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The Contribution of *Chikanda* Orchids to Rural Livelihoods: Insights from Mwinilunga District of Northwestern Zambia

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Abstract

Studies examining the role of *chikanda* orchids in bolstering rural livelihoods coupled with the associated socio-economic intricacies remain absent, especially in African settings. This study examined the contribution of *chikanda* orchids in supporting rural livelihoods, taking into account socio-economic influences through a case study of the Mwinilunga District of northwestern Zambia. The study employed a mixed methods approach using 303 semi-structured questionnaires, complemented by three focus group discussions and nine in-depth interviews. Study findings showed that revenue generated from *chikanda* orchid sales supported rural livelihoods and served a crucial function in addressing food scarcity challenges. Income derived from *chikanda* orchid sales accounted for 30.8% of total household income and exhibited an income equalization effect of 8% among households. Participation in harvesting *chikanda* orchids exhibited a significant correlation with gender ($\chi^2 = 6$; $p < 0.05$) and marital status ($\chi^2 = 8$; $p < 0.05$). This study showed the significance of *chikanda* orchids in supporting livelihoods, including socio-economic influences, particularly for poorer households that exhibit vulnerability to food deficits. Consequently, the need to develop effective *chikanda* orchid management strategies that are locally tailored and acknowledge the socio-economic intricacies associated with the *chikanda* orchids trade is fundamental.

Keywords: *chikanda* orchids; non-timber forest products; wild edible plants; rural livelihoods; socio-economic factors

Academic Editors: Daowei Sun, Aizhi Yu, Xinliang Xu and David Mitchell

Received: 23 May 2025
Revised: 20 June 2025
Accepted: 23 June 2025
Published: 4 July 2025

Citation: Kwenye, J.M.; Kabwe, G.; Mulenga, P.; Dalu, M.T.B. The Contribution of *Chikanda* Orchids to Rural Livelihoods: Insights from Mwinilunga District of Northwestern Zambia. *Sustainability* **2025**, *17*, 6131. https://doi.org/10.3390/su17136131

1. Introduction

Non-timber forest products (NTFPs), defined as all biological resources obtained from forests for human consumption aside from timber [1], are vital in many rural settings of African developing nations. They are essential for fulfilling household subsistence needs and serve as a significant source of cash income, which helps to cover domestic expenses [2–4]. NTFPs also provide crucial natural insurance during emergencies, such as periods of food scarcity resulting from crop failures [5–7]. Furthermore, they hold traditional and cultural significance [7] and are integral to the livelihoods of rural communities [3,8], mostly poor households [9]. Since harvest locations are open or semi-open access and their extraction does not require specialized knowledge or equipment, NTFPs are especially appealing to the rural poor in Africa [6,10].

Among the diverse range of NTFPs, wild edible plants (WEPs) are especially noteworthy. In numerous developing nations, WEPs are a crucial food source for impoverished

households facing food insecurity [11,12]. They provide essential vegetables, tubers, nuts, and fruits that are vital for ensuring food availability and enhancing the nutritional quality of diets [4]. As a critical food resource, WEPs support approximately 300 million people in developing countries [13] and serve as important backup options in vulnerable nations susceptible to drought and famine [14–16]. When household income is low, there is a high propensity for women, with greater responsibility for cooking, to rely on WEPs more frequently, especially those living in poverty [9,17].

Wild terrestrial orchids of the family *Orchidaceae* are vital WEPs gathered for their edible tubers, particularly in the Southern African region [18,19]. The tubers are used for food and therefore traded within and across countries. Consequently, orchid collection has long been a tradition in numerous rural areas of developing nations [20]. In many African nations, *chikanda*, a traditional meatloaf-like dish, is made from processed orchid tubers, primarily from the genera *Disa*, *Hebenaria*, and *Satyrium* [21,22]. For ethnic groups in the northeastern part of Zambia, *chikanda* was traditionally eaten at the rural household level during famine or as a seasonal supplement to staple foods [23]. Over time, this traditional delicacy has gained popularity nationwide as a nutritious snack [24]. This has also been observed in other African countries in the southeastern region, such as Malawi, Tanzania, and Democratic Republic of Congo, where *chikanda* orchid tubers are traded within and across countries [19,25].

Wild terrestrial orchids have been studied from various scholarly viewpoints, including distribution, diversity and utilization patterns [19], domestication potential and nutrient composition [26], molecular species identification [24], genetic sequencing alongside species diversity [22], and properties [25], as well as diversity, frequency, and population density [27]. Some studies [18,23,28] have concentrated on the escalation in the demand for edible orchids, which has subsequently led to a proliferation of transnational commerce. In view of the increasing demand for *chikanda* orchid tubers, some studies have highlighted emergent concerns regarding their sustainability, as the considerable exploitation pressure poses a threat to their future existence [19,22,29]. Nevertheless, investigations that scrutinize the role of *chikanda* orchids in bolstering rural livelihoods, along with the intricate socio-economic dimensions pertaining to their collection and trade, remain conspicuously absent, thereby rendering such aspects inadequately comprehended, particularly within the African context. This gap exists notwithstanding the fact that orchids constitute one of the most extensive plant families engaged in commercial trade at the local, national, and international scales [30,31]. Consequently, our research represents the inaugural effort to investigate the contribution of *chikanda* orchids in supporting rural livelihoods, taking into account the influence of socio-economic factors through a case study conducted in the Mwinilunga District of northwestern Zambia. This study helps to contribute to a deeper understanding of the importance and potential of *chikanda* orchids from a rural livelihood perspective. It also provides valuable insights for fostering the sustainability of both the *chikanda* orchids and the communities that derive support from this vital WEP.

