cosmetics

MDPI

Article

Herbal Cosmetics Knowledge of Arab-Choa and Kotoko Ethnic Groups in the Semi-Arid Areas of Far North Cameroon: Ethnobotanical Assessment and Phytochemical Review

Evariste Fongnzossie Fedoung [1,*], Tize Zra [1], Christine Fernande Nyangono Biyegue [1], Achille Nouga Bissoue [1], Suzanne Baraye [1] and Nole Tsabang [2]

[1] Advanced Teacher's Training School for Technical Education, University of Douala, Douala 1872, Cameroon; zratiz79@yahoo.fr (T.Z.); spfernande@yahoo.fr (C.F.N.B.); anbissoue@yahoo.fr (A.N.B.); barayesuzanne@yahoo.fr (S.B.)

[2] Institute of Medical Research and Medicinal Plant Studies, Yaounde 6163, Cameroon; tsabang@hotmail.com

* Correspondence: fong_nzossie@yahoo.com; Tel.: +237-677207532

Received: 31 March 2018; Accepted: 23 April 2018; Published: 2 May 2018

Abstract: The plant-based traditional knowledge of many Cameroonian populations concerning beauty and skin care is still poorly documented, yet they are real resources of innovation and economic development. The aim of this study is to document the indigenous knowledge of Choa Arab and Kotoko ethnic group in Kousséri (Far North Region of Cameroon) about plants used for cosmetics. Ethnobotanical data collected among key informants revealed a total of 13 plants species belonging to 12 families used by local people. *Canarium schweinfurthii* Engl and *Santalum album* L. obtained the highest frequency of citation. Trees are the most abundant life forms, while barks and seeds are the most frequently used parts. More than 40% of recorded plants are used for skin care. The cosmetic allegations of recorded plants include: dermatology, anti-cancers, antioxidant agent, perfume, anti-inflammatory, antimicrobial, wounds healing activity, skin lightening, dental caries, astringent and hair care. They all contain various phytochemicals that are of interest in cosmetics. Despite the strong relationship between the Choa Arab and Kotoko people and herbal cosmetic ingredients, these plants are still less investigated for their cosmetic application. The authors urge for the development of sustainable supply chain for plants with potentials as cosmetics, involving local communities in the planning, implementation and monitoring process, following principles of Nagoya protocol on Access and Benefit Sharing.

Keywords: Choa Arab; Kotoko; indigenous knowledge; phytochemicals; cosmetics

1. Introduction

The Far North Region of Cameroon is part of the African dryland ecosystems comprising five main Eco-regions: sahelian Acacia savannah, East sudanian savanna, Mandara Plateau mosaic, afrotropic Lake and Lake Chad flooded savannah [1]. This area, known as semi-arid is an important reservoir of plant biodiversity and has been receiving increasing attention from the scientific community [2,3]. This is because dryland biodiversity contains distinguishable features that are often overlooked. These include heterogeneity, remarkable diversity of micro-organisms, presence of wild relatives of globally important domesticated species, and traditionally adapted land use systems. As many other dryland ecosystems around the world, the Far North Region of Cameroon is among the most vulnerable to the global environmental problems such as desertification, climate change and loss of genetic resources [4]. It contains many of Africa's poorest and most food insecure people [5].

Conserving and valuing drylands natural resources are considered a pathway to raise awareness among all stakeholders and stimulate wider action to boost drylands conservation and development.

In Africa in general, local plant-based traditional knowledge have been used in conserving biodiversity and enhancing many essential services to society including material goods (for example, food, timber, medicines, cosmetics and fiber), ecosystem functions (flood control, climate regulation, and nutrient cycling), and nonmaterial benefits such as recreation [5]. Cosmetic products, according to European Union directives is defined as "any substance or preparation intended to be placed in contact with the various external parts of the human body (epidermis, hair system, nails, lips and external genital organs) or with the teeth and the mucous membranes of the oral cavity with a view exclusively or principally to cleaning them, perfuming them, or protecting them in order to keep them in good condition, change their appearance or correct body odours" [6]. Cosmetics have been used for as long as there have been people to use them. They have been present in almost all civilizations, and have been used in various forms and in many different circumstances (burial of the dead, religious rituals and everyday life), with the aim of preserving health and amplifying beauty. Researchers have reported the presence of paint pigments in archeological contexts over 75,000 years old. As early as 4000 BC, ancient Egyptians used natural resources to produce cosmetics [7] which were an integral part of their daily hygienic routine. They used creams and oils for protection, because of the hot and dry climatic conditions of Egypt. Of the majority of perfumes used in that period of time in religious practices and preservation of the dead, there were essential elements from herbs like cedar, peppermint, almond oil, rosemary, rose, *Aloe vera*, sesame oil, chamomile, and lavender [8]. Anti-wrinkle preparations with fresh squeezed olive oil, cypress, and scent mixed with freshly obtained milk was applied on the face for a week by Egyptians [9]. Furthermore, there is literature evidence supporting that ancient Egypt was the birthplace of aromatherapy; oils, perfumes and fragrance derived from pine trees and flowers were used by women, which demonstrates the vital role cosmetics played for this civilization [8].

Several ethnic groups live in the Far North Region of Cameroon and results from previous ethnographic survey have shown the predominance of five ethnic groups: Mousgoum, Bornouan, Peulhs, Arab Choa and Kotoko. The Kotoko historically trace their origins to the Sao people, early inhabitants of the Lake Chad area who converted to Islam beginning in the 16th century [10]. The Arab Choa group is found mainly in the Far North Region of Cameroon. Their origins can be traced as far back as the original seminomadic Arab tribes that populated the reaches of southern Egypt and pushed south into the Lake Chad region in the 14th century, where they live on the borders of Cameroon and Chad [10].

