pobo	0.27	All	T	Bu	Fr	Pl	Wet	Rw	NE
Verbenaceae										

Lantana trifolia L. NA35	Abelwinyo	0.17	All	H	Bu	Fr	Pl	Wet	Rw	NE
Vitaceae										
Ampelocissus africana (Lour.) Merr. NA2	Olok	0.27	All	V	Bu	Fr	Pl	Wet	Rw	NE
Zingiberaceae						Fr				
Aframomum alboviolaceum (Ridl.) K.S chum. NA5	Oceyo	0.7	All	H	Bu	Fr	Pl	Dry	Rw	NE
Unidentified species										
Species 1	Atotobi	0.01	ANO	H	B	Fr	Dg	Wet	Rw	
Species 2	Cet lakwal	0.03	ANO	Sh	Fo	Fr	Pl	Dry	Rw	
Species 3	Nyarogenga	0.06	All	H	DS	Lf	Pl	Wet	Ck	

Key: District of citation: AG= Amuru and Gulu, AGO = Amuru, Gulu and Omoro, All=All districts, ANG=Amuru, Nwoya and Gulu, ANO = Amuru, Nwoya and Omoro, AO = Amuru and Omoro, G = Gulu, GNO = Gulu, Nwoya and Omoro, N = Nwoya, NO=Nwoya and Omoro; GF = Growth forms: H = Herb, Sh = Shrub, T = Tree, V = Vine; Form eaten: Ck = Cooked, Rw = Raw; Habitat: Bu = Bush, DS = Disturbed soil, Fo = Forest, Rv = Riverine, Wa = water; Harvest method: Co = Collecting, Dg =Digging, Pl = Plucking; HS = Harvest season; IUCN conservation status: LC= Least concern, NE=Not evaluated and VU=Vulnerable; Part eaten: Fr = Fruit, Lf = Leaf, Rt = Root; Sd = Seed, St = Stem.

Mode of harvesting and conservation status of wild edible plants

Wild edible plants were mainly harvested using various methods including digging (tubers and roots), plucking from plants (leaves, fruits and seeds), and collection of seeds and fruits that have fallen on the ground. The most dominant method of harvesting was plucking from mother plants (79%) followed by collecting from the ground (11%) and digging (10%). The only globally threatened plant species recorded in this study was *V. paradoxa* (vulnerable). The rest of the species were either least concern (LC) or not evaluated (NE), (Table 1). Three plants could not be identified up to species level.

Discussion

The results of the present study showed that a rich diversity of wild and semi-wild plants species exists in the Acholi sub-region despite the loss of traditional culture on natural resources and climate change. The number of species reportedly consumed in this study is comparable to that of Ogoye-Ndegwa (2003) who reported 72 edible plant species used by the Luo communities of western Kenya. However, the total number of species of wild and semi-wild edible plants reportedly gathered and consumed in this study is lower than those reported from other studies within Uganda such as Ojejel *et al.* (2019), who reported 100 wild edible species used by the communities in the Teso-Karamoja sub-region and Tabuti *et al.* (2004) who documented 105 edible plant species in Bulamogi county, Eastern Uganda. Reports from other parts of Africa, e.g., Mutie *et al.* (2020) documented 137 wild edible plants used by the Konso ethnic communities in Southern Ethiopia and Mutie *et al.* (2020) reported 199 edible plant species from Kitui County, Kenya.

The possible explanation for these differences in diversity of edible plants among the study areas could be differences in agro ecological conditions, local traditions, and customs of using these plants (Bortolotto *et al.* 2015; Ojelel *et al.* 2019). Some of the documented wild edible plants in this study are also reportedly consumed elsewhere in other parts of Uganda (Acipa 2013; Tabuti 2004; Ojelel *et al.* 2019) and elsewhere in Africa (Maroyi 2011; Mutie *et al.* 2020), both in times of plenty and food scarcity. Of the 73 species, five species *V. doniana*, *A. alboviolaceum, S. comorensis, H. surattensis, and B. aethiopum* were the most frequency used and cited. These species could be targeted for cultivation, sustainable utilization and assessment of conservation status. Fruits from *V. doniana* are sold in urban markets. In other parts of Africa, the young leaves are harvested and used as vegetable in home cooking and for sale. Despite their importance, *V. doniana* trees are under threat especially in farmlands (Oumorou *et al.* 2010). *Afromomum angustifolium* is one of the most important wild edible plant species in Uganda (Nyakoojo and Tugume 2020; Anywar and Kirimuhuzya 2015). Nyakoojo and Tugume (2020) also reported a tendency of the young being involved in the collection of the wild edible plants. This agrees with our findings. *S. comorensis* is a widely used fruit and medicinal tree in the L. Victoria basin area of Uganda (Okullo *et al.* 2014), *H. surattensis* is also widely used both as a food (Katende *et al.* 1999) but also as a medicine for malaria (Adia *et al.* 2014), and *B. aethiopum* is a widely used food plant in northern Uganda (Acipa *et al.* 2013).

