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Traditional Knowledge and use of Wild Cowpeas (*Vigna unguiculata*) in Selected Communities of Tanzania

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Wild cowpeas are utilized as food, medicine, and nutritious fodder. However, there are limited reports on the cultural significance of wild cowpeas across different agroecologies of Tanzania. This study analyzed the traditional knowledge and identified the most culturally important species. The study involved 260 respondents interviewed from 13 villages in seven districts, using descriptive and ethnobotanical methods to assess traditional knowledge. Fisher's exact test (p = 0.0403) revealed that knowledge of wild cowpeas depends on age, not gender and education. A Pearson's test showed significant differences in use categories of wild cowpeas among the respondents, with 31% as animal fodder, 6% as medicine, 3.5% as food, and 2.5% as green manure, while 57% did not use it. Spearman rank correlations revealed positive correlations among the variables tested, with FC and UR significantly having a high correlation index of 0.98, while the cultural value (CV_e) index highly correlated with all ethnobotany indices evaluated. *Vigna dekindtiana* is the most culturally significant species, with the highest frequency of citation (FC_s = 20), use reports (UR_s = 27), and cultural importance (CI_s = 1.125). The leaves of *V. dekindtiana* have been used as animal feed and vegetables, while its roots have been used to treat gastrointestinal disorders. This study revealed that wild cowpeas can be utilized in various ways, such as ecological and social aspects, and in breeding programs to improve cultivated cowpeas.

KEYWORDS

vigna, wild cowpeas, traditional knowledge, use categories, Tanzania

1 Introduction

Ethnobotanical studies associate plants and people in a specific area with cultural practices and various plant uses (Benyahya et al., 2023; Mashabela and Otang Mbeng, 2021). The studies play a crucial role in emphasizing the significance of native plant species in the local communities livelihood (Amjad et al., 2020), as well as in discovering more edible plant species to reduce food insecurity (Asfaw et al., 2023; Hankiso et al., 2023), finding new medicinal plant species Achigan-Dako et al. (2010) revealed the socio-cultural importance of wild plants in many African communities. For instance, Dansi et al. (2008) reported over 187 collected wild plant species are consumed by over 29 ethnic groups in Benin. These wild edible species are crucial components in farming systems. However, they have been overlooked in the development of the agricultural industry (Vazquez-Garcia, 2008). Wild cowpeas are among the wild plants that have evolved without human intervention. These plants have developed desirable traits against adverse biotic and abiotic factors and could be used to donate desirable traits to cultivated crops. Despite the socio-cultural and economic benefits they can provide to local communities, most are at risk of extinction due to habitat fragmentation and overexploitation caused by anthropogenic activities (Ahmad et al., 2013). Moreover, indigenous knowledge of wild-related plant species is diminishing in most communities due to urbanization, changes in food preferences, and reliance on modern medication (Höft et al., 1999). Khakurel et al. (2021) revealed that many wild cowpeas exist worldwide; however, their uses are poorly documented. This calls for more research on these resources, their uses, and their nutritional qualities. Wild cowpeas are versatile plants that can withstand drought and poor soil fertility compared to cultivated cultivars (Sprent et al., 2017). They can be used as a resilient crop against drastic climate change (Khan et al., 2023). The genus Vigna has versatile uses for food (root and tubers, pulses and vegetables) (Catarino et al., 2021), feed for livestock (Tomooka et al., 2014), and for medicinal purposes and soil cover (Catarino et al., 2021; Van Wyk, 2019). Pasquet (2013) reported five wild subspecies of cowpeas: ssp. *dekindtiana*, ssp. *protracta*, ssp. *pubescens*, ssp. *stenophylla*, and ssp. *tenuis*. *V. unguiculata* ssp. *dekindtiana* var. *spontanea* commonly found throughout sub-Saharan Africa are believed to be the predecessor of cultivated cowpea. In Africa, wild cowpea grasps a significant cultural importance and has been used in various ceremonials such as harvest and burial festivals, and holds figurative value as the foundation of resilience and sustenance (Nielsen et al., 1997). In the case of food, wild cowpeas provide an exceptional source of protein, fibre, and a wide range of micronutrients (Boukar et al., 2011). Furthermore, wild cowpea grains are 20–30% protein by dry weight, and the leaves also have high protein content (Nielsen et al., 1997). Based on these attributes, Vigna is suitable for meeting diverse social and cultural needs, facilitating high acceptability in the food system (Enriquez and Archila-Godinez, 2022). In Tanzania, wild cowpeas exist in different parts; however, their interactions with people are poorly documented and receive less attention than those of cultivated cowpeas (Harouna et al., 2018). The genus Vigna has over 100 taxa, predominantly diploid and selfing (van Zonneveld et al., 2020), of which nine species are under cultivation (*V. unguiculata*, *V. radiata*, *V. angularis*, *V. subterranean*, *V. vexillata*, *V. reflexo-pilosa*, *V. mungo*, *V. aconitifolia*, and *V. umbellate*) (Tomooka et al., 2014). Despite their integral role in community development, most cowpea species are found in the wild (Harouna et al., 2018), and their usage is unclear. Previous reports by Adegbuyi et al. (2020) and Adegbuyi et al. (2019) revealed that wild cowpea species are essential to many communities in Sub-Saharan African countries as they are used as painkillers and treating many diseases like insomnia, convulsion, migraine headaches, and other neurobehavioural problems. Moreover, Harouna et al. (2018) narrated the contribution of wild cowpeas species in food security and combating malnutrition in the growing population in Sub-Saharan Africa. However, very few non-domesticated wild cowpea*s* species are consumed as human food; for example, *V. racemosa* is used to fortify cassava flour in Nigeria (Folashade et al., 2017), *V. vexillata* in Bali and Tomor (Karuniawan et al., 2006), and *V. marina* in Australia (Norihiko et al., 2011) and in many parts of Africa are used as animal feeds. Wild cowpea species, such as *V. vexillata*, have been reported to have higher protein, sulfur, and amino acid content than domesticated cowpeas (Marconi et al., 1997). However, despite all these crucial attributes, its digestibility is very low, hindering its acceptance by most people (Liman, 2019).

The southern part of Africa has a remarkable diversity of wild cowpeas and is considered a centre of speciation (Boukar et al., 2020). According to Padulosi and Ng (1997), wild cowpeas are widely dispersed in Namibia, Botswana, Zambia, Zimbabwe, Mozambique, South Africa, and Swaziland. South Africa, for example, is the home of diverse wild cowpeas such as *V. tenuis*, *V. stenophylla*, *V. protracta*, and *V. rhomboidea* (Catarino et al., 2021). Furthermore, wild cowpeas have also been recorded in East African countries. Tanzania is the most endowed with a high diversity of wild cowpea species such as *V. kirkii*, *V. platyloba*, and *V. wittei* (Boukar et al., 2020).

This study focuses on the ethnobotany of wild cowpeas in selected communities of Tanzania. About 65% of Tanzanians are in rural areas, earning their livelihoods from wild resources (Salinitro et al., 2017). For example, *V. frutescens* is a tuber plant adapted to a semi-desert environment and is mainly consumed by the Hadzabe community in northern Tanzania (Schoeninger et al., 2001).

However, there is limited comprehensive documentation on the cultural significance of wild cowpeas among the indigenous communities of Tanzania. Understanding this cultural context is crucial for developing conservation strategies that are not only biologically effective but also culturally sensitive and inclusive. Therefore, the research gap lies in the intersection of ethnobotany and conservation, where a detailed study could reveal how indigenous knowledge and cultural practices contribute to the in-situ conservation of these wild cowpeas. Such knowledge could be pivotal in designing conservation programs that align with the cultural values and practices of the local communities. This study relied on three research questions: What are the uses of wild cowpeas, what is the diversity of wild cowpeas in Tanzania, and what is the abundance and distribution of wild cowpeas in Tanzania? The study aims to explore the diversity, distribution, abundance, and uses of wild cowpeas in three regions of Tanzania, and we hypothesized that various species of wild cowpeas exist, with multiple uses among the indigenous people of Tanzania.