Recent botanical surveys in the Far North Region of Cameroon revealed a woody flora made of 75 species dominated by Caesalpiniaceae and species like *Piliostigma reticulatum*, *Annona senegalensis*, *Ziziphus mauritiana*, *Hexalobus monopetalus*, *Boswellia dalzielii*, *Combretum glutinosum*, *Entada Africana* and *Balanites aegyptiaca* were the most represented [11]. Other studies reported high ecological importance of *Guiera senegalensis*, *Anogeissus leiocarpus* and *Combretum collinum* [12]. In the sudano-sahelian zone of the Far North Region of Cameroon, *Adansonia digitata*, *Balanites aegyptiaca*, *Borassus aethiopum*, *Detarium microcarpum*, *Diospyros mespiliformis*, *Haematostaphis barteri*, *Hyphaena thebaica*, *Parkiabi globosa*, *Sclerocarya birrea*, *Ximenia americana*, *Vitellaria paradoxa*, *Vitex doniana*, *Tamarindus indica* and *Ziziphus mauritiana* have been cited among the most preferred and the most commercialized fruits in Adamawa, FarNorth and North Regions of Cameroon [13]. A survey conducted in Kousseri recorded 36 medicinal plants used to cure several ailments like diarrhoea, malaria/fever, rheumatism, wound and cough, with *Piliostigma reticulatum*, *Tamarindus indica*, *Balanites aegyptiaca*, *Azadirachta indica*, and *Mitragyna inermis* being the most cited plants [14]. About 29 of these medicinal plants were sold in the markets [15].

Natural resources extracted from plants have varied uses both on an industrial and traditional scale: pharmacology, herbal medicine, cosmetics, perfumes, dyes, insecticides, etc. Today, with the recent development of green technologies, the use of renewable raw materials plays a central role as an alternative to production processes that are not compatible with the principles of sustainable

development. If pharmacopoeia that lists plants for therapeutic use have long been experiencing significant development, work in the field of traditional cosmetics are still poorly documented in writings. Ethnobotanical literature on folklore cosmetic knowledge is lacking in Cameroon, though historical experiences with plants as therapeutic tools have helped to introduce many cosmetic formulations. Indeed, early surveys on active principles of medicinal plants of semi-arid areas showed that a number of them contain numerous phytochemicals of interest in cosmetics [16]. As the concept of Cosmetopoeia is being developed today to fill this gap, plants, by their ability to produce a wide variety of molecules, are receiving a growing interest for research in cosmetics. As for pharmacopoeia, cosmetopoeia is the repository of the use of plants for the beauty and body care. It represents an important part of the common history which unites the humans and their environment, and aims at better knowledge of the traditional uses of the plants in cosmetic in order to preserve them, to optimize their use in the respect of biodiversity and equitable benefit sharing. As the use of plant extracts in cosmetic formulation is currently increasing, mostly because of the poor image that chemical products have acquired during the past few years, there are many ongoing ethnobotanical investigations in Cameroon in search of new active cosmetic ingredients in the plant world. Among the Gbays ethnic group in East Cameroon, 36 plants and 78 derived cosmetic recipes were reported as used for facial masks and scrubs, body cream, hair cream, and preparation for teeth hygiene and dandruff among the Gbaya ethnic group in East Cameroon [17]. They all contained phytochemicals like enzymes, minerals, vitamins, alkaloids, phenolic compounds, steroids, saponins, glycosides, carbohydrates, coumarins, lecithin, and essential oils that are all active cosmetic ingredients.

This ethnobotanical survey for herbal cosmetics was carried out to document the indigenous knowledge of Choa Arab and Kotoko ethnic group about plants used for cosmetics.

2. Materials and Methods

2.1. Description of the Study Site

The far North region of Cameroon is part of the Sudano-Zambesian Region in Africa. The climate is semi arid, characterized by a long dry season (October to May) and a short rainy season (June to September). Annual rainfall varies between 850 and 1100 mm per year [18], with an average of 529 mm. The temperature varies from 21.7 to 35.7 °C, with an average of 28.4 °C. The hydrology distribution is characterized by river flow in two main drainage basins associated with the river Niger and Lake Chad. The Logone river is the major one. The surrounding vegetation corresponds to a typical Sudano-sahelian type, comprising thorn-bush steppe and savanna dominated by Acacia species, with variations depending upon groundwater supply. Continuous vegetative cover is largely restricted to the margins of watercourses [19]. Major ethnic groups populating the far North Cameroon include Arab-choa, Bornoa, Kotoko, Mandara from Cameroon and Kaninsou people who came from Chad. They practice agriculture, livestock farming, and fishing.

Data were collected in Kousseri neighborhood (Figure 1), located at 12.0871° N, 15.0148° E.

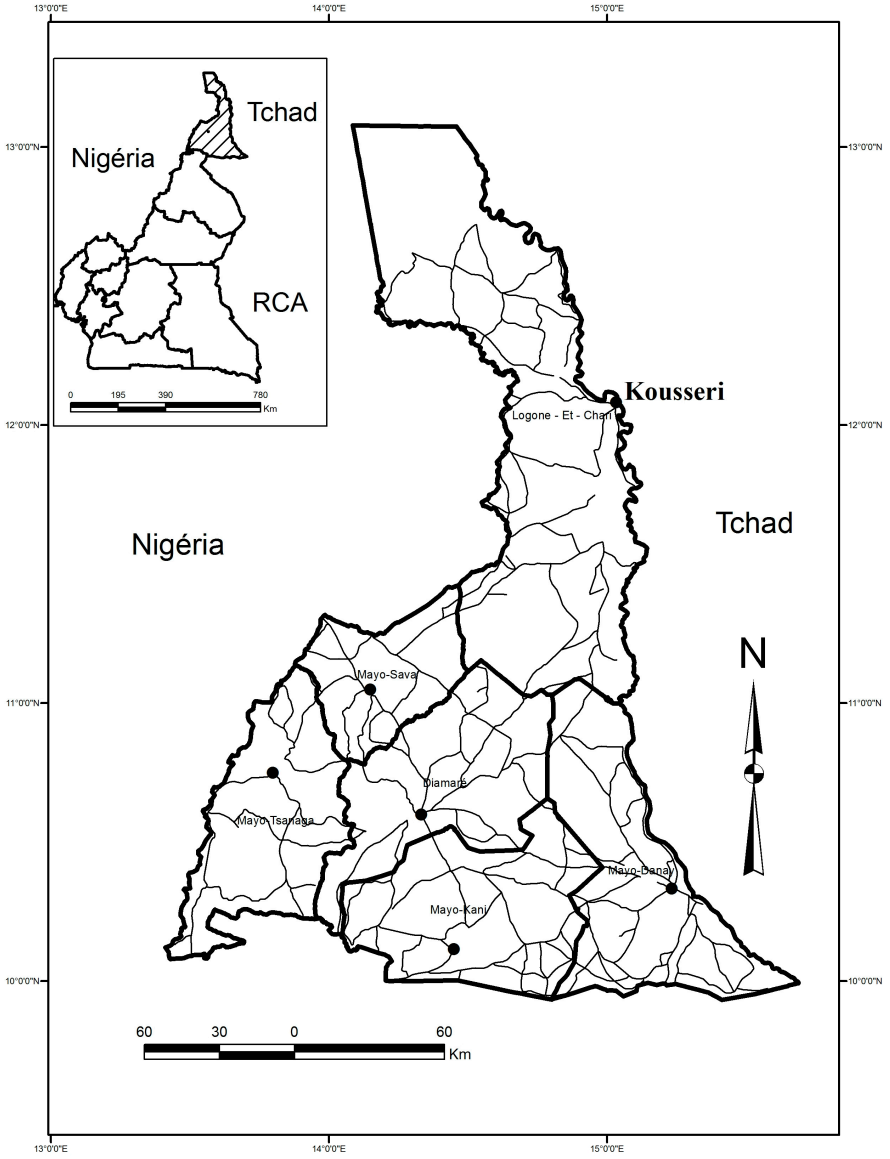

Figure 1. Location of study site.

