

LOCAL KNOWLEDGE AND USE OF CACTUS (*NOPALEA COCHENILLIFERA* (L.) SALM-DYCK) AS FEED FOR SMALL RUMINANTS IN RURAL COMMUNITIES OF MALAWI AND MOZAMBIQUE

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ABSTRACT

Research was conducted to determine the knowledge of farmers from the Malawi and Mozambique on the use of cactus (*Nopalea Cochenillifera* L. Salm-Dyck) as fodder for small ruminants. The scarcity of rainfall, aridity and seasonal severe droughts that characterize Southern Africa lead to loss of livestock. The use of cactus fodder can hydrate small ruminants and provide feed during dry season. This study was conducted to assess the knowledge of farmer from Malawi and Mozambique on cactus as fodder. The research was conducted in Mzimba, Mchinji and Chikwawa districts (in Malawi) and Manhiça, Changara and Lichinga districts (in Mozambique), where 450 farmers keeping ruminants were surveyed through semi-structured interviews. Each respondent was interviewed alone in Chewa and/or English (in Malawi) and Tsonga, Nyungwe, Yao and/or Portuguese (in Mozambique). During the interview, farmers were shown pictures stuck on a poster and numbered (no name), where they recognized the species, mentioned the local name and shared their experience on cactus as fodder. The legend of the images on the poster were listed on separate page to which farmers did not have access. Respondents were allowed to explain the preparation procedure before cacti were given to animals. They were asked to mention other uses of cactus in their region. Related uses were grouped in terms of frequency of mention. Interviews were recorded as audios on a Samsung Galax J1 cellular phone and a notepad. In addition, a literature search was undertaken in order to find some of the most common species of cactus in Africa (emphasis was given to East and Southern Africa). Images displaying stems, spines, leaves, flowers and fruits of cacti were collected. The study concluded that most farmers and probably other residents from the districts and villages where the present study was conducted knew cactus as medicine, edible fruit, ornament and live fence. The knowledge of cacti as fodder both in Malawi and Mozambique was negligible.

Keywords: *cactus; fodder; knowledge; local name.*

1. Introduction

The Southern Africa region, including Malawi and Mozambique, is characterized by scarcity of rainfall, aridity and seasonal severe droughts, which in most cases lead to loss of livestock (Daka, 2002; Kuivanen *et al.*, 2015). This increases the need to cultivate forage plants that can hydrate animals and provide feed during dry season. Tobergte and Curtis (2013), stated that farmers can sustain animal production throughout recurrent droughts with use of cactus. Cactaceae have been found to comprise 1500 – 1800 species, of which more than ten are randomly distributed in the Southern Africa region (Walters *et al.*, 2011; Myre, 1974).divided into 3 – 6 subfamilies (Anderson, 2001; Crozier, 2004;; Majure *et al.*, 2012). The use of cactus as source of energy and reduction of the need for drinking water for both cattle and small ruminants in Southern Africa (specifically in South Africa) started over 300 years ago (FAO 2017; Oelofse 2002). Most species were firstly introduced to South Africa (Fouche *et al.*, 2014; FAO, 2017) from Latin America. Edible fruit, live fence, ornament, medicine and fodder are some of the reasons for their introduction (Walters *et al.*, 2011; Witt and Luke, 2017). The species are not evenly known by residents and the importance given to each species depends on the local priorities. The uses of these plants vary according to the importance given in a certain area. The species of cactus much more known in Malawi and Mozambique include *Oputina cochenillifera*, *Oputina ficus-indica*, *O.monacantha* and *O.robusta*, among others. In some countries local names derive from their place of origin (Nefzaoui *et al.*, 2010). In some studies, species have been found to be significantly recognised by image than voucher specimens, especially in ethnobotanic researches, conducted in remote and isolated areas (Thomas *et al.*, 2007; Doyle *et al.*, 2016). *Oputina ficus-indica* is one of the oldest species in South Africa (over 300 years), with more than 80 publications (Vila Nova, 2018), but *Oputina cochenillifera*, coming from Tanzania (Hunt, 1968), with one report in Mozambique (Myre, 1974), is much known in Malawi and Mozambique compared to the former. Though some knowledge on cactus as fodder exists in the Southern region of Africa (de Kock, 2001; de Waal *et al.*, 2006; Potgieter and Mashope, 2009; Nefzaoui *et al.*, 2010; Gusha *et al.*, 2013), it is somehow poor in Malawi and Mozambique (FAO 2017). Considering this state of affairs, the present study was conducted to determine the knowledge of farmers from the two countries on use of cactus as fodder.

