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Vulnerability assessment of *Gnidia glauca* (Thymelaeaceae) exploitation, traditional uses and domestication potential in the community forest of Kilum-Ijim, North Western Cameroon

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A study was conducted in the western highland region of Cameroon with the aim to assess sustainability of *Gnidia glauca* exploitation in its natural habitat. In 33 plots of 40 x 40 m, the unexploited, exploited and dead trees were evaluated for vitality using a multi-criteria vulnerability assessment method. An ethnobotanical survey was conducted with 60 respondents in six villages around Mount Oku area. Data were submitted to ANOVA and means separated using Duncan test. The results revealed that 95 % of G. glauca trees were unexploited and only 3.92% showed signs of exploitation, among which 1.08% were dead. Among the exploited stems, 18% showed a completely dead crown, whereas 73% were described to be regular and healthy. Wood (29%) and bark (28%) were the main products being exploited. However, the species' bark was the most frequently harvested product (64%). *G. glauca* was shown to be more vulnerable in forests (2.6) than in savanna (2.4). The motivating factors for the species' domestication were the fragility of its habitat, the potential high future demand for its products and the unsustainable exploitation techniques being applied. It is therefore recommended to promote the species uses, conservation and cultivation within its national distribution range for local livelihood improvement.

Key words: Ethnobotany, *Gnidia glauca*, sustainable management, vulnerability, Cameroon.

INTRODUCTION

Mountain forest ecosystems of the Bamenda Highlands in Cameroon were considered as zones of high biodiversity concentration in the Africa continent in 2007 (Bergl et al., 2007; Burgess et al., 2007) and globally in

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2000 (Myers et al., 2000). In fact, species richness, range-size rarity, and threatened species scores are all significantly higher in Bamenda highlands along with Eastern Arc and Albertine Rift than in other sub-Saharan Africa land use type (Burgess et al., 2007). Mount Oku is one of the highest peaks in the Bamenda Highlands, and is among the sites with the highest endemism rates in the region, including 14 plants and 10 animals species as assessed in early 2000 (Cheek et al., 2000; Asanga, 2002; Forboseh et al., 2003). The Oku mountain forest provides diverse ecological functions as it plays a vital role for local human populations, providing them with drinking water, firewood and wood for construction, honey, medicine and food plants. This forest is also part of the spiritual and cultural heritage at Cameroon level (Gardner et al., 2001). Among the exploited products of this mountain forests are non-timber forest products, mostly collected from their natural environment. This mount Oku forest, already naturally isolated from other forested areas within the country due to its mountainous characteristics, is also highly fragmented by the progression of farm lands, repeated fires, increasing wood harvesting (Gardner et al., 2001) and unregulated exploitation of forest products (Stewart, 2009).

Since 1994, the Kilum-Ijim Forest Project has been working with 44 communities with the aim of establishing legally recognized community forests, which will cover the entire forest highland within the area. The main goal of this action was to insure the sustainable management of the Kilum-Ijim Forest resources. In actual fact, the communities around the forest have a strong interest in the forest, depending on it for a wide range of products, the most important being fuelwood, medicines (*Prunus africana*), honey, building materials and pulp for paper. For this last use, the bark of *Gnidia glauca* (Thymelaeaceae) is used for the local manufacture of wrapping papers (Ferrari, 2002).

The Thymelaeaceae comprise 46 to 50 genera and 890 to 900 species, mostly confined to Africa, Australia, and Asia and found in lowland to montane environments (Klitgård and Baracat, 2014). Many species of the family are reported to have diverse traditional uses (Ferrari, 2002).

