

Original Research Article

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Socio-economic diagnosis of some non-timber forest products of interest in the town of Bertoua, East Cameroon

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Article Info

Abstract

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In the cities of Cameroon, Non-Timber Forest Products (NTFPs) more precisely spice plants, occupy a place of choice for the well-being of the population. NTFPs such as *Irvingia gabonensis*, *Ricinodendron heudelotii* and *Tetrapleura tetraptera*, which are among the most consumed in the city of Bertoua. The objective of this study was to make a socio-economic diagnosis of the state of these NTFPs. A questionnaire was administered to 500 people, including 18 collectors, 22 wholesalers, 165 retailers and 295 consumers in the sub-districts of Bertoua 1, Bertoua 2 and Mandjou. We found that the female gender was predominantly represented in all categories of actors (68-94%). Fruits/seeds represent the most used parts of these NTFPs (98-99%). The uses of these NTFPs are mainly for food and pharmacological (40-80% depending on the species). The mode of use is mainly decoction especially in soup (95-99%). The main constraints linked to the commercialization of these NTFPs are the seasonality of production for collectors, the price variation for retailers on the market, and the lack of customers for traders. The satisfaction levels of wholesalers, retailers and collectors are divided between the difficulties encountered during marketing and the speed of sale of the different species. This study confirms the importance of spice plants for the well-being of households. For a sustainable management of spice plants in Bertoua and its periphery, the integration between the actors, the economy and the preservation of natural resources should be at the centre of any forestry policy.

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Introduction

Considered as Non-Timber Forest Products (NTFPs), spice plants have attracted considerable interest

worldwide in recent years (Ibanda, 2021). These plants provide local populations with basic food, medicinal and technological products to satisfy their primary needs mainly in rural areas (Malela et al., 2016; Ganglo

et al., 2017). As a result, their contribution to household economy, food security as well as environmental objectives has been recognized by many studies (Mananga et al., 2020). Spice plants has nutritional, therapeutic and socio-cultural values hence generate income which contribute to poverty alleviation (Ngijol et al., 2020). With their biochemical and nutritional qualities, rich in proteins, lipids, carbohydrates, minerals and various vitamins and fibers, they have demonstrated their potential to solve food, nutrition and health crises in Africa (Osseni et al., 2018).

In Cameroon, thousands of rural people depend on NTFPs for food, economic income and many other services (Bayoi et al., 2021). There exist several NTFP organized in value chains like for example Djansang (*Ricinodendron heudelotii*), Wild Mango (*Irvingia gabonensis*), Gnetum (*Gnetum* spp.), whose turnover exceeds €500,000 per year (Lescuyer, 2010). This is endorsed by (Eba'a et al., 2013; Makomra, 2020), who stated that non-timber forest products yield gross profits of nearly €64.12 billion per year. Several studies have been carried out in Cameroon on the socio-cultural and economic value chain of NTFP (Betti et al., 2016; Ladoh-Yemeda et al., 2016 ; Mpondo et al., 2017 ; Sutjaritjai et al., 2019). For Awono et al. (2014), 24% of NTFP products are consumed by the producing household, 15% given to third parties as gifts and the rest distributed between marketing and losses. Eba'a et al. (2013) showed that the NTFP and other spices sector generates the equivalent of 32,700 direct jobs in Cameroon for approximately 250,000 other indirect jobs involved at different levels of the value chain.

In the East region of Cameroon, the exploitation of spice plants is an increasingly attractive activity for many people. However, despite their importance to the lives of many rural populations, much information about the socio-economic impact of certain species remains unexplored in some of Cameroon's cities, which hinders the ability to monitor, specie plants regulate and manage (Moupela et al., 2011; Tchapda et al., 2022). In the case of the city of Bertoua, the regional capital of the East Region, a study found that people have a particular interest in certain NTFPs (Bayoi et al., 2021). This is the case for *Irvingia gabonensis*, *Ricinodendron heudelotii*, *Tetrapleura tetraptera* identified by consumers and traders during exploratory studies. Knowing that the socio-economic importance of a species can be an asset for its promotion and knowledge of its current management can guide the

choice of appropriate management methods (Moupela et al., 2011). Given the importance of these species to rural communities, it is important to broaden and deepen knowledge in order to inform decision-makers on the relevance of conservation and management actions.