2. Materials and Methods

2.1. Location of study

The study took place from November 2016 to January 2017, involving farmers of the Southern, Central and Northern regions of both Mozambique and Malawi. The choice of study location was made so as to cover all regions of each country, as well as to shelter varying geoclimatic characteristics as drought has been recorded in all regions of these countries irrespective of the local microclimate. Six districts were selected, namely Mzimba, Mchinji and Chikwawa (in Malawi) and Manhiça, Changara and Lichinga (in Mozambique). To get detailed characteristics on each selected location refer to the Table 2.1. The study prioritized goat farmers regardless of the number of goats they keep. However, some farmers of other ruminants were casually included in order to get some of their experience on use of cactus as fodder. Thus, 116 goat farmers, 83 sheep farmers, 190 involving those keeping goats and sheep together, who were regarded as small ruminant farmers for the purpose of this study and finally 61 cattle farmers were selected.

Table 2.1. Characteristics of study locations

Extension Area	Country	Altitude (m)	Rainfall (mm)	Temperature (°C)	Goat Population	Soil type	Reference
Maluana (Manhiça - Southern)	Mozambique	25 – 100	13 – 130	19.1 - 26	33,283	Mostly sandy	MICOA: 2012
Marara (Changara - Central)		200 - 1000	± 644	20.5 – 32.5	62,017	Clayey and alluvial	MAE: 2014, DPSA_Tete, 2019
Lichinga (Lichinga - Northern)		480 - 1300	1200 - 1400	18 - 24	18,715	Clayey	MAE: 2005, 2014; SDAEL Lichinga, 2018
Belew (Chikwawa - Southern)		95 - 107	170 - 967.6	27.6 °C – 37.6 °C	361,638	sandy-clay, heavy clay	Nicholson <i>et al.</i> , 2014; Ngongondo <i>et al.</i> , 2011; Joshua <i>et al.</i> , 2016; Malota and Mchenga 2018; GOM-Agriculture Production Report – 2018/2019
Mchinji (Mchinji - Central)	Malawi	1181	500 - 1230	19 – 37.5	323,364	Latosols, calcimorphic, hydromorphic, lithosols	Ngongondo <i>et al.</i> , 2011; Moyo <i>et al.</i> 1993; Mleta, 2010; Mwandama, 2016; Munthali, 2018; GOM-Agriculture Production Report – 2018/2019
Emsizini (Mzimba - Northern)		1349 - 1954	650 - 1300	15.5 - 19.8	344,331	loamy	MINISTRY OF IRRIGATION AND WATER DEVELOPMENT: 2011; Nicholson <i>et al.</i> , 2014; Mzimba District Planning Department 2008; Hogeboom and Hoekstra, 2017; GOM-Agriculture Production Report – 2018/2019

NB: The farmers divided into three groups in the field, those keeping goats, those keeping sheep, those with both goats and sheep and finally those keeping cattle. The combination of goats and sheep was addressed to as 'small ruminant' to distinguish them from those who raise simply goats or simply sheep

According to Dias (2010), in terms of vegetation, like its closest district (Maracuene), Manhica consists of bush savannah and shrubs, whereas Changara comprises four types of vegetation, which include open savannah, mixed forest of Combretum, Mopane and baobab, the open forest of Ziziphus and semi-natural forest (MAE: 2014; Mitader: 2014). In Lichinga, the vegetation is quite diverse and the predominance of miombo woodland is noted. Bush savannah is also common, which varies in density, and sometimes interspersed with grasslands with a wide variety of grass, usually of larger size (MAE, 2014). In Mchinji the vegetation is typical savannah woodland with Brachystegia as the species most commonly found (Mkanda, 1995) alongside natural growing grass (Mleta, 2010). Mzimba is mostly covered with indigenous and woodland forests, mainly semi-evergreen woodlands of Brachystegia Julbernardia and Erythrophloeum. Chikwawa is a semi-arid land. It's called Zambezian and Mopane woodland or vegetation with mostly colophospermum Mopane, Adansonia digitata, Combretum apiculatum, Acacia nigrescens, Trichilia emetica, Azadirachta indica, Moringa oleifera & Cordyla africana (Dowsett-Lemaire and Dowsett, 2002). Characterized by thorny bushes with short grasses. Cactus are also common (GOM, 2019).