1.1 Theoretical framework

This study is based on key ethnobotanical hypotheses that explain plant use, knowledge acquisition, and the influence of socio-cultural factors. The Plant Use Value Hypothesis suggests that plant utility is linked to characteristics like abundance and size (Gaoue et al., 2017). The Optimal Foraging Theory explains plant selection based on efficiency and availability (Gaoue et al., 2017). The age, gender, and knowledge dynamics hypothesis (de Albuquerque et al., 2011) highlights how demographic traits affect plant knowledge, with older individuals and women possessing more outstanding expertise. The urbanization and knowledge loss hypothesis (Reyes-García et al., 2013) predicts a decline in traditional plant knowledge due to modernization. Finally, the social network hypothesis emphasizes the role of social connections in knowledge distribution and retention (Gaoue et al., 2017). These theories provide insights into how plant knowledge evolves and is maintained within communities.

2 Materials and methods

2.1 Description of study areas

The study was conducted in three regions of Tanzania: Tanga, Morogoro, and Dodoma. According to recent statistics, the Tanga region has a population of 2,615,597, while Morogoro and Dodoma have populations of 3,197,104 and 3,085,625, respectively (NBS, 2022).

The Tanga region covers approximately 26,667 km^2 with diverse vegetation types, including bushland, palm gardens, village cultivations, estates (mainly sisal), natural forests, shrub thickets, and open savannah grasslands interspersed with scattered trees (Lyimo, 2024). The Morogoro region spans 70,624 km^2 and is characterized by extensive Miombo woodlands and mountainous vegetation (Lyimo, 2024). In contrast, Dodoma covers 41,310 km^2 (Kulwijila et al., 2018) and falls within a semi-arid zone dominated by savanna, grasslands, and scattered woodlands (Msanya et al., 2018). The climatic conditions in these regions vary significantly. Tanga experiences an annual rainfall of approximately 1,200 mm, with mean monthly temperatures between 19°C and 33°C. Morogoro receives an average annual rainfall of 600–1,200 mm, with temperatures varying from 18°C in mountainous areas to 30°C in river valleys (Lyimo and Mwatawala, 2022). Dodoma, being semi-arid, receives between 395 and 780 mm of annual rainfall, which follows a mono-modal pattern, beginning in late November, peaking in December–January, and concluding in April (Msanya et al., 2018). The region's monthly temperatures range from a maximum of 29.6°C in February to a minimum of 17.6°C in July (Msanya et al., 2018). Soil characteristics also differ across the three regions. Morogoro is predominantly composed of sandy clay loams in the topsoil and clays in the subsoil. Tanga's soils range from sandy in the coastal belt to clayey and loamy in the hinterland, with leached mineral laterites found in the highlands (Lyimo and Mwatawala, 2022). Dodoma exhibits a variety of soil types, including reddish clayey, reddish loamy, brown loamy, and sandy soils. Dark, sticky, cracking clays and friable and calcareous clays characterize poorly drained lowland plains and swampy areas (Msanya et al., 2018). Agricultural activities vary among the regions. In Tanga, key crops include maize, cassava, bananas, beans, cowpeas, spices, fruit crops, and cash crops such as sisal and tea. Morogoro supports the cultivation of maize, rice, beans, horticultural crops, and cash crops like sugarcane. Dodoma's agricultural production is dominated by drought-resistant crops such as cowpeas, millet, sorghum, groundnuts, and sunflowers.

The occurrence and distribution data of wild cowpeas in Tanzania were obtained from the National Herbarium of Tanzania (NHT) in the Arusha region. A multistage approach, as described by Constantine et al. (2020), was adopted in this study. The first stage was a purposive sampling of regions. The second stage was a purposive sampling of the district based on the occurrence information in the herbarium data. The third stage was a sampling of wards. The fourth stage was sampling villages. Thirteen villages from seven districts in three regions were engaged in the study. From each sampled Region (Tanga, Morogoro, and Dodoma), two districts were selected, i.e., the Tanga region, which includes Muheza district, with three villages (Lusanga, Ngomeni, and Magoda) and the Korogwe district, with one village (Kwalukonge). In the Morogoro region, two districts were sampled: Morogoro Urban district with one village (Kididimo) and Mvomero district with two villages (Mnyanza and Tangeni). Further, the study was conducted in the Dodoma region, where three districts and two villages from each district were involved. The Chamwino district involved Mahama and Kawawa villages, the Mpwapwa district (Behelo and Manghangu villages), and the Kondoa district (Bumbuta and Mauno villages) (Figure 1).

2.2 Selection of sample size

The sample size of the individuals interviewed was determined according to the equation developed by Ostrom (1990).

$$n = \frac{Z^2 p(1-p)}{Q^2} = n = \frac{(1.96)^2 \times 0.75(1-0.75)}{(0.05)^2} = 288$$

where n = required sample size, Z = confidence level at 95% (standard value of 1.96), p = proportional of farmers estimated at 75%s, Q = marginal error at 5% (0.05).

The initial sample size of 288 respondents was determined using a sample size formula to ensure the desired confidence level and margin of error. However, only 260 interviews were conducted due to logistical challenges, including difficulties accessing certain remote areas and time constraints that limited data collection. While this reduction may slightly increase the margin of error, it does not significantly affect the confidence level of the study. Semi-structured interviews were conducted in each village. Each questionnaire was administered for approximately 2 h to ensure effective communication and accuracy in data collection. Interviews were conducted with key informants familiar with the local languages and Swahili. The responses were first translated from their local languages into Swahili and subsequently into English. This approach ensured inclusivity and minimized language barriers, allowing for comprehensive data collection across different groups within the community.

2.3 Data collection

The regional administration and local government officers in respective regions and districts were consulted before the beginning of the interview to obtain a research permit. The verbal consent was established before the interview by following the code of ethics, such as clarity of objectives and respect for cultural norms. The code of ethics was adapted from the International Society of Ethnobiology (ISE 2006/2008), available on the website http://ethnobiology.net/code-of-ethics. The potential participants from each village were involved in the research discussion so that they understood the goal and the possible outcome of the study. The researcher allowed the participants to ask questions about the information gathered during data collection. Finally, the researcher asked the potential participants if they would like to participate in the study. The participants were assured of the confidentiality of the information collected from the survey, and their identity or personal information would not be revealed in any publication that may result from the study. The method allows phase-to-phase communication, providing ample time for participants to ask questions and get real-time clarification of the study before providing their voluntary agreement to participate.

