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Present and potential uses of *Moringa oleifera* as a multipurpose plant in Guinea-Bissau

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Abstract

A field survey in Guinea-Bissau revealed the present uses of *Moringa* and the knowledge of rural populations about its properties in this West African country. Also, a market survey in Bissau assessed the moringa products traded there. The species is planted all over the country, mainly as a living fence in homegardens. The leaves are the most commonly used part of the plant, primarily as food and in traditional medicine. The seeds are used to treat a few ailments. Only in recent years began the seeds and ground dried leaves to be traded in the markets and the local knowledge on the medicinal and dietary properties of moringa to increase. However, many of the uses reported in other parts of Africa remain unknown or undocumented in Guinea-Bissau. Much further potential use and dissemination of the qualities of this plant seem possible in the country.

Key-words: edible plants, medicinal plants, nutraceuticals, useful plants, West Africa

Declarations of interest: none

Highlights

- *Moringa oleifera* is widely used as living fences in Guinea-Bissau
- The main uses in the country are medicinal, nutritional and horticultural
- Seeds and ground dried leaves are beginning to be marketed as medicines
- Important uses in other African countries are not found in Guinea-Bissau

1. Introduction

Moringa (*Moringa oleifera* Lam., Moringaceae), also known as “tree of life” or “miracle tree”, is a small tree native to northern India and Pakistan but it was introduced in the tropics and subtropics and became naturalized in many African countries (Bosch, 2004). *Moringa* acquired huge worldwide importance due to its multiple uses, good adaptability to different soils and climate, and easy propagation. It is likely to become an increasingly more important multipurpose crop in Africa (Asante et al., 2014; Bosch, 2004; Kasolo et al., 2010). The primary uses of moringa concern human nutrition (leaves, seeds, flowers, fruits), human and veterinary medicine (leaves, roots and seeds), fodder (leaves and treated seedpod-cake), biogas (leaves), domestic cleaning (crushed leaves), blue dye (wood), fencing (living trees), soil fertilizer (seed-cake, leaves), foliar nutrient (extract from leaves), green manure (leaves), and biodiesel (seeds) (Daba, 2016; Gandji et al., 2018; Gopalakrishnan et al., 2016). Almost the whole plant can be used for numerous purposes due to its high content of bioactive compounds (Brilhante et al., 2017; Dhongade et al., 2017) and it is considered a good functional food ingredient (Ma et al., 2019; Shay et al., 2017). In West Africa, some health projects to fight malnutrition are quite successful by promoting the use of moringa’s leaf powder in the diet of children and pregnant and lactating women (Kuku-Shittu et al., 2016). It is also used to purify water, due to its antifungal and antibacterial compounds (Rahman et al., 2010). Among several plants evaluated in bioprospective studies, moringa stood out in alternative medical therapies as beneficial to control several diseases (Gupta et al., 2018; Nour et al., 2018; Oyeyinka and Oyeyinka, 2018; Zayed, 2012). *Moringa* is known as *ben oil tree*, *drumstick tree* or *horseradish tree* in English, *mouroungue*, *ben ailée*, *moringa ailée*, *pois quénique*, *néverdié*, in French, and *moringa* or *moringueiro*, in Portuguese. Whereas in Asia the fruits are the most important edible part of moringa, in Africa the leaves are preferred. However, the species is still considered neglected and underutilized namely in West Africa, as its potential is not sufficiently known and economically valued, although the economic

importance of the species has increased worldwide (Gandji et al., 2018; Sahay et al., 2017). In Guinea-Bissau, for instance, the possibility of production and commercialization of the plant became relevant. The objective of this work was to address the situation of moringa as a multipurpose plant in Guinea-Bissau, and to report its current uses as well as potential uses that are not yet known in the country.

2. Methods

2.1. Study site

Guinea-Bissau is located in the Northern Intertropical Zone of West Africa, between 10°59' - 12°20' North and 13°40' - 16°43' West, and occupies 36,125 km². In 2017, its population was 1.86 million people, with an annual growth of about 2.5% (World Bank, 2019).