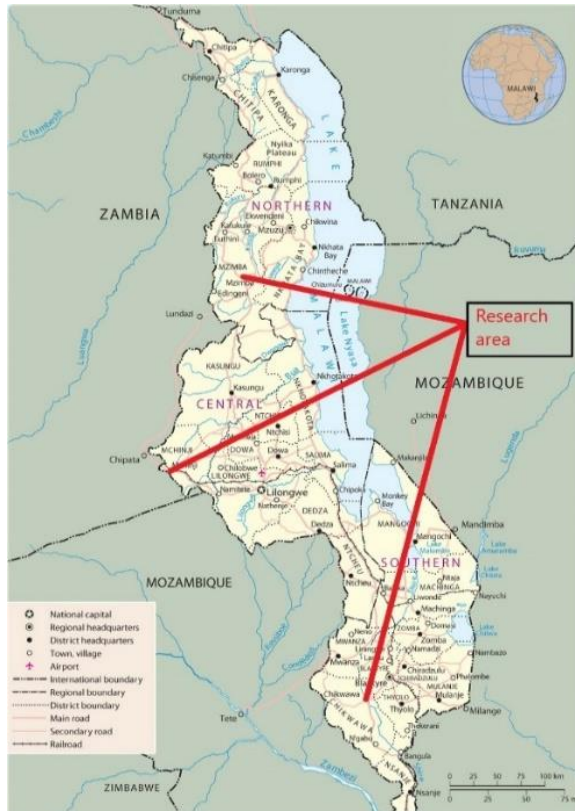


Figure 2.1. Map of Malawi, Geographic location of study, source: <https://jaizmelanews.blogspot.com/2019/10/malawi-ni-taifa-la-namna-gani.html>

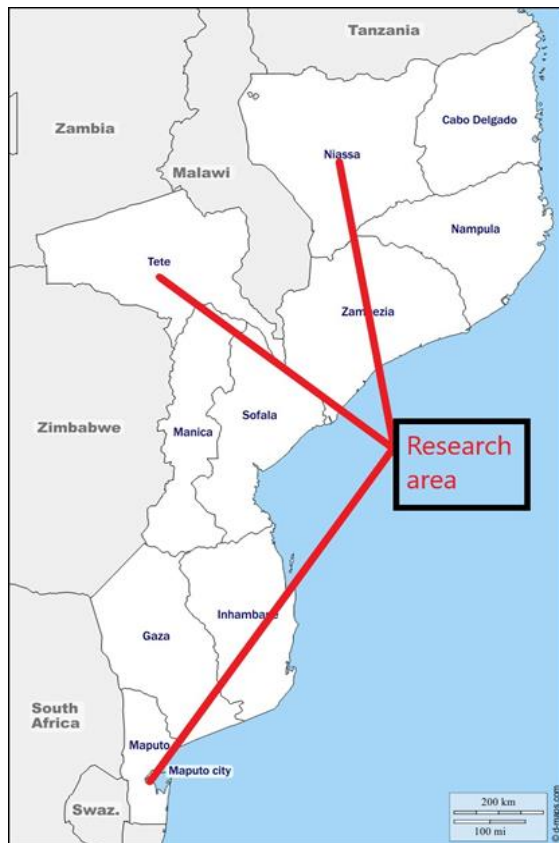


Figure 2.2: Map of Mozambique, Geographic location of study, source: https://d-maps.com/carte.php?num_car=3536&lang=en

2.2.1. Data collection

2.2.1.1. Sample size

The study included keeping ruminant farmers. Of these, priority was given to those keeping goats. The sample size was defined based on “snow ball” technique (Silvano, 2001) and the sample was considered sufficient, based on the effect of progressive inclusion. A total of 22 literatures reporting cacti as fodder for ruminants in the East and Southern Africa were consulted. Four hundred and fifty interviews were conducted with respondents from both Malawi and Mozambique (288 from three districts of Malawi and 162 from the same number of districts of Mozambique). The study covered Chikwawa, Mchinji and Mzimba districts of Malawi and Manhiça, Changara and Lichinga of Mozambique. An average of six reference farmers were visited, with which introductory questions such as species of ruminants they kept and the occurrence of cacti in the district were asked. A total of 255 and 33 small ruminant keepers and cattle farmers, respectively, were interviewed in Malawi. In Mozambique, 134 and 28 producers were interviewed in the same order as that of Malawi.