2.2. Research Method

Ethnobotanical data collection was done through interviews conducted with key knowledgeable native informants. A total of 24 key informants including 13 Kotokos and 11 Choa arabs participated in the survey. Information regarding plants, parts used, usage, mode of preparation and administration were documented. Plant species were identified using reference floras of drylands areas [20]. Voucher specimens of unknown species were collected and preserved using standard herbarium techniques, and their identification was confirmed at the National Herbarium of Cameroon.

3. Results

3.1. Plants Used As Traditional Cosmetics

A total of 13 plants species belonging to 13 genera and 12 families has been recorded during this study (Table 1). The plant *Canarium schweinfurthii* and *Santalum album* obtained the highest frequency of citation.

Table 1. Recorded list of plants used as traditional cosmetics among Arab Choa and Kotoko.

N°	Species	Local Name	Part Used *	Usage	Frequency (%)
1	*Canarium schweinfurthii* Engl	Gamari	Bk, Fb, Rs	Barks, resins and flower buds are burned as incense to perfume the house	12.7
2	*Santalum album* L.	Sandal	Bk	Perfume for cloths	12.17
3	*Lawsonia inermis* L.	Hinna	Lv	Tattooing of hands and feet, nail varnish	11.64
4	*Elaeis guineensis* Jacq	Hamra	Fr	Gumming product for skin care	10.58
5	*Arachis hypogae* L.	Foul	S	Gumming product for skin care	10.05
6	*Panicum miliaceum* L.	Dourra amar	S	Gumming product for skin care	10.05
7	*Zea mays* L.	Massara	S	Gumming product for skin care	10.05
8	*Terminalia avicennioides* Guill. & Perr	Dorot	Bk	Perfume for clothes, Female genital tract shrinkage	6.88
9	*Croton Zambesicus* Müell. Arg.	Chébé		Acceleration of hair growth	5.82
10	*Citrus limon* (L.) Burm.f.	Lemon	Fr	Used for body waxing	4.76
11	*Crocus sativus* L.	Courcoum	Rt	Gives a beautiful, bright complexion with a yellowish color	3.17
12	*Syzigium aromaticum* (L.) Merr. & L.M.Perry	Grounfal	Fr	Skin care	1.06
13	*Vitellaria paradoxa* C.F. Gaertn.	Oum kouroum	S	Hair care	1.06

* Bk = bark; Fb = Flower bud; Rs = resin; Lv = leaves; Fr = fruits; S = seeds; Rt = roots.

3.2. Biological Forms and Part Used

These plant species are of three botanical forms: trees, shrubs and herbs. Trees are the most abundant life forms accounting for 60.85% of all plants recorded, followed by herbs (33.33%), shrubs (5.82%) (Figure 2).

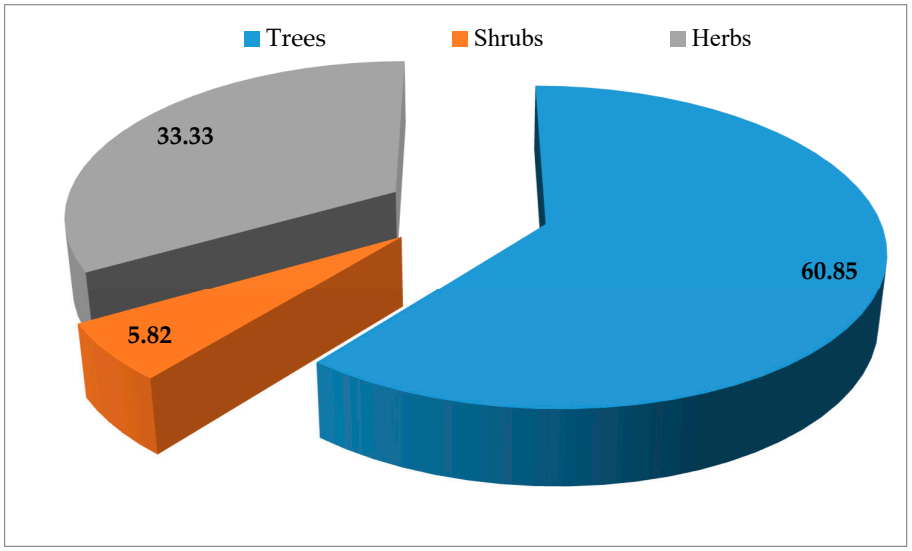

Figure 2. Biological forms of plants recorded.

Different parts of the plant species recorded are used as cosmetics including bark (31.2%), seeds (30.1%), fruits (16.4%), leaves (11.6%), flower buds (6.3%) and root (3.1%). The barks and seeds were the most frequently used plant parts (Figure 3).