In this paper, we seek to address the following research questions: (a) Does the *chikanda* orchid trade contribute to supporting rural livelihoods? (b) Is participation in *chikanda* orchid collection and trade associated with socioeconomic factors? The conceptual framework upon which this investigation is anchored is depicted in Figure 1. Previous research has demonstrated that NWFPs are essential components of rural livelihoods [3,8,9] and are influenced by various socioeconomic factors, such as gender, wealth status, marital status, and education level, among others [3,32]. Consequently, the conceptual framework for this study asserts that the collection and trade of *chikanda* orchids contribute to enhanced rural livelihoods and are correlated with socioeconomic factors (Figure 1).

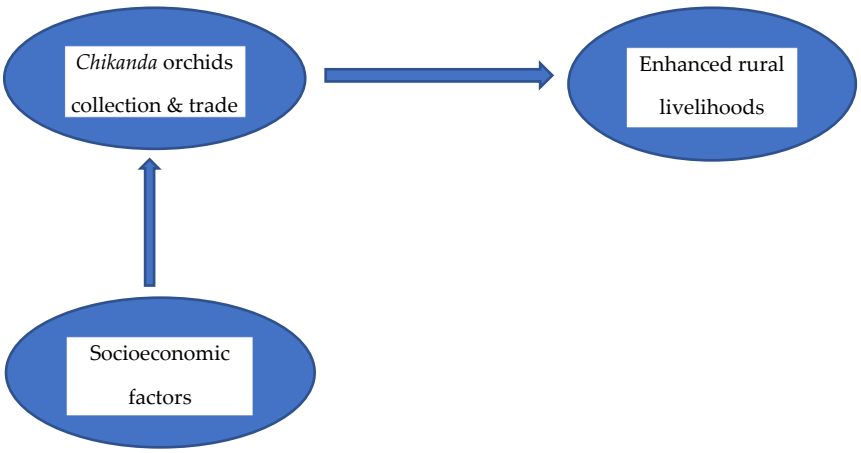

Figure 1. Conceptual framework.

2. Materials and Methods

2.1. Study Area

The study was conducted in Mwinilunga District, located in Zambia's northwestern province. The district receives 1386 mm of rainfall on average each year, with cool–dry season temperatures ranging from 6 °C to 15 °C and hot–dry season temperatures from 24 °C to 32 °C [33]. The district is rich in Miombo woodlands, as well as Kalahari and Cryptosepalum forests. According to the most recent census carried out in Zambia, the population of the Mwinilunga District stands at 136,770 [34].

The Mwinilunga District was chosen for this study based on evidence of the presence of terrestrial orchid species utilized in *chikanda* production. Based on their involvement in *chikanda* orchid gathering, three communities in the district were chosen for the study. The communities included Kasang'a, Munwa, and Nyamikanda, as shown in Figure 2. The Lunda ethnic group, who lives in the chosen communities, is anecdotally known to collect *chikanda* orchids for both subsistence and income generation.