Thus, in this study the general objective is to make a socio-economic diagnosis of the spice plants (*Irvingia gabonensis*, *Ricinodendron heudelotii*, *Tetrapleura tetraptera*) mostly identified in the area during exploratory studies as being of greater value to the populations of East Cameroon.

Materials and methods

Study site

The present study was carried out from January to March 2022 in the markets of the city of Bertoua and its surroundings. It is the Regional capital of East Cameroon, located in Lom and Djerem division, precisely in Bertoua I, Bertoua II and Mandjou subdivisions (Figure 1). This area belongs to the southern Cameroonian plateau, with an altitude varying between 600 and 900 m. The type of climate is Equatorial Guinea, with a bimodal annual average rainfall, marked by four seasons: the long dry season (mid-October to March); the short dry season (June to mid-August); the long rainy season (mid-August to October); the short rainy season (March to June). The temperature is high throughout the year, with a maximum of 30°C. Rainfall is relatively abundant with 1500 to 2000 mm per year. The soils are red ferralitic, clayey, loose and permeable. Agriculture and the exploitation of forest products are the main activities practiced by the inhabitants of the rural areas of this locality. The urban areas are much more marked by public and private sector employees and traders. From an ethnic point of view, this area is characterized by a mixture of several ethnic groups, both indigenous and non-indigenous; there are also several migrants from neighboring countries, such as those from Central Africa Republic.

Choice of target species

Three spice species were identified in this study: *Irvingia gabonensis*, *Ricinodendron heudelotii* and *Tetrapleura tetraptera*. According to Bayoi et al. (2021), these are the most important species according to consumers and traders in the markets surveyed. In

addition, they are appreciated by the population and are part of the main culinary dishes in the locality.

Data collection

Data collection was carried out in two phases;

- First phase: Exploratory survey and selection of respondents

The exploratory survey was carried out in the markets of Mandjou, Bertoua 1 and Bertoua 2 to confirm information provided by Bayoi et al. (2021). This survey consisted at visiting the markets to confirm the market value of these spice species and also to make contact with the traders, identify potential study markets, test the structured questionnaire that had been drawn up beforehand in order to become aware of the shortcomings and possible difficulties in the area and to take the necessary steps before the actual survey. The questionnaire was tested, amended and updated with resource persons in the framework of this study, namely collectors, traders (wholesalers and retailers) and consumers of these species. The retailers identified referred us to the wholesalers and the wholesalers to the collectors. However, the consumers were selected by the snowball method.

- Second phase: Sampling and survey

The surveys were carried out among the target resource persons previously identified during an exploratory survey. This survey focused only on the target species identified. Surveys of retail traders in the markets allowed for the identification and administration of the questionnaire to the wholesalers who supply them with these resources, collectors and then consumers (N'Zebo et al., 2018). The selection of consumers to be surveyed was based on the snowball method like recommended by Ndjoumoui et al. (2021). The minimum age of respondents was 20 years.

The questionnaire focused mainly on collecting data related to the socio-economic profile, uses of spice plants, level of satisfaction with the products by the actors and constraints related to marketing, which are of several kinds, were collected from collectors, wholesalers and retailers. Table 1 shows the number of respondents according to the species marketed.

Data processing and analysis

The collected data were encoded in an Excel 2010 spreadsheet database where mainly descriptive analyses

were performed. The "alluvial" and "radar" packages were used to assess the level of satisfaction of the resource persons with these target spice species (Bojanowski and Edwards, 2016; Ricardo, 2019; Yogom et al., 2020).

