Vol.17(3), pp. 73-83 July-September 2025
DOI: 10.5897/JDAE2025.1450
Articles Number: 13735C273662
ISSN: 2141-2170

http://www.academicjournals.org/JDAE

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Journal of Development and Agricultural Economics

Full Length Research Paper

The contribution of *Dioscorea hirtiflora* to the livelihoods of local communities in Lindi and Mtwara Regions, Tanzania

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Received 15 June, 2025; Accepted 13 August, 2025

This study assessed the contribution of *Dioscorea hirtiflora* to the livelihoods of local communities in the Lindi and Mtwara regions of Tanzania. Specifically, it aimed to identify and assess the factors influencing the utilization of *D. hirtiflora* (Ming'oko), examine the socioeconomic factors influencing its collection, and evaluate its contribution to rural livelihoods. The study used a sample size of 160 respondents randomly selected from eight villages: Mnamba, Madangwa, Hingawali, Nachunyu, Mkunwa, Dihimba, Namayanga, and Pachoto B. Primary data were collected using a structured questionnaire, while secondary data were obtained from District Forest and Agricultural Offices. Data analysis was performed using SPSS software, with descriptive and inferential statistics determined, and regression analysis conducted to assess relationships between variables. The findings indicate a positive relationship between the collection of *D. hirtiflora* and certain socioeconomic variables. The study found that tubers are harvested from the wild throughout the year, with the highest activity occurring between May and November, peaking in June. Based on these findings, the study recommends that the government and NGOs invest in the propagation and domestication of *D. hirtiflora* to ensure a sustainable supply throughout the year.

Key words: Livelihood, food security, *Dioscorea hirtiflora* wild yam, non-timber forest products (NTFPs).

INTRODUCTION

Dioscorea hirtiflora, known as *Ming'oko* in the Makonde language, is a tuberous climbing wild edible plant (WEP) indigenous to southern Tanzania. This wild yam typically produces one to six cylindrical tubers, each growing to

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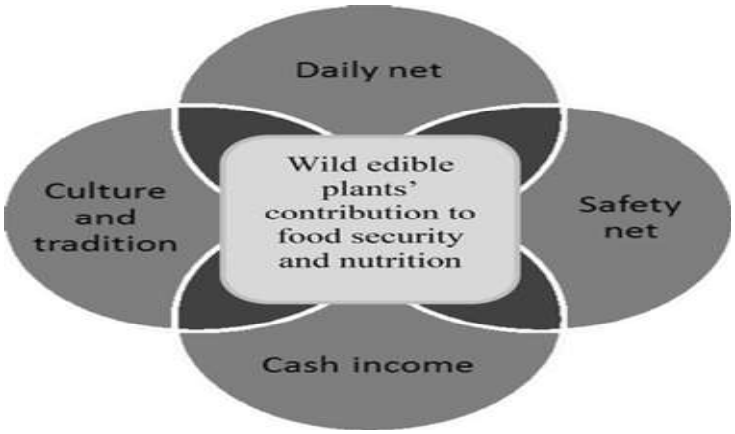

Figure 1. Conceptual framework for analysing the contribution of *D. hirtiflora* to the livelihood of people.
Source: Shackleton et al. (2004, 2017).

about 50 mm in diameter (Wilkin, 2001). Wild edible plants are integral to the cultural and genetic heritage of various regions worldwide (Pinela et al., 2017). During drought, many Tanzanian communities resort to alternative food sources from forests (Majule and Nyaombo, 2022; Liwenga, 2003). The exploitation of indigenous natural resources is crucial for supporting rural livelihoods, especially where agriculture faces challenges like drought and limited market access. In the Lindi and Mtwara regions, where cashew and cassava dominate, *Ming'oko* serves as a vital alternative livelihood source for marginalized populations. This wild yam functions as both a staple food and an economic resource, providing seasonal income through collection and sale. Populations of WEPs are declining, along with associated traditional knowledge (Padulosi et al., 2024). The current status of *D. hirtiflora* in Lindi and Mtwara regions is uncertain. Most cases of *D. hirtiflora* occurrence are in the wild, with very limited domestication (Zulu et al., 2019). Its existence is threatened by a high deforestation rate, averaging about 469,000 ha per annum due to human activities (Carton, 2021, FAO, 2020). Recently, *D. hirtiflora* has increasingly appeared in markets as an alternative food source, significantly contributing to income generation. Numerous studies highlight the value of *D. hirtiflora* as food during hunger and disaster (Kulindwa et al., 2016; Majule et al., 2010) and assess its nutritional potential (Mwanjala et al., 2024). This study aimed at adding the literature by assessing the contribution of *D. hirtiflora* to local livelihoods in Lindi and Mtwara regions, Tanzania.

