RESEARCH ARTICLE

REVISED Prices and sold amount dynamics, endogenous knowledge and distribution of *Picralima nitida* (Stapf) T. Durand and H. Durand across in the Dahomey Gap and Guinea-Congolese regions [version 3; peer review: 1 approved, 1 approved with reservations]

Previously titled: Economic value, endogenous knowledge and distribution of *Picralima nitida* (Stapf) T. Durand and H. Durand in Africa

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Abstract

Picralima nitida (Apocynaceae) represents is an important African medicinal plant species. It is frequently used in traditional medicine and pharmaceutical industries for drugs manufacturing against infectious diseases, malaria and diabetes and commercially traded as well. Despite its importance, the species is becoming rare, especially in the Dahomey Gap because of it is commercial importance. There is an issue about the controversy of the plant species on its distribution across both regions. Without further forest resources inventory, it is difficult to address efficiently the issue of the controversy of its distribution, the unsustainable use and the endogenous knowledge about of plant species usages.

Ethnobotanical surveys were conducted in the Dahomey Gap with 120 informants randomly selected and interviewed. A literature review of scientific papers and books was also used to provide information on the sale prices dynamic, amount sold per units, uses, distribution area

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using the GBIF Platform, and threats of the species in both climatic regions.

P. nitida products were more expensive (per sale unit) in the DG than the GC region. All parts of the species were collected and used to treat 34 diseases. The plant species appear to be poorly distributed in the DG than the GC region. The overuse, endogenous knowledge loss in DG and deforestation in GC region appeared the main driver of scarcity of the species.

P. nitida has various medicinal uses across both regions. The sale price and amount sold per unit tend all to vary across both regions as well. However, the plant species is becoming scarcer in the DG than CG region. The issue of resource scarcity may drive loss of endogenous knowledge about the plant species uses. A forest inventory and documentation of uses are highly needed to assess the exact density and distribution area of *P. nitida* across both regions

Keywords

Climate gradient, Dahomey gap, Guineo-Congolese region, *Picralima nitida*, distribution, conservation.

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Any reports and responses or comments on the
article can be found at the end of the article.

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REVISED Amendments from Version 2

The modifications brought about this third version concern all the parts of the article.

Title

The title has been changed but the meaning remains the same. The precisions have been brought according to reviewer's recommendation

Abstract

The modification about this part were especially at conclusion level. The others parts have been corrected and the precisions have been brought according to reviewer's recommendation.

Introduction

At introduction level, the modifications concerned the background and the specific objectives. The new literature reviews have been brought to background part. The specific objectives have been reformulated and the drivers of species scarcity have been added as specific objective. The aim of the study remains the same. Figure 1 has been deleted in this new version because it was deemed unnecessary by the reviewers.

Methods

Study areas:

The information about the Usages of the species, Economic values, Erosion of endogenous knowledge and available initiatives to overturn such loss as well as the drivers of resources decline and Plant species distribution have been added.

Data collection:

This section has been completely rewritten according to the reviewer's recommendation.

Results

The titles have been changed according to the news specific objectives. The grammar errors have been corrected through the document and the part "Local population perception on the drivers of the scarcity of the *P. nitida* species across both regions" and Figure 4 have been added as recommended by the reviewers.

Conclusion

The conclusion has been improved and recommendation section has been added.

Any further responses from the reviewers can be found at the end of the article

Introduction

Picralima nitida is one of the most important medicinal plant species in the West and Central African folk medicine (Bickii *et al.*, 2007; Odebiyi & Sofowora, 1978) as it. In West African folk medicine, *P. nitida* is widely used for the treatment of several diseases, such as febrifuge and cure for infectious disease (Akabassi *et al.*, 2017), malaria (Betti *et al.*, 2013), diabetes (Teugwa *et al.*, 2013), and as a pain killer (Aguwa *et al.*, 2001). In Central African folk medicine, the species is used in different ways. For instance, in Cameroon and Guinea, a decoction of the fruit and the bark is taken to treat coughs or typhoid fever (Adjanohoun *et al.*, 1996). In the fangs Pahouin tribes in Gabon and Cameroon, the fruits and barks are chewed

in small quantities to appease hunger during long walks in the bush (Bickii *et al.*, 2007).