Results

Socio-demographic characteristics according to stakeholders

Out of the 500 people surveyed, the consumers of target spice species were essentially women (86.2%), and women were represented in the majority of all categories of actors (collectors 94.4%, consumers 85.4%, retailers 89.1% and wholesalers 68.2%). The inquired people mostly represented according to age group varies according to the stakeholder groups: collectors [41;50] (66.7%), consumers [31;40] (35.6%), retailers [31;40] (41.2%) and wholesalers [41;50] (63.1%). All groups of actors are predominantly married (77.8% for collectors, 65.4% for consumers, 82.7% for retailers and 68.4% for wholesalers). In general, these actors belonging to several ethnicities. However, the largest ethnic groups are the Bamilekes 46.87%, followed by the Bamoum 13.17%, the Gbaya 10.15% and the Maka'a 7.13% (Table 2).

The main activities of the respondents varied and ranged from wage earners to housewives, traders and farmers. However, the main activity of collectors is agriculture (83.3%). Among consumers, retailers and wholesalers, trade is the main activity (70.8%, 98.2% and 81.8% respectively). In each household, the number of active persons varied from 1 to 5 persons. Fifty percent (50%) of the respondents have 2 active persons in their household (conventional household), followed by 21.4% of the respondents who have 1 active person in their household, which is typical of single-parent households, and 28.6% who have at least 3 active persons in the household (Table 2).

Different uses and parts used by consumers

Fruits represented the main parts of *R. heudelotii*, *I. gabonensis*, *T. tetraptera* collected which represented 98.1%, 98.9%, 99% respectively in function of spice species. The place of supply of these products by consumers is mainly the market (92.3%, 95.6%, 95% respectively) (Table 3).

Table 1. Number of respondents according to spice species marketed.

	<i>R. heudelotii</i>	<i>I. gabonensis</i>	<i>T. tetraptera</i>	Number of respondents
Collectors	8	5	5	18
Wholesalers	9	5	8	22
Retailers	64	45	56	165
Consumers	104	91	100	295
Total	185	146	169	500

Table 2. Socio-demographic profile of actors involved in the value chain of these three target species.

Profile elements		Collectors (%)	Consumers (%)	Retailers (%)	Wholesalers (%)	Total (%)
Gender	Female	94.4	85.4	89.1	68.2	86.2
	Male	5.6	14.6	10.9	31.8	13.8
Age	[20;30]	0	27	7.9	0	18.4
	[31;40]	27.8	35.6	41.2	31.6	37.1
	[41;50]	66.7	26.7	40	63.1	34.2
	[51;+∞]	5.6	10.7	10.9	5.3	10.3
Marital Status	Single	22.2	29.1	13.3	31.6	23.8
	Divorced	0	1.1	0	0	0.6
	Married	77.8	65.4	82.7	68.4	71.6
	widow	0	4.4	4	0	4
Collection district	Bertoua 1	61.1	9.8	9.1	31.8	12.4
	Bertoua 2	38.9	79.7	78.2	68.2	77.2
	Mandjou	0	10.5	12.7	0	10.4
Markets	Bertoua 2 market	38.9	62.4	62.4	68.2	61.8
	Kolbikon market	61.1	9.8	9.1	31.8	12.4
	Mandjou market	0	10.5	12.7	0	10.4
	Small market of Enia	0	17.3	15.8	0	15.4

Three forms of use of the organs of *R. heudelotii*, *I. gabonensis*, *T. tetraptera* were identified: food, marketing and pharmacopoeia. These NTFPs are used by consumers in the preparation of soup in general. *R. heudelotii* is mainly used to thicken soups such as tomato sauce, meat and fish broths. *I. gabonensis* is the main component of its sauce which is *Ndoh* sauce. *T. tetraptera* is a spice that can be used to flavor almost any sauce (tomato, broth, *Nkui*, yellow sauce, black sauce, etc.).

Food and commercial uses are the most frequent (62.5%, 80%, 40.4% respectively for *R. heudelotii*, *I. gabonensis* and *T. tetraptera*). In the pharmacopoeia, *R. heudelotii* and *T. tetraptera* are generally used for intimate cleansing of the female genitalia, while *I. gabonensis* is less used in the pharmacopoeia. These products are dried and crushed to 96.2%, 96.7%, 96% respectively for better preservation and use. The mode of use is mainly decoction 97.1%, 98.9%, 94.9% respectively for *R. heudelotii*, *I. gabonensis* and *T. tetraptera* (Table 3).