However, the extent to which *D. hirtiflora* contribute to household food security and income is little known and not well documented in Lindi and Mtwara regions. Therefore, this study is intended to fill this gap by generating information that will lead to sustainable use of *D. hirtiflora*. The study's objectives are identifying and assess the factors influencing utilization of *D. hirtiflora* (Ming'oko), examine Social economic factors influencing collection of *D. hirtiflora* and evaluate the Contribution of *D. Hirtiflora* to rural livelihood. Addressing this gape will help stakeholders to advocate for policies that recognize the importance of *D. hirtiflora* (Ming'oko) in national economic planning. This could lead to better support for conservation efforts and funding for sustainable development initiatives.

Conceptual framework of the study

Forests provide various products, including *D. hirtiflora*, contributing to rural livelihoods. It is assumed that rural communities surrounding forests exploit these products for income generation and food security. Among WEPs, *D. hirtiflora* plays four distinct roles: in local diets, food security, nutrition, and income (Figure 1). The daily net function encapsulates the daily use and contribution of *D. hirtiflora* to household food needs. *D. hirtiflora* has been used for over 50 years and remains vital to the lifestyles of many people. In some areas, the species requires various management strategies to ensure its supply. The safety net functions during times of shock or adversity. The most recognized food is famine food. Although such safety nets use is irregular and hard to predict, it can be crucial for maintaining food diversity and security during times of hardship. Some underutilized species, such as *D. hirtiflora* are harvested and consumed. The cash income functions through small-scale trade. This strategy is an indirect contribution to food security and nutrition as the cash earned allows households to purchase other important foods in short supply, perhaps proteins or staples. Alternatively, the cash may fund education or hygiene. Local culture plays a significant role in shaping food preferences. While nutritional outcomes are crucial for physical and cognitive performance, food preferences

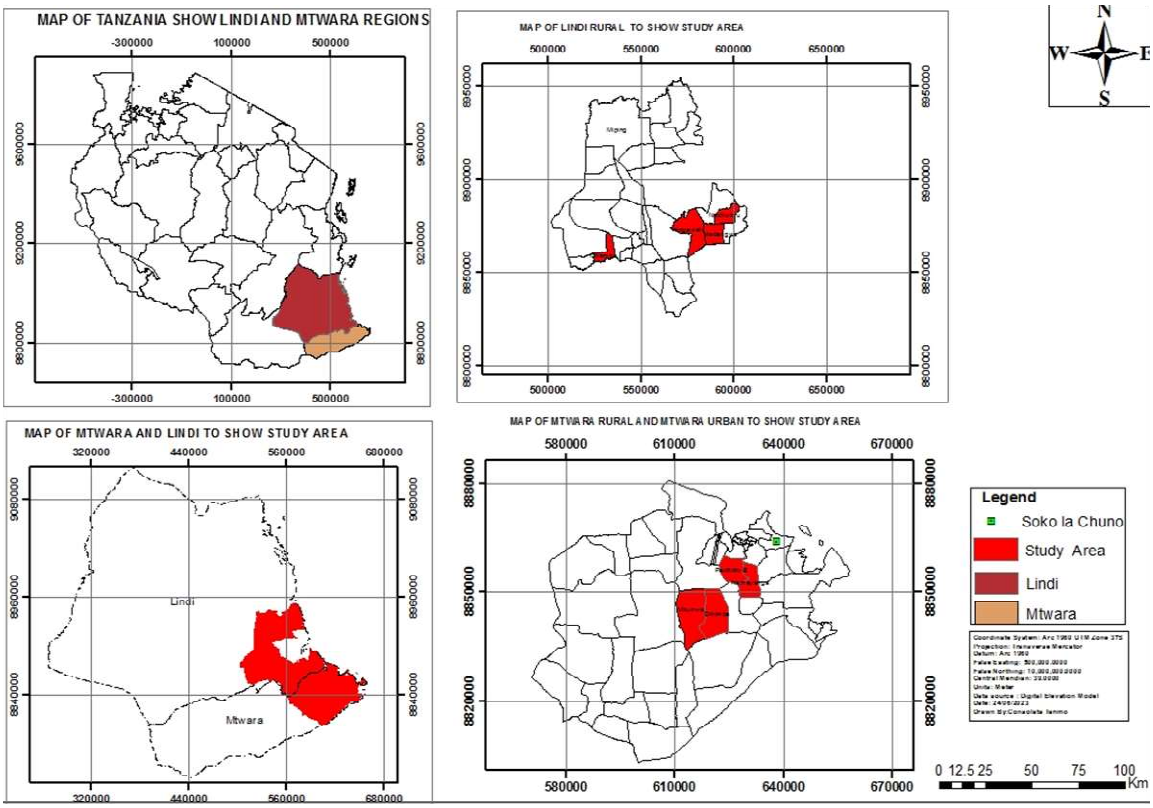

Figure 2. A map showing geographical location of study area.
Source: Own Construct Using GIS (2024).

are also influenced by individual taste, exposure, and cultural acceptance or avoidance. However, the cultural significance and taste of *D. hirtiflora* can evolve over time through exposure to new foods, recipes, contexts, and social pressures and norms.