G. glauca is one of the most important species of the Thymelaeaceae family. It is a small tree of 6 to 25 meter in height, with a hard fibrous bark. The species is largely widespread in tropical Africa, from Nigeria in the west towards Sudan at the east, and from Ethiopia in the North towards Malawi and Zambia in the south. Almost all parts of *G. glauca* plants are reported to have several medicinal uses and it provides many households services throughout its natural distribution range. In traditional phytomedicine, leaves, roots, and barks are documented for the treatment of throat ache, abdominal pains, sores, burns, snake bites, contusions, swellings, back and joint pains, indigestion, rabies and blisters in East Africa (Amarajeewa et al., 2007; Kareru et al., 2007). Moreover, the species potential in nanomedicine have been positively tested (Mittal et al., 2013). As a household service, fiber from the bark is made into rope and thread. The plant is also known to have toxic properties and is used as an insecticide, piscicide, poison for fish and arrow (Brink, 2009).

Although *G. glauca* is reported in many vegetation studies (Asanga, 2002; Assi-kaudjhis et al., 2010) from central African highlands, its uses, management and ecological status within the region is poorly documented; hence offsetting the elaboration of a strategy for its sustainable management. A previous study reported that *G. glauca* was among the most vulnerable medicinal tree species exploited in Chilimo forest of Ethiopia, showing lack of regeneration and an erratic stand structure (Soromessa and Kelbessa, 2015). In order to promote the species valorization in Cameroon, there is a need to document the actual products and uses of the species, as well as the exploitation practices and vulnerability status of exploited stands. Therefore, the present work was designed to determine optimal practices for the exploitation of the bark of the plant. The participation of the local populations in the various processes of evaluation and follow-up in order to define a viable operating system which is socially suitable, economically viable and ecologically durable was taken into account (Guedje et al., 2017). The aim of the study is to characterize the sustainability of exploited populations of *G. glauca*, in relation to local uses in the Oku area within the Kilum Ijim Mountain Forest of Cameroon.

MATERIALS AND METHODS

Description of study area

Mount Oku does not form a clear mountain as it occurs on the Bamenda Plateau. The Kilum-Ijim forest, which covers Mount Oku, is the largest of the remaining patches and is the most important remnant of Afro-montane forest in West Africa. It is located on Mount Kilum (3011 m a.s.l.) and the adjoining Ijim Ridge (2000 to 2500 m a.s.l.). It was recognised in 2001 as a globally important centre for endemism (Gardner et al., 2001). Habitats on Mt Oku consist of montane forest with high altitude *Podocarpus* forest, *Gnidia glauca* and *Maesa lanceolata* woodlands, mature bamboo forest, *Erica mannii* scrubland, montane grassland, and subsistence agriculture. The national Gross Domestic Product per capita is considered to be the lowest for the Central African region with the national monthly revenue per inhabitant estimated at 117US $ in 2016 (World Bank, 2017).

The population is constituted mainly by small scale farmers cultivating *Coffea arabica* as cash crop associated with staple food crops such as maize, potatoes, yams and beans among others in farmlands of less than 2 ha. Therefore, they strongly depend on NTFPs exploitation for their daily health care, food, and income.

In the Kilum-Ijim montane forest area, there is significant relationship between the exploitation of forest resources and the well-being of communities adjacent to forest landscape. This implies that the exploitation of forest resources greatly helps in generating income that is used by the communities in purchasing their basic needs. The exploitation of resources such as fuel wood and building materials directly help to sustain the daily needs of