Table 3. Uses and parts used by consumers.

	<i>Ricinodendron heudelotii</i>	<i>Irvingia gabonensis</i>	<i>Tetrapleura tetraptera</i>
Parts collected	Seeds : 98.1%	Almond 98.9%	Fruit 99%
Supply locations	Seeds and bark 1.9%	Almond and bark 1.1%	Fruit and bark 1%
	Forest 1%	Market 95.6%	Forest 1%
	Market 92.3%	Market, field 1.1%	Market 95%
	Market, field 2.9%	Market, forest 2.2%	Market, field 1%
	Market, forest 2.9%	Market, fallow land 1.1%	Market, forest 2%
Diversity of use	Market, fallow land 1%		Market fallow land 1%
	Food 26%	Food 18.9%	Food 20.2%
	Food, commercialization, 62.5%	Food, commercialization, 80%	Food, commercialization, 40.4%
	Food, commercialization traditional medicine 10.6%	Food, traditional medicine 1.1%	Food, commercialization, traditional medicine 34.3%
Mode of consumption	Food, pharmacopeia 1%		Food, traditional medicine 5.1%
	Dry, powder 96.2%	Dry, powder 96.7%	Dry, powder 96%
	Dry, whole 1.9%	Dry, whole 2.2%	Dry, whole 2%
Usage mode	Dry, fresh, powder 1.9%	Dry, fresh, powder 1.1%	Dry, fresh, powder 2%
	Decoction 97.1%	Decoction 98.9%	Decoction 94.9%
Top menus	Infusion 2.9%	Infusion 1.1%	Decoction, maceration 2%
			Infusion, Decoction 1%
	Tomato sauce, meat and fish broth, meat and fish roasts	Sauce <i>Ndoh</i>	Tomato sauce, meat and fish broth, meat and fish roasts, <i>Nkui</i> , yellow Sauce, black Sauce, <i>Mbol</i>
Use in traditional medicine	Intimate cleaning of the female genitalia, Fontanel	Intimate cleaning of the female genitalia, fertility Problem, cough, stomach ache, dispels evil spirits	