MATERIALS AND METHODS

Study area

The study was conducted in Mnamba, Madangwa, Hingawali, and Nachunyu villages in Lindi Region and in Mtwara Municipal at two streets, Namayanga and Pachoto B, as well as Mtwara District in two villages, Mkunwa and Dihimba (Figure 2).

Vegetation and topographical characteristics

The two regions are mostly arid, with a dry season from May to October and a rainy season from November to April, featuring temperatures ranging from 25 to 35ºC. Annual rainfall averages about 1100 mm.

Population and ethnic group

The population of Mtwara and Lindi Regions is 1,634,947 and 1,194,028, respectively (The United Republic of Tanzania [URT], 2022). Lindi Region is located between 7°55’ and 10°50’ South and 36°51’ to 40° East, while Mtwara lies along the Makonde plateau, approximately 900 m above sea level. The main ethnic groups include the Mwera, Makonde, Machinga, and Matumbi, with Mwera and Makonde known to collect *D. hirtiflora* for food and income.

Social economic activities

The livelihoods of people in both regions primarily depend on mixed fishing and farming, especially maize, groundnuts, cowpeas, sweet potatoes, cassava, sunflower, soya beans, and rice, supplemented by natural resources. The rural household survey sites included Lindi (Mtama), Mtwara DC, and Mtwara Municipal districts (Figure 2).

Research design, sampling procedure and techniques

Sampling techniques and sample size

Cross-sectional research designs were employed where data were collected once in each selected village in Mtwara and Lindi regions. The cross-sectional design is adopted because it is cost-effective, less time consuming, and a lot of information is obtained in a relatively short time and allows data to be collected at one point in time from different individual or groups of respondents (Hemed, 2015; Mohajan, 2020). Random selection was used from eight villages of the study area. The sample size was determined using Cochran's sample size formula, as recommended by Bartlett et al.

Table 1. Regions sampled in Mtwara and Lindi.

S/N	Gender	Lindi (%)	Mtwara (%)	Average (%)
1	Male	36.25 (n = 29)	35 (n = 28)	35.62 (n = 57)
2	Female	63.75 (n = 51)	65 (n = 52)	64.37 (n = 103)

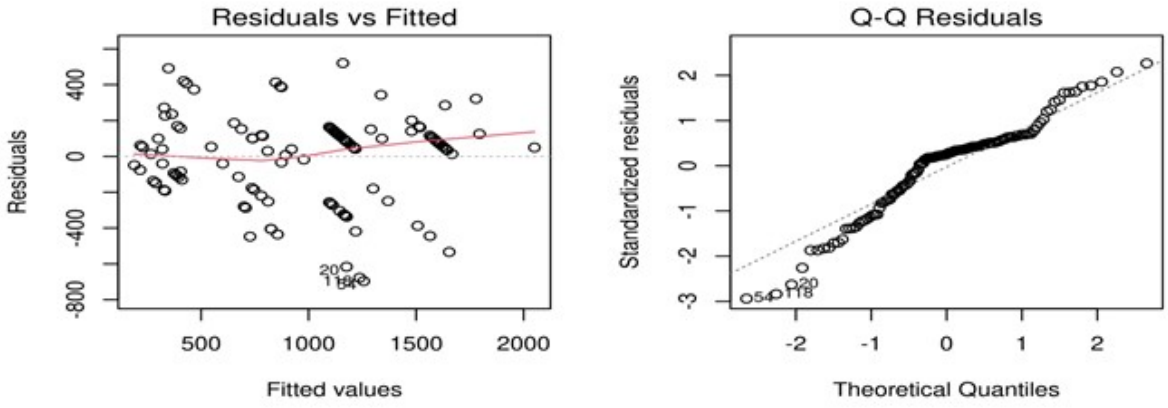

Figure 3. The linear regression assumptions.

(2001). This formula made sure the sample size was sufficient to produce results that were both statistically meaningful and significant. Subsequently, random sampling was employed to implement the determined sample size, thereby minimizing selection bias and increasing the likelihood that the sample accurately represented the entire population of *D. hirtiflora* collection and consumption.

$$n = \frac{Z^2 . p . (1-p)}{e^2}$$

where n is the required sample size, z is the value for the selected alpha[1] level, e.g. 1.96 for (0.25 in each tail) at 95% confidence level, p = proportion of respondents who will give a positive response, q = proportion of respondents who will give an incorrect response, pq = estimate of variance of the population, that is, p = 0.5, q = 0.5 (pq = 0.25) that is (maximum possible proportion (0.5) × 1- maximum possible proportion (0.5) produces maximum possible sample size) and E = acceptable margin of error for proportion being estimated. When E = 0.05, Equation 1 gives

$$n = \frac{(1.96)^2 \times 0.5(1-0.5)}{0.05^2} = \frac{3.8416 \times 0.5}{0.05^2} = \frac{3.8416 \times 0.5}{0.0025} = \frac{0.9604}{0.0025}$$

n = 384.16

Although the ideal sample size for an unknown population at 95% confidence level is 384 (Cochran, 1977), then the final sample size was calculated. A sample size for this study included 160 households which were randomly selected, 80 respondents from Lindi and 80 from Mtwara which still allows for meaningful analysis and representation across the selected villages and was distributed proportionally among the target population based on *Dioscorea hirtiflora* collection and consumption intensity. Table 1 shows the regions samples in Mtwara and Lindi. Hingawali, Madangwa and Pachoto B villages are relatively close to the main road where they sell directly to the passengers while Mnamba, Namayanga, Dihimba, Mkunwa and Nachunyu villages are relatively far from the main road and markets.