As a result of the above, the plant species are under threats at various levels management and based on data on the International Union Conservation for Nature (IUCN) Red List of Threatened plant species, there are no conservation initiatives in place for the rare *P. nitida* plant species, and it is considered as threatened. At the regional local level, available studies showed that the plant species are vulnerable because of the overexploitation of its organs that restricts its geographical area of distribution. For instance, in the typical Guinea-Congolese (GC) region (Nigeria), the species occurs freely in the wild without any forms of management practices and it is considered under threat of extinction (Gbadamosi, 2014). In the eastern region of Cameroon, *P. nitida* is considered as the first critically endangered plant species among the four species used by the indigenous populations for the typhoid fever treatment (Betti, 2004). Similarly, in the Dahomey Gap (DG) region (Benin), *P. nitida* is also considered as very rare and encountered at low density in many areas (Akabassi *et al.*, 2018; Akabassi *et al.*, 2020). At local level, Holaly *et al.* (2015) reported the presence and use of *P. nitida* in the treatment of diabetes in the traditional medicine of the Maritime region of Togo while knowledge about its economic value as well as its distribution is scant. Assogbadjo *et al.* (2011a) have shown that in the absence of a sustainable management approach, NTFPs with economic value for local populations are often threatened with genetic erosion. Trade in organs impacts the regeneration of plant species leading to their disappearance.

As far as its distribution is concerned, there is a controversy on the exact distribution areas of *P. nitida*. According to Adjanohoun *et al.* (1996), the distribution range of *P. nitida* extends from Côte d'Ivoire to Uganda including the Democratic Republic of Congo and Cabinda region in Angola. However, poor knowledge is available on the distribution of the plant species in Togo. The study of Eyog *et al.* (2006) reported that *P. nitida* is a tropical African species that is distributed in Ghana, Côte d'Ivoire, Nigeria, Angola, the Democratic Republic of Congo, Cameroon, and Tanzania. According to Omino (1996), the distribution area of *P. nitida* does not cover the DG. On the contrary, an early forest inventory study of Akpagana *et al.* (1994) on the news angiosperm species in the flora of Togo reported vealed that *P. nitida* is found in the ecological district IV of the country. Such controversy knowledge needs to be clarified if the proper distribution of the plant species has to be assessed for sustainable management approaches of the resource in DG regions (Benin and Togo).

Additionally, the lack of policy and regulations to guide the sustainable use and management of the threatened commercial medicinal plant species of *P. nitida* medicinal plant species may contribute to putting more pressure on the species in the wild. This paper aims at assessing the price dynamic economic

value of *P. nitida* (Stapf) T. Durand and H. Durand, document the endogenous knowledge on the plant species, and sheds a light on the drivers of species scarcity, and its distribution in DG and GC regions through mix approaches.

Methods

Study areas

The study areas were in two regions, the Dahomey Gap (DG) and Guinea-Congolese (GC). The GC regions (Cameroon, Central African Republic, Congo Brazzaville, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Ghana, Nigeria, and Uganda) are characterized by rainforests with a rainfall of up to 2500 mm. The average temperature of GC varies between 23 and 29°C with a relative humidity between 65 and 98%. In this region, the species is more distributed in natural vegetation without any forms of management practices (Gbadamosi, 2014). *P. nitida* species was more used in Cameroon, Congo Brazzaville, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Ghana and Nigeria as medicinal plant. However, the study related to endogenous knowledge and economic value on the species were very limited (Adjanooun *et al.*, 1996).

On the contrary, the DG region (Benin and Togo) is characterized by savannas that extend down to the coast with a mosaic of rainforest (Figure 1). There is also mangrove formations subject to tidal regimes. The DG is the dry zone that separates the two blocks of forest in tropical Africa (Bongers *et al.*, 2004). The overall annual rainfall varies between 900–1400 mm. The average temperature of these two regions varies between 25 and

29°C with a relative humidity between 69% and 97%. In this region, *P. nitida* distribution is limited in home garden. It use is purely medicinal and no study has been carried out on the endogenous knowledge and economic value related to the species.