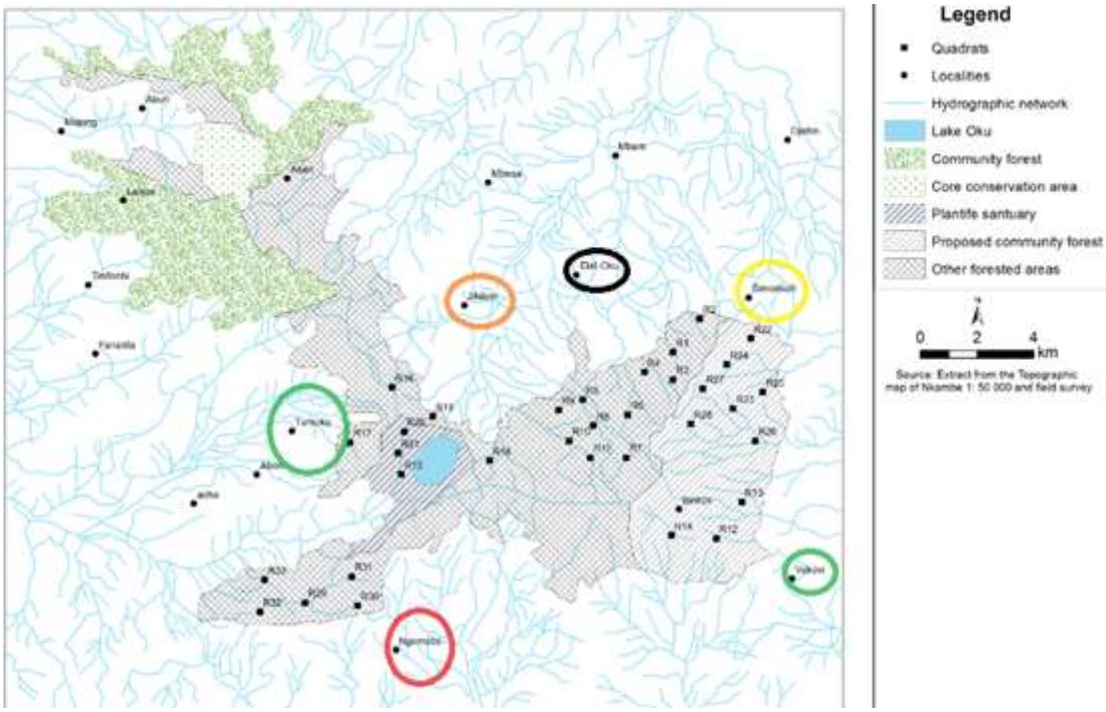

Figure 1. Distribution of sampling villages and sites around the Mount Oku area.

households around this forest area (Kimengsi and Ngala, 2018).

Selection of study site

Montane forests around Mount Oku were sampled at various altitudes. The sampling criteria were based on the occurrence of *G. glauca* in the nearest forest to selected villages, communities' knowledge of the species and its uses, as well as the willingness of villagers to freely participate in the study. The selected villages were: Elak (2474 to 2785 m above sea level), Vekovi (2283 to 2348 m a.s.l.), Simonkoh (2185 to 2391 m a.s.l.), Jikijem (2326 to 2401 m a.s.l.), Ngemsiba (1963 to 2198 m a.s.l.) and Lake (2185 to 2459 m a.s.l.). The sampled sites are represented on the Mount Oku Map illustrated in Figure 1.

Ethnobotanical survey

Interviews were conducted from September to October 2012 with resourceful persons, using previously established questionnaires. Sixty respondents, selected using snowball method and consisting of 36 men and 24 women, divided into 3 age classes, 38 people (≥40 years), 14 people (25 to 40 years) and 8 people (17 to 25 years) were sampled for the study. The number of respondents per village was determined by the availability of the species' knowledgeable persons and varied from a minimum of 8 respondents (Vekoki, Ngemsiba and Lake village) to 10, 12 and 14 people at Jikijem, Simonkoh and Elak Oku respectively. The respondents were first informed on the objectives of the study and their free and verbal consent requested before starting the interview. The discussion themes focused on knowledge about products, uses, harvesting methods, plant parts collected, frequency and season of collection of *G. glauca* in Kilum-Ijim Forest.

Vulnerability assessment

The method of quadrat (total: 1600 m^2) was used to assess the sustainability of exploitation method being applied on *G. glauca*. In 2007, the surface area of mount Oku forest was 9544 ha (Momo et al., 2012). Thus, 5.28 ha of the Kilum-Ijim Forest was sampled representing approximately 0.05% of the above mentioned forest area. The thirty three plots of 40 x 40 m were set from 1963 to 2785 m a.s.l. in the *G. glauca* woodlands. In each plot, all *G. glauca* exploitable stems (dbh≥20 cm) were identified and counted.