Data collection methods

For better insight, validity, and reliability of the research findings, this study used mixed methods of qualitative and quantitative approaches for data collection to assess income generation from *D. hirtiflora* products in Lindi and Mtwara regions. Questionnaires, focus group discussions (FGDs) and key informant interviews were used in collecting data. The information collected on the socio-economic characteristics of the respondents were age, gender, marital status, education, primary occupation. A total of six Key Informants' Interviews (KII) was organized with District Forest officers, District Natural resources officer and agriculture officials were selected purposively for discussion. A grey literature search was also used to examine the contribution of ming'oko to the household income and livelihoods. Four FGDS were used as a valuable method for collecting data to identify key stakeholders (Village Executive officer, Village chairperson, 2 sellers, 2 collectors, 2 buyers 2 youth representatives based on gender) engaged in the *D. hirtiflora* value chain and traditional practice on communities.

Data analysis

Descriptive statistics was performed on the data to get frequency and percentage. To get more insights from the collected data, regression analysis was performed to assess the relationships between the dependent and independent variables. These analyses were performed to assess the relationships between the amount of *D. hirtiflora* collected, the socio-economic factors, seasons of Ming'oko in a year, and its collection frequency among others.

Table 2. Variance inflation factor.

Variable	Value
Age range	1.3
Sex	1.3
Marital status	1.4
Stakeholder type	1.2
Education level	1.2
Occupation	1.1
Season length	1
Price per kg	1.1
Collection frequency per week	1.1

Analyses were conducted using R software (version 4.4.1). In addition, Microsoft excel was used as an intermediary for data pre-processing, tabulation and some basic graphing. Content analysis was employed for qualitative data that was collected from the key informants' interviews and FGDs. (Lalika, 2006). Multiple linear regression model (Equation 1) was used to determine the factors influencing household members in collection of *D. hirtiflora*. Also, multiple regression analysis was used to give the insights on the relationship between the quantity of *D. hirtiflora* collected and income. The linear function form was adopted and used to give the best fit model as explicitly stated in the Equation 1.

$$Yij = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + \ldots + \mu \quad (1)$$

where y is amount of *D. hirtiflora* collected from wild, b_0 is intercept, $b_1 \ldots b_n$ is coefficients, μ is error term, X1 is age, X2 is sex, X3 is gender, X4 is marital status, X5 is education level, X6 is frequency of collection, X7 is occupation, X8 is stakeholder's type in *D. hirtiflora*.

The model estimated the contribution of socio-economic factors on collection of *D. hirtiflora*. This procedure was selected because it effectively quantifies, predicts, and explains relationships between variables with relative ease and clarity, making it an essential tool in the social and natural sciences research. The diagnostic tests were performed to ascertain if the linear regression assumptions have been met by the model. Figure 3 show the test for linearity and normality of the model. The test for autocorrelation using Durbin-Watson test has 1.74 (p-value of 0.12), these indicate the absence of autocorrelation. VIF was further used to test for multicollinearity and the results are as shown in Table 2.

RESULTS

Socio-economic characteristics of respondents

Different characteristics of respondents were considered in this study. The respondents' characteristics included age, sex, education level, marital status and occupation of the respondent in *D. hirtiflora* (Table 3).

The importance of Ming'oko to the rural households in Lindi and Mtwara Regions

The respondents' characteristics included age, sex, education level, marital status, and occupation related to *D.hirtiflora*. According to key informants, *D. hirtiflora* has been a traditional food source for local communities, particularly during food scarcity, especially in the 1990s. The harvesting of *Ming'oko* is accompanied by local knowledge to differentiate it from similar but inedible wild yams, such as Malondolo or Lilondolo. A majority of respondents (89.4%) prefer to gather *D. hirtiflora* from undisturbed forests, reflecting its historical and cultural significance in southern Tanzania. The study found that tubers are harvested year-round, with peak activity occurring between May and November, particularly in June when they are most mature for food and trade (Table 4). The consumption of *D. hirtiflora* is closely tied to the cultural practices of the Makonde and Mwera communities, with over 97.5% of respondents in Lindi acknowledging this connection.

Social economic factors influencing collection of *D. hirtiflora*

To socio-economic factors like sex, stakeholder type, collection frequency per week and season length significantly affects *D. hirtiflora* collection from the forest at a 5% significance level. Additionally, the age range has a significant influence at the 10% significance level (Table 5).