Economic value and endogenous knowledge of *P. nitida* in Africa

Sampling approach: Based on preliminary surveys conducted with 90 (45 per country) individuals that were randomly sampled and composed of various ethnic groups that use the plant species in the DG (Togo and Benin). I was found that 85% in Benin and 83% in Togo of respondents had knowledge knew at least one use for the species. This information was used to calculate the sample size according to the formula of Dagnelie (1998).

$$n = U_{1-\alpha/2}^2 \times \frac{p(1-p)}{d^2}$$

With n the size of the sample, p the proportion of peoples using the species ($p = 0.275$; from the preliminary survey), $U_{1-\alpha/2} = 1.96$ is the value of the normal random variable at a probability value of $\alpha = 0.05$ and d is the margin error of the estimation of any parameter to be computed from the survey. A value of 8% was considered. Under these assumptions, 120 people were sampled during the main survey.

Figure 1. The map of Guineo-Congolese region and Dahomey Gap. Figure 1 has been reproduced with permission of [Church, 1966].

Data collection

Individual interviews were conducted in Togo and Benin with a total of 120 (60 per country) key informants. The main local languages interviewed were Fon, Goun, Nago, Yorouba, Adja in Benin and Mina, Ewe, Kotafon in Togo. The survey has been piloted before its final implementation. In Benin, the survey covered two phytodistricts (Pobè and Vallée de l'Ouémé where the plant species are encountered (Akoègninou *et al.*, 2006) and 30 informants were selected in each phytodistricts. In Togo, the survey covered Danyi located in ecological district IV (the only area where in of the plant species are encountered (Akpagana *et al.*, 1994) and all the 60 informants were selected. The survey was performed between January and July 2018 and was conducted in the local language using a questionnaire (see *Extended data*) (Akabassi, 2020c; Akabassi, 2020d). The survey was carried out through the households using a local guide. The local guide approached households in person and participants aged 18 and over were considered regardless of education level, ethnicity and gender.

The households were selected at random. However, households with sellers of medicinal plants were systematically selected instead of the households without such sellers. At total, 47 households with sellers and 39 without sellers were selected. After this Approach, a focus group discussion has been performed in each country to cross-check information gathered. The key aspects discussed during the focus group were the economic and socio-cultural values of the species, the uses and organs used, the frequency of use and main threats of the species. In Benin, 45 people indicated their willingness to participate in the focus group discussion while 42 people volunteered in Togo. Most informants were selected from localities with at least one *P. nitida* individual. These localities were Ifangni, Sakété, Adja-Wèrè, Ikpilè, Kétou, Avrankou, Adjarra (in Benin) and Kouma, Danyi, Akposso- Akébou, Kpalimé-Atakpamé (in Togo). Data were collected on the economic and socio-cultural values of the species, the plant parts used, the usage frequency and the main threats of the species.

Literature search approach

In the typical GC region, data were collected through a literature search. The original articles obtained from various databases including Google Scholar (www.scholar.google.fr), ScienceDirect (www.sciencedirect.com), Scopus, PubMed Central, and African Journals Online (www.ajol.info) in addition to reports and thesis. Biodiversity databases (www.prota.org and GBIF.org) were used to gather information on the importance of the species. The main research theme used were: "Economic value" AND "*Picralima nitida*"; "Endogenous knowledge" AND "*Picralima nitida*"; "Economic value" "Distribution" "*Picralima nitida*" "Togo" AND "Benin". A total of 21 published articles between 1996 and November 2018 were selected based on their importance for the topic. All articles not dealing with ethnobotanical importance and distribution of *P. nitida* were excluded. Letters, encyclopedia, case-reports, manuals, and guidelines were also excluded. The data that were extracted from selected articles were the socio-economic importance, the different traditional uses of *P. nitida* organs, mode of preparation, dosage, and coordinates of study location.

Ethics and consent

Ethical approval was not sought for this study. The study is deemed by the researchers to be low risk, as it did not record any identifying information of participants; was not an interventional- or clinical-based study. However, consent has been received from community leaders and participants of the DG and ensured that the informed consent was received for data collection and analysis.

Data analysis

The importance of *P. nitida* for the surveyed populations was determined by the calculation of the use frequency of the plant properties (FUP).

$$FUP = (Rv + Rah + Raf) \times 100 / Ne;$$

Ne is the total number of interviewees; Rv, Rah and Raf are the number of old, adult and young interviewees that used the property, respectively. A property was considered as 'credible' in case FUP is above 50% (Assogbadjo *et al.*, 2011a; Camou-Guerrero *et al.*, 2008).