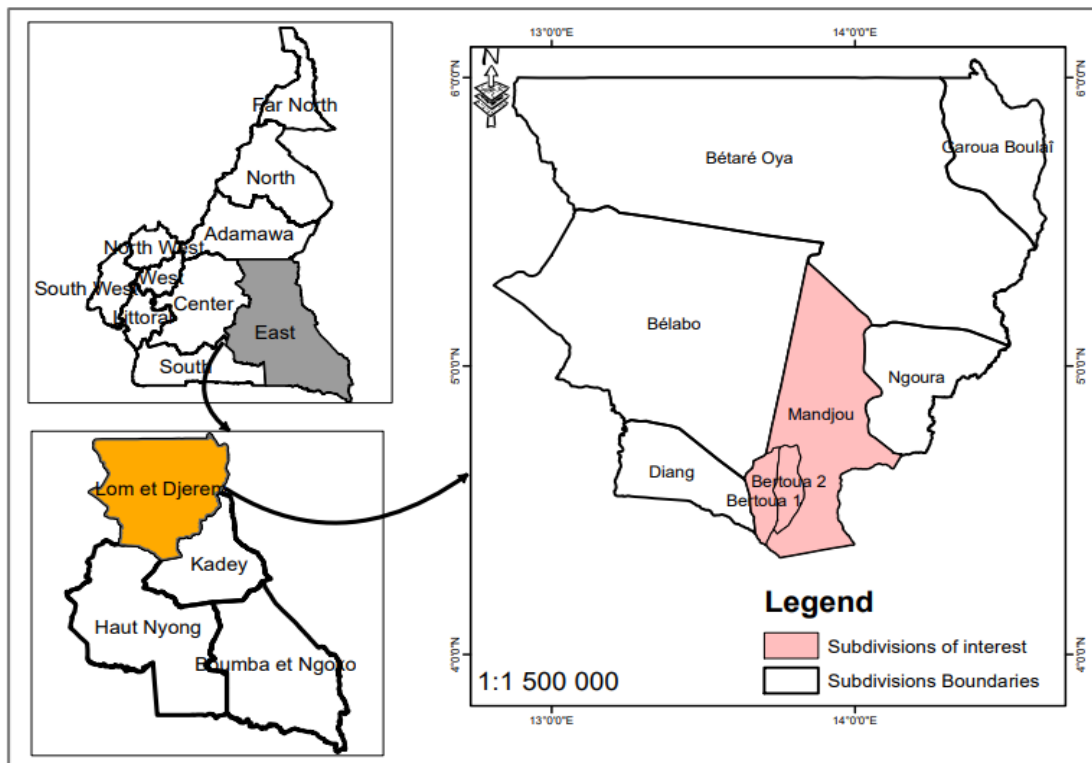


Fig. 1: Geographical location of Mandjou, Bertoua I and Bertoua II sub-divisions in the East region of Cameroon.

Level of satisfaction with products by the actors

The level of satisfaction of each actors group depends on the species traded. Figure 2 shows that the perception of the level of satisfaction of these species by the actors varies from one species to another and also according to the actors. Thus, whatever the species, all collectors (100%) are satisfied with what these products bring them both economically and for their family well-being. However, in the specific case of *I. gabonensis*, 36% of retailers are satisfied, compared to 57% who are

not satisfied because the market is hard; however, for 7%, they replied "Nothing to report or say". For *R. heudelotii*, 39% of the retailers are satisfied against 57% who are not satisfied because the market is hard; however, for 8%, they answered "Nothing to report or say". For *T. tetraptera*, 30% of retailers are satisfied against 63% who are not satisfied because the market is hard; however, for 7%, they answered "Nothing to report or say". For wholesalers, the level of satisfaction "yes" is 75, 89 and 100% respectively for *T. tetraptera*, *R. heudelotii* and *I. gabonensis* (Fig. 2).