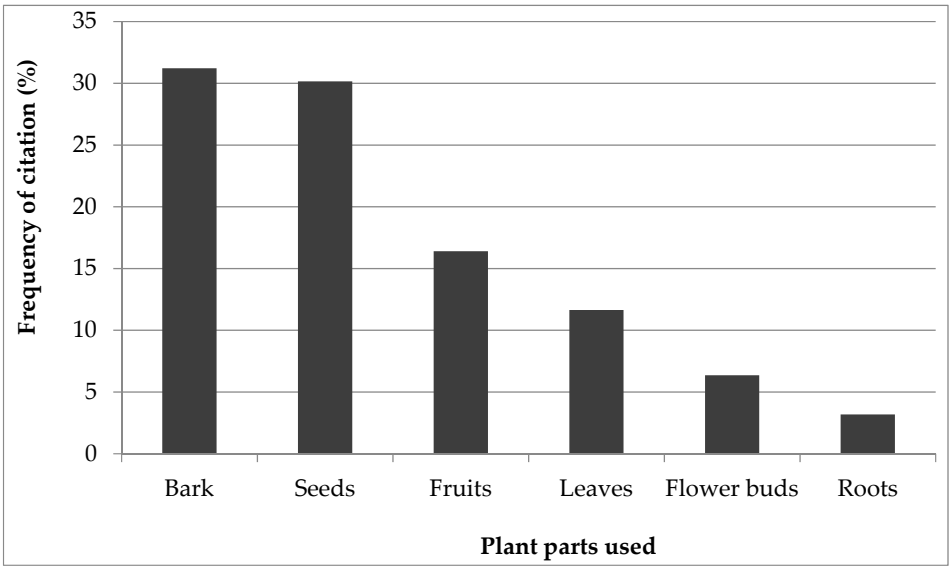

Figure 3. Plant parts used as cosmetics.

3.3. Cosmetic Use of the Recorded Plants

A great majority of recorded plants are used for skin care (42% of citations), perfume (27%) and for tattooing (11% of citations). Preparations for hair care were the least frequent use of recorded plants (Figure 4).

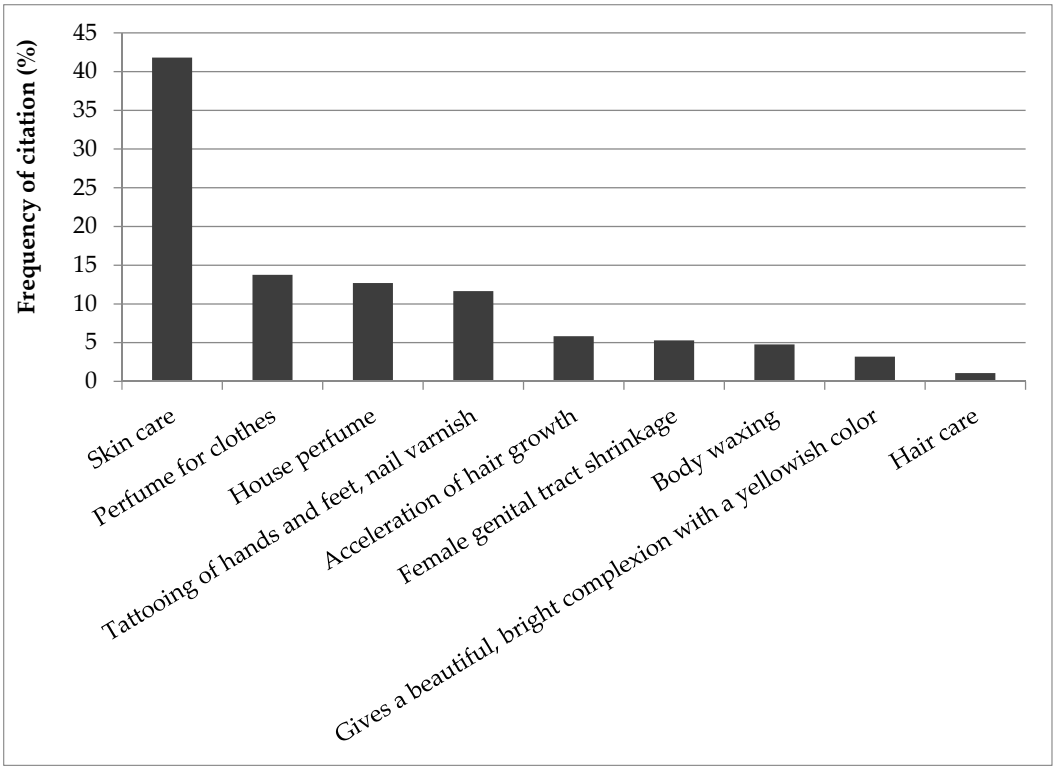

Figure 4. Cosmetic use of the recorded plants.

3.4. Phytochemical Review

For the 13 plants recorded, their cosmetic allegations concern essentially dermatology, anti-cancers, antioxidant agent, perfume, anti-inflammatory, antimicrobial, wounds healing activity, skin lightening, dental caries, astringent and hair care (Table 2). They all contain various phytochemicals that are all of interest in cosmetics.

Table 2. Phytochemical constituents and biological activity of recorded plants.

Species	Part Used	Phytochemical Constituents	Properties/Activities	References
Canarium schweinfurthii Engl	Seed	Seed kernel oil extract	chemoprevention of cancers and other oxidative damage-induced diseases	[21]
	Resin	Essential oil	natural antioxidant agent	[22,23]
	Barks	Polyphenols, triterpenes and steroids	antibacterial and antifungal activities	
Santalum album L.	wood	Tannins, terpenes, resins and waxes	Sandalwood oil useful in perfume industry	[24]
	wood	Essential oils	Antibacterial and antifungal activity	
	wood	A-Santalumol	skin cancer preventive effect	
Lawsonia inermis L.	Leaves	Lawsone, flavonoids, coumarins, triterpenoids, steroids, xanthones	anti-inflammatory, antibacterial, antimicrobial, antifungal, antiviral, antidermatophytic, antioxidant	[25,26]
Elaeis guineensis Jacq	oil	Phenolic, tannin and flavonoid compounds, vitamine E isomers (Tocopherols and tocotrienols)	Antioxidant activity	[27,28]
		Alkaloids, saponins, tannins, anthraquinones, steroids, flavonoids	Antimicrobial activity	
		Terpenoids and alkaloids	Wounds healing activity	[29]
		Oil	Excipient in most cosmetic preparation like the production of soaps	[30]
		Vitamine A	Slows the desquamation of the cells of the epidermis	[26]
Arachis hypogae L.	Seeds	Resveratrol, Tannins, phlobatannins, saponins, flavonoids, quinones, terpenoids and cardiac glycosides	Melanolytic and skin lightening activity, reducing cancer risks, inhibiting dental caries, antioxidant capacity	[31–33]
Panicum miliaceum	Seeds	Carbohydrates, protein, oleic acid, linoleic acid, stearic acid and essential minerals like phosphorus, manganese, calcium and magnesium and rich in B-complex vitamins	Applied as a poultice for abscesses and sores	[34]
Zea mays		Carotenoids, Phenolic compounds, Phytosterols, Selenium, vitamins A, C, and K, Anthocyanins	has the potential to alleviate pain and possess analgesic activity, antimicrobial, and anti-inflammatory properties	[35]
Terminalia avicennioides Guill. & Perr	Bark	Phenols, steroids, glycosides, flavonoids, tannins, ellagic acids, Anthraquinone, saponins, and terpenes	antimicrobial activity, Wound Healing Activity, Antioxidant activity, Antibacterial activity, Antifungal Activity	[36,37]
Croton zambesicus Müell. Arg.		Flavonoids, Saponins, Alkaloid, Tannins, Phenols, Triterpene, sesquiterpenes, Phytosterol, Anthraquinones and Carbohydrates, Labdanes, Trachylobanes, isopimaranes, Volatile Oils	antioxidant property	[38]
Citrus limon (L.) Burm.f.		Lemon peel	Astringent and good antimicrobial agent.	[39]
		Phenolic compounds, sesamin, sesamol, sesamolin, and phytosterol	Antioxydant	[28,40]
Crocus sativus L.		Phenolics flavonoids and Apocarotenoids, safranal, crocin	Antioxidant activity	[41,42]
		Crocin, crocetin, diglucosylcrocetin, and dimethylcrocetin	Anti-carcinogenic effects	[43]
Syzigium aromaticum (L.) Merr. & L.M.Perry	oil	Monoterpenes, sesquiterpenes, phenolics and hydrocarbon compounds, eugenol, eugenyl acetate and β-caryophyllene	antibacterial, antifungal, insecticidal, antioxidant, anticarcinogenic capacities	[44–46]
			topical analgesic in dentistry	