2.2.2. Identification of cactus species and interview

A literature search was undertaken in order to find some of the most common species of cactus in Africa (emphasis was given to East and Southern Africa). Images were used during interviews as plant species have been found to be significantly recognised by respondents than voucher specimens in ethno botanic studies, conducted in remote and isolated areas (Thomas *et al.*, 2007; Doyle *et al.*, 2016). Images displaying stems, spines, leaves, flowers and fruits of cacti were collected. In the first visit to a district there was a short informal conversation with a few farmers in order, to establish a *rapport* (confidence) between the researcher and respondents, where they were explained the objectives of the study and told that they were free to choose whether or not to participate. After this short unstructured session, semi-structured interviews were conducted as per Alexiades (1996). For details on the locations and ruminant group involved per district refer to the **Table 2.2**. Each respondent was interviewed alone in Chewa and/or English (in Malawi) and Tsonga, Nyungwe, Yao and/or Portuguese (in Mozambique). During the interview, farmers were shown pictures stuck on a poster and numbered (no name), where they recognized the species, mentioned the local name and shared their experience on cactus as fodder. The legend of the images on the poster were listed on separate page to which farmers did not have access. Respondents were allowed to explain the preparation procedure before cacti were given to animals. They were also free to mention other uses of cactus in their region. Related uses were grouped in terms of frequency of mention. Interviews were recorded as audios on a Samsung Galax J1 cellular phone and a block note.

Table 2.2. District and ruminant group per study location

Country	District	No. of farmers interviewed			
		goats	sheep	s.ruminants	cattle
Malawi	Chikwawa	22	16	68	10
	Mchinji	15	21	29	12
	Mzimba	14	16	54	11
Mozambique	Manhiça	14	10	9	10
	Changara	37	11	13	15
	Lichinga	14	9	17	3
Total		116	83	190	61

Data regarding knowledge of cactus as fodder data were summed up per group of farmers to determine the total number of those who know

3. Results

3.1. Literature search

Thirty coloured images displaying nine species of cacti were collected from studies undertaken in Africa.



Figure 3.1.1: *Opuntia cochenillifera* - Tanzania (Hunt, 1968).

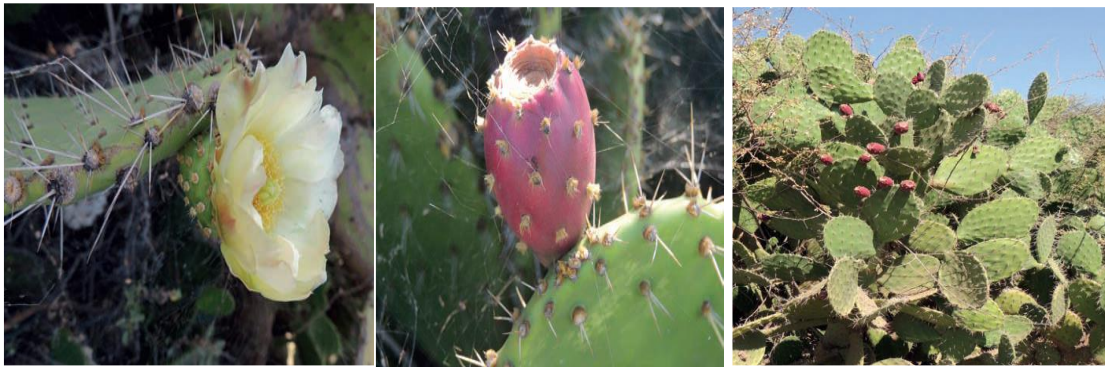


Figure 3.1.2: *Opuntia elatior* – East Africa (Witt and Luke, 2017)



Figure 3.1.3: *Opuntia engelmannii* – East Africa and South Africa (Hunt, 1968; Walters *et al.*, 2011; Witt and Luke, 2017)