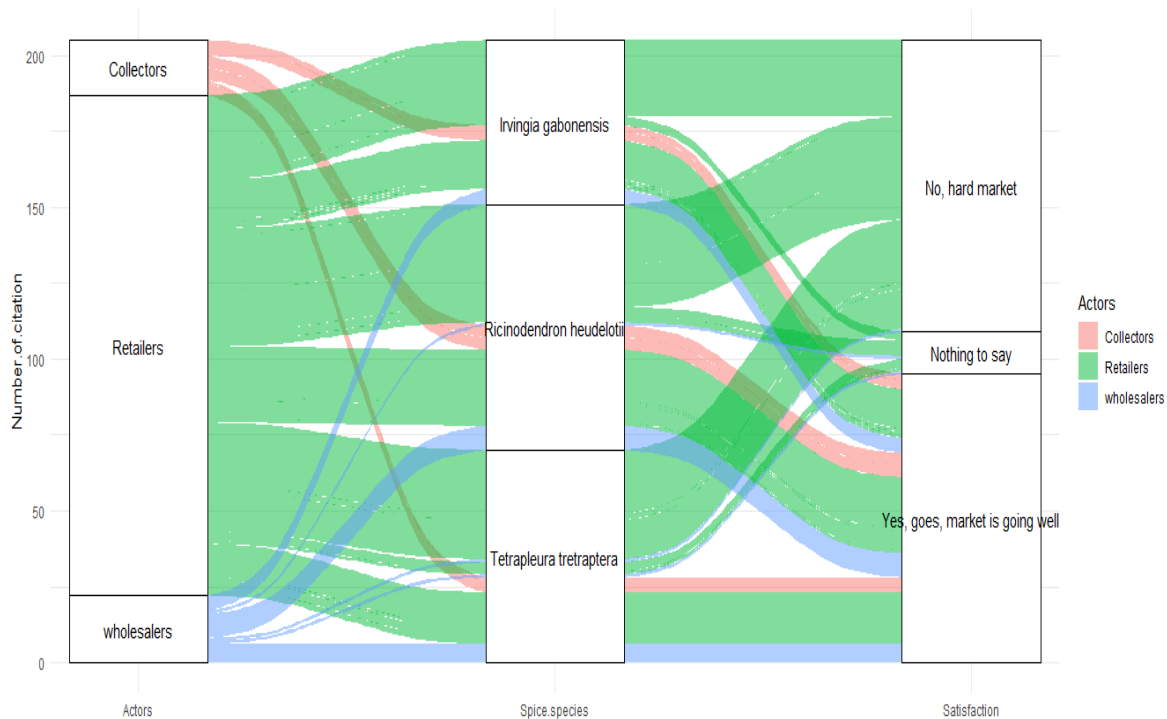


Fig. 2: Assessment of the level of satisfaction of the populations according to the target species and the actors.

Constraints to marketing these non-timber forest products

NTFPs are seasonal, which is why prices fluctuate with seasons. They are lowest during the peak production season: November-February for *R. heudelotii* (71.4%), August-October for *I. gabonensis* (50%) and November-February for *T. tetraptera* (62.5%) and highest during the scarcity seasons. In addition, prices vary according to whether one is a wholesaler, retailer or consumer. For retailers, who are the most represented, the unit of measure when buying is generally a 2-liters container; when selling, it is the glass or the heaps (rough estimate of the size of the container).

Nevertheless, there are several difficulties:

- When buying products, three difficulties stand out: lack of products at certain times of the year, high price and high price plus lack of product. For retailers, the most mentioned difficulty is the high price (56% for *R. heudelotii*, 66.7% for *I. gabonensis* and 66.7% for *T. tetraptera*). For wholesalers, the main difficulty is the lack of products (57.1% for *R. heudelotii*, 66.7% for *I. gabonensis* and 75% for *T. tetraptera*). 100% of collectors complain about the lack of products (Fig. 3).
- Difficulties encountered during sales (lack of customers, abundance on the market and lack of customers plus abundance on the market). 100% of the wholesalers have the difficulty of abundance on the

market with all these products, while 100% of the collectors complain about the lack of products. However, the major difficulty for retailers is the lack of customers (64.81% for *R. heudelotii*, 62.86% for *I. gabonensis* and 57.45% for *T. tetraptera*) (Fig. 4).

The collection method for these three spices is 100% picking. On average, according to the respondents, the distance from the collection area to the village is less than 10 km. The collection area is 60% owned by the village.