Table 2. *Cont.*

Species	Part Used	Phytochemical Constituents	Properties/Activities	References
Vitellaria paradoxa C.F. Gaertn.	Seed oil	Provitamine A, allantoine, tocopherols	Antioxydant, antimicrobial, treatment of scars, burns and erythemas, skin lightening, dryness of the hair and produces a good lubrication of the hair	[47]
		Triglycerides phospholipides palmitic, stearic, oleic, linoleique and linolenic acids		

4. Discussion

The 13 plant species identified in this study are well known for their various traditional uses in the tropical and semi-arid areas of Africa. Some like *Elaeis guineensis*, *Arachis hypogae*, *Syzigium aromaticum*, *Citrus limon*, *Lawsonia inermis* and *Vitellaria paradoxa* are very popular sources of cosmetic ingredients [17,47,48].

The uses of the resin/Gum, oil and fruits of *Canarium schweinfurthii* as food and medicine is well documented in Nigeria [49].

Terminalia avicennioides has been employed for many decades as a remedy to many diseases afflicting humans such as dental caries, skin infections, sore and ulcer, syphilis, bloody sputum, ringworm infection, gastrointestinal helminthes and several others [36,37].

Croton zambesicus is used in tropical west and central Africa to treat fever, dysentery and convulsions, urinary infections and malaria-linked fever [38].

Corn (*Zea mays*) is one of the most commonly grown foods in the world. Besides its use as food, *Zea mays* is used in therapeutics and cosmetics as analgesic, antiseptic, astringent, anti-diabetes, and diuretic, skin protectant, anti-inflammatory and anti-arthritic. *Zea mays* is also used to reduce tooth mobility, mitigate gum swelling and for its skin regenerative properties [50].

The Indian Sandalwood (*Santalum album*) is highly aromatic heartwood used to make artifacts and medicine. Sandalwood is well known for its uses in Indian traditions. In temples it is burned directly or in the form of incense sticks to worship Buddha [51]. In modern aromatherapy, it is used as Antiseptic, antinflammatory, Astringent, Disinfecting, Emollient, Soothing, etc. [52].

Proso millet (*Panicum miliaceum*) is a good source of carbohydrates, protein, oleic acid, linoleic acid, stearic acid; essential minerals like phosphorus, manganese, calcium and magnesium; phytochemicals like phytate, which is associated with reducing cancer risks, along with phenolic acids and benzoic acids [34].

In Islamic Traditional Medicine, Saffron (*Crocus sativus*), is reported to be used as gastro-hepatoprotective, oxytocic, treatment of urogenital disorders, antidepressant, treatment of ocular disorders, treatment of respiratory disorders, cardioprotective effects, anti-cancer effects, absorption enhancing and anti-inflammatory agent [41].

Vitellaria paradoxa is an important source of fat in food and cosmetics [53]. Its fatty matter has long been used in Africa for different purposes: food and soap processing, healthcare and other medicinal uses [54].

Previous ethnobotanical studies in the Sahelian areas of West Africa reported the multipurpose uses of many woody plant species like *Piliostigma reticulatum*, *Azadirachta indica*, *Acacia albid*, *Balanites aegyptiacus*, *Prosopis Africana*, *Sclerocarya birrea*, *Acacia nilotica*, *Guiera senegalensis*, *Hyphaene thebaica* and *Combretum glutinosum* [55–58]. Cameroon dry land flora is very rich in plant species which produce natural substances, essential oils and organic and wide-ranging aromas, all of which are vital to the food, pharmaceutical and cosmetics industries. Despite these potentials, most plant resources of this area have been overlooked by extension services at the expense of over-promoted exotic species [13].

With the growing demand for beauty and beauty products in the country in recent years, there is a great challenge of how Cameroon can profit from this huge demand while creating opportunity for herbal cosmetics and aroma products. Despite the country's rich endowment in biological resources, there is still little investment in research and development of new phytocosmetics. Yet, some giants of the cosmetics industries are showing increased interest in searching for new

cosmetics ingredients from the country's flora. This is the case for the Novella Project in Cameroon, Ghana, Nigeria, Tanzania and Kenya, a collaborative initiative between a commercial company (Unilever), an international Non-Governmental Organization (SNV Netherlands Development Organization), local NGOs, local businesses, collectors, transporters and processors, aimed at developing a sustainable supply chain for Allanblackia oil [59]. *Echinops giganteus* and *Mondia whitei* are two other species concerned by such pilot initiatives. Their vanilla-odour roots are currently sought by the French company V MANE FILS for the production of perfume, within the framework of a pilot Access and Benefit Sharing (ABS) project implemented in collaboration with the Ministry of Environment, Protection of Nature and Sustainable Development (ABS competent national Authority), the Magha community in South-West Cameroon) and a local non governmental organization Environment and Rural Development Foundation (ERuDeF) [60]. However, although an important amount of plant biodiversity is concentrated in the Southern developing countries, the technological capacities for transforming them into commercially viable products are predominantly found in industrialized countries. Recently, there has been an emerging paradigm in most African countries challenging the open access regime resulting in unrestricted South-North flow of plant-based raw materials increasingly translated into Intellectual Property-protected inventions, with the resulting economic benefits being appropriated by private Northern entities. As a result, most countries are currently working towards ratification of the Nagoya protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) [61] and developing national tools for the implementation of this protocol. Beyond that, it will be critical for countries to create a conducive environment to promote and encourage research related to conservation and wise use of plant biodiversity and to use the research-development continuum as a model for sustainable development.