Figure 3.1.4: *Opuntia ficus-indica* – East Africa and South Africa (Witt and Luke, 2017)



Figure 3.1.5: *Opuntia mycrodasys* – East Africa and South Africa (Waters *et al.*, 2011; Witt and Luke, 2017)



Figure 3.1.6: *Opuntia monacantha* – Tanzania and South Africa (Witt and Luke, 2011; CABI, 2016)

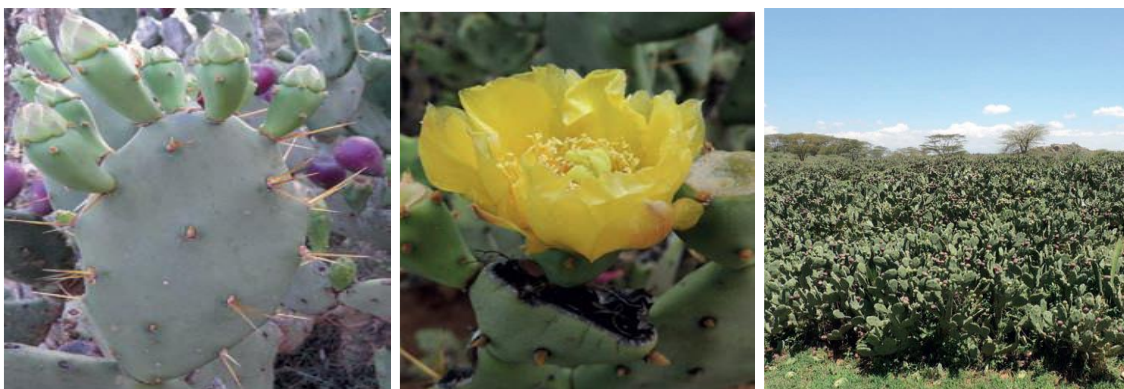


Figure 3.1.7: *Opuntia stricta* -m Madagascar and Tanzania (Witt and Luke, 2017)



Figure 3.1.8: *Opuntia robusta* - South Africa (Waters *et al.*, 2011)



Figure 3.1.9: *Opuntia leucotricha* DC. – South Africa (Waters *et al.*, 2011)



Figure 3.1.10: *Opuntia elata* Salm-Dyck var (Waters *et al.*, 2011).

3.2. Cross sectional study

Three hundred interviews were conducted with 450 respondents from both Malawi and Mozambique (288 from three districts of Malawi and 162 from the same number of districts of Mozambique). The study covered Chikwawa, Mchinji and Mzimba districts of Malawi and Manhiça, Changara and Lichinga of Mozambique. An average of six reference farmers were visited, with which introductory questions such as species of ruminants they kept and the occurrence of cacti in the district were asked. A total of 255 and 33 small ruminant keepers and cattle farmers, respectively, were interviewed in Malawi. In Mozambique, 134 and 28 producers were interviewed in the same order as that of Malawi.

3.2.1. Recognition of cactus species

In Malawi, respondents recognised 3 species from the images on the poster. *Oputina cochenillifera* was the most recognised, with 24 (8.3%) respondents, followed by *O. ficus-indica* and *O. megacantha*, with 15 (5.2%) and 12 (4.2%), respectively. In Mozambique *O. cochenillifera*, *O. ficus-indica*, *O. megacantha*, *O. monacantha* and *O. robusta* were familiar with 29 (17.9%), 22 (13.6%), 14 (8.6%), 9 (5.6%) and 7 (4.3%) respondents, respectively (Figure 3.1) Comparatively, general knowledge of cactus seems to be higher in Mozambique than Malawi.

Table 3.2.1. General knowledge of cactus per District

Malawi					
Number of farmers recognizing the species					
	O.cochenillifera	O. ficus-indica	O.megacantha	O.monacantha	O.robusta
Chikwawa	9	6	5	0	0
Mchinji	8	5	3	0	0
Mzimba	7	4	4	0	0
Total	24	15	12	0	0
Mozambique					
	O.cochenillifera	O. ficus-indica	O.megacantha	O.monacantha	O.robusta
Changara	17	9	9	1	2
Manhiça	0	0	0	7	0
Lichinga	12	13	5	1	5
Total	29	22	14	9	7

3.3. Local names of cactus

Three local names were found in all regions of Malawi. *Madolofigo*, *chipwete*, *kaloga* are the Chewa names. However, local designations of cacti varied depending on the region of Mozambique, where *xihaha* and *pinisela*; *mudhorosiya*, *djumo* and *mugembekeme*; *chilenje* and *nantata* were found in South, Central and North, respectively (see Table 3.1.).