The vulnerability parameters (Table 1) used in the assessment constituted of 4 criteria and 3 level scales as described by Betti (2001), Tsabang (2008), and Kemeuze (2010). Such criteria included: gathering method, the life form or morphology, the vegetative organ harvested, as well as the popularity of the species at a given site. The crown health status of the trees was evaluated based on the percentage of drying out (0, 20, 40, 60, 80 and 100% (dead individual).

The values from 1 to 3 are assigned to each of the parameters used for the assessment, which affected the survival of the species within a particular land use system. The overall vulnerability index (VI) was estimated by calculating the average of the values obtained for all the 4 parameters considered in Table 1, with: $1 < VI \leq 2$, meaning that the plant is not vulnerable and the natural potential is still quite appropriate for exploitation; $2 < VI \leq 2.5$ indicates that the plant is becoming vulnerable in the given environment; $VI \geq 2.5$ shows that the plant is highly vulnerable and need sustainable management strategies.

The health status of the tree crown of *G. glauca* was adapted from the methodology developed by Cunningham (2001). The method is based on the possible effect of the bark harvesting on the

Table 1. Parameters assessed for the estimation of the vulnerability index (VI) in the various land use systems considered for the study.

Parameters	Vulnerability scales		
	Weak (Scale 1)	**Medium (Scale 2)**	**High (Scale 3)**
Life form	Herbs	Shrub	Tree
Popularity	Not popular (F<20%)	Less popular (20%<F<60%)	Popular (F>60%)
Part collected	Leaves	Fruits	Bark, roots and wood
Collection methods	Harvesting of the leaves	Harvesting of the seeds	Debarking and felling

Scale 1: low vulnerability (high chance of surviving after harvest), Scale 2: average vulnerability; and 3: highly vulnerable after exploitation (Betti, 2001).

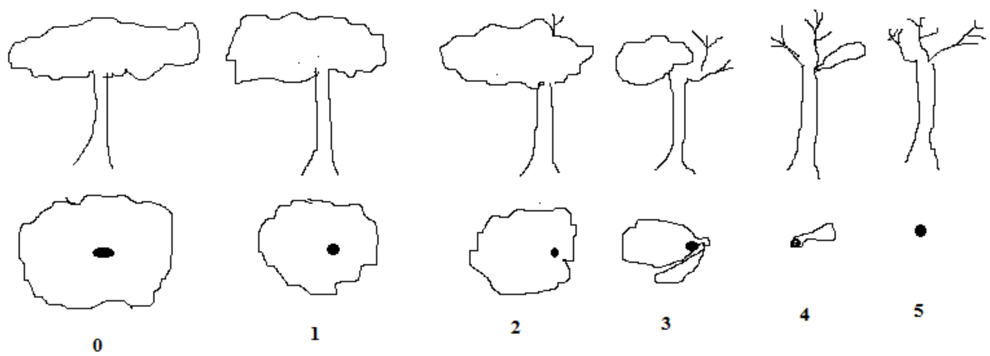

Figure 2. Classification of the health status of the tree crown as a function of the state of their crown (Modified from Cunningham, 2001). The status of the crown is thereafter related to the exploitation intensity of the tree (Cunningham, 2001): (0): Perfect, complete circle; excellent size and development, wide, symmetrical and generally circular in plan; (1): Good irregular circle; slightly asymmetrical with some dead branch tips (silviculturally satisfactory" to forester); (2): Tolerable: half of the crown; markedly asymmetrical, some die-back; (3): Poor: extensive die-back, leaves form less than half of the original crown size; (4): Very poor: few leaves on the branches; badly damaged, unlikely to survive; (5): Dead.

reduction of the tree crown, starting from the entire crown for an unexploited and healthy stem (0) to complete death of the crown for an overexploited and dead tree(5) (Figure 2).

Data analysis

Data recorded for different variables (exploited and dead individuals) were analyzed using the statistical software package SPSS 17.0 for Windows. Collected data were tested for normality using the Shapiro-Wilk test before being submitted to Analysis of Variances (ANOVA) to determine variability among means of exploited, unexploited and dead trees and the DUNCAN test was used to separate significantly ($p<0.05$) different means.