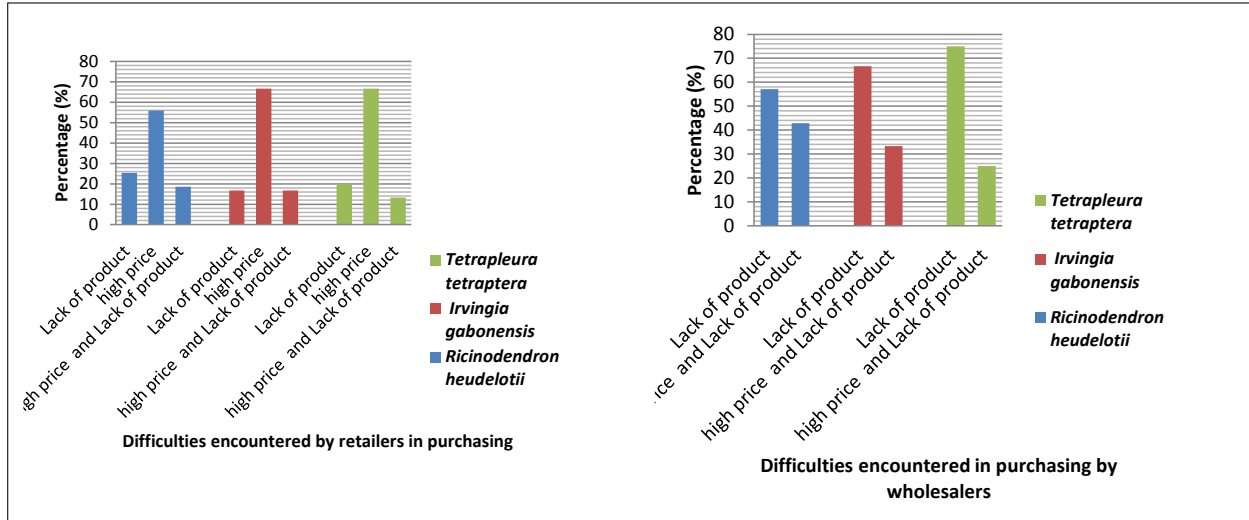


Fig. 3: Difficulties encountered by retailers and wholesalers in purchasing.

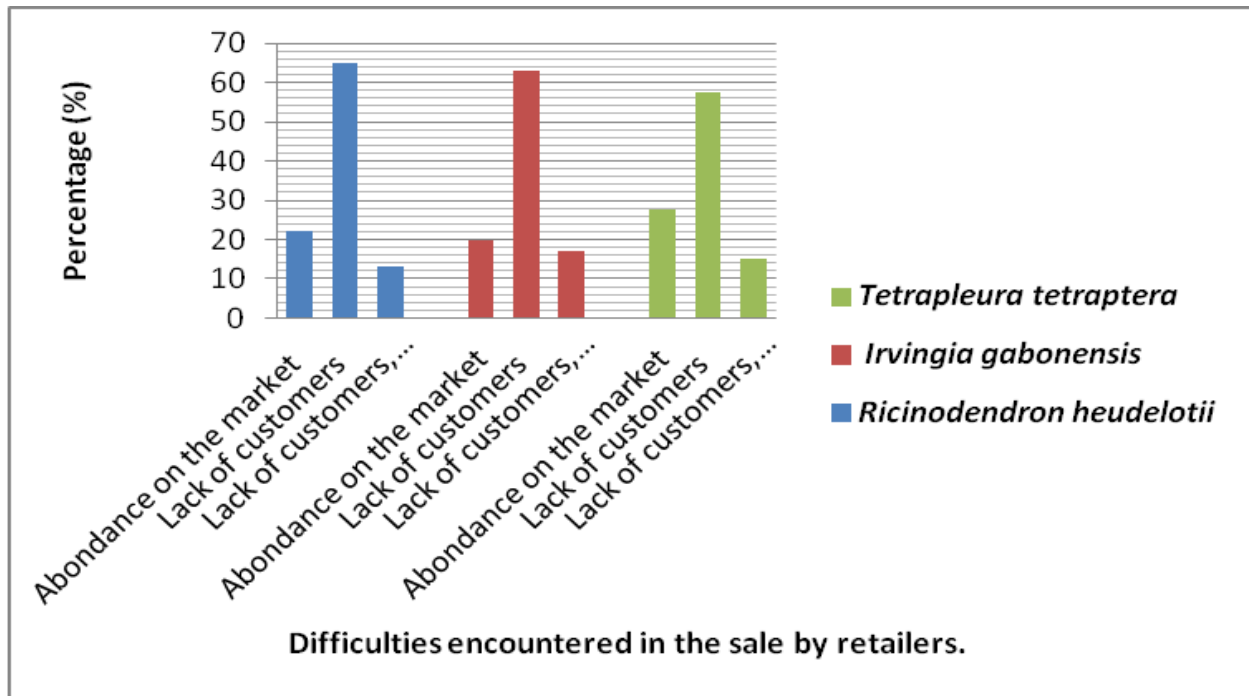


Fig. 4: Difficulties encountered in the sale of *Ricinodendron heudelotii*, *Irvingia gabonensis* and *Tetrapleura tetraptera* by retailers.