The independent variables fit well into the regression model (R^2 = 0.8071). The model explains 80.7% of the variation in *D. hirtiflora* production, indicating a strong influence on its collection. The R value of 0.898 and the adjusted R^2 of 0.7711 further confirm the strong relationship between the dependent and independent variables. Increased *D. hirtiflora* collection correlates with higher annual income Figure 4. The nature of this relationship is illustrated in Figure 3, with results shown in Table 5. This suggests that the study aimed to examine whether the quantity of *D. hirtiflora* collected affects household livelihoods and income.

Factors influencing utilization of *D. hirtiflora*

The key informant interviews and focus group discussions

Table 3. Socio–economic characteristics of respondents in the study area.

Variable	Social-economic factor	Lindi		Mtwara	
		Frequency (N)	Percentage	Frequency (N)	Percentage
Sex	Male	29	36.25	28	35
	Female	51	63.75	52	65
Age	18-35	33	41.25	31	38.75
	36-60	40	50	45	56.25
	Above 60	7	8.75	4	5
Marital status	Widow/Widower	6	7.5	6	7.5
	Divorced	19	23.75	16	20
	Married	39	48.75	42	52.5
	Single	16	20	16	20
Education level	Adult education	1	1.25	4	5
	No formal education	17	21.25	24	30
	Primary education	49	61.25	41	51.25
	Secondary education	11	13.75	9	11.25
	Tertiary education	2	2.5	2	2.5
Occupation	Farmer	55	68.75	63	78.75
	Petty trade	16	20	13	16.25
	Civil servant	3	3.75	3	3.75
	Peasant	6	7.5	1	1.25
Total number of respondents (N)		80	100	80	100

Table 4. Harvesting season for *D. hirtiflora.*

S/N	Season	n	Percentage
1	May – November	85	53.12
2	March – September	36	22.50
3	April – November	8	5.00
4	February – October	5	3.12

Table 5. Regression results on the factors affecting the amount *D. hirtiflora* collected.

Variable	Estimate	Std. Error	t value	Pr(>|t|)	Signif.
(Intercept)	-2193.4385	332.714	-6.593	0.000	***
Age range	34.2083	20.116	1.701	0.092	.
Sex	219.6912	58.742	3.740	0.000	***
Marital status	-5.2589	22.801	-0.231	0.818	
Stakeholder type	90.3252	27.787	3.251	0.002	**
Education level	-0.9178	27.234	-0.034	0.973	
Occupation	4.9406	33.581	0.147	0.883	
Harvesting season length	171.7870	35.072	4.898	0.000	***
Price per kg	0.0338	0.139	0.244	0.808	
Collection frequency per week	416.8627	23.548	17.703	0.000	***

Signif. codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1; R: 0.897, Multiple R-squared: 0.805, Adjusted R-squared: 0.79.

Table 6. Factors influencing the utilization of *D. hirtiflora* in Lindi and Mtwara.

S/N	Use	Lindi (%)	Mtwara (%)	Average (%)
1	Cultural practices	97.5 (n = 78)	86.2 (n = 69)	91.9 (n = 147)
2	Business	62.5 (n = 50)	52.5 (n = 42)	57.5 (n = 92)
3	Food	43.75 (n = 35)	47.5 (n = 38)	45.6 (n= 25)
6	Medicine	2.5 (n = 2)	0 (n = 0)	1.25 (n = 2)