RESULTS

Current practices of *G. glauca* exploitation in the Mount Oku area

Exploitation of *G. glauca* is carried out both in the dry and rainy seasons. 91.66% of respondents harvests the species bark during both seasons, 5.78% in rainy season while 2.78% of them were harvested in dry season. *G. glauca* products are usually harvested individually for personal use, as none of these products were found to have any commercial value following ethnobotanical survey. The choice of *G. glauca* was driven by the presence and the abundance of exploitable stems, the user's need and site accessibility. The criteria for the selection of the harvestable trees were the thickness of the bark (22 % of respondents), size of the tree (67%) and the color of the bark after notching (11%). Machetes were the only harvesting tool cited by all respondents as needed for the peeling of the bark. The debarking technique applied varied from circular ring removal of the bark on more than 50% on the tree boles starting at the base to the middle of the trunk, to the collection of small patches of bark of irregular sizes taken at different levels of the bole, covering a total of less than 50% of the tree bole surface, and also the tree felling and harvesting of all the bark on its trunk and branches (Figure 3). The tree felling method was practiced only on 1.09% of the

Figure 3. Ring debarked stem of *Gnidia glauca* in the highland savanna of the Mount Oku.

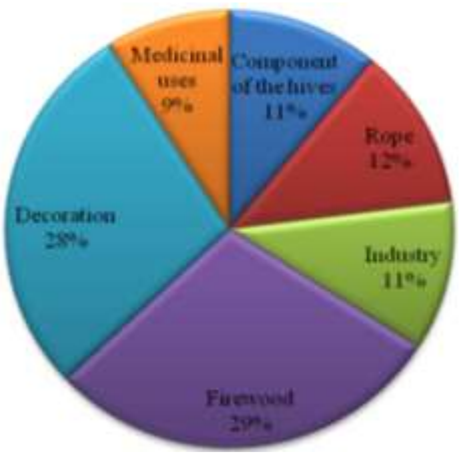

Figure 4. Various uses of *Gnidia glauca* products by the population of the community forest of Kilum-Ijim, North-West Region, Cameroon.

exploited trees in the area of Mount Oku, while ring and patches debarking were applied respectively on 9.28% and 89.63 % of the exploited individuals.

Products and parts of *G. glauca* used in the community forest of Kilum-Ijim

Products exploited from *G. glauca* trees have various uses for local populations of the Oku area (Figure 4). The main products of the species are stem, branches used as firewood (29%), and bark for decorations (28%). The colorful fiber obtained from the bark is locally well appreciated to improve the beauty of various craft instruments such as mats. Bark, leaves and roots were also cited for being used marginally (9%) for medicinal purposes.

Barks were the most frequently used part (64%), followed by stems (19%), leaves (11%), while the roots were the least used (6%).

Potential for exploitation and vulnerability status of *G. glauca* in the community forest of Kilum-Ijim

The largest number of exploitable stems was observed at Simonkoh and Lake villages. The proportion of stems exploited in the sites of Simonkoh, Jikijem and Elak villages are comparable; while Ngemsiba, Vekovi and Lake show the fewer percentage of exploited individuals (P= 0.04). The percentage of dead trees after exploitation was significantly (p =0.003; Table 2) higher in Elak (3.50%) compared to other sites.

Table 3 shows the vulnerability indices calculated for the two main production systems of *G. glauca* in the Mount Oku area. The values were found to be high for parameters such as popularity (3), parts used (3) and harvesting methods (3) in both savanna and forest lands. However, the vulnerability values were average and low for availability parameter in the forest and savanna ecosystem respectively. The morphological parameter showed an average value of vulnerability irrespective of the ecosystem. On the basis of these values for vulnerability parameters, the vulnerability index was estimated at 2.4 in savanna and 2.6 in the forest.

Vitality of the exploited trees

Figure 5 gives indications on the crown health status of the exploited trees, based on the percentage of dead or reduced crown (0, 20, 40, 60, 80 and 100%). It was observed that 18% of the exploited trees had a completely dead crown (100%) (Figure 6); and 73% of them could be described as having healthy and regular crown.