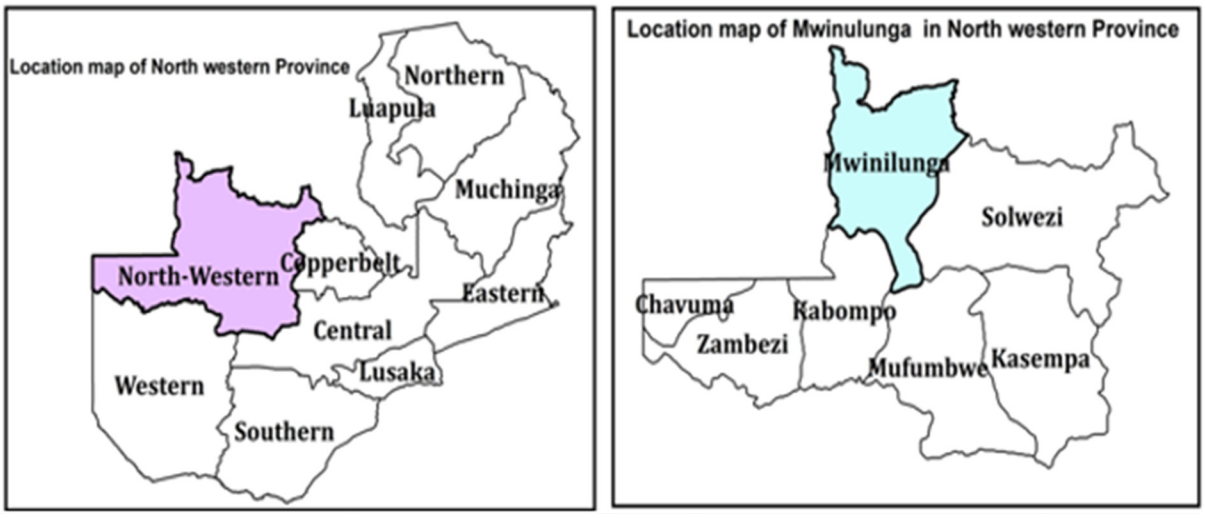

Figure 2. *Cont.*

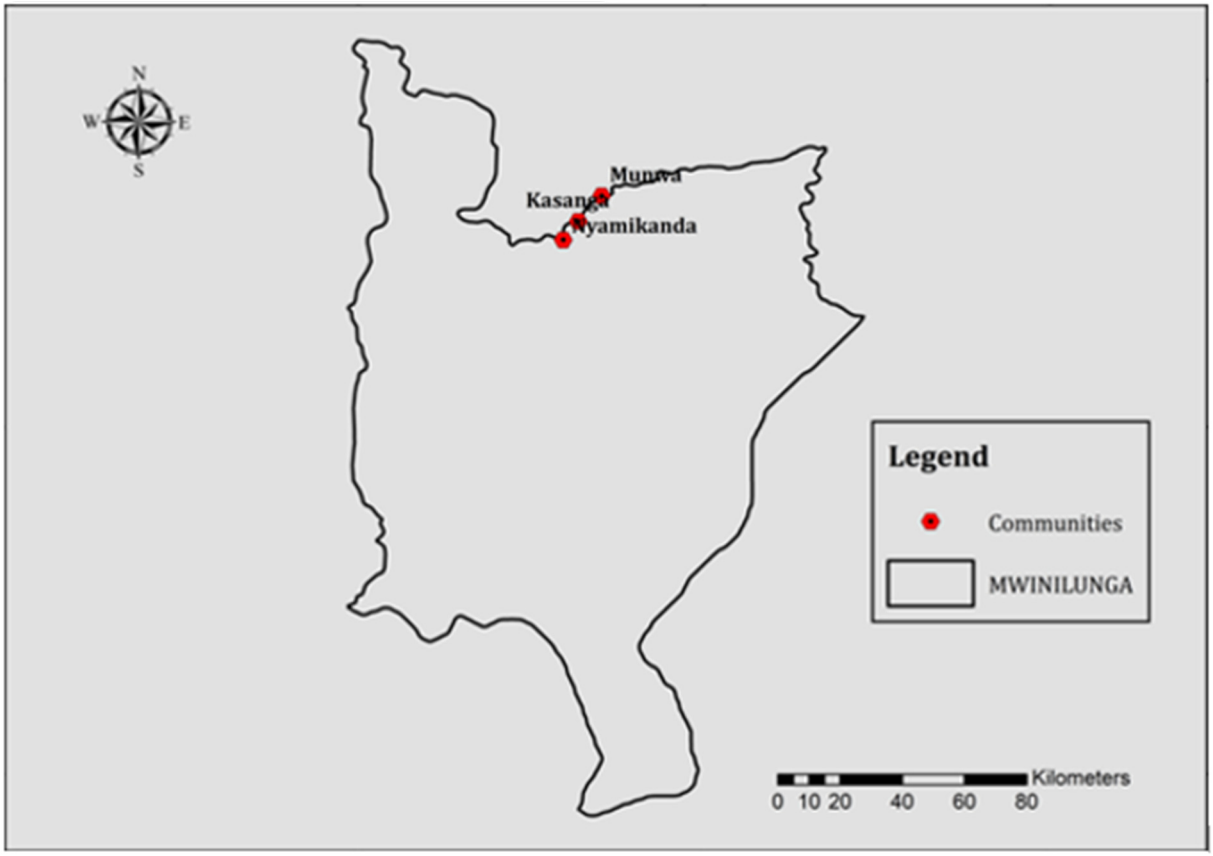

Figure 2. Maps of Zambia, northwestern province, and study sites in the Mwinilunga District.

2.2. Data Collection and Analysis

The data for this study were procured through a household survey, focus group discussions (FGDs), and in-depth key informant interviews. A structured questionnaire, alongside in-depth key informant interviews and FGD guidelines, were developed in accordance with established formats and were approved by the Research Review Board at Copperbelt University. Prior informed consent was sought from all research participants. The sampling frame utilized for the household survey encompassed the aggregate number of households within the designated communities (N = 391). To obtain a 95% desired accuracy at the 95% confidence level, the required minimum sample size using Yamane's formula [35] was 198. Nevertheless, to enhance statistical power, reliability of the results, robustness, and generalizability, the sample size for the survey was 303 households (66, 94, and 143 households in Kasang'a, Munwa, and Nyaminkanda, respectively), reflecting a sampling intensity of 77%. The sampling unit was the household, whereas the unit of observation was the head of the household.

Random sampling was used to select respondents for the household survey. This sampling technique was used because it accorded community members an equal chance of being selected, thereby minimizing bias and increasing the likelihood that the sample was representative. To obtain the random sample for the household survey, a number of steps were undertaken. Firstly, the list of households in the communities were obtained from the village registers. Secondly, based on the obtained list, households were assigned random numbers and then sorted by their random numbers. Lastly, the targeted households were selected in ascending order of the random numbers until the desired sample size was reached.

Key elements of the questionnaire for the household survey encompassed the socio-economic attributes of heads of households (gender, wealth status, marital status, and

education level), household livelihood portfolios, and the species and quantities of *chikanda* orchids that were gathered, consumed, and sold, along with their corresponding sale prices. For the purposes of comparison, data were also acquired pertaining to the sale prices and quantities of agricultural products and additional forest products that were collected and sold.

The currency referenced in this manuscript was USD, which was converted from the local currency Zambian Kwacha (ZMW) at a conversion rate of USD 1 = ZMK 13, reflective of the prevailing exchange rate during the period of data collection. Data concerning the quantities that were collected, consumed, and sold were assessed utilizing the recall method [36]. The recall method was used due to its efficiency and ability to minimize bias from direct observation. To reduce the potential for recall bias, the household survey was administered right after the harvesting season for *chikanda* orchids. Households were stratified according to wealth in order to encapsulate the diverse categories of households [32,37,38]. Prior research demonstrated that local populations possessed a superior capacity to accurately evaluate the relative wealth within their communities [32,39]. Consequently, village leaders (n = 3–5) contributed to the delineation of wealth categories within the rural communities (Table 1). Prior to undertaking the household survey, the questionnaire underwent a pre-testing phase within the Nyaminkanda community (among 20 participants not included in the main survey) to enhance its efficacy. Both the main survey and the pre-testing were executed in July 2019 to synchronize with the period for *chikanda* orchid harvesting in the region.

Table 1. Household wealth categories.