The climate is tropical sub-humid, with a mean annual temperature of 26.5 °C and two seasons. The annual rainfall is the climatic factor that establishes considerable contrasts in the country, ranging from 2400-2600 mm in the southwest to 1200-1400 mm in the north-east (Machado, 1972).

The forest vegetation in upland zones is mainly composed of woodland and savanna woodland, as well as palm groves and some patches of dry forest in the southwest of the country, but the more common vegetation types in the country are secondary formations, such as derived savannas and fallows (Catarino et al., 2008).

Smallholder peasant agriculture prevails in the country and two main crops and agricultural systems largely shape the agricultural practices in upland areas. Rice is the staple food and is cropped both in paddy fields and in slash-and-burn systems, and cashew is the main cash crop, booming in the last decades (Catarino et al., 2015; Monteiro et al., 2017).

2.2. Data collection

Data on the distribution of moringa, its uses and vernacular names in Guinea-Bissau were obtained at LISC Herbarium from Lisbon University, which hosts the largest collection of Guinea-Bissau flora. Also, a bibliographical search was made for the main reported uses of the plant in Africa.

The field survey to characterize the uses of moringa in Guinea-Bissau was conducted in November 2018 through semi-structured interviews with six heads of households, aged between 40 and 89, in both urban (Bissau city) and rural areas (Quinhamel, São Vicente and Bolama Island). After explaining the objectives of the study and obtaining informed consent to collect the data, samples and photographic records, the informants were asked about their use of moringa and their knowledge of its properties.

In order to assess the moringa products traded in the country, further surveys were made at Bissau's main market (Bandim market) and in the communitarian pharmacy of Caritas Guinea-Bissau, the main places to where such products converge.

To compare the uses of moringa found in Guinea-Bissau with those reported in other African countries, the data obtained in the field and market surveys and those gathered from bibliographical sources were organised in a table according to types of uses and plant parts.

3. Results and discussion

Table 1 presents the uses of moringa recorded in Guinea-Bissau and those found in bibliographical sources for other African countries. The first known record of the species in Guinea-Bissau corresponds to the herbarium voucher collected by Joaquim do Espírito Santo in 1948, at Farim, northern Guinea-Bissau (*Espirito Santo 2468*, LISC). This shows its presence in the territory since the first decades of the 20th century, at least. It is known in the country by several names: *nene-badadje*, in Guinea-Bissauan creole, *incan-n'biesse* ("lazy's fence") in Batanta language, and *labidaio*, in Fulani language (Catarino et al., 2008).

Moringa is planted all over the country, mostly in homegardens, and used for several purposes, the leaves and seeds mainly for medicinal and nutritional purposes, and the whole plant as a living fence (Table 1).

The leaves are eaten mainly in stews and sauces, as well as in traditional medicine. The seeds are used for medicinal purposes, mostly to treat diabetes and hypertension and to relieve stomach ache. In recent years, the knowledge on the medicinal and dietary properties of the seeds and the ground dried leaves has increased among Guinea-Bissau communities. For instance, the communitarian pharmacy of Caritas Guinea-Bissau (Catholic institution for charity and social relief) produces and sells moringa leaf powder to increase breastfeeding milk and fight anaemia and malnutrition.

However, the diversity of uses of moringa, as well as its commercial importance are still limited in the country. In fact, the different parts of the plant are used across the African continent for a variety of medicinal, nutritional, phytochemical and horticultural purposes, among others (Table 1). Many of these uses are not known or documented in Guinea-Bissau, such as those concerning the consumption of immature fruits and seeds as food, or the use of leaves to purify water.

Given its nutritional and medicinal properties, moringa is considered a nutraceutical plant that can be used as a component of dairy diets and to improve the health condition of the rural populations in developing countries. In addition, moringa is a very resilient plant, tolerating a wide range of climate and soil conditions. Given the forecasted climate changes and the probable reduction of rainfall, which is likely to negatively impact on small farming, moringa can represent a viable alternative for the rural populations in Guinea-Bissau.

The data on moringa distribution and use in Guinea-Bissau allows to conclude that it is grown all over the country, generally in homegardens and used for several purposes, mainly medicinal and nutritional. However, despite the efforts of some people and institutions, like Caritas Guinea-Bissau, several of the most interesting properties and uses of moringa remain

unknown in the country. A more intensive and complete use of the plant should be encouraged.