DISCUSSION

Current practices of *G. glauca* exploitation

The result of the present study indicates that *G. glauca* exploitation does not vary with season. Such results indicate that the availability of the exploited products does not depend on weather conditions. It was also shown that bark and wood were the main products exploited. Although both products could be available at all seasons, previous studies on *Prunus africana and Parkia biglobosa* exploitation showed that bark peeling was easier in the rainy season and bark harvesting during the

Table 2. Characteristics of *G. glauca* stands in the sampled villages around the Mount Oku area.

Sites	Number of plots (Total 33)	Number of exploitable stems	Exploited stems (%)	Dead stems (%)
Simonkoh	7	812	8.71±3.96[a]	1.14±0.97[b]
Jikijem	7	394	5.67±4.33[ab]	0.17±0.27[b]
Elak	4	400	5.25±5.25[ab]	3.5±2.5[a]
Ngemsiba	5	242	2.5±1.33[b]	0.83±1.11[b]
Lake	6	824	0.08±0.85[b]	0.86±0.49[b]
Vekovi	4	192	1.33±0.44[b]	0.00±0.00[b]
Mean			3.92±3.20	1.083±1.15
P (ANOVA)			0.04	0.003

In the column, means with same letter(s) are not significantly different at base on the probability level presented.

Table 3. Vulnerability Indices (VI) for forest and savanna stands of *G. glauca* in the Oku Mountain Area, North-west region, Cameroon.

Ecosystem type	Morphology	Availability	Popularity	Parts collected	Methods of collection	VI
Savanna	2	1	3	3	3	2.4
Forest	2	2	3	3	3	2.6

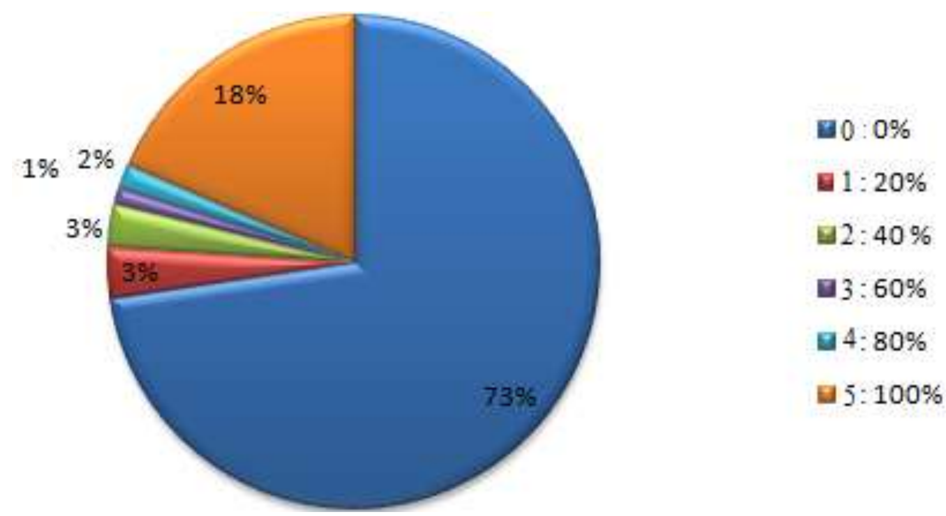

Figure 5. Vitality status of exploited trees of *G. glauca* in the area of Mount Oku as function of their percentage of dryness. The scale from 0 to 5 represents the degree of dryness or reduction of the crown as per the chart described by Cunningham (2001).

dry season, resulted in susceptibility to pests and diseases and poor regrowth (Nkeng et al., 2009; Delvaux et al., 2010).

The selection criteria for exploitable trees mainly depend on the bark thickness and size of the tree. This result is consistent with those obtained for many bark producing species such as *Garcinia lucida* (Guedje et al., 2016; Guedje et al., 2017), *P. africana* (Nkeng et al., 2009) and *Rytigynia* spp. (Kamatenesi et al., 2014). Usually, big size trees (with Diameter at Breast Height (DBH) greater than 30 cm) are preferred due to high yield, bark thickness and concentration of active ingredient. Previous studies had shown that the bark thickness and yield are positively correlated to tree

Figure 6. A completely dead crown of *G. glauca* at Elak village, Kilum-Ijim area, North-west region, Cameroon.