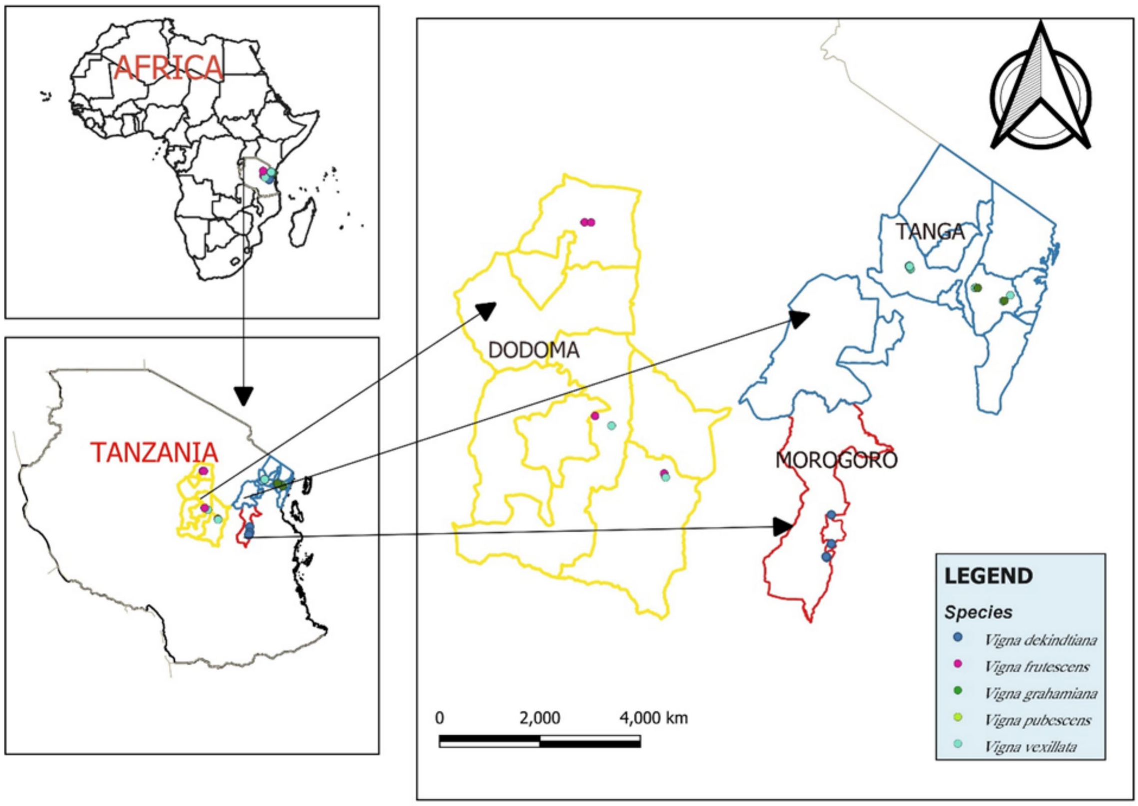

FIGURE 1
Shows study locations; the top left is the Africa map, the bottom left is the Tanzania map showing regions involved in data collection, and the right-hand map shows the areas and districts with wild cowpeas' distribution. The *V. vexillata* and *V. unguiculata* subsp. *pubescens* were called "Kunde pori." (Tanga) by Sambaa community. The *V. unguiculata* subsp. *dekindtiana* were called "*Kunde mbala*" in Morogoro by Uruguru community. *V. vexillata* and *V. frutescens* were called "*Nandala nyinda*" in Dodoma by Gogo community, and *V. frutescens* were called "*Kovalampera*" in Dodoma by Rangi community.

The Voucher specimens of wild cowpea species were collected from the field survey and used during an interview. The semi-structured interviews captured information on awareness and perception of wild cowpea species, including their local names and uses. The questionnaire was administered in Swahili language and translated into their local languages when needed. Each specimen's local names and uses were recorded, and the herbarium was prepared for submission to the National Herbarium of Tanzania (NHT) for identification.

2.3.1 Pre-testing of the questionnaire

The questionnaire was designed as a semi-structured instrument, incorporating open-ended and closed-ended questions to capture detailed insights while ensuring comparability across responses. The structured sections included demographic information, knowledge and perception of Vigna species, habitat preferences, and environmental factors influencing species distribution. Additionally, open-ended questions allowed respondents to elaborate on their experiences and observations, ensuring a more nuanced understanding of the subject.

Before full implementation, the questionnaire underwent pre-testing with a small representative group to assess its clarity, relevance, and ability to capture the intended information effectively. During this phase, adjustments were made to improve question phrasing, eliminate ambiguities, and enhance respondent comprehension. Notably, the language of the questionnaire was adapted to better suit the target participants, ensuring that the terminology and expressions were culturally and contextually appropriate. This process significantly improved the reliability and validity of the instrument, ensuring that it accurately reflected field conditions and respondent perspectives.

2.3.2 Focus group discussions

A focus group discussion (FDG) was conducted with 20 people, which involved five people from each group based on gender and age to triangulate information collected by other research tools. This method facilitated an in-depth exploration of these species' perceptions, experiences, and traditional knowledge, enabling a comparative analysis of gender- and age-based variations in awareness and utilization.

2.4 Data analysis

The data analysis involved descriptive analysis to determine the sociodemographic characteristics and the relationship between awareness and gender, age categories, and education level. Furthermore, the descriptive analysis was used to determine the proportion of relation within a single variable, such as plant use categories, specific uses, and plant part used. Quantitative analysis was done using the ethnobotanyR package in R software (Whitney, 2019) to assess ethnobotanical indices such as frequency of citations, number of uses (NU), use reports (UR), cultural importance (CI), the relative frequency of citation (RFC), relative importance (RI), and cultural value (CV).

2.4.1 Descriptive statistics

The descriptive analysis involved the chi-square test goodness-of-fit to determine the proportion of distribution from a single categorical variable (Gerbing, 2020), such as plant use categories, specific uses, and plant parts used within a dataset. In addition, the chi-square test of independence (Gerbing, 2020) was used to determine the proportion of awareness between males and females. Moreover, Fisher's exact test (Fisher, 1922) was used to determine the relationship between age categories and awareness.

2.4.2 Quantitative analysis

The quantitative data was analyzed using the R software ethnobotany package to determine the Vigna wild cowpeas' ethnobotanical indices. Before analysis, data was transformed from character to numeric to fit into the R program. The ethnobotany indices were computed based on informant consensus.

Use report (UR) per species determines the total number of uses for plant species by all informants within each use category (Whitney, 2019). Therefore, the use report index determined the number of uses for the species when informants (*i* to *Ni*) mentioned uses of the wild cowpea species in a specific use category. Use reports are the counts of the number of informants who mentioned every use category for the species (Equation 1) sum of the uses in every use category as described by Whitney (2019).

$$\mathrm{UR_s} = \sum_{u=u_1}^{u\mathrm{NC}} \sum_{i=i}^{iN} \mathrm{UR}_{ui} \tag{1}$$

The cultural importance (CI) index was calculated by dividing the use report by the number of informants to account for various uses of the species (Whitney, 2019). The $\mathrm{CI_s}$ function used to calculate the cultural importance of each species is shown in Equation 2;

$$\mathrm{CI_s} = \sum_{u=u_1}^{u\mathrm{NC}} \sum_{i=i}^{iN} \mathrm{UR}_{ui} / N \tag{2}$$

This index considers the spread of the use (number of informants) for each species and its versatility, i.e., the diversity per species was calculated as the sum of informants that cited (mentioned) uses of species as described by Prance et al. (1987) in Equation 3.

$$\mathrm{FC} = \sum_{i=i}^{iN} \mathrm{UR}_i \tag{3}$$

The number of uses (NU) per species is the sum of all use categories for which species were considered useful (Prance et al., 1987; Whitney, 2019) as shown in Equation 4. The function of $\mathrm{NU_s}$ is as follows:

$$\mathrm{NU_s} = \sum_{u=u_1}^{uNC} \tag{4}$$

where *NC* is the number of use categories.

The *Relative Frequency of Citation (RFC) index* for each species was calculated as described by Tardío and Pardo-de-Santayana (2008) in Equation 5.

$$\mathrm{RFC} = \frac{\mathrm{FC_s}}{N} = \frac{\sum_{i=i}^{iN} \mathrm{UR}_i}{N} \tag{5}$$

whereby FC is the frequency of citation for each species, UR_i is the use report for all informants, and *N* is the total number of all informants interviewed in the study area.

Relative Importance Index (RII) for each species in the data set was calculated by using Equation 6 below

$$\mathrm{RII} = \frac{\mathrm{RFC_{s(max)}} + \mathrm{RNU_{s(max)}}}{2} \tag{6}$$

$\mathrm{RFC_{s(max)}}$, the relative frequency of citation over the maximum, was obtained when $\mathrm{FC_s}$ were divided by the maximum value in all the survey species. [$\mathrm{RFC_{(max)}} = \mathrm{FC_s}/\mathrm{max}$] and $\mathrm{RNU_{s(max)}}$ is the relative number of use categories over the maximum, which is obtained when the number of uses of the species is divided by the maximum value in all the species of the survey [$\mathrm{RNU_{s(max)}} = \mathrm{NU_s}/\mathrm{max(NU)}$] as described by Tardío and Pardo-de-Santayana (2008).

The cultural value (CV_s) index was used to assess the importance of species' cultural, practical, and economic dimensions (ethno) and was determined as shown in Equation 7.

$$\mathrm{CV_s} = \left[\mathrm{NU_s} / \mathrm{NC}\right] \times \left[\mathrm{FC_s} / N\right] \times \left[\sum_{u=u_1}^{u\mathrm{NC}} \sum_{i=i}^{iN} \mathrm{UR}_{ui} / N\right] \tag{7}$$

The number of use categories (NC) was divided where the first factor is the number of uses ($\mathrm{NU_s}$) reported for the ethnospecies in the surveyed area. The second factor is the frequency of citation ($\mathrm{FC_s}$) for each species divided by the total number of informants (*N*) interviewed, and this factor is also known as the relative frequency of citation (RFC). The third factor is the use report (UR), the sum of several participants who mentioned each species use, divided by several informants accounting for various uses *N*. All three factors are multiplied together as described by Tardío and Pardo-de-Santayana (2008).