Discussion

The diagnosis of the socio-economic value of spice species (*I. gabonensis*, *R. heudelotii*, *T. tetraptera*) in the Bertoua city and its surroundings of the East region

of Cameroon showed that almost 86.2% of the actors involved in NTFP activities are women. As in the study by Tchabda et al. (2022) on the Leguminosae Mimosoideae in Cameroon, the predominance of women could be explained by the fact that the surveys

were carried out in markets dominated by women who are generally involved in the marketing and preparation of spices. For men, these are female activities. However, they may occasionally lend a hand to support them. These results differ from those of Mpondo et al. (2017) in Cameroon who found a high participation of men in the markets of Douala East (60.41%). Consistent with the findings of this study, the work of Bamiwuye et al. (2020) on women's participation in NTFP exploitation in South-East Nigeria showed that women are part of all categories of actors identified in the NTFP trade chain by being collectors, processors and traders.

In the light of the results obtained, the forms of use of the organs of *R. heudelotii*, *I. gabonensis*, *T. tetraptera* that were identified are: food, marketing and pharmacopoeia. The study conducted by Piba et al. (2015) on plant species used by the populations of Ivory Coast, had reported similar forms of use. Also, this result is similar to those of Kouakou (2018) conducted in Ivory coast and Tajeukem (2017) conducted in Cameroon. Food and marketing are the common denominator of all spices. However, the spices used in the pharmacopoeia are specific because they solve a number of health problems of the populations. Local populations have a deep knowledge of NTFPs and have been using them for a long time (Tchatat and Ndoye, 2006). Several associations and compositions are made by village herbalists to find specific solutions for the healing of different ailments (Bayoi et al., 2021).

Decoction is the most practiced mode of use at more than 97.1% for *R. heudelotii*, 98.9% for *I. gabonensis* and 94.9% for *T. tetraptera*. This study is similar to study of Kouchadé et al. (2016), who reporting that the decoction of the species is 93.48% following an ethnobotanical study on medicinal plants used in the treatment of diseases; Lougbégnon et al. (2015), having reported a decoction of the species at 75%; and Adomou et al. (2012) at 86%. This is in contrast to those of Ali (2019), who showed that maceration is the most common pharmaceutical form. These dissimilarities can be explained by the fact that these studies focused on the species in general. However, it should be noted that the use of seeds in the treatment of diseases is one of the means of safeguarding biodiversity as opposed to the use of organs such as roots, bark and so on, which are detrimental to the monitoring of the species (Ali, 2019). The level of availability of spice plants in markets is seasonal. They are more abundant during the peak production period and the price is relatively affordable

compared to the season of scarcity. In terms of marketing of *T. tetraptera*, only the fruits are self-consumed and marketed by local people (Tchapda et al., 2022). Sales prices and units of measurement vary from collectors to retailers. Prices are lowest among collectors and highest among retailers. The economic satisfaction of each group of actors depends on the species traded. Collectors have a higher level of satisfaction when they collect *R. heudelotii* and *I. gabonensis* because these species are highly prized by the population.

In the case of the town of Bertoua, collectors, retailers and wholesalers derive monetary value from NTFPs through their commercialization. Several authors have shown that they can contribute to increasing household income (Latifah et al., 2019; Pandey et al., 2019). For the case of Marancar Godang village in Indonesia, the contribution of NTFPs to household income is classified as moderate. NTFPs have been shown to contribute to human survival across generations and have an impact on increasing the income of people living around forests (Latifah et al., 2019). While commercialization trends are largely demand-driven, the main threat to future income opportunities will be overexploitation of the resource (Vuola et al., 2018).

Conclusions

The objective of this study was to make a diagnosis of socio-economic potential of *I. gabonensis*, *R. heudelotii*, and *T. tetraptera* in the city of Bertoua (East Cameroon). The results show that the target spice plants play an important role in the lives of the population. Women are mainly involved in the value chain of these NTFPs, and they represent an economic, food and medicinal source used for the well-being of households. These plants are mainly used as a decoction in meals. The seasonality of production is the main constraint encountered in the marketing of these spice plants, along with price fluctuations.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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