5. Conclusions

In the Far North Region of Cameroon, there is a strong relationship between the Arab Choa and Kotoko people and plant resources. They have good knowledge of utilization of plants for cosmetic purposes. A total of 13 plant species have been reported in this study and their chemical evaluation based on available literature indicated they can be promising resources for cosmetic industry. Trees are the most frequent life forms of plants used as cosmetics; the barks and seeds are the most frequently used plant parts and skin care was the most frequent use of plants recorded.

This knowledge is however only transmitted orally and therefore, likely to be lost because of interference of modern and foreign cultural influence. Therefore, efforts are needed to understand and adequately document the indigenous knowledge about the use of herbal cosmetics. Despite their extensive traditional use in the study area and across semi-arid areas of tropical Africa, these plants have been investigated less for their cosmetic application. This study is an early investigation focusing on cosmetic utilization of local plants and there is further need of detailed and intensive investigations with particular reference to herbal cosmetics in the Far North Region of Cameroon. Indeed, traditional uses of plants are as real resources of innovation and economic development and it is therefore interesting for Cameroon to be familiar with their value and use. In addition, for a better valorization of local cosmetic plants, phytochemical and specific bioassay studies should be performed on promising species. For sustainable and long term conservation and promotion of plant resources of the area, there is a need to actively involve the local communities, planning, implementation and monitoring process following principles of Nagoya protocol on access to genetic resources and sharing of benefits derived from their utilization.

Author Contributions: E.F.F. and T.Z. conceived the experimental design of this study; E.F.F., T.Z. and S.B. performed the data collection; E.F.F. prepared the first draft of this paper; C.F.N.B. and A.N.B. adjusted the experiments and reviewed the first draft of the manuscript; N.T. revised the first draft of this manuscript.

Acknowledgments: The authors did not receive any funds for covering the costs to conduct this research or to publish in open access. We wish to express their gratitude to all the people of Kousseri locality for their cooperation and assistance.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Olson, D.M.; Dinerstein, E.; Wikramanayake, E.D.; Burgess, N.D.; Powell, G.V.N.; Underwood, E.C.; D'Amico, J.A.; Itoua, I.; Strand, H.E.; Morrison, J.C.; et al. Terrestrial ecoregions of the world: A new map of life on Earth. *BioScience* **2001**, *51*, 933–938. [CrossRef]
2. Thornthwaite, C.W. An approach toward a rational classification of climate. *Geogr. Rev.* **1948**, *38*, 55–94. [CrossRef]
3. Wessels, K.J. *Dryland Systems, Ecosystems and Human Well-Being: Current State and Trends*; Island Press: Washington, DC, USA, 2006; Chapter 22; pp. 623–662.
4. Maestre, F.T.; Salguero-Gómez, R.; Quero, J.L. It is getting hotter in here: Determining and projecting the impacts of global environmental change on drylands. *Philos. Trans. R. Soc. Biol. Sci.* **2012**, *367*, 3062–3075. [CrossRef] [PubMed]
5. Rands, M.R.; Adams, W.M.; Bennun, L.; Butchart, S.H.; Clements, A.; Coomes, D.; Entwistle, A.; Hodge, I.; Kapos, V.; Scharlemann, J.P.; et al. Biodiversity Conservation: Challenges Beyond 2010. *Science* **2010**, *329*, 1298–1303. [CrossRef] [PubMed]
6. European Parliament and Council of the European Union. Regulation (EC) N° 1223/2009 of the European Parliament and of the Council of 30 November 2009 on cosmetic products (recast). *Off. J. Eur. Union* **2009**, *L342/59*, 151.
7. Hetta, M.H. Phytocosmetics in Africa. *Int. J. Phytocosmet. Nat. Ingred.* **2016**, *3*, 1. [CrossRef]
8. Mahomoodally, F.M.; Ramjuttun, P. Phytocosmetics from the African Herbal Pharmacopeia. *Int. J. Phytocosmet. Nat. Ingred.* **2017**, *4*, 4. [CrossRef]
9. Oumeish, Y. The cultural and philosophical concepts of cosmetics in beauty and art through the medical history of mankind. *Clin Dermatol.* **2001**, *19*, 375–386. [CrossRef]
10. DeLancey, M.D.; Mbuh, R.N.; DeLancey, M.W. *Historical Dictionaries of Africa*; No. 113; The Scarecrow Press, Inc.: Lanham, MD, USA; Toronto, ON, Canada; Plymouth, UK, 2010; 531p.
11. Todou, G.; Froumsia, M.; Souaré, K.; Nnanga, J.F. Woody plants diversity and type of vegetation in non cultivated plain of Moutourwa, Far North, Cameroon. *J. Agric. Environ. Int. Dev.* **2016**, *110*, 217–227.
12. Haiwa, G.; Tchobsala; Ngakou, A. Ecological characterization of the Vegetation in the Sudano-Sahelian Zone of Cameroon. *Acad. J. Biosci.* **2017**, *5*, 164–173.
13. Mapongmetsem, P.M.; Kapchie, V.N.; Tefempa, B.H. Diversity of local fruit trees and their contribution in sustaining the rural livelihood in the northern Cameroon. *Ethiop. J. Environ. Stud. Manag.* **2012**, *5*, 32–46. [CrossRef]
14. Betti, J.L.; Mebere Yemefa'a, S.R. An ethnobotanical study of medicinal plants used in the Kalamaloué National Park, Cameroon. *J. Med. Plants Res.* **2011**, *5*, 1447–1458.
15. Betti, J.L.; Mebere Yemefa'a, S.R.; Nchembi, F.T. Contribution to the knowledge of non wood forest products of the far north region of Cameroon: Medicinal plants sold in the Kousséri market. *J. Ecol. Nat. Environ.* **2011**, *3*, 241–254.
16. UNESCO. *Les Plantes Médicinales des Régions Arides*; UNESCO: noy, Paris-7, France, 1960; 97p.
17. Fongnzossie, E.F.; Tize, Z.; Fogang Nde, P.J.; Nyangono Biyegue, C.F.; Bouelet Ntsama, I.S.; Dibong, S.D.; Nkongmeneck, B.A. Ethnobotany and pharmacognostic perspective of plant species used as traditional cosmetics and cosmeceuticals among the Gbaya ethnic group in Eastern Cameroon. *S. Afr. J. Bot.* **2017**, *112*, 29–39. [CrossRef]
18. L'Hote, Y. *Climatologie et Agroclimatologie de la Province Extrême Nord (PEN) du Cameroun. Préparation de l'Atlas de la PEN*; Laboratoire d'Hydrologie, 1998; 31p, Available online: http://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_6/griseli1/010014730.pdf (accessed on 2 May 2018).
19. Boutrais, J.; Boulet, J.; Beauvilain, A.; Gubry, P.; Barreteau, D.; Die'j, M.; Breton, R.; Seignobos, C.; Pontie, G.; Marguerat, Y.; et al. *"Le Milieu Naturel"—Le Nord du Cameroun: Des hommes, une Région*; ORSTOM (Collection Memoires n°102): Paris, France, 1984; pp. 19–100.