Characteristics	Wealth Categories		
	Wealthy	**Intermediate**	**Poor**
Household size (rooms)	>4	1–3	1–3
Type of roofing	Iron sheets	Iron sheets	Thatch
Size of pineapple field	>10 Ha	5–10 Ha	<5 Ha
Number of barkhives	>100	50–100	<50
Type of sanitation	Pit latrine	Pit latrine	Nil
Source of power supply	Solar energy	Solar energy	Nil

FGDs and key informant interviews were conducted to complement and deepen the insights gathered from the questionnaire responses. The FGDs and interviews served to triangulate the responses obtained from the household survey. Purposive sampling was used to select the participants for the focus group discussions and interviews. Purposive sampling was used because it enabled the selection of participants based on their knowledge and experience in *chikanda* orchids collection, consumption, and sale, which was fundamental for addressing the study's research questions. It was through FGDs that species of harvested *chikanda* orchids were ascertained. Three FGDs, one in each targeted community, were held. Each FGD included nine participants, comprising both male and female youths (19–35) and adults (over 35 years) from various wealth categories. A total of nine participants in the FGDs were within the ideal range feasible for allowing good balance between diverse perspectives and sufficient time for each participant to contribute to the discussion [40]. A total of nine (9) key informants, three (3) from each target community, consisting of village leaders and adult males and females, participated in the interviews.

Data for this study were analyzed using STATA (version 14.2) and Microsoft Excel (version 2016). Key statistical evaluations performed included descriptive statistics, the chi-square test of independence, and Gini coefficient analysis. To assess the relationship between categorical variables, the chi-square test of independence was employed. In

accordance with the assumptions underpinning the chi-squared test [41], the dataset utilized in this study was acquired through random sampling, thereby enhancing the reliability of the findings. Moreover, the measurement scales employed for the variables were categorized as nominal and ordinal. In addition, the classifications of the variables were designed to be mutually exclusive.

The Gini coefficient analysis was utilized to assess the overall per capita income and the impact of income derived from the sale of orchid tubers in reducing income inequality among households. As articulated by [42], the Gini coefficient operates under the premise of no predetermined distribution of the data, with ordinal data being sufficiently robust for its calculation. The dataset for this investigation adhered to these foundational assumptions. Qualitative data were analyzed by synthesizing responses to identify emerging themes and categories.

3. Results

3.1. Socio-Economic Characteristics of the Study Sample

The mean size of households consisted of six individuals, with a predominant representation of male-headed households (83.5%). A significant proportion of household heads possessed less than a primary level of education, accounting for 37.0%, whereas those with tertiary education represented a negligible fraction (0.3%). Nearly half of the households were classified as poor (56.8%), and married household heads were in the majority (79.2%) (Table 2).

Table 2. Summary of the characteristics of the study sample.

Characteristic	Category	Frequency (%)
Community	Nyaminkanda	143 (47.2)
	Munwa	96 (31.7)
	Kasang'a	66 (21.8)
Household wealth status	Rich	13 (4.3)
	Intermediate	118 (38.9)
	Poor	172 (56.8)
Household head gender	Male	253 (83.4)
	Female	50 (16.5)
Household marital status	Married	240 (79.2)
	Single	32 (10.6)
	Divorced	25 (8.3)
	Widowed	6 (2.0)
Household education	Less than primary	112 (37.0)
	Primary	134 (44.2)
	Secondary	56 (18.5)
	Tertiary	1 (0.3)

The gender of household heads demonstrated a statistically significant correlation with the wealth status of the household ($\chi^2 = 37$; $p < 0.001$), as well as the educational attainment ($\chi^2 = 10$; $p < 0.05$). Furthermore, a notable association was identified between marital status and wealth status ($\chi^2 = 38$; $p < 0.001$), along with a correlation between educational attainment and wealth status ($\chi^2 = 17$; $p < 0.05$). Additionally, a significant relationship was established between gender and educational attainment ($\chi^2 = 10$; $p < 0.05$).

3.2. Harvesting Chikanda Orchids Species and Perceptions on Wild Orchids Populations

The harvested species of *chikanda* orchids belonged to the genera *Disa*, *Hebenaria*, and *Satyrium*. The predominant species harvested were identified within the genus *Satyrium*. The majority of the participants in the household survey (99%) reported a perceived decline

in the wild populations of *chikanda* orchids. This concern was similarly emphasized by participants in the FGDs. Upon inquiry regarding the status of *chikanda* orchid populations, one female discussant articulated her observations:

> *Overall the population of chikanda orchids in the wild is of great concern to us as there is definitely a significant reduction in the quantities of these valuable resources. In the past we never used to walk long distances to harvest chikanda orchids as is the case at the moment (Nyamikanda community interviewee).*

The decline in *chikanda* orchid populations was further accentuated by respondents during the in-depth interviews. When prompted to provide commentary on the status of *chikanda* orchid populations, one male interviewee expressed his insights:

> *In the past we used to harvest as much as 20 kg of chikanda orchids from morning to mid-day. This is not the case anymore as often times we only manage to harvest a maximum of about 3 kg per day. This has now forced most of us to go as far as our neighbouring Democratic Republic of Congo (DRC) to harvest chikanda orchids (Munwa community interviewee).*

Overall, the findings derived from FGDs, in-depth interviews, and household surveys revealed a collective agreement concerning the declining populations of *chikanda* orchids in the study area.

3.3. Association Between Chikanda Orchids Harvesting and Socio-Economic Factors

Household survey findings indicated that 88.1% of household heads participated in the harvesting of *chikanda* orchids. In comparative terms, a greater proportion of female household heads engaged in this activity (98%) in contrast to their male counterparts (86.2%). The gender of household heads demonstrated a statistically significant correlation with participation in the harvesting of *chikanda* orchids ($\chi^2 = 6$; $p < 0.05$). In terms of marital status, it was observed that all widowed and divorced heads of households participated in the harvesting of *chikanda* orchids, while 96.9% of married and 85.4% of single heads of households were similarly engaged. Marital status exhibited a significant association with household heads' involvement in the harvesting of *chikanda* orchids ($\chi^2 = 8$; $p < 0.05$).

The majority of the heads of households engaged in the harvesting of *chikanda* orchids possessed primary education (45%). Conversely, those with tertiary education represented a minority (0.4%). No statistically significant association was identified between educational attainment and involvement in the harvesting of *chikanda* orchids by the household heads ($\chi^2 = 1$; $p > 0.05$). Furthermore, no association was established between engagement in the harvesting of *chikanda* orchids by household heads and wealth status of the household ($\chi^2 = 1$; $p > 0.05$) (Table 3).