Diameter at breast height (Williams et al., 2007; Delvaux et al., 2010). Moreover, these bigger diameter trees show little damages and better recovery capacity after exploitation than those at younger stages (Nkeng et al., 2009; Delvaux et al., 2010; Kamatenesi et al., 2014; Guedje et al., 2016).

The exploitation techniques applied varied from collection of small bark patches to circular ring debarking and tree felling. The multiplicity of exploitation techniques always reflects the diversity of uses as well as the level of pressure on the species (Cunningham, 2001). It is well known that exploitation for traditional and household uses are always restricted to collection of bark patches, while the huge quantity of barks needed to meet commercial demand implies strip and ring debarking and tree felling to maximize yield (Delvaux et al., 2010; Guedje et al., 2017;Ramana and Raju, 2017). Therefore, the high proportion of trees exploited using small bark patches technique indicate that the exploitation of *G. glauca* bark in the study zone is still restricted to local use with little pressure on the species resources at the ecosystem level. The commercial exploitation of *G. glauca* was suspended in 1997, following the change in raw material of the paper making-company named the "Kilum Forest Craft Paper Cooperative"; as consequence, there is loss of an income generation opportunity to local population (Gardner et al., 2001). Although the species is still locally exploited for household use, the present study also contributes to highlight the untapped industrial potential of the *G. glauca* bark in the Kilum Ijim community forest.

The few trees exploited using ringbarking and felling could have been used to accelerate their dryness for firewood use; rated as first most important use of the species in the study zone.

Apart from the bark, leaves, roots, stem and branches of *G. glauca* are exploited and used in diverse ways by the Kilum Ijim people. However, the numbers of uses reported for this study are few compared to those already documented in Eastern Africa by Amarajeewa et al. (2007) and Kareru et al. (2007). Moreover, the medicinal use highly valued and documented in East Africa is still marginal in this study zone. All these reasons are indications that the species potential is still poorly exploited in the context of the present study. Therefore sensitization and proper documentation of the medicinal properties of the species are highly needed for its valorization in the Kilum Ijim area and in Cameroon.

Exploitation potential and vulnerability status of *G. glauca* in Kilum Ijim community forest

The number of stems varied considerably from one village to another (Table 2). The high number of exploited stems in the sites of Simonkoh, Jikijem and Elak are due to their proximity with a formal paper production company situated at Elak. The closer the sites are to the villages and the easier it is to access the trees, the more they are prone to exploitation of their bark, stem or leave. This result is also reflected in the number of dead trees observed in Elak.

According to the values of Vulnerability indices obtained in this study, *Gnidia glauca* is vulnerable in the study zone. Apart from “availability”, all the vulnerability parameters assessed scored high vulnerability values (scale 3), indicating the multiplicity of plant parts diversely exploited for different uses. A similar result was obtained for *Pterocarpus santaloides* in South Benin which was found vulnerable due to the multiplicity of plant organs exploited and used (Ayena et al., 2016). The forest stand of *G. glauca* is more vulnerable to exploitation than the savanna population. Among the vulnerability parameters assessed, only the value of the “availability parameter” differ between forest (2) and savanna (1) habitats, indicating a higher number of exploitable stems in savanna as compared to the forest ecosystem. This could be explained by the proximity of forest stands to the villages, making them more easily accessible than savanna stands. Open and easy accessibility of resources are known to favor overexploitation; therefore increasing vulnerability if strong regulations are not put in place (Cunningham et al., 2016; Guedje et al., 2016). Recent studies also indicated that open access resources were more prone to overexploitation than individuallyowned plants preserved in farming systems (Cunningham et al., 2016; Guedje et al., 2017).