Fidelity level (FL) per species the fidelity level per species was calculated as described by Whitney (2019) in Equation 8.

$$\mathrm{FL} = \frac{N_\mathrm{s}}{\mathrm{UR_s}} \tag{8}$$

N_s is the number of informants that use certain species for a specific purpose, and $\mathrm{UR_s}$ is the total number of use reports for the species.

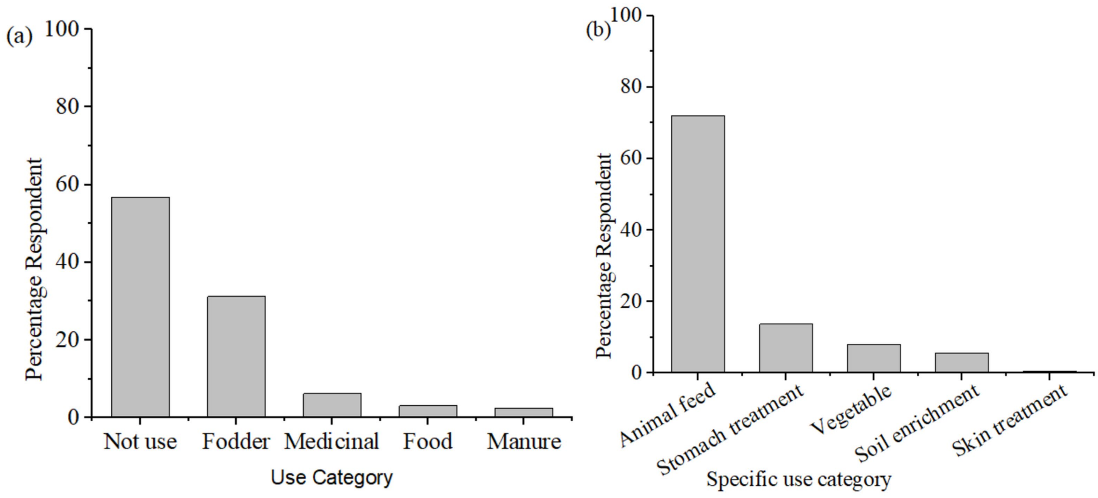

FIGURE 2
The proportion of **(a)** use categories and **(b)** specific use categories for wild cowpeas in 13 selected villages of Tanzania.

3 Results

3.1 Species identified during the survey

During field surveys of five wild cowpea species [*V. vexillata* (L.) A. Rich. (1845), *V. unguiculata* subsp. *pubescens* (R. Wilczek) Pasquet (1993), *V. unguiculata* (L.) Walp. subsp. *dekindtiana* (Harms) Verdc. (1970), *V. frutescens* A. Rich. (1848), and *V. grahamiana* (Wight & Arn.) Verdc (1970), currently known as *Wajira grahamiana* (Wight & Arn.) Verdc (2004)] were identified in the sampled regions. The botanical names were clarified using websites such as Plants of the World Online[1] and Germplasm Resources Information Network (GRIN).[2] The study did not cover the entire country due to logistics, expenses, ecological distribution, and seasonal variation. Therefore, the present results reflect the species that were available and accessible within the specific areas covered by the field surveys. However, this does not represent all wild cowpea species in the regions. The sampled geographic range covered during the surveys does not encompass all habitats in the different regions of Tanzania where wild cowpea species could occur. In addition, species distributions depend on the agroecological zones, climatic conditions, and seasonality during surveys. Several wild cowpea species were recorded from the herbarium specimens in the National Herbarium of Tanzania (NHT), but not all species were encountered during field surveys.

3.2 Descriptive analysis

3.2.1 Sociodemographic information of participants

Sociodemographic information showed that males were 52% (134) and females were 48% (126). The age categories of the participants were grouped into three levels: youths (20–39), adults (40–59), and elders (60–99). The most prominent participants were adults (43%), youth participants 35% and elders 22%. Fisher's exact test results showed a statistically significant association between age category and awareness of wild cowpeas ($p = 0.04$), with a small effect size ($d = 0.3$), suggesting that the awareness of wild cowpeas varies significantly across different age groups. The age category between 20–39 shows poor awareness of the uses of wild cowpeas. Further, Fisher's exact test showed no association between education levels and awareness of wild cowpeas ($p = 1$). This indicates that awareness is uniformly distributed across different levels of education.

3.2.2 Uses categories of wild cowpeas

The chi-squared goodness-of-fit test reveals significant differences in the distribution of use categories within the dataset ($\chi^2 = 452.906$, df = 4; $p = 0.001$). Most respondents (56.7%) reported no use of wild cowpeas. The remaining (31.2%) use plants as fodder, the second most common use category. Medicinal (6.2%), food (3.5%), and manure (2.5%) were the lowest use category (Figure 2a). Based on the specific uses category, there is a highly significance difference in the distribution of the specific uses of wild cowpeas ($\chi^2 = 303.543$, df = 4; $p = 0.001$). Most respondents (72%) confirmed that wild cowpeas are used as animal feed, followed by medicinal uses specifically for stomach relief (13.7%) and skin treatment (0.6%), 8% of the wild cowpeas are used as leafy vegetables, and 5.7% used to improve soil fertility in the farms (Figure 2b).

3.2.3 Part of the plant used in *Vigna unguiculata* crop wild cowpeas

The results indicated that older leaves are the most commonly used plant part, with citations of 74.9%, followed by roots (12%), young leaves (7.4%), and whole plants (5.7%) (Figure 3). Most informants mainly used the older leaves as animal feed and soil cover. In contrast, young leaves of wild cowpeas had been used as vegetables, particularly in the Morogoro region, where *V. unguiculata* subsp. *dekindtiana* was the dominant species. Further, the roots of wild cowpeas were used as medicine to treat gastrointestinal disorders.

1 https://powo.science.kew.org

2 https://www.ars-grin.gov/

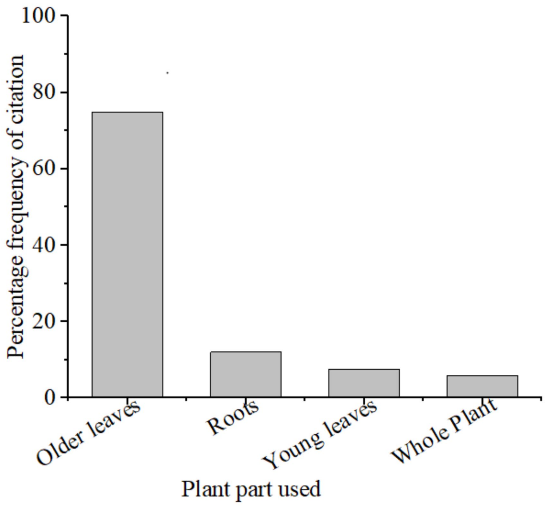

FIGURE 3
Proportions of the wild cowpeas plant parts used by farmers in 13 selected villages.

3.2.4 Quantitative analysis

3.2.4.1 Frequency of citation and use report

All the species sampled had the frequency of citation (FC) and use report (UR) of 156 and 175, respectively. The species *V. vexillata* was the most common in all surveyed villages with FC of 53, which accounts for 33% of the total FC recorded, followed by *V. unguiculata* subsp. *dekindtiana* (45), *V. frutencens* (39), *V. unguiculata* subsp. *Pubscens* (12) and *V. grahamiana* (7). *Vigna vexillata* was common in the Tanga and Dodoma regions, with an FC 53. However, the frequency of citations per location was higher for *V. unguiculata* subsp. *dekindtiana* at Tangeni village in the Morogoro region (FC = 20), followed by *V. vexillata* in Manghangu village in the Dodoma region (FC = 13) and *V. frutescens* at Mauno village in Kondoa district (FC = 12). The lowest frequency of citations of 3 was recorded for *V. unguiculata* subsp. *pubescens*, *V. unguiculata* subsp. *dekindtiana*, and *V. vexillata* in Magoda and Kwalukonge villages in the Tanga region (Table 1). Moreover, the *V. unguiculata* subsp. *dekindtiana* in Tangeni village recorded the highest use report (UR) of 27, followed by Kididimo (19) and Mnyanza (12) in the Morogoro region. The rest of the species UR's contributions ranged between 3 and 11 in different locations (Table 1).