Table 3. Relationship between involvement in *chikanda* orchid harvesting and socio-economic factors.

Socio-Economic Factor (N = 303)	**Involvement in *Chikanda* Orchids Harvesting**	
	χ^2	***p*-Value**
Gender	6	<0.05
Marital status	8	<0.05
Education level	1	>0.05
Wealth	1	>0.05

3.4. Relationship Between Household Food Shortages and Socio-Economic Factors

A significant 91% of households that participated in the survey experienced food shortages in the year prior to the current study, with poor households constituting the

majority (96%) as compared to intermediate households (88%) and wealthy households (46%). A significant correlation was detected between the experience of food shortages and the wealth status of the household ($\chi^2 = 37$; $p < 0.001$). No significant correlation was found between the experience of food shortages and gender ($\chi^2 = 1$; $p > 0.05$). Additionally, the experience of food shortages was not significantly associated with marital status ($\chi^2 = 2$; $p > 0.05$) and educational level ($\chi^2 = 1$; $p > 0.05$) (Table 4).

Table 4. Correlations between household food shortages and socio-economic factors.

Socio-Economic Factor (N = 303)	Food Shortages	
	χ^2	*p*-Value
Gender	1	>0.05
Marital status	2	>0.05
Education level	1	>0.05
Wealth	37	<0.001

3.5. Association Between Household Food Shortages and Socio-Economic Factors

Results revealed that 95% of the surveyed households across the three studied communities utilized income derived from the trade of *chikanda* orchids to mitigate household food deficiencies. When analyzed by gender, a slightly higher percentage of female-headed households employed income from the orchid trade to alleviate food deficits (96%), compared to male-headed households (94%). No significant association was observed between gender and the use of income derived from the *chikanda* orchids trade for mitigating food deficits ($\chi^2 = 1$; $p > 0.05$). When analyzed by wealth status, results indicated that a greater proportion of poor households utilized income from the *chikanda* orchids trade to alleviate food deficits (97%), compared to intermediate households (92%) and wealthy households (85%). A statistically significant association was noted between wealth status and the use of income generated from the *chikanda* orchids trade for mitigating food deficits ($\chi^2 = 6$; $p < 0.05$). When asked whether income derived from the *chikanda* orchids trade helped to cushion food deficits, a poor female head of household responded:

> *"If it was not for the income my household derives from the sale of chikanda, hunger would have eliminated us by now. The income we derived from chikanda sales is very critical in my household so all members of my household participate in chikanda orchids harvesting" (Munwa community interviewee).*

No notable correlation was detected between marital status and the mitigation of food deficits utilizing income generated from the sale of *chikanda* orchids ($\chi^2 = 3$; $p > 0.05$), as well as between educational attainment and the alleviation of food deficits through income derived from *chikanda* orchid sales ($\chi^2 = 2$; $p > 0.05$) (Table 5).

Table 5. Correlations between socio-economic factors and cushioning food deficits with income from *chikanda* orchid sales.

Socio-Economic Factor (N = 303)	Cushioning Food Deficits Using Income from *chikanda* Sales	
	χ^2	*p*-Value
Gender	1	>0.05
Marital status	3	>0.05
Education level	2	>0.05
Wealth	6	<0.05

3.6. Income from Chikanda Orchids Sales in Comparison to Other Sources

Surveyed households exhibited diverse income portfolios encompassing the sale of *chikanda* orchids, the marketing of forest products, agricultural and livestock production, financial assistance from non-governmental organizations (NGOs) through social welfare programs, and government-funded social cash transfers. When analyzed by community, income from *chikanda* orchid sales constituted 42.9% of the total household income within the Nyaminkanda community, whereas in the Munwa and Kasang'a communities, the respective contributions were 34.6% and 39.7% (Figure 3).

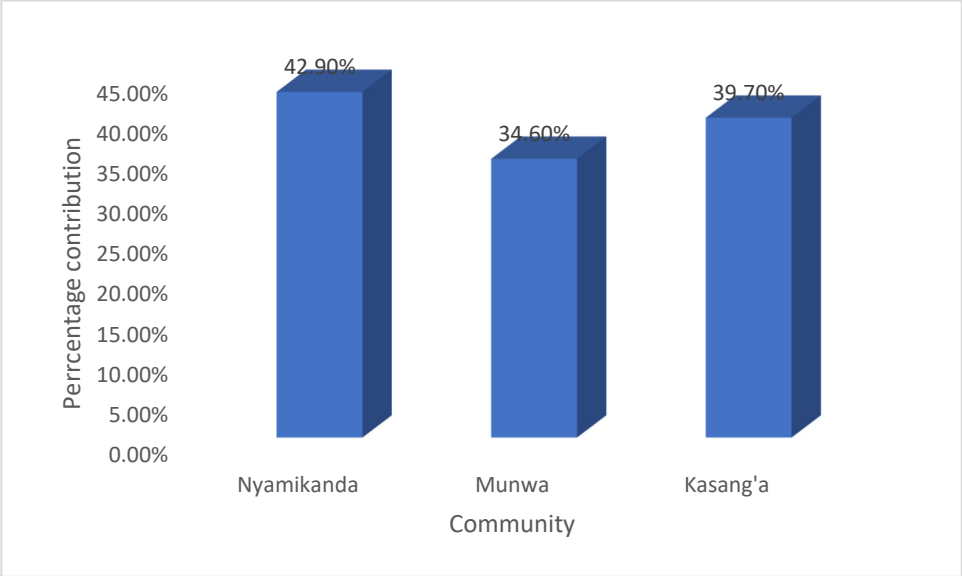

Figure 3. Contribution of income from *chikanda* orchid sales to total household income stratified by target communities.