20. Arbonier, M. *Arbres Arbustes et Lianes des Zones Sèches d'Afrique de l'Ouest*; MNHN-Quae: Paris, France, 2009; 571p.
21. Atawodi, S.E. Polyphenol composition and in vitro antioxidant potential of Nigerian *Canarium schweinfurthii* Engl. Oil. *Adv. Biol. Res.* **2010**, *4*, 314–322.
22. Ngbolua, K.N.; Moke, L.E.; Lumande, J.K.; Mpiana, P.T. *Canarium schweinfurthii* Engl. (Burseraceae): An updated review and future direction for sickle cell disease. *J. Adv. Med. Life Sci.* **2015**, *1–5*. Available online: https://pdfs.semanticscholar.org/e81c/8b67699994fddda149ff106f84cbb5fedc8f.pdf?_ga=2.43720102.2019391631.1525225105-1418532351.1513041768 (accessed on 2 May 2018).
23. Tcheghebe, T.O.; Seukep, A.J.; Ngouafong Tatong, F. A Review on Traditional Uses, Phytochemical Composition and Pharmacological Profile of *Canarium Schweinfurthii* Eng. *Nat. Sci.* **2016**, *14*, 17–22.
24. Rakesh, K.S.; Upma, A.K.; Sahil, A. *Santalum album* Linn: A review on morphology, phytochemistry and pharmacological aspects. *Int. J. PharmTech Res.* **2010**, *2*, 914–919.
25. Borade, A.S.; Kale, B.N.; SheteWagini, R.V. A phytopharmacological review on *Lawsonia inermis* (Linn.). *Int. J. Pharm. Life Sci.* **2011**, *2*, 536–541.
26. Wagini, N.H.; Soliman, A.; Abbas, M.S.; Hanafy, Y.A.; Badawy, E.S.M. Phytochemicl analysis of Nigerian nd Egyptian henna (*Lawsonia inermis* L.) leaves using TLC, FTIR and GCMS. *Plant* **2014**, *2*, 27–32. [CrossRef]
27. Yin, N.S.; Abdullah, Y.; Phin, C.K. Phytochemical constituents from leaves of *Elaeis guineensis* and their antioxidant and antimicrobial activities. *Int. J. Pharm. Pharm. Sci.* **2013**, *5*, 137–140.
28. Kalyana, S.; Ravigadevi, S.; Yew-Ai, T. Palm fruit chemistry and nutrition. *Asia Pac. J. Clin. Nutr.* **2003**, *12*, 355–362.
29. Sreenivasan, S.; Nilawatyi, R.; Rathinam, X.; Lachimanan Yoga, L.; Amala, R. Wound healing potential of *Elaeis guineensis* Jacq leaves in an infected albino rat model. *Molecules* **2010**, *15*, 3186–3199.
30. Rabasco, A.A.M.; González, R.M.L. Lipids in pharmaceutical and cosmetic preparations. *Grasas y Aceites* **2000**, *51*, 74–96.
31. Galgut, J.M.; Ali, S.A. Effect and mechanism of action of resveratrol: A novel melanolytic compound from the peanut skin of *Arachis hypogaea*. *J. Recept. Signal Transduct. Res.* **2011**, *31*, 374–380. [CrossRef] [PubMed]
32. Sim, E.W.; Lai, S.Y.; Chang, Y.P. Antioxidant capacity, nutritional and phytochemical content of peanut (*Arachis hypogaea* L.) shells and roots. *Afr. J. Biotechnol.* **2012**, *11*, 11547–11551.
33. Prabasheela1, B.; Venkateshwari, R.; Nivetha, S.; Mohana Priya, P.; Jayashree, T.; Vimala, R.; Karthik, K. Phytochemical analysis and antioxidant activity of *Arachis hypogeal*. *J. Chem. Pharm. Res.* **2015**, *7*, 116–121.
34. Nuwan, V.G.S.I.; Ediriweera, E.R.H.S.S.; Wasana, R.K.R. Medicinal and nutritional value of *Panicum miliaceum* L. (Meneri): A review. In Proceedings of the National Research Symposium: Fundamentals of Indigenous Medicine: Challenges and New Perspectives, Colombo, Sri Lanka, 22 December 2016.
35. Owoyele, B.V.; Negedu, M.N.; Olaniran, S.O.; Onasanwo, S.A.; Oguntoye, S.O.; Sanya, J.O.; Oyeleke, S.A.; Ibidapo, A.J.; Soladoye, A.O. Analgesic and anti-inflammatory effects of aqueous extract of *Zea mays*. Husk in male Wistar rats. *J. Med. Food* **2010**, *13*, 343–347. [CrossRef] [PubMed]
36. Mann, A.; Yahaya, Y.; Banso, A.; John, F. Phytochemical and antimicrobial activity of *Terminalia avicennioides* extracts against some bacteria pathogens associated with patients suffering from complicated respiratory tract diseases. *J. Med. Plants Res.* **2008**, *2*, 94–97.
37. Azeez, M.A.; Yekeen, T.A.; Animasaun, D.A.; Durodola, F.A.; Bello, O.B. *Terminalia avicennioides* as a potential candidate for pharmaceutical industry: A Review. *Res. J. Pharm. Biol. Chem. Sci.* **2015**, *6*, 748–754.
38. Salatino, A.; Maria, L.; Salatino, F.; Giuseppina, N. Traditional uses, Chemistry and Pharmacology of Croton species (Euphorbiaceae). *J. Braz. Chem. Soc.* **2007**, *18*, 11–33. [CrossRef]
39. Maruti, J.D.; Chidamber, B.J.; Jai, S.G.; Kailash, D.S. Study of Antimicrobial activity of Lemon (*Citrus lemon*) Peel extract. *Br. J. Pharmacol. Toxicol.* **2011**, *2*, 119–122.
40. Campêlo, L.M.L.; Gonçalves, F.C.M.; Feitosa, C.M.; Freitas, R.M. Antioxidant activity of *Citrus limon* essential oil in mice hippocampus. *Pharm. Biol.* **2011**, *49*, 709–715. [CrossRef] [PubMed]
41. Shoib, A.B.; Aubid, H.M.; Zahoor, A.W.; Tabasum, M.; Zeeshan, S.; Nazia, A.; Nasheeman, A. Phytochemical analysis and antioxidant activity of different tissue types of *Crocus sativus* and oxidative stress alleviating potential of saffron extract in plants, bacteria, and yeast. *S. Afr. J. Bot.* **2015**, *99*, 80–87.
42. Bhargava, V.K. Medicinal uses and pharmacological properties of *Crocus sativus* Linn (Saffron). *Int. J. Pharm. Pharm. Sci.* **2011**, *3*, 22–26.