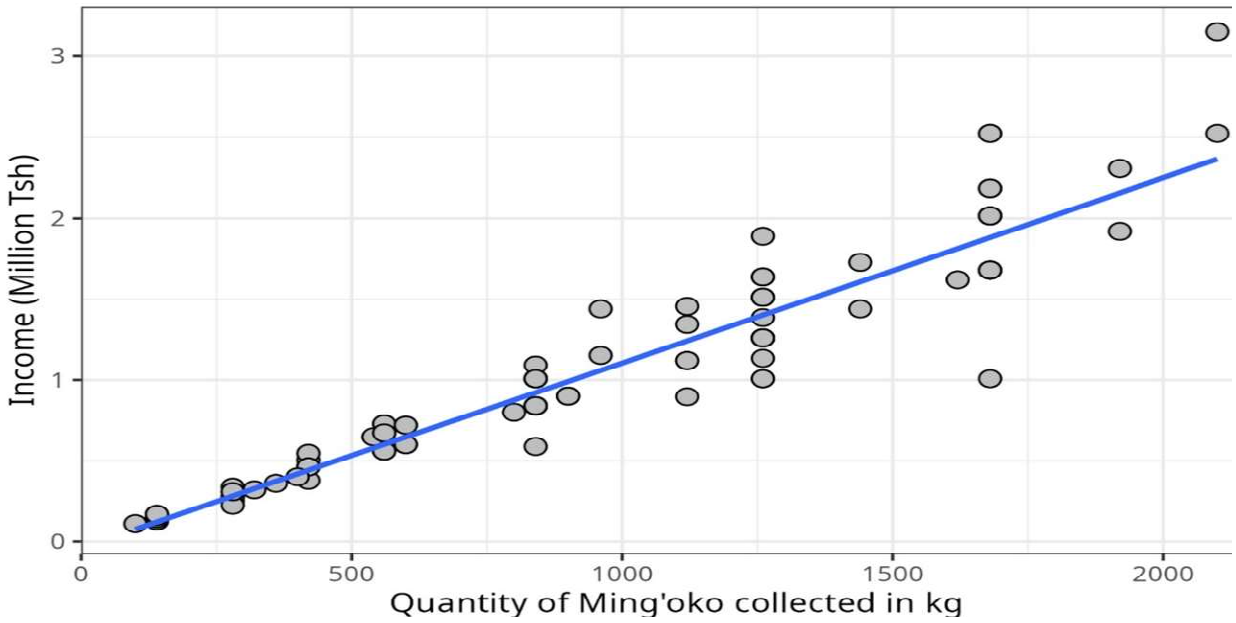

Figure 4. Nature of relationship between income and quantity of *D. hirtiflora* collected.

highlighted several factors influencing the utilization of *D. hirtiflora* in the study area. These factors include cultural practices, food security (due to its carbohydrate content), business opportunities (income generation), medicinal use, and its resilience to climate change. The results show that the consumption of *D. hirtiflora* is closely tied to the cultural practices and social customs of the Makonde and Mwera communities, with more than 97.5% of respondents in Lindi and 86.2% in Mtwara acknowledging this connection (Table 6).

Additionally, 62.5% of respondents in Lindi and 52.5% in Mtwara considered it a business, while 43.73% in Lindi and 47.5% in Mtwara identified it as a food source. Only 2.5% in Lindi reported medicinal use, lacking scientific support.

Contribution of *D. hirtiflora* to the rural livelihoods compare to the other sources

The results showed agriculture is the key economic activity in the study area. Non-timber forest products (NTFPs) ranked second after agriculture 35% in Lindi and 30% in Mtwara (Table 7).

Contribution of *D. hirtiflora* compared to other NTFPs to the rural livelihood

Findings show that NTFPs do contribute to the household livelihood in the study area. Among the NTFPs, *D. hirtiflora* is the most widely collected as well as the highest, aggregate and average, contributor to income (Table 8). About 66.87% of the households collected *D. hirtiflora* as source of income. Similar feedbacks were also given during focus group discussions and key informant interviews, followed by Vitundi which has 17.5 %.

Factors contributing to the loss of *D. hirtiflora*

The results indicate that overharvesting is the primary cause, responsible for 44% of the loss of *D. hirtiflora*, followed by agricultural activities at 35%. Deforestation contributes 17%, population growth accounts for 3%, and urbanization is responsible for 1%. These are significant drivers of decline in both regions. Figure 5 shows the factors contributing to the loss of *D. hirtiflora*.

Table 7. The mean household incomes from different source.

Other sources of income	Lindi		Mtwara	
	Frequency	Proportion (%)	Frequency	Proportion (%)
Agriculture	39	48.75	35	43.75
Business	4	5	7	8.75
Fishing	8	10	13	16.25
NTFPs	28	35	24	30
Employment	1	1.25	1	1.25

Table 8. Different sources of income from NTFP.

S/N	Use	Lindi (%)	Mtwara (%)	Average (%)
1	Ming'oko (Roots)	67.5 (n = 54)	66.25 (n = 53)	66.87 (n = 107)
2	Vitundi (Roots)	15 (n = 12)	20 (n = 16)	17.5 (n = 28)
3	Vitolo (Fruits)	7.5 (n = 6)	3.75 (n = 3)	5.63 (n= 9)
4	Matili (Fruits)	5 (n = 4)	2.5 (n = 2)	3.75 (n = 6)
5	Uyoga (Mushrooms	5 (n = 4)	7.5 (n = 6)	6.25 (n = 10)