When stratified by wealth status, the average income generated from *chikanda* sales for poor, intermediate, and wealthy households were USD 26.39, USD 29.46, and USD 42.54, correspondingly. Poor households reported the highest annual household income from *chikanda* sales at USD 292.31, in contrast to intermediate households at USD 149.23 and wealthy households at USD 211.54. Furthermore, when categorized by gender, average incomes from *chikanda* sales were USD 34.92 for female-headed households and USD 27.23 for male-headed households. Female-headed households garnered the highest annual household income from chikanda orchids sales, amounting to USD 292.31, compared to male-headed households, which earned USD 211.54 per annum (Table 6).

Table 6. Annual household income generated from *chikanda* orchid sales stratified by gender and wealth status.

Variable	Average Income (USD)	Minimum Income (USD)	Maximum Income (USD)
Gender			
Female headed	34.92	1.92	292.31
Male headed	27.23	1.92	211.54
Wealth status			
Poor	26.39	1.92	292.31
Intermediate	29.46	3.84	149.23
Wealthy	42.54	5.77	211.54

In terms of contributions to overall household annual income, the findings revealed that income from the *chikanda* orchid sales constituted 30.8% of the total annual household income, while income from crop-based agricultural production made up 37.9%. Income from livestock production, sale of forest product, social cash transfer, and NGO social welfare support programs accounted for 16.7%, 12.4%, 1.7%, and 0.6% of the total annual household income, respectively (Figure 4).

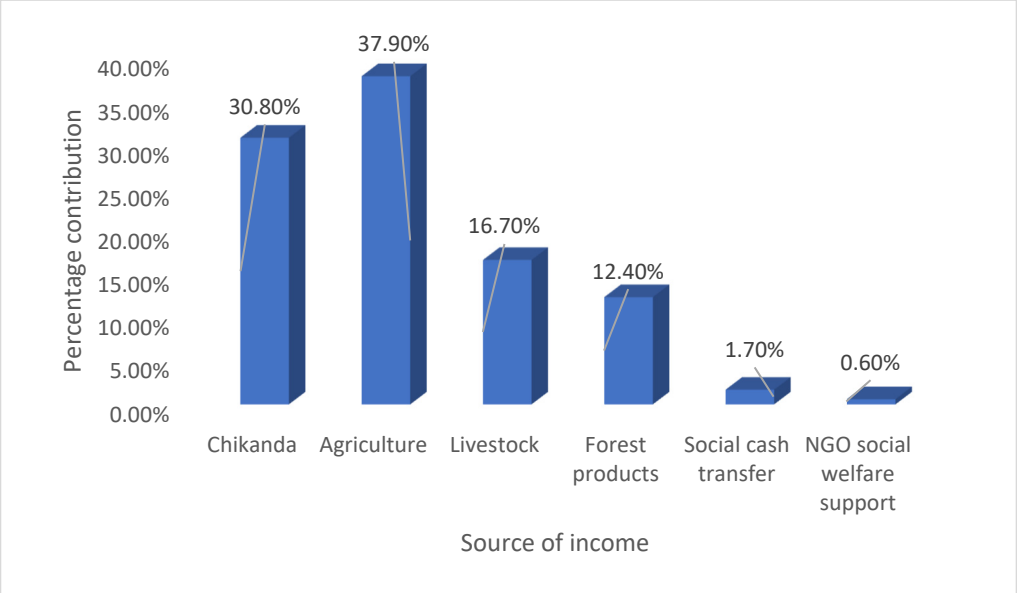

Figure 4. Contribution of *chikanda* orchid income to the total annual household income in comparison to other sources.

When stratified by household wealth status, income generated from *chikanda* orchid sales contributed 43.6% to the total annual household income of poor households, while contributions to intermediate and wealthy households were 37.4% and 28.6%, respectively (Figure 5).

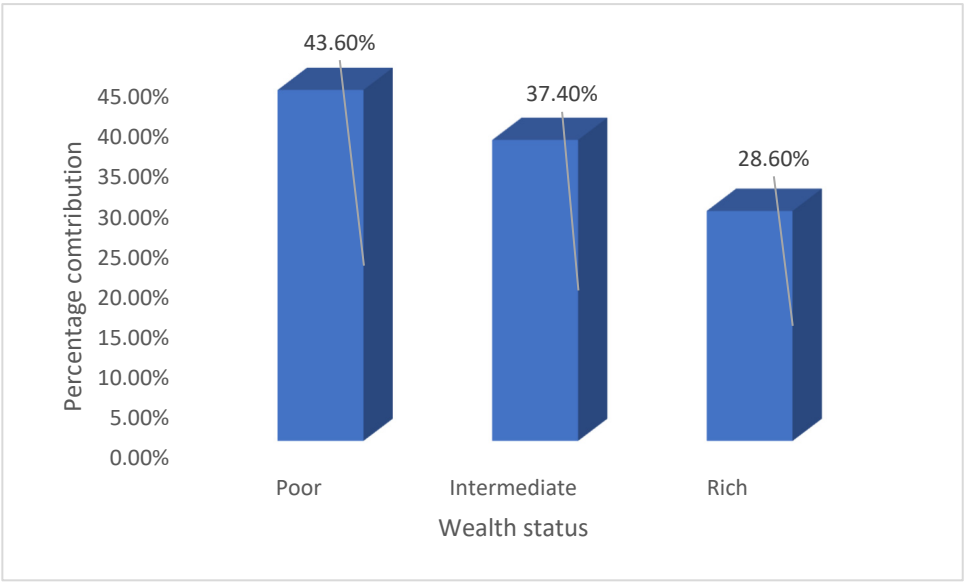

Figure 5. Contribution of *chikanda* orchid income to the total household income stratified by wealth status.

The computed Gini coefficient for total household income was 0.49. Upon the exclusion of income derived from the *chikanda* orchids trade, the Gini coefficient increased by 8% (0.57), indicating a rise in income inequality among households in the absence of income from *chikanda* orchid sales.