3.2.5 Cultural importance and number of uses

All the species sampled had the cultural importance (CI_s) and the number of uses (NU_s) of 8.877 and 33, respectively (Table 1). *V. unguiculata* subsp. *dekindtiana* assigned, respectively, the highest cultural importance (CI) of 1.125 and 0.95 in Tangeni and Kididimo villages, with significantly high NU at Myanza (4), Kididimo (3), and Tangeni villages (3) in the Morogoro region (Table 1).

3.2.6 Relative frequency of citations and relative importance

The relative frequency of citations (RFC_s) values ranged from 0.15 to 0.833 for all species, with *V. unguiculata* subsp. *dekindtiana* recording the highest RFC_s of 0.833 at Tangeni, followed by Kididimo (0.6) and Mnyanza (0.35) in the Dodoma region. *V. frutescens* recorded relatively high RFC values of 0.6 and 0.55 at the Mauno and Kawawa villages, respectively. The Relative Importance Index of each Vigna species to the local communities revealed the lowest RI of 0.46 for *V. unguiculata* subsp. *dekindtiana* and *V. vexillata* at Kwalukonge village Tanga (Table 1).

3.2.7 Cultural values for ethnospecies

The cultural value (CV_e) index for ethnospecies ranged between 0.006 and 0.703, with *V. unguiculata* subsp. *dekindtiana* recording the highest cultural value of 0.703 and 0.46 at Tangeni and Kididimo villages. The remaining species and villages recorded the lowest CV values, ranging from 0.015–0.2 (Table 1).

3.3 The interactions between user categories, experts, and species collected

The Sankey diagrams (Figures 4–6) illustrate the relationship between wild cowpea species, their reported uses, and the informants who provided the data from the three regions surveyed. On the left side, the diagram categorizes the uses of wild cowpea species into four main categories: Food, Fodder, medicine, and Green Manure. These categories are connected through coloured flows to the corresponding wild cowpea species in the central column. The species included in the diagram are *V. dekindtiana*, *V. grahamiana*, *V. pubescens*, and *V. vexillata*. Each species is further linked to the informants (experts) on the right side of the diagram, who provided the use reports. Each flow represents the specific use of a wild cowpea species, as mentioned by an informant. The diagram visually demonstrates how different species are utilized and highlights the distribution of knowledge among informants. The varying thickness of the lines represents the frequency of reports for each use category, providing insight into the prominence of each use. The informants 051, 052, 053, 054, 055, 056, 057, and 058 from the Tanga region use the species *V. unguiculata* subsp. *dekindtiana* and *V. grahamiana* for food. Most informants in the same area use *V. unguiculata* subsp. *pubescens* for livestock feeding, while *V. vexillata* is commonly used for medicinal purposes and green manure (Figure 4). Furthermore, in the Morogoro region, *V. unguiculata* subsp. *dekindtiana* was the only wild cowpea recorded and widely used by informants in different use categories (Figure 5). The dominance of this species in Morogoro could be influenced by ecological suitability. A previous report by Lush et al. (1980) revealed that environmental factors (rainfall, temperature, and soil) are key to the abundance and distribution of wild cowpeas. Figure 6 shows that the *V. frutescens* and *V. vexillata* are mainly used as medicine and feeds for animals in the Dodoma region.

3.4 Spearman correlation between cultural indices

Spearman correlations revealed positive correlations among the variables tested (Table 2). All the correlations were significantly high at $p < 0.05$ ($n = 260$). The correlation index between the FC and UR is significantly high (0.98). Moreover, the cultural value (CV_e) index highly correlated with all ethnobotany

TABLE 1 Showing the values of each ethnobotanical indices by locations.

Region	District	Village	Species	FC_s	UR_s	NU_s	CI_s	RFC_s	RI_s	CV_e
Tanga	Muheza	Lusanga	*V. vexillata*	4	4	2	0.174	0.174	1	0.015
Tanga	Muheza	Lusanga	*V. unguiculata* subsp. *pubescens*	4	4	2	0.174	0.174	1	0.015
Tanga	Muheza	Ngomeni	*V. vexillata*	5	5	1	0.294	0.294	1	0.022
Tanga	Muheza	Ngomeni	*V. unguiculata* subsp. *pubescens*	5	5	1	0.294	0.294	1	0.022
Tanga	Muheza	Magoda	*V. vexillata*	3	4	2	0.400	0.300	1	0.060
Tanga	Muheza	Magoda	*V. unguiculata* subsp. *pubescens*	3	3	1	0.300	0.300	0.750	0.022
Tanga	Korogwe	Kwalukonge	*V. grahamiana*	7	8	2	0.400	0.350	1	0.070
Tanga	Korogwe	Kwalukonge	*V. vexillata*	3	3	1	0.150	0.150	0.464	0.006
Tanga	Korogwe	Kwalukonge	*V. unguiculata* subsp. *dekindtiana*	3	3	1	0.150	0.150	0.464	0.006
Morogoro	Morogoro urban	Kididimo	*V. unguiculata* subsp. *dekindtiana*	13	19	3	0.950	0.650	1	0.463
Morogoro	Mvomero	Mnyanza	*V. unguiculata* subsp. *dekindtiana*	9	12	4	0.462	0.346	1	0.160
Morogoro	Mvomero	Tangeni	*V. unguiculata* subsp. *dekindtiana*	20	27	3	1.125	0.833	1	0.703
Dodoma	Chamwino	Mahama	*V. vexillata*	7	7	1	0.350	0.350	1	0.031
Dodoma	Chamwino	Kawawa	*V. vexillata*	11	11	1	0.550	0.550	1	0.076
Dodoma	Chamwino	Kawawa	*V. frutescens*	11	11	1	0.550	0.550	1	0.076
Dodoma	Mpwapwa	Behelo	*V. vexillata*	7	7	1	0.467	0.467	1	0.054
Dodoma	Mpwapwa	Behelo	*V. frutescens*	7	7	1	0.467	0.467	1	0.054
Dodoma	Mpwapwa	Manghangu	*V. vexillata*	13	13	1	0.520	0.520	1	0.068
Dodoma	Kondoa	Bumbuta	*V. frutescens*	9	9	2	0.450	0.450	1	0.101
Dodoma	Kondoa	Mauno	*V. frutescens*	12	13	2	0.650	0.600	1	0.195

UR_s, use reports; CI_s, cultural importance; FC_s, frequency of citations; NU_s, number of uses; RFC_s, relative frequency of citations; RI_s, relative importance; CV_e, cultural value for ethnospecies.

indices evaluated (Table 2). In addition, the cultural importance (CI_s) index is highly correlated with the FC, UR, and RFC (Table 2).

3.5 Fidelity level per species

The fidelity level was assessed for each wild cowpea (Table 3). *V. frutescens* had the highest fidelity level of 97.44%, followed by *V. vexillata* and *V. unguiculata* subsp. *pubescens*, with fidelity levels of 96.23 and 83.33%, respectively, which were linked to the use category of fodder (animal feeds). *V. grahamiana* also had a high fidelity level of 71.43 and 42.86%, which was linked to the use category of food and fodder, respectively. The fidelity level of *V. unguiculata* subsp. *dekindtiana* was 53.33 and 48.89%, which were linked to the use category for fodder and medicine, respectively. The lowest fidelity level value was assigned to *V. vexillata* under the use category of medicine (1.89%) (Table 2).

4 Discussion

4.1 Farmers' awareness of the uses of wild cowpeas and source of knowledge

The farmers considered wild cowpeas for multipurpose uses (food, fodder, medicine, green manure) and perceived them as important legumes that lack awareness in the communities and scientific attention. Wild cowpeas are locally named based on the tribe interviewed. In the Tanga region, the *V. vexillata* and *V. unguiculata* subsp. *pubescens* were identified as "*Kunde pori*." while in the Morogoro region, *V. unguiculata* subsp. *dekindtiana* was named "*Kunde mbala*" in the Uruguru community. In the Dodoma region, *V. vexillata* and *V. frutescens* were identified as "*Nandala nyinda*" in the Gogo community, while *V. frutescens* in the Kondoa district was named "*Kovalampera*" in the Rangi community. This reveals that the wild cowpeas are named differently by different ethnic groups, which calls for a botanical study to establish passport data for these incredible plants.