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Table 1 – Uses of *Moringa oleifera* in Guinea-Bissau and elsewhere in Africa. The sources of information are indicated within brackets, except when data (for Guinea-Bissau) was obtained in the present study.

Type of use	Plant part	Uses in Guinea-Bissau	Uses across Africa
Horticultural	Whole plant	Living fence in homegardens (<i>herbarium voucher, Martins & Moreira 1002, LISC</i>)	Living fences (Bosch, 2004).
Food	Leaves	Fresh leaves cooked as a vegetable and to make sauces. Milled leaves used in Caritas's pharmacy to improve breastfeeding.	Fresh leaves eaten as salad, and cooked in soups and sauces; leaf powder in the diet of children and pregnant and lactating women to fight malnutrition; also, as condiment, spice, flavouring, and in infusions (Bosch, 2004; Burkill, 1985).
	Seeds	Ground, in food.	Roasted seeds eaten like groundnut (Gandji et al., 2018).
	Roots		The tuberous root cores can replace horseradish; infusions (Bosch, 2004; Burkill, 1985).
	Fruit	Edible (<i>herbarium voucher, Espírito Santo 2468, LISC</i>)	Young fruits eaten as a vegetable, older fruits added to sauces (Bosch, 2004).
	Flowers	Cooked, as a vegetable and in sauces.	Eaten as a vegetable, added to sauces or used in infusions (Bosch, 2004).
	Bark		Drink: infusions (Burkill, 1985)
Medicines	Leaves	Bruised leaves placed in water to treat eye diseases (<i>herbarium voucher, Vidigal et al. 198, LISC; this study</i>). To treat sprains and fever.	Namely as antipyretic, antibiotic, bacteriostatic, fungistatic and pain-killer. To treat abscess, anaemia, arthritis, asthenia, convulsions, cough, diabetes, diarrhoea, dysentery, dysmenorrhea, epilepsy and spasms, eyesight problems, flu and sinusitis, gonorrhoea, headaches and migraine, haemorrhoids, hypertension, infertility, intestinal worms, icterus, indigestion, immune deficiency caused by HIV, malaria, oligospermia, otitis, paralysis, rheumatism, sexual dysfunction, skin and mucosae infections, stomach troubles, typhoid fever, varicella (Agoyi et al., 2017;

			Burkill, 1985; Kasolo et al., 2010).
	Seeds	To regulate blood pressure and treat asthma.	To treat diabetes, fever, malaria and sexual dysfunction (Agoyi et al., 2017).
	Roots	To treat sprains and fever: crushed, flushed and then wrapped around the injured part with a cloth.	Used namely as antipyretic, anti-inflammatory, antibiotic, and pain-killer. To treat abscess, anaemia, articular pains, cancers, dysentery, dysmenorrhea, eyesight problems, flu and sinusitis, gonorrhoea, headaches and migraine, hernia, icterus, indigestion, otitis, prostatitis, pulmonary troubles, stomach pains, swellings, tooth decay, tumours, varicella, sexual dysfunction and oligospermia (Agoyi et al. 2017; Burkill, 1985).
	Bark	Stem bark used to treat sprains.	To treat fever, icterus, indigestion, malaria, pulmonary troubles, stomach pains, tooth decay (Agoyi et al., 2017; Burkill, 1985).
	Gum		As pain-killer and to treat liver diseases (Burkill, 1985).
	Fruits		As vermifuge (Burkill, 1985).
	Stems		As pain-killer (Burkill, 1985).
Phytochemistry	Seeds		To purify water, in Sudan. The seed oil, known as 'Ben oil' or 'Behen oil', can be used for cooking, in hair-dressing, as a lubricant and in perfumes (Bosch, 2004).
	Leaves		Dried and crushed: as antibiotic, bacteriostatic, fungistatic to purify water (Burkill, 1985).
Fodder	Leaves	Eaten by pigs and goats.	Eaten by livestock, especially goats, camels and donkeys (Bosch, 2004).
Veterinary	Leaves	Fresh: to treat pigs' diseases.	