4. Discussion

Our results underscored the significance of the *chikanda* orchids trade in supporting rural households, taking into account socioeconomic influences. Our findings revealed that harvested *chikanda* orchid species belonged to the genera *Disa*, *Hebenaria,* and *Satyrium*, consistent with findings documented in previous research [24,34]. Knowing which species are collected for the expanding *chikanda* orchids trade allows for the identification of species that are vulnerable to overharvesting and can guide conservation planning, as noted by [24]. Our results also showed that a substantial proportion of households within the study sites participated in the harvesting of *chikanda* orchids, and the gender of the head of household was significantly associated with involvement in *chikanda* orchids harvesting for income generation. Furthermore, a substantial proportion of female-headed households actively participated in harvesting *chikanda* orchids for commercial purposes. This observation corroborates previous research indicating that orchid harvesting is predominantly undertaken by women [19,43]. It also aligns with existing scholarship that has elucidated gender-specific roles in the extraction of forest resources [32,44,45]. Our findings suggest that in order to proficiently formulate policies aimed at the sustainability of orchids, it is imperative to incorporate considerations of gender by acknowledging the impact of gender norms and roles on the accessibility, management, and engagement in the conservation and utilization of orchids. This calls for the establishment of equitable rights to resources, the encouragement of female involvement in decision-making processes, and the rectification of gender-specific obstacles associated with livelihoods reliant on *chikanda* orchids.

The involvement of household heads in the harvesting of chikanda orchids was found to exhibit a significant correlation with marital status, with a notably higher proportion of married heads of households participating in this activity. This observation is consistent with the findings of [46], which documented the impact of marital status on the extraction of forest products, particularly highlighting higher levels of involvement among married women. Our research study did not find a significant correlation between educational attainment and participation in the harvesting of *chikanda* orchids by heads of households. Nonetheless, a larger segment of participants possessed lower educational qualifications. This may be attributable to the notion that higher educational levels tend to divert individuals from subsistence-oriented livelihood activities, such as the harvesting of non-timber forest products (NTFPs), as education often provides access to alternative employment opportunities [4,47,48].

No significant relationship was detected between engagement in *chikanda* orchid collection and the economic status of the household, although a greater proportion of economically disadvantaged households were involved in this activity. Our findings indicated that wealth differentiation did not significantly influence participation in *chikanda* orchids harvesting, albeit economically poorer households exhibited a higher level of involvement, compared to their intermediate and wealthier counterparts. This observation reinforces prior studies that contended that economically disadvantaged households are more reliant on forest resources than their wealthier counterparts [49]. It is posited that due to their limited purchasing power to procure sufficient food to offset inadequate harvests, low-income households are compelled to depend heavily on the extraction of natural resources. The results of our study underscore the importance of taking into account the income levels of community members when formulating policies and conservation

strategies pertinent to *chikanda* orchids. Specifically, such policies should be designed to be inclusive, thereby facilitating avenues for the economic empowerment of rural communities while concurrently safeguarding the conservation of *chikanda* orchids.

The income generated from *chikanda* orchid sales was identified as a significant contributor to the livelihoods of rural households in this study. Consistent with existing literature on rural livelihoods [1,50,51], our study showed that households within the study area employed multiple income sources to diversify their livelihood strategies. The income derived from the *chikanda* orchids trade constituted a significant proportional contribution to the annual household income. Furthermore, when stratified by wealth status, the relative contribution of income from *chikanda* orchid sales exhibited variability across wealth categories. However, despite the wealthy households attaining higher mean incomes from the sale of *chikanda* orchids than their poorer counterparts, the proportional contribution of *chikanda* orchids income to total household income was found to be greatest among poorer households, compared to intermediate and wealthy households. This shows that the contribution of income from the *chikanda* orchids trade to the overall annual household income diminishes as household wealth increases. This finding shows that the *chikanda* orchids trade is a significant income generator for economically disadvantaged households. This corroborates existing literature that identified non-timber forest products (NTFPs) as vital income streams within the economic framework of rural households [52–54]. Our study findings underscore the economic importance of *chikanda* orchids for economically disadvantaged households that exhibit greater vulnerability to food deficits [14–16] than their intermediate and wealthy counterparts. This accentuates the need to formulate conservation strategies and policies for *chikanda* orchids that recognize the economic significance of these orchids for rural communities while simultaneously promoting responsible harvesting and effective resource management. This is crucial in view of the observed decline in *chikanda* orchid populations [24,27,29]. To lessen reliance on the unsustainable harvesting of *chikanda* orchids, communities must have access to alternative sources of income. Consequently, it is essential to create policies that support such options. Furthermore, establishing policies that support fair pricing and trade practices is also crucial in order to guarantee that orchid collectors are fairly compensated for their products. Additionally, promotion of the community-based management of *chikanda* orchid resources is imperative. This necessitates the empowerment of communities to sustainably manage *chikanda* orchid resources, thereby cultivating a sense of ownership and accountability. Furthermore, facilitating and conducting community outreach initiatives to educate rural communities about the significance of *chikanda* orchid conservation and the advantages of sustainable practices is fundamentally important. In this sense, policies must effectively reconcile the economic requirements of rural communities with the long-term conservation of *chikanda* orchids.

The results of this study showed that in relative terms, income derived from agricultural production was the major contributor to total household income, followed by income derived from *chikanda* orchids. However, the derived Gini coefficient indicated an escalation in income inequality in the absence of income from *chikanda* orchids. This finding aligns with previous studies that underscored the income equalization effects of NTFPs within rural communities [32,55,56]. Given that the trade in *chikanda* orchids has the potential to reduce income disparities in rural communities, strategies that promote equitable access and involvement in the harvesting and trade of *chikanda* orchids are essential to maximizing the potential for income equality.