Table 3.3. Local names of cactus in Malawi and Mozambique
(frequencies between brackets)

Country	Local Names per region
Malawi	All country: Madolofigo (35), chipwete (16), kaloga (16)
Mozambique	Central: Muguembequeme (24), djumo (9), mudhorosiya (5) Southern: xihaha (5), pinissela (2) Northern: chilenje (24), nantata (12)

There was no relationship between the local name and cacti species/cultivars. Respondents from one district mentioned the same names. In Malawi respondents grouped cacti based on presence or absence of spines. In Lichinga and Changara, where two cultivars were similarly found, farmers were able to mention spiny or spineless cactus, whereas in Manhiça respondents were found to be exclusively familiar with spiny cactus (*O.monacantha*).

3.3.1. Knowledge of farmers on cactus as fodder

All respondents (100%) from Malawi were not aware of use of cacti as fodder. In Mozambique most farmers (95.1%) didn't know, though (in Changara) there were those who had some knowledge of use of cacti as fodder. Out of the 7 farmers (4.3%) who knew about it (Table 3.2.), 3 (1.9%) cattle farmers had participated in a lecture and 4 (2.5%) read about it.

Table 3.3.1. Frequency of answer about knowledge of farmers on cactus as fodder

Country	District	Answers from respondents (number of farmers)											
		goats	Yes	No	sheep	Yes	No	S.ruminants	Yes	No	cattle	Yes	No
Malawi	Chikwawa	12	0	12	6	0	6	31	0	31	5	0	0
	Mchinji	9	0	9	6	0	6	15	0	15	6	0	0
	Mzimba	14	0	14	8	0	8	28	0	28	2	0	0
Mozambique	Manhiça	8	0	8	5	0	5	12	0	12	9	0	9
	Changara	21	1	20	9	2	7	21	0	21	14	4	10
	Lichinga	16	0	16	7	0	7	21	0	21	3	0	0
Total		80	1	79	41	2	39	128	0	128	39	4	19

Those who participated in a lectures on feeding animals with cactus learned about mixing chopped cladodes with *Leucaena leucocephala* or with *Pennisetum purohpureum* to feed goats and sliced cladodes for cattle. Farmers who read about feeding cactus (1.4%) stated that they got information about feeding fruits or mixing sliced cladodes with toasted soya

beans and cactus mixed with chopped straw or bran. However, none of the farmers had ever tried supplementation with their own livestock. The main reason (80%) claimed for not adopting these plants as fodder was its invasive characteristic which leads to reduction of livestock carrying capacity. Associated to that was also the difficult handling of the plants due to spines. Other than the spines, toxic contents (20%) in the cacti limited utilization as feed

3.3.2. Non-fodder uses of cactus

Non-fodder uses stated by respondents include medicine, edible fruit for humans, ornament and home live-fence were mentioned both in Malawi and Mozambique.

4.2, 2.7, 2.0 and 0.7% of citations in Malawi, and 41.9 and 4.9% of citations in Mozambique, respectively (Figure 3.2). Farmers from Malawi did not specify the medicinal use of cacti. Those from Mozambique pointed out treatment of diabetes, respiratory disease and pimple removal in humans. They also mentioned treatment of Newcastle disease as one of uses cactus in animal health.