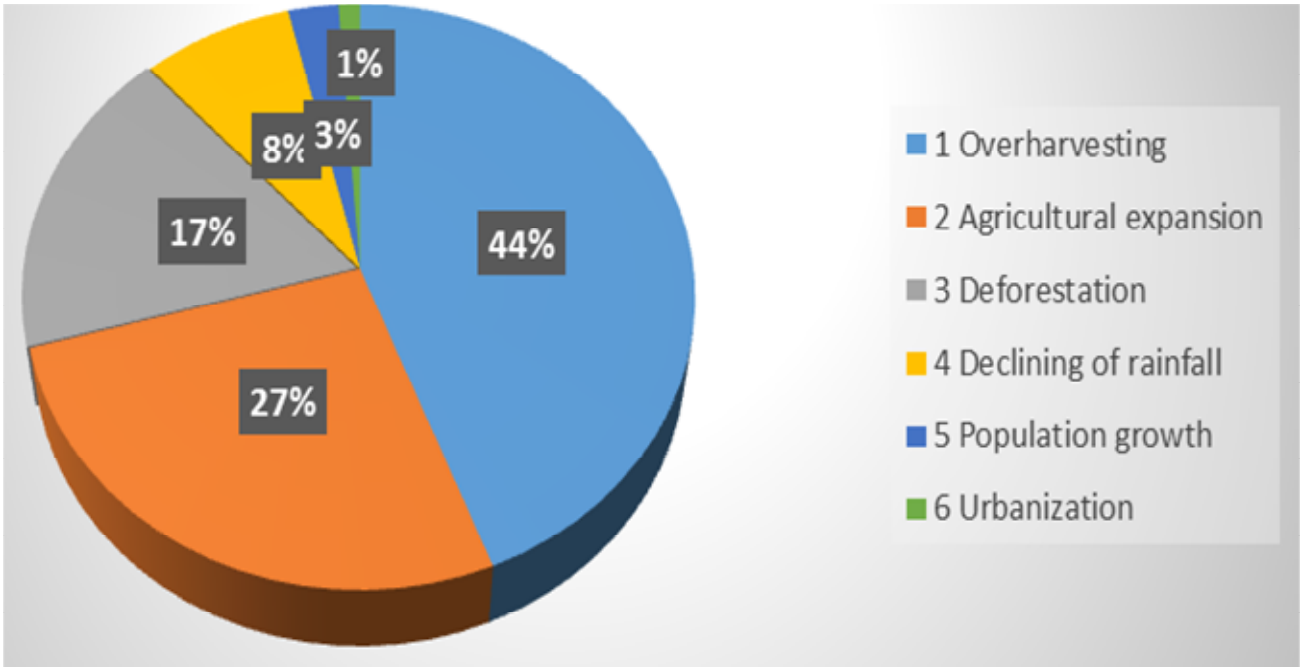

Figure 5. Factors contributing to the loss of *D. hirtiflora*.

The loss of *D. hirtiflora*

The results indicate that to address the decline of *D. hirtiflora*, 80% of respondents recommended implementing a conservation program to support the growth of ming'oko species in the area. Additionally, 13% suggested policy regulations, 10% favored reforestation efforts, and 2% proposed village land use plans. Table 9 shows the ways of addressing the loss of *D. hirtiflora* in the study area.

DISCUSSION

Social economic factors influencing household collection of *D. hirtflora*

Collection is influenced by socio-economic factors

Table 9. Ways of addressing the loss of *D. hirtiflora* in the study area.

S/N	Ways of addressing the loss of *Hirtiflora*	Response	Percent per response
1	Conservation programs	127	80
2	Policy and regulation	22	13
3	Reforestation efforts	17	10
4	Village land use plans	4	2

reflecting resource availability. Socio-economic variables were identified as key determinants in the study area that affect participation in the collection of *D. hirtiflora*. The results revealed that *D. hirtiflora collected* was significantly affected by sex, age, peak season, and the frequency of collection per week (Table 5). Studies by Angelsen and Wunder (2003) and Sunderlin et al. (2005) suggest that factors such as household size, labor availability, and collection frequency play a critical role in determining the extent of income derived from NTFPs.

Sex was found to be positively significant at $p < 0.05$, indicating that women were more involved in the collection of *D. hirtiflora* compared to men. *D. hirtiflora* collection from the wild was dominated by women (Zulu et al., 2019). The physical strength of women, along with their willingness to take risks in collecting *D. hirtiflora* for income generation, contributed to their higher participation and highlighted the availability of labor. Furthermore, the number of working-age members in a household showed a positive relationship with the *D. hirtiflora collected*. Larger households likely have more workers and fewer constraints on available work time, enabling them to collect more *D. hirtiflora*. Primary occupation is significantly affecting collection in both regions. Many individuals in the study area engage in subsistence farming, which limits their time for foraging activities. However, during the dry season, when agricultural work is less demanding, collection of Ming'oko becomes a vital source of food and income.

Factors influencing household utilization of *D. hirtiflora* in the study

D. hirtiflora is utilized for food and plays a crucial role in household livelihoods, primarily used as a main dish or for both food and business purposes. The study by Mwanjala et al. (2024) suggests that *D. hirtiflora* is a rich source of nutrients and antioxidants, enhancing local diets. Traditionally, *D. hirtiflora* was consumed during the dry season, but it has gained popularity and is now used year-round. According to key informants, *D. hirtiflora* has been a vital part of the diet and economy in the Lindi and Mtwara regions for over fifty years, underscoring its significance. The traditional method of preparing *D. hirtiflora* primarily involves boiling, often ground and mixed with flour, known locally as "chikandaga." Study by Majule et al. (2010) shows that *D. hirtiflora* is served for meals at least once daily.

The contribution of *D. hirtiflora* to the rural household livelihoods

The findings of this study indicate that *D. hirtiflora* (Ming'oko) holds significant economic value for community members, accounting for an average of 66.87% when compared to other NTFPs in the area like vitundi which contribute to 17.5%. The vitundi yams have become very popular during the ramadhan period (Boa, 2004).