A substantial proportion of our study sample encountered food scarcity in the year prior to our study. The experience of food shortages was significantly correlated with the wealth status of the household, suggesting that economically disadvantaged households were disproportionately affected in comparison to their intermediate and wealthy coun-

terparts. This finding substantiates prior studies that documented associations between food security and income levels within rural households [27,57]. Furthermore, our findings showed that a majority of the households that experienced food shortages utilized income from *chikanda* orchids to mitigate food deficits within their households. This underscores how important *chikanda* orchid revenue is as a safety net in addressing food shortages. Our results corroborate the findings by [54], which showed that NWFPs are indispensable in alleviating food shortages, as evidenced by a case study conducted in a rural community in Nigeria. While the results of our study demonstrated that the trade in *chikanda* orchids helps to alleviate food shortages and generate revenue, sustainable management strategies are essential to safeguard *chikanda* orchid populations and ensure their long-term viability. This is particularly vital in light of the diminishing populations of *chikanda* orchids, as indicated by [19,27,55,58]. Consequently, conservation strategies for *chikanda* orchids should be integrated into forest management policies to guarantee their sustainability. Both in situ and ex situ management practices are essential to promote *chikanda* orchid conservation.

Our study was not devoid of limitations. To start with, the study relied on self-reported quantities of *chikanda* orchids. This approach harbors the potential for recall bias in the self-reported quantities of *chikanda* orchids. Nevertheless, we mitigated the likelihood of such bias by administering the household survey right after the harvesting season for *chikanda* orchids, thereby augmenting the respondents' recall prowess. Furthermore, our study employed cross-sectional data, which consequently limited the capacity to observe temporal variations, essential for understanding trends and causal relationships. The incorporation of longitudinal data in subsequent research would be advantageous in this context. Similarly, the identification of harvested *chikanda* orchid species was exclusively reliant on lists of species provided by participants during focus group discussions (FGDs). This approach was susceptible to groupthink bias and may have restricted the range of identified species, thereby impeding the formulation of a comprehensive inventory of the harvested *chikanda* orchid species. Future research could consider the use of molecular methods, such as DNA barcoding, to improve the accuracy of *chikanda* orchid identification.

5. Conclusions

This study examined the contribution of *chikanda* orchids to rural livelihoods, taking into account the influence of socio-economic factors. Our study showed that the *chikanda* orchids trade plays an importance role in supporting rural livelihoods, and socio-economic factors, such as gender and marital status, do have significant influence in determining participation in *chikanda* orchid harvesting and trade. Our findings showed that income generated from the *chikanda* orchids trade plays an important role in addressing food insecurity, particularly for economically disadvantaged households that are more susceptible to food shortages. In addition, income generated from the *chikanda* orchids trade constitutes a more significant proportion of the overall household income for poorer households in comparison to their more affluent counterparts. Our computed Gini coefficient illustrated an escalation in inequality in the absence of *chikanda* orchid income, thereby underscoring the equalizing effects of *chikanda* orchids-derived income. In this sense, income from *chikanda* orchids has the potential to lessen income disparity in rural communities, as evidenced by its equalizing effects. In particular, in rural areas, the trade in *chikanda* orchids can help close the gap between high- and low-income earners by offering reasonably accessible and lucrative sources of income. However, it is crucial to note that the extent to which the trade in *chikanda* orchids achieves an income-equalizing effect may depend on various factors, such as market accessibility, the scale of production, and the overall economic context of the region under consideration.

While our study empirically demonstrated the importance of the *chikanda* orchids trade in generating revenue and promoting food security, particularly for households that are economically disadvantaged, unsustainable harvesting methods can result in the overexploitation of these wild orchids. Consequently, a shift towards sustainable practices, community engagement, and effective regulations is needed to ensure that the trade continues without inflicting ecological damage. To preserve *chikanda* orchid populations, sustainable harvesting techniques, including rotational and selective harvesting, must be used. Furthermore, encouraging the cultivation or domestication of *chikanda* orchids may lessen the strain on wild populations and offer a more sustainable supply of the product. Further, raising awareness of the value of sustainable practices and involving community members in conservation initiatives are essential.

Our study also showed that in order to effectively develop policies for the sustainability of *chikanda* orchids, socio-economic factors, including gender, must be taken into account by recognizing the influence of gender norms and roles on orchid accessibility, management, and participation in conversation and use. In this sense, it is crucial to establish fair rights to resources, promote female participation in decision making, and address gender-specific barriers related to orchid-dependent livelihoods. Moving forward, further research is needed to monitor orchid populations, understand the dynamics of the *chikanda* trade, and evaluate the effectiveness of conservation initiatives.

Author Contributions: Conceptualization, J.M.K.; methodology, J.M.K. and G.K.; software, J.M.K. and P.M.; validation, J.M.K., G.K., P.M. and M.T.B.D.; formal analysis, J.M.K. and P.M.; writing—original draft preparation, J.M.K.; writing—review and editing, J.M.K., G.K., P.M. and M.T.B.D.; visualization, J.M.K., G.K. and P.M.; supervision, J.M.K.; project administration, J.M.K. and G.K.; funding acquisition, J.M.K., G.K. and M.T.B.D. All authors have read and agreed to the published version of the manuscript.

Funding: Funding for this research study was provided through the Darwin Initiative (UK Government) Grant No. 23034. The University of Mpumalanga provided support for the article processing charges (APC).

Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee at Copperbelt University (Project Identification Code; CBUSNR100) on 30 June 2019.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the research study.

Data Availability Statement: Data presented in this study can be obtained from the corresponding author upon request.

Acknowledgments: We express our gratitude to Francis Chishiba for facilitating communication with village leaders, rendering interpretation services, and serving as our local guide; to Saini Ngambu for assisting in the organization of community members for our data collection efforts and providing interpretation services; and to Jean Moussa for the creation of the maps.

Conflicts of Interest: The authors have no conflicts of interest to declare.

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