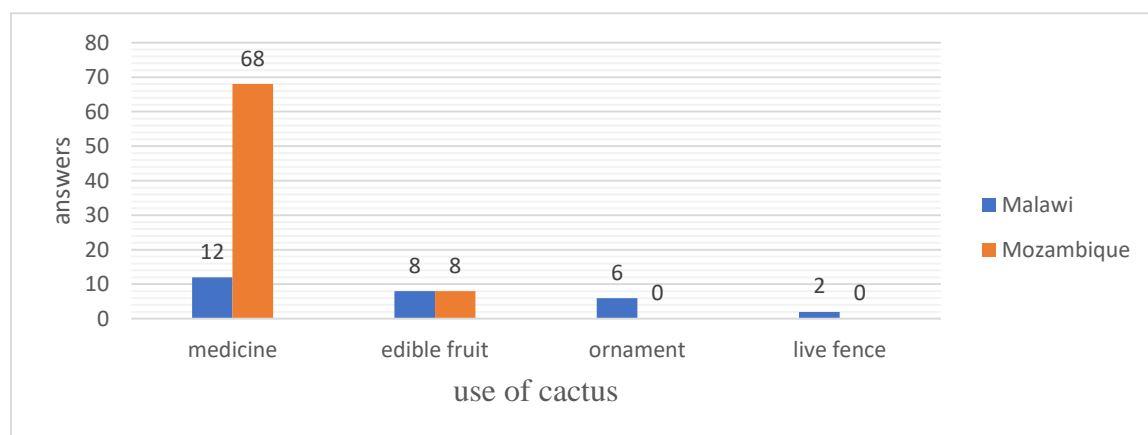


Figure 3.3.2: Frequency of non-feed uses of cactus

4. Discussion

4.1. Recognition of cactus image

The recognition of *Opuntia cochenillifera* by farmers from study countries is not surprising, as its introduction to Tanzania (a country bordering both Malawi and Mozambique) has been reported since 1942 (Hunt, 1968) and Mozambique in 1974 (Myre, 1974). It is most likely that cacti spread (with no record) over time from one country to the other, to the extent that most of the existing species became familiar to farmers depending on the importance locally given. This seems to be true because most species of cacti in Southern Africa were first introduced to South Africa (Fouche *et al.*, 2014; FAO, 2017) from Latin America. However, *Opuntia ficus-indica*, for example, one of the oldest species in South Africa (over 300 years), with more than 80 publications (Vila Nova, 2018), was less recognised by respondents, compared to *Opuntia cochenillifera*, both in Malawi and Mozambique. The fact that the number of respondents who recognised *O. megacantha* is next to that of those familiar with *O. ficus-indica* concurs with the logic that these two species make part of the same group, with the only difference being that the latter is spiny. *Opuntia monacantha* and *O. robusta* were only recognised in Mozambique. *Opuntia monacantha* was particularly recognised in Manhiça, most probably because it is naturalized in countries bordering Maputo (South Africa and Swaziland) and it prefers sandy soils in coastal bush and moist savannah which are typical characteristics of Maputo (Walters *et al.*, 2011). Though *O. robusta* is naturalized in South Africa and Botswana and is predominantly spineless, it does not seem to have been given huge importance in Malawi and Mozambique, in part, because its fruit is not attractive to people due to its sourness (Walters *et al.*, 2011). It could have been introduced in Mozambique for ornament purpose.

4.2. Local names of cactus

Mentioning local names of cactus that respondents could remember in their region originates from the fact that some species/variety names in Africa derive from their place of origin as found by Nefzaoui *et al* (2004). However, this does not seem to be true in Malawi and Mozambique as all names did not have anything to do with the districts or localities of region. There was no investigation on the etymologic origin of the words used to identify cacti, but there are certain names that are given according to the plant use. In that case, limitations related to low knowledge of vocabulary of the local languages made it difficult to determine the origin of the names. Nevertheless, recognition

of the images and mentioning of local names served as confirmation that cacti exist in the two countries and farmers are familiar with it.

4.3. Knowledge of use of cactus as fodder

The species of cactus much known by respondents based on the image pointed during interviews was *O. cochenillifera* (L) Mill. Its reports in the Southern Africa region is scarce, whereas its occurrence in East Africa is well documented (Witt and Luke, 2017). The reasons for its introduction were edible fruit, live fence and ornament. It may be presumed that it was introduced in Malawi and Mozambique from East Africa and probably that is the reason why most of those who have some knowledge on cactus use are unaware of its use as fodder, except that experimental study of its related species (*Nopalea cochenillifera* (L) Salm-Dyck), was once reported in Mozambique over 40 years (Myre, 1974). The reason for introduction of *O. ficus-indica* and *O. monacantha* in East and Southern Africa includes edible fruit, live fence, ornament as well as their use as fodder. However, only a few number of respondents (from Mozambique) mentioned the use of cactus as fodder. This is in agreement with studies reporting Malawi and Mozambique to be in the list of countries of the Southern Africa region that have not yet introduced cacti as fodder (FAO 2017). Apart from answers given by respondents, occurrence of *Opuntia monacantha* in Mozambique has been testified (Walters *et al.*, 2011). This, once again, is an evidence that the importance given to cacti in each part where it was introduced depended strictly on local priorities. The number of respondents who have ever heard of use of cactus as fodder, both in Malawi and Mozambique, is very small. This is in agreement with other studies in the region, where most farmers are unaware that the plant can be fed to livestock (Nefzaoui *et al.*, 2004).