Although a high diversity of wild cowpeas has been recorded in this study, the results reveal little awareness of the uses of these species in the area surveyed. Among those few informants who avowed to use the species for different purposes, they inherited the knowledge from their elders. This implies a need to build awareness of these species among the broader community, as they have significant ecological and social impacts on the community. The world population is estimated to be 9.7 billion by 2050 (Pawlak and Kołodziejczak, 2020), which will increase food demand, especially in Sub-Saharan African countries; deliberate efforts should be put forward to increase the awareness of wild cowpeas species of cultivated plants that can be used for food and feeds. Moreover, the drastic climate change is worsening food availability, particularly in Sub-Saharan African countries. The wild cowpea species will provide genes against the extreme adverse effects of climate change. This calls for utilizing the untapped genetic diversity of the existing wild cowpeas species to improve cultivated cowpeas (Zhang et al., 2019), as they are an essential source of genes for resistance to diseases, pests, and stresses such as drought and extreme temperatures (Scheelbeek et al., 2018).

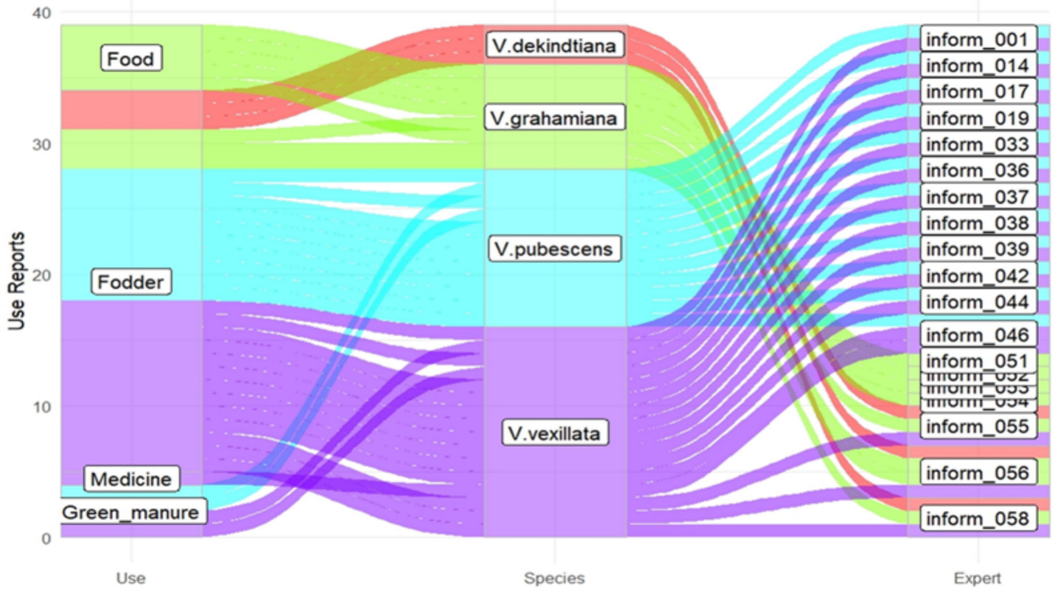

FIGURE 4
Relationship between use categories, the species, and the informants (people) in the Tanga region.

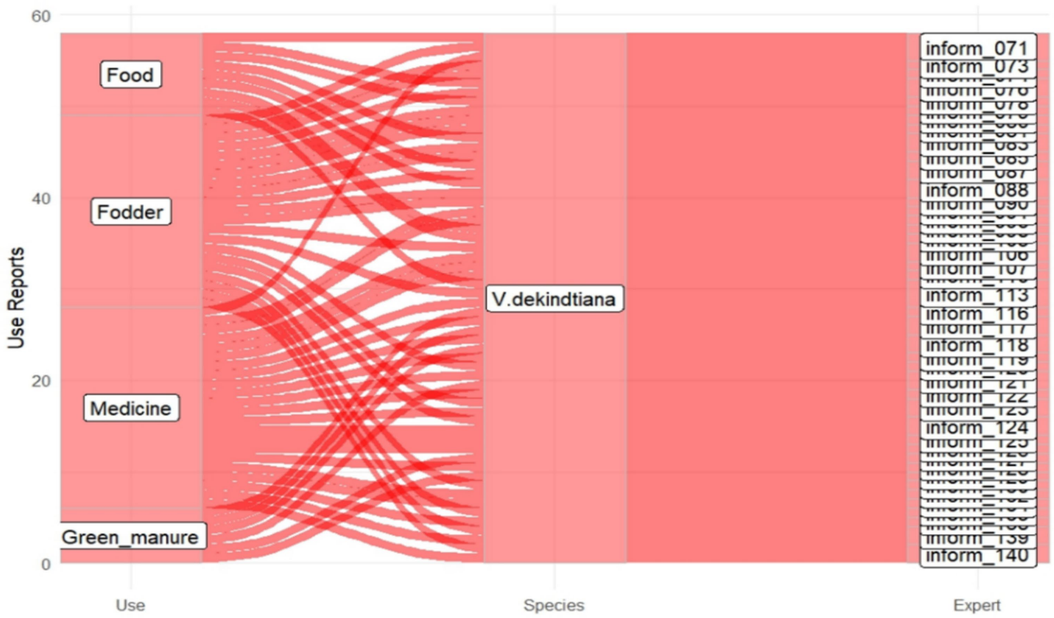

FIGURE 5
Relationship between use categories, the species, and the informants in the Morogoro region.

From this study, few informants have shown the importance and have used wild cowpea species for different purposes. For example, wild cowpea species have been used for livestock feeding in the Dodoma region. During a long dry spell, when all alternative plants die, most wild cowpea species retain green leaves, and farmers harvest them for goat and sheep feeding. The tribes of "Gogo" and Hadzabe in the Dodoma region have used the tuber of *V. frutescens* as a food and water source during dry periods (Schoeninger et al., 2001). Moreover, in the Morogoro and Tanga regions, the wild cowpea species have been used as cover crops and animal feeds, and few informants use them for medicinal purposes, e.g., in the Morogoro region, the informants shown to use *V. unguiculata* subsp. *dekindtiana* as remedial for the gastrointestinal treatment. Similarly, Harouna et al. (2018) reported the uses of wild cowpeas for fodder and medicinal purposes in Arusha and Kilimanjaro regions.

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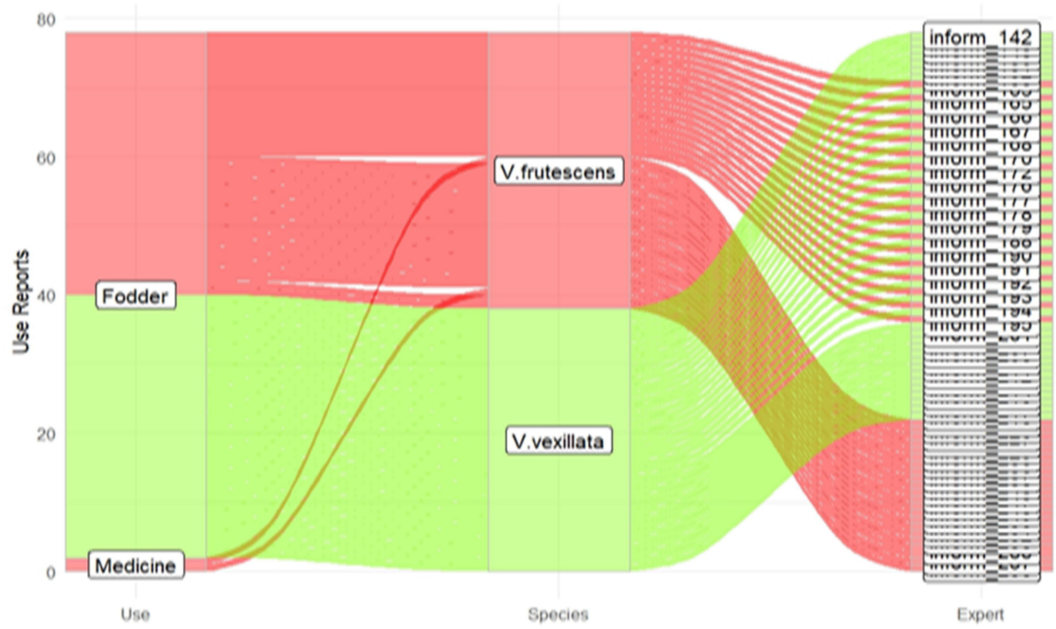

FIGURE 6
Relationship between use categories, the species, and the informants in the Dodoma region.

TABLE 2 Spearman rank order correlations among all ethnobotany indices studied.