Herbs constituted most edible wild and semi-wild plants, compared to the trees and vines/climbers, while shrubs and grasses were the least. A similar trend has been reported in Eastern Uganda in Obalanga sub-county, Amuria district, Uganda (Ojelel & Kakudidi 2015), in the Eastern Cape Province in South Africa (Maroyi, 2020), and in the Lebialem highlands of southwestern Cameroon (Ngone *et al*. 2016). This is probably because herbs grow fast and become harvestable within a relatively shorter time, are more tolerant to weather conditions (Agea *et al.* 2011; Ojelel & Kakudidi 2015) and are relatively most common in the study area than other growth forms. This finding contrast with the findings of Ojejel *et al.* (2019) in the Teso-Karamoja sub-region, Uganda, Teklehaymanot & Giday, (2010) in the Lower Omo River valley and by Berihun & Molla (2017) in the Bullen district, Ethiopia, where trees represented most edible plant species.

Most of the edible plant parts (60%), were eaten uncooked or raw. Similar results have been reported from studies in other parts of the country (Acipa, *et al.* 2013; Ojelel, *et al.* 2019) and in other places in Africa such as in Burji district, Ethiopia (Ashagre *et al.* 2016), Nhema Communal Area, Zimbabwe (Maroyi 2011), Sesheke District, and Western Province, Zambia (Chinsembu 2016) and in Bullen district, Northwest Ethiopia (Berihun & Molla 2017). Fruits and leaves were also the most reported edible plant parts gathered and consumed by the local communities in the region. The dominance of fruits and leaves as the edible wild and semi wild plant parts were also reported in previous studies undertaken in Uganda (Acipa 2013; Ojelel, *et al.* 2019; Tabuti *et al.* 2004) and in other countries, e.g., Ethiopia (Berihun & Molla, 2017; Teklehaymanot & Giday 2010) and Kenya (Addis *et al.* 2013). On the contrary, a study in Paphos and Larnaca in Cyprus (Della *et al.* 2006) reported leaves and stems as the most widely used parts of wild edible plants. This could be due to variation in culture of food preference and preparation. The high frequency of mentions of

fruits and leaves as edible parts over the underground plant parts such as roots was probably because these parts are easier to harvest and prepare and are available most of the time of the year (Ojelel *et al.* 2019).

The most threatened plant species reported in this study was *V. paradoxa* (Shea nut tree). *V. paradoxa* is an important indigenous tree species that grows wild and takes about 25 years to mature. Harvesting is done once a year, usually between May-June. The traditional conservation practices include on farm retention during cultivation and the use of folklore (mainly taboos), customs and rituals (Gwali *et al.* 2012). This is a vulnerable species that is indigenous to most of the Savanna belts of Uganda (Okullo *et al.* 2004), and rural communities mainly depend on it for income and food. Unfortunately, some local people have been cutting down this tree species for charcoal burning and hard wood timber. However, the conservation status of the majority of the edible plant species has not yet been evaluated by IUCN. Such information is urgently needed to prioritize their conservation status.

Conclusion and recommendations

A total of 73 wild and semi-wild edible plant species from 39 families were documented in the Acholi sub-region despite the loss of traditional culture. The most frequently used plant species were *V. doniana*, *A. alboviolaceum*, *S. comorensis*, *H. surattensis*, and *B. aethiopum*. These species could be targeted for assessment of their conservation status, domestication, and sustainable value addition. Documentation and preservation of traditional knowledge of these plants could contribute to better coping strategies in the face of recurrent droughts and climate variability which are affecting the subsistence agricultural production in the area.

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Declarations

Ethics approval and consent to participate: The study was reviewed and approved by the Gulu University Research Ethics Committee (Approval No. GUREC-098-18), in compliance with the Nagoya Protocol on Access and Benefit Sharing. Prior to data collection, permission to conduct an ethnobotanical survey was secured from the local council chairpersons of respective villages after briefing them about the importance of documenting wild edible plants. Similarly, we elaborated to the respondents the primary objectives, risks and benefits of the study to enable then to decide whether or not to participate in the study before receiving their consent. Respondents aged below 18 years were assented through their parents or guardians prior to the interviews.

Consent for publication: Not applicable

Competing interests: The authors declare that they have no competing interests.

Availability of data and materials: No datasets have been deposited in public repositories.

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Availability of data and materials: All the data generated during this study are available upon request to the first author. The plant voucher specimens were deposited at the Makerere University Herbarium.

Authors' contributions: AN, GMM, IA designed this study; AN collected and analyzed data and wrote the initial draft of the manuscript. IA and GMM, GA, and WO were responsible for data interpretation and editing of the manuscript. All authors read and approved the final manuscript.

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