Mixing cactus with some other species of forage is in agreement with several studies conducted in Southern Africa, in which animals have been found to be fed on cactus mixed with *Leucaena leucocephala*, *Acacia angustissima*, *Gliricidia sepium* meal and *Pennisetum purpureum* (Gusha *et al.*, 2013).

Respondents mentioned toxicity as being one of the reasons for reluctance to adopt cactus as fodder. This is most probably related to reports of serious digestive disorders, loss of condition and death of livestock as the consequence of ingestion of minute spicules that are present on the flower petals and pear if enough care is not taken (Ueckert *et al.*, 1990;

Nefzaoui *et al.*, 2004, Witt and Luke, 2017). Ornament and fodder could be the most probable reasons for introduction of *O.robusta* in Mozambique (where it was recognized by respondents), as its fruits have been described as sour, thus not being preferred as edible (Walters *et al.*, 2011).

4.4. Non-feed uses of cacti

The use of cacti as medicine is in agreement with several studies reporting use of cladodes, flowers and fruits from these plants as good for healing several diseases and/or pain relief (De Waal *et al.*, 2015; Dube, 2017). However, in this study respondents were not inquired on the specific medicinal purpose. Similarly, edible fruits for humans, ornament and home live-fence that were mentioned by majority of respondents, have been described in several regions of the continent, including Southern Africa (Walters *et al.*, 2011; Witt and Luke, 2017).

4.5. Morphological characterization

Morphological characteristics taken into consideration by farmers, both from Malawi and Mozambique when classifying cacti, could be misleading somehow. Table 4.1. shows some circumstances that could make different spineless or spiny species be grouped as one.

Table 4.1: Morphological differences that could make farmers group different spineless or spiny species in together.

Order		Species	
	Similarities	<i>O.cochenillifera</i> (L) Mill	<i>O.ficus-indica</i>
1	Height	(if tall) – up to 5m	(if short) - 5m
	Cladodes	[8–35 (–50) cm long and 5–12 (–15) cm wide]	20–60 × 10–20(–40) × 2.5–5 cm
	Spines	usually absent	absent (or very short) in some cultivars
	Flowers	[5–6 (–7) cm long and 1.2–1.5 cm across]	5–10 × 4–9 cm
	Fruits	Red	yellow, orange, red or purple
		<i>O.monacantha</i> Haw	<i>O. robusta</i>
2	Height	2(–3) m	2–5 m
	Cladodes	10–30 × 7.5–10(–12.5) cm,	40 × 40 × 4–5 cm,
	Spines	2–4 cm long, brown towards tip and base, off-white	Absent (in some cultivars) or up to 5 cm long
	Flowers	5–7.5 × 7.5–10 cm, yellow or orange-yellow; outer tepals tinged red	5 × 5–7 cm, yellow
	Fruit	pyriform, 5–7.5 × 4–5 cm, green with red-purple shades	7–8 cm long. long-tuberculate while still green, deep red to purple; pulp purple

Source: De Waal *et al.*, (2015) ; Dube, (2017)

Apart from that, there is the possibility that morphological differences within the same species be divide it into several, such as spiny forms belonging *O.ficus-indica* (*Opuntia elatior* Mill., *O. maxima* Mill., *O. megacantha* Salm-Dyck, *O. schumannii* Weber, *O. tuna* Haw).

4.6. Conclusion

In conclusion, most farmers and probably other residents from the districts and villages where the present study was conducted know cactus as medicine, edible fruit, ornament and live fence. The knowledge of cactus as fodder both in Malawi and Mozambique is negligible nd should be promoted.

5. References

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