Health status of the crown and vitality of exploited trees

The high proportion of exploited trees showing “perfect” crown could be related to the appreciable rate of stems exploited using small bark patches technique in the study zone. The result is consistent with those observed by Guedje et al. (2016) on *Garcinia lucida,* Nkeng et al. (2009), Cunningham et al. (2016) on *Prunus africana* and Kamatenesi et al. (2014) on *Rytigynia* spp*.* which revealed that the capacity of these species for bark reconstitution after harvesting and therefore their survival after exploitation depend on the exploitation techniques and debarking intensity. This capacity to resist stress caused by exploitation of bark should however offer a potential for a durable harvest.

Domestication and valorisation potentials of *G. glauca* in the Kilum-Ijim area

Many factors could be used to assess the domestication potential of a species among which are the socio-economic importance that determine its products demand at local, regional and international levels; the species population dynamic and current vulnerability to exploitation which could orientate available exploitable potential and leads to reduction over time; the willingness of the local population to manage the species in their farms is usually assessed through their current planting initiatives (Tchoundjeu et al., 2006; Asaah et al., 2011). From this result, the socioeconomic importance of the species is proven through its multiple uses at local level. However, the inexistence of a structured market could be a constraint for the economic development of the species (Leakey and Van Damme, 2014). Moreover, the low exploitation rate unveils the need for an alternative source of supply, while the current potential is still untapped (Leakey and Asaah, 2013). However, the exploitation history of the species, indicating its use as raw material for a paper-making enterprise has been further confirmed in recent study, assessing its wood characteristics (Gardner et al., 2001; Momo et al., 2017). Moreover, the species documented potential in phytomedecine and nanomedicine poorly valued in the study area need to be further explored.

It is well known that a proper documentation of the use, commercial and industrial potentials of NTFPs is a prerequisite for their valorization (Cunningham, 2001). However, the common weakness of enterprises based on NTFP harvests, by small scale producers, are their inability to get large volumes to meet market demand, the lack of attention to quality, quantity as well as production on time (Cunningham, 2011). Although there is still a high number of exploitable trees yet unexploited in the study area, the usually huge demand needed to sustain industries will require additional supply sources. In the same line, the fact that the specie is already preserved in farmlands indicates farmer’s interest for its management on-farm and also its suitability for the existing agroforestry systems in the study site (Gyau et al., 2012). Therefore, the fragility of the species’ habitat coupled with its industrial potential and suitability for local agroforestry systems, as well as the unsustainability of the exploitation methods observed could be considered as motivating factors to initiate its domestication. The same approach was applied to include species such as *Prunus africana, Pausinystalia johimbe and Annickia chlorantha* in the list of priority species for domestication in Cameroun (Tchoundjeu et al., 2006; Leakey, 2012). In such case, the domestication process is seen as a conservation-development strategy for the species being threatened by poor exploitation techniques and habitat destruction (Leakey, 2012). *Gnidia glauca* could therefore be considered as a potential candidate for domestication in the Kilum-Ijim area and other highlands landscapes at national level. This domestication initiative will contribute in meeting the expectation for green and niche markets for an improved and locally accessible product (Tchoundjeu et al., 2010; Leakey and Van Damme, 2014). However, further studies on its interaction with associated crops as well as nursery-based propagation and growth requirements are needed to anticipate for the future necessity for quality, uniformity, and regularity of supply implies for a successful domestication process (Leakey and Van Damme, 2014).

Conclusion

In spite of the unsustainable exploitation technique of *G. glauca* in the Kilum Ijim forest, the area still have a high proportion of living and exploitable individuals that is worth harvesting for community livelihood. *G. glauca* has multiple uses as the population thought its potential as traditional medicine is still to be explored in the study area. It could therefore be concluded from our study that *G. glauca* population in the Mount Oku area, though vulnerable to unsustainable harvesting technique should be reconsidered for exploitation by population, provided that a more appropriate debarking method is developed, tested and handed on to local harvesters. Moreover, domestication process initiated through tree preservation on-farm should be encouraged to ensure future supply sources.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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