	UR_s	NU_s	CI_s	RFC_s	RI_s	CV_e
FC_s	0.98	0.52	0.90	0.91	0.59	0.86
UR_s		0.63	0.90	0.89	0.62	0.92
NU_s			0.30	0.23	0.36	0.56
CI_s				0.98	0.53	0.91
RFC_s					0.52	0.88
RI_s						0.56

UR_s, use reports; CI_s, cultural importance; FC_s, frequency of citations; NU_s, number of uses; RFC_s, relative frequency of citations; RI_s, relative importance; CV_e, cultural value for ethnospecies.

TABLE 3 Show the species, primary use, and fidelity level from 13 villages surveyed.

sp_name	Primary use	FL_s
V. unguiculata subsp. *dekindtiana*	Food	20.00
V. unguiculata subsp. *dekindtiana*	Fodder	53.33
V. unguiculata subsp. *dekindtiana*	Medicine	48.89
V. unguiculata subsp. *dekindtiana*	Green manure	13.33
V. frutescens	Fodder	97.44
V. frutescens	Medicine	5.13
V. grahamiana	Food	71.43
V. grahamiana	Fodder	42.86
V. unguiculata subsp. *pubescens*	Fodder	83.33
V. unguiculata subsp. *pubescens*	Green manure	16.67
V. vexillata	Fodder	96.23
V. vexillata	Medicine	1.89
V. vexillata	Green manure	3.77

The findings of this study reveal an inadequacy of knowledge and awareness on the conservation of wild cowpea species. Most informants do not consider these plants valuable for agricultural, cultural, and economic purposes. They consider wild cowpeas as naturally occurring species that grow abundantly in various environments, leading to a general disregard for their conservation (Harouna et al., 2019). This perception poses significant challenges to preserving wild cowpea species, particularly those with potential agronomic, nutritional, and ecological benefits (Harouna et al., 2020). The lack of conservation initiatives for wild cowpea species suggests a gap in awareness regarding their potential uses. While farmers may not currently see economic or food value in these plants, research has shown that underutilized species often play a critical role in food security, especially during periods of environmental stress or crop failure (Brilhante et al., 2023; Manda et al., 2025). Encouraging the sustainable use of wild cowpea species through awareness programs, participatory research, and value-chain development could help integrate these species into local farming systems, ensuring their conservation and contribution to rural livelihoods.

Additionally, the study highlights the need for in-situ conservation strategies, particularly in regions where wild cowpea species are naturally abundant. Establishing protected areas, community seed banks, and on-farm conservation initiatives could help maintain the genetic diversity of these species. Engaging local communities in conservation efforts by demonstrating the potential benefits of wild cowpeas—such as their nutritional value, soil-enriching properties, or potential market opportunities—could shift perceptions and encourage more proactive conservation measures.

4.2 The uses of wild cowpeas

The results revealed that the leaves of the wild cowpeas are frequently used for multiple purposes, such as vegetables, animal food, and medicine. The young tender leaves of *V. unguiculata* subsp. *dekindtiana* and *V. grahamiana* have been used as vegetables. For instance, the informants have used tender leaves of *V. unguiculata* subsp. *dekindtiana* as a vegetable in the Morogoro and Tanga regions. This result corroborates a previous report by Adegbuyi et al. (2019), who pointed out that tender leaves of wild cowpeas are used as vegetables. In addition, Alemu et al. (2024) have previously reported using wild *V. unguiculata* subsp. *dekindtiana* as a leafy vegetable for human consumption. However, farmers in all study areas used wild cowpeas as animal feed, especially those farmers who practice mixed farming. They harvest wild cowpeas to feed their livestock, particularly cows and goats. Alemu et al. (2019) confirmed that wild cowpea leaves are an essential food source for some African cultures, further revealing that they are also used for animal feed and green manure. Moreover, Harouna et al. (2024) suggested that further studies should be done to assess the protein content of different plant parts of wild cowpeas, such as leaves, roots, and stems of wild cowpeas, to unveil the essential source of protein. Interestingly, the leaves of *V. vexillata* and *V. frutescens* have been used as ethnomedicine to treat gastrointestinal problems in the Tanga and Dodoma regions. In the Morogoro region, the roots of *V. unguiculata* subsp. *dekindtiana* have been used to treat gastrointestinal disorders. These results concur with previous reports by Mazerand and Cock (2020), Adegbuyi et al. (2020), and Akinpelu et al. (2017), reporting the ethnomedicinal effects of *V. vexillata* leaves, roots, and cambium layer. Although the ethnomedicinal effects of wild cowpeas are known worldwide, the awareness in Tanzania is minimal, with only 6% of local communities from 13 sampled villages aware of the medicinal potential of wild cowpeas. Based on the use category, species are used as human food, animal food, and medicinal and soil enrichment materials (Harouna et al., 2018). The informants reported wild cowpea, *V. unguiculata* subsp. *dekindtiana*, in all four use categories (food, fodder, medicine, and green manure). Similar results were reported by Catarino et al. (2021) in Angola, confirming the potential link between the species *V. unguiculata* subsp. *dekindtiana* and the socioeconomic importance to human beings. Further, Gonçalves et al. (2016) and Timko and Singh (2008) reported wild cowpeas' social and economic importance in SSA, narrating the importance of conservation. A high abundance of the species *V. unguiculata* subsp. *dekindtiana* was revealed in the Morogoro region, confirming that the area is a hot spot and could be used for *in situ* conservation. The species *V. vexillata* was mentioned in three use categories (fodder, medicine, and green manure). *V. unguiculata* subsp. *pubescens*, *V. grahamiana*, and *V. frutescens* were mentioned in only two use categories for each species. *V. unguiculata* subsp. *pubescens* (fodder and green manure), *V. frutescens* (medicine and fodder), and *V. grahamiana* (food and fodder). The potential uses of wild cowpeas revealed in this study underscore the importance of conserving these naturally occurring plants through *ex-situ* as seed or in situ to reduce food and nutritional insecurity (Catarino et al., 2021; Owade et al., 2020). However, due to insufficient knowledge, most informants give little attention to these species. The informants confirmed that the tender leaves of the wild cowpea (*V. unguiculata* subsp. *dekindtiana*) taste similar to cultivated cowpea (*V. unguiculata* subsp. *unguiculata*). From this study, the fidelity level of 20 for *V. unguiculata* subsp. *dekindtiana* under the use category of food, which means that less than half of the informants pointed out as a vegetable while *V. grahamiana* has been used by the majority of informants as a vegetable. Therefore, *V. unguiculata* subsp. *dekindtiana* and *V. grahamiana* are vegetables, but only a few people use them and know their relevance as food. These results align with findings reported by Harouna et al. (2018) in the Kilimanjaro and Arusha regions when assessing the usability of wild cowpeas, which confirmed that they have been used as green vegetables and served during dishes. Moreover, the review by Owade et al. (2020) confirmed the importance of wild cowpeas as a vegetable in SSA. Wild cowpeas are used as animal feed, and this use category is cited by most of the informants interviewed in the study area. The informants suggested that they harvest the wild cowpeas to feed their livestock. Farmers believe that the leaves of wild cowpeas have higher nutritional values than other locally available plant species, which considers them important fodder for the livestock. Similarly, Dramé et al. (2023) reported the nutritional quality of wild cowpeas when used as fodder for livestock. Furthermore, Harouna et al. (2018) listed the nutritional value of *V. vexillata*, which contains a high protein content of ~29.3% and a sufficient amount of minerals such as sulphur and amino acids that range from 2.05 to 3.63 g per 16 g N with resistant starch content ranging from 64 to 75%. Informants ascertained that all species recorded during a survey in 13 villages had been perceived as good sources of feed, contributing significantly to the livelihood of local communities as they get income from selling quality milk.