43. Javadi, B.; Sahebkar, A.; Emami, S.A. A Survey on Saffron in Major Islamic Traditional Medicine Books. *Iran. J. Basic Med. Sci.* **2013**, *16*, 1–11. [PubMed]
44. Mittal, M.; Gupta, N.; Parashar, P.; Mehra, V.; Khatri, M. Phytochemical evaluation and pharmacological activity of *Syzygium aromaticum*: A comprehensive review. *Int. J. Pharm. Pharm. Sci.* **2014**, *6*, 67–72.
45. Diego, F.C.R.; de Souza Fernandes, C.R.; Oliveira, W.P. Clove (*Syzygium aromaticum*): A precious spice. *Asian Pac. J. Trop. Biomed.* **2014**, *4*, 90–96.
46. Huang, X.W.; Feng, Y.C.; Huang, Y.; Li, H.L. Chemical composition, antioxidant and the possible use as skin-care ingredient of clove oil (*Syzygium aromaticum* (L.) Merr. & Perry) and citronella oil (*Cymbopogon goeringii*) from China. *J. Essent. Oil Res.* **2013**, *25*, 315–323.
47. Ansel, J.L.; Butaud, J.F.; Raharivelomanana, P. Bibliographical analysis of main lignified taxons used in tropical cosmetopoiea. *C. R. Chim.* **2016**, *19*, 1035–1048. [CrossRef]
48. Sharma, R.K.; Goel, A.; Bhatia, A.K. *Lawsonia inermis* Linn: A plant with cosmetic and medical benefits. *Int. J. Appl. Sci. Biotechnol.* **2016**, *4*, 15–20. [CrossRef]
49. Dawang, S.N.; Danahap, T.S.; Makvereng, S.S.; Nyam, M. Preliminary Survey of the Indigenous Knowledge of *Canarium schweinfurthii* Engl. (Atile) In Some Parts of Plateau State, Nigeria. *IOSR J. Pharm. Biol. Sci. (IOSR-JPBS)* **2016**, *11*, 76–78.
50. Linnea. *Zea mays* Unsaponifiable Fraction. 2012. Available online: https://www.linnea.ch/media/4857/lin_scheda-zea-mays.pdf (accessed on 23 February 2018).
51. Chinese Herbs Healing. Sandalwood (*Santalum Album*, Tan Xiang). 2012. Available online: http://www.chineseherbshealing.com/sandalwood/ (accessed on 23 February 2018).
52. Fallick, K. *Relevance of the Chemical Constituency of East Indian Sandalwood Essential Oil to Therapeutic and Traditional Use*; Australasian College of Natural Therapies: Sydney, Australia, 2009; 14p.
53. Nikiema, A. Agroforestry Parkland Species Diversity: Uses and Management in Semi-Arid West Africa (Burkina Faso). Ph.D. Thesis, University of Wageningen, Wageningen, The Netherlands, 2005.
54. Warra, A.A. Cosmetic potentials of African sheet nuts (*Vitellaria paradoxa*) butter. *Curr. Res. Chem.* **2011**, *3*, 80–86.
55. Diop, M.; Kaya, B.; Niang, A.; Olivier, A. *Les Espèces Ligneuses et Leurs Usages: Les preferences des paysans dans le Cercle de Ségou, au Mali*; ICRAF Working Paper No. 9; World Agroforestry Centre Nairobi: Nairobi, Kenya, 2005.
56. Lykke, A.M.; Kristensen, M.K.; Ganaba, S. Valuation of local use and dynamics of 56 woody species in the Sahel. *Biodivers. Conserv.* **2004**, *13*, 1961–1990. [CrossRef]
57. Okullo, J.B.L.; Omujal, F.; Agea, J.G.; Vuzi, P.C.; Namutebi, A.; Okello, J.B.A.; Nyanzi, S.A. Physico-chemical characteristics of shea butter (*Vitellaria paradoxa* C.F. Gaertn.) oil from the shea districts of Uganda. *Afr. J. Food Agric. Nutr. Dev.* **2010**, *10*, 2070–2084. [CrossRef]
58. Coulibaly, Y.; Ouedraogo, S.; Niculescu, N. Experimental study of shea butter extraction efficiency using a centrifugal process. *ARPN J. Eng. Appl. Sci.* **2009**, *4*, 14–19.
59. Attipoe, L.; Van Andel, A.; Nyame, S.K. *The Novella PROJECT. Developing a Sustainable Supply Chain for Allanblackia Oil*; SNV Netherlands Development Organisation: Accra, Ghana, 2006; 11p.
60. UNDP. *A Bottom-Up Approach to ABS: Community Level Capacity Development for Successful Engagement in ABS Value Chains in Cameroon (Echinops giganteus and Mondia whitei)*; Cameroon Project Document; UNDP: Yaoundé, Cameroon, 2016; 120p.
61. Buck, M.; Hamilton, C. The nagoya protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization to the convention on biological diversity. *Matthias Buck Clare Hamilt.* **2011**, *20*. [CrossRef]