Others are sold to buyers, either in processed or unprocessed forms. The majority of community members utilize *D. hirtiflora* for both food and income-generating purposes, highlighting the role of NTFPs in enhancing household income by supplementing other livelihood sources (Table 8). The study also found that agriculture and fishing were the primary activities in the area, with the majority of respondents engaged in these sectors. However, despite the dominance of agriculture and fishing, *D. hirtiflora* remains an important source of surplus food and a quick cash income, particularly during different seasons (Table 8). *D. hirtiflora* plays a key role in contributing to household income in the study area, a finding supported by Maiguru (2013). Income from (TFPs) like *D. hirtiflora* complements other sources of income and serves as a vital means of livelihood for poor families. The species is considered a valuable source of quick income for many individuals involved in its trade.

The tubers of *D. hirtiflora* are collected from the wild year-round, particularly from May to October, with peak activity in June (Table 4). This finding is consistent with a study by Yakang (2015), which shows that women collect *D. hirtiflora* between March/April and December. Furthermore, the findings suggest that the collection of *D. hirtiflora* plays a significant role in the livelihood security of communities in Lindi and Mtwara, particularly for those living near forest areas, as it serves as a key source of food and income (Table 8).

Factors contributing to the loss of *D. hirtiflora*

The loss of *D. hirtiflora* in Lindi and Mtwara is attributed to several interrelated factors. Overharvesting for its food uses has led to a decline in its population, especially as

local communities depend on it for sustenance. Agricultural expansion, driven by the need to cultivate more land for crops, has encroached on the natural habitats where *D. hirtiflora* thrives, further reducing its available environment. A study by Kadigi et al. (2017) explored the effects of agricultural expansion in Southern Tanzania. It highlighted how land-use change, driven by agriculture, is one of the significant causes of habitat destruction for several plant species, including wild yam varieties. Deforestation, often a consequence of both agricultural and urban expansion, has led to the destruction of the ecosystems that support this plant. Population growth and urbanization in the regions have increased the demand for land and resources, contributing to habitat loss and unsustainable exploitation of Ming'oko. These combined pressures have made it difficult for *D. hirtiflora* to thrive, putting it at risk of extinction in these areas. A study by Andriamparany et al. (2014) examined the role of wild yams in rural livelihoods in Tanzania and noted that overexploitation was a key factor contributing to the loss of several wild yam species, including *D. hirtiflora*. Overharvesting for local consumption and market trade, especially when the species is not cultivated, leads to a reduction in its availability in the wild.

Addressing the loss of *D. hirtiflora*

Most respondents proposed that there is a need for conservation programs which will help in educating people on the best ways through which they can harvest and sustainably benefit from Ming'oko. To maximize the benefits of *D. hirtiflora* for income generation and livelihood improvement, several strategies can be implemented. Sustainable Harvesting Practices this will promote sustainable harvesting techniques to ensure the long-term viability of wild populations. This includes educating collectors on sustainable practices that minimize environmental impact while maximizing yield. Participants across various communities proposed utilizing diverse platforms to educate people about the value of WEPs and the need for their conservation (Oduor et al., 2024). Domestication and cultivation can be promoted by initiating programs focused on the domestication of ming'oko to reduce pressure on wild populations. Research into propagation methods will enhance cultivation efforts, making it more accessible for farmers to grow this valuable crop (Aighewi et al., 2015).

Market development should focus on establishing market linkages that connect rural producers with urban consumers more effectively. This could involve the formation of cooperatives or associations that empower local collectors and traders to negotiate better prices and access larger markets (Sikwela et al., 2016).

Supporting policy initiatives that recognize the importance of NTFPs like ming'oko in national economic planning can lead to improved conservation efforts and funding for sustainable development initiatives (Hicks et al., 2014).

Conclusion

The study demonstrates that *D. hirtiflora* (Ming'oko) plays a vital role in the livelihoods of rural households in Lindi and Mtwara regions, contributing significantly to both food security and household income. Its collection and utilization are influenced by various socio-economic factors, including gender, age, and seasonality. Women, in particular, dominate the collection process, emphasizing the gendered nature of resource use. However, *D. hirtiflora* faces significant threats due to overharvesting, agricultural expansion, and deforestation, which have led to a decline in its availability and sustainability. Despite these challenges, it remains a key resource for rural communities, especially as a supplementary income source and during the off-peak agricultural seasons.

RECOMMENDATIONS

To ensure the sustainability of *D. hirtiflora*, it is crucial to implement conservation programs that educate local communities on sustainable harvesting practices and promote the cultivation of the plant. Conservation areas should be established to protect the wild populations, and alternative livelihoods should be promoted to reduce pressure on the natural resource. Additionally, involving local communities in conservation efforts and monitoring the ecological health of the habitat will be essential in addressing the loss of this valuable plant species.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

The authors are indebted to Sokoine University of Agriculture (SUA) for granting permission to undertake this study. They are also grateful to the Lindi and Mtwara Region authorities, especially the district authorities and local communities of the selected villages, for their hospitality and active participation during the entire period of the study.

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