Informants in the Tanga and Morogoro regions mentioned three wild cowpeas species (*V. unguiculata* subsp. *dekindtiana*, *V. vexillata*, and *V. unguiculata* subsp. *pubescens*) as important sources of nutrients in their farms when left in the fields. The informants also revealed that wild cowpeas prevent soil erosion in their farms as they stabilize the soil. Informants from the Tanga region reported that wild cowpeas (*V. vexillata* and *V. unguiculata* subsp. *pubescens*) are usually left in sisal farms to improve soil fertility. In addition, farmers in the Morogoro region believed that wild cowpeas (*V. unguiculata* subsp. *dekindtiana*) improve soil fertility in farms when they grow as weeds during off-seasons. Legumes are acknowledged for improving soil fertility as they form symbiotic relationships with rhizobium bacteria (van Zonneveld et al., 2020), which fix atmospheric nitrogen in the soil. Catarino et al. (2021) revealed that wild cowpeas significantly affect soil improvement by adding atmospheric N and avoiding erosion during runoff. Finally, the informants revealed the importance of wild cowpeas in preventing and curing some human diseases in all surveyed regions. In the Tanga region, for example, some informants cited that the leaves of *V. vexillata* are used to treat gastrointestinal and skin diseases. Similarly, some informants revealed the medicinal effects of *V. unguiculata* subsp. *dekindtiana* in the Morogoro region for treating stomach pains. The fidelity level of *V. unguiculata* subsp. *dekindtiana* for medical uses is 48.89, meaning less than half of the informants know about the uses of *V. unguiculata* subsp. *dekindtiana* as a medicinal. Mazerand and Cock (2020) have reported the ethnomedicinal effects of wild cowpeas, which revealed some wild species have been used to prevent constipation problems in human beings. Furthermore, Leu et al. (2012) reported the ethnomedicinal effects of *V. vexillata* to cure inflammatory diseases. Moreover, the extract of various wild cowpea species has been reported to contain antioxidant properties (Doblado et al., 2005), reduction in cholesterol (Itoh and Furuichi, 2009), antibacterial

(Franco et al., 2006; Hori et al., 2006), and Anticancer (Joanitti et al., 2010).

4.3 Food security and climate change resilient

Cultivated cowpeas are called resilient crops due to their superiority over other crops to withstand adverse environmental conditions (Metwally et al., 2021). However, due to the highly adverse effects of climate change, the crop is slowly losing its capacity to withstand abiotic and biotic stresses (Raubach et al., 2021). Dumet et al. (2012) revealed that wild cowpeas evolved independently of human needs, adapted to various evolutionary forces, and are a reservoir of untapped genes. This diversity of genes may play a crucial role in improving the genetics of cultivated cowpeas in the context of climate change. Similarly, Metwally et al. (2021) reported the presence of genes for resistance to diseases, pests, and stresses such as drought and extreme heat in wild cowpeas, which can be harnessed through breeding programs to improve cultivated cowpea adaptation to drought, salinity, and heat (Scheelbeek et al., 2018). Moreover, Zhang et al. (2019) revealed that wild cowpeas harbour rich genetic diversity that can offer unique alleles for developing crop cultivars that are more resistant and resilient to harsh growing conditions. Based on this, the high diversity and abundance of wild cowpeas reported in this study can be utilized in breeding programs in the local context to improve yield performance and drought tolerance, as well as withstand high pressure from disease and pests exacerbated by climate change. This could curb malnutrition problems in the growing population, particularly those under 5 years of age, as it provides cheap protein to rural and urban dwellers, reducing food insecurity in the region. This study revealed the presence of a high diversity of wild cowpea species, which could be used for breeding programs to impart tolerance genes to abiotic and biotic stress.

4.4 Quantitative ethnobotany indices

This study analyzed cultural indices (CI) in each village (Table 1) to reveal which plant/plant parts are extensively used by people in surveyed regions. The *V. unguiculata* subsp. *dekindtiana* revealed the highest CI_s, RFC_s, and CV_e, showing that this species is culturally important to the community over other wild cowpeas due to its several uses and high citation frequency (Turner, 1988). The Tangeni village recorded that the *V. unguiculata* subsp. *dekindtiana* had the highest CI values, RFC_s, and CV_e (Table 1) over the other villages surveyed because of its multiple uses and frequency of citation on its usefulness. Moreover, the results revealed that the CI_s index and the RFC_s are highly correlated, implying that the culturally important species is determined by the frequency of citation and its usefulness under various use categories (Shaheen et al., 2017; Tardío and Pardo-de-Santayana, 2008). The *V. unguiculata* subsp. *dekindtiana* has the highest citations (FC = 20) and uses reports (UR = 27) per site; hence, these results aligned with the highest correlation result between FC and UR (0.98). For this reason, the species that have the highest citations are likely to have the highest number of use reports due to the high correlation results between FC and UR (0.98), and it has been demonstrated for *V. unguiculata* subsp. *dekindtiana* which have high FC and UR compared to the other species. A positive correlation between NU_s and CV_e index shows that the CV_e index gives excessive weight to the diversity of uses (Shaheen et al., 2017). Further, the *V. unguiculata* subsp. *dekindtiana* has been mentioned in four different uses, i.e., $NU_s = 4$; hence, *V. unguiculata* subsp. *dekindtiana* is more culturally valued than the other wild species observed due to its multiple uses and known among people due to their usefulness (Sõukand et al., 2013; Tardío and Pardo-de-Santayana, 2008).

4.5 The fidelity levels

The fidelity levels were used to determine the percentage of informants who cited the uses of the species under various use categories (food, fodder, medicine, and green manure). The species *V. frutescens* had the highest fidelity levels for the use category of fodder, indicating that this wild species is recognized as animal feed among the surveyed areas. Moreover, *V. grahamiana* revealed the highest fidelity level for the use category of food, followed by *V. unguiculata* subsp. *dekindtiana*, revealing that *V. unguiculata* subsp. *dekindtiana* and *V. grahamiana* are used as vegetables in most areas. For the case of the use category for medicine, *V. unguiculata* subsp. *dekindtiana* showed a significantly high fidelity level, implying that the species has medicinal value in society.

5 Conclusion

The wild cowpeas receive minimal attention from the farmers. The ignorance of wild cowpea legumes is not related to gender or education level, but it depends on the age category. Few farmers used wild cowpeas as animal feed, medicine, human food, and soil-improving material (green manure). According to the CI index, *V. unguiculata* subspecies *dekindtiana* is the most important species, with four uses (NU) and 58 UR, and it is the most cited species from the surveyed areas of Morogoro, Dodoma, and Tanga. The *V. unguiculata* subspecies *dekindtiana* has a high cultural value of 0.73 (CV) in Tangeni village. The CI and NU values for *V. unguiculata* subspecies *dekindtiana* in this study provide additional evidence that this species will likely be useful for utilization as food and fodder. The study demonstrated that leaves are part of plants that are highly used compared to other parts of plants. Wild cowpea species have been reported to contain genes for abiotic and biotic stress tolerance, which can be introgressed in cultivated varieties to improve performance. This calls for using the diversity of existing wild cowpea species reported in this study crossing with cultivated cowpea varieties to improve yield and increase regional food security. Despite the ignorance of wild cowpeas, many farmers perceive wild cowpeas as important legumes that need further research and scientific attention. In addition, farmers suggested that more research should be conducted to discover the medicinal ingredients in the wild cowpea extract of the plant parts to approve the use of these ingredients for health status. Nevertheless, further research needs to be conducted to ensure the effective use of these wild cowpea species as a source of protein for ruminant or non-ruminant animals.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Sokoine University of Agriculture. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because this research did not involve any human testing sample, was just interviewing on the importance of Vigna wild relative species in their local areas. We thought having verbal consent was better because it provide a phase to phase communication and the potential participants got ample time to ask questions and obtain immediate response from researchers. Verbal informed consent was obtained from the Ministry of Regional Administration and Local Government (Mr. Ali Rashid) and extension officers from Muheza District (Ruth Mwilongo). Village executive officer in Korogwe district in the Tanga region (Kajiti Mapande). Village executive officer in Kondoa District in the Dodoma region (Emmanuel Mayemba), village executive officer in Chamwino District in the Dodoma region (Paskazia Kaijage). Village key informants in the Mvomero district in the Morogoro region (George Teodoli), village key informant in the Morogoro urban district in the Morogoro region (Kassim Amin). Verbal consent was executed before starting the data collection process.

Author contributions

JG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. LL: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. GT: Conceptualization, Funding acquisition, Project administration, Visualization, Writing – original draft, Writing – review & editing. WH: Formal analysis, Resources, Visualization, Writing – original draft, Writing – review & editing. MZ: Conceptualization, Data curation, Formal analysis, Funding acquisition, Resources, Visualization, Writing – original draft, Writing – review & editing. SN'D: Data curation, Formal analysis, Funding acquisition, Visualization, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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