The global credibility level of the plant properties was calculated as follows:

$$GCLP = (Nvc + Nvpc) \times 100 / Ntv;$$

Nvc is the number of 'credible properties'; Nvpc, the number of 'probable credible properties' and Ntv, total number of identified properties. The GCLP-value showed the importance of a plant property: GCLP < 25% (little important); 25 ≤ GCLP < 50% (fairly important); 50 ≤ GCLP < 75% (enough important) and 75 ≤ GCLP < 100% (very important) (Assogbadjo *et al.*, 2011b; Camou-Guerrero *et al.*, 2008).

The most used plant organ was identified through the computation of the index value related to useful organs (IVO).

$$IVO = Nvo / Ne \times 100;$$

Nvo, the number of properties in the organ; Ne, the total number of identified properties.

Further, based on the literature review and the above analysis, absolute global credibility (AGC) for each use was calculated using the following formula:

$$AGC = Npu / Ntp \times 100;$$

With N_{pu} the distribution areas of the use X, N_{tp} the total distribution area of the species. Usage is considered absolute if AGC ≥ 50%. The countries (Uganda and the Central African Republic) where no information was obtained on the use value of the species were not taken into account.

Basing on the collected data, the uses of the species were grouped into three fields of traditional application, namely: medicine, medico-magic and culture. A use was considered medicinal when results from the use of one part of the species associated or not with other plants or ingredients of an animal without any ritual, prayers or incantations. Use was considered as medico-magic when it associates the medicinal use with ritual, prayers or incantations. Use was considered cultural when practices during ritual ceremonies, funeral ceremonies, weddings, sacrificial rites and handicrafts.

Distribution and density of *P. nitida*. Data collection and analysis. In the DG, the samples of *P. nitida* were collected during the ethnobotanical survey carried out between January and July 2018 in both Benin and Togo to assess the density and the distribution of the species. The zones of the presence of the species in Benin (phytogeographical districts of “Pobè and Vallée de Ouémé”) and Togo (ecological subdivision IV of Togo) were explored. The presence of *P. nitida* was obtained through a field exploration in collaboration with the local population largely the medicinal plant dealers to identify the presence of the species. The georeferenced coordinates were recorded for each sample of *P. nitida* identified. A total area of 4,590.52 km² was explored in Benin compared to 115.765 km² in Togo.

In the typical GC region, data on the species distribution were collected through the GBIF website. The species occurrence coordinates were gathered from the GBIF.org (16 May 2018) GBIF Occurrence Download <https://doi.org/10.15468/dl.powalw> and ArcGIS 10.2 (ESRI, Redlands, California, USA) were used to create a distribution map showing the current spatial distribution of the species. In this present study, the occurrence points of *P. nitida* were qualified of average when the number of occurrence points gathered did not reach two hundred. When it exceeds two hundred, it qualified as high.

Results and discussion

Economic value and endogenous knowledge of *P. nitida* in Africa

Dynamics of selling price and amount sold per unit of *P. nitida* across both regions. The survey conducted in the DG revealed that the fruits of *P. nitida* are sold at various forms and selling price tends to vary according to the selling form of the specie. Indeed, the largest fruit of *P. nitida* (about 1000 g) costs US\$1 per unit, the average fruit size of (about 700 g) costs US\$0.80. T and the smallest fruit size of (about 300 g) costs US\$0.5. On the contrary, one seed cost US\$ 0.05 and a kilogram of *P. nitida* seeds cost between US\$6 and US\$10.

In the GC region (Ghana), *P. nitida* seeds that were dried, powdered, encapsulated, and sold as “Picap capsules” cost between US\$12.99 and US\$225 depending on the quantity (see link 1 in the reference section). In Cameroon, seeds, bark, and fruit were sold (US\$5 for 550 g of seeds or bark) in local markets (Betti, 2002; Betti, 2004). In Congo, 800 g of fruit cost about US\$1 (see link 2 in the reference section). This indicated how the species can contribute to household income. Although, *P. nitida* products were more expensive in the DG than the GC region, we noted the lack of price standardization across region. This

lack of price standardization across region may be due to the various forms of sale of the same species. This constitute a difficulty of carrying out comparison studies across both regions.

P. nitida is very rare in this region and this probably justifies the high prices observed in the DG. The species was mainly found in home gardens and/or house yards in the DG. The domestication of non-timber forest species like *P. nitida* is an opportunity to alleviate poverty with positive benefits on the environment, since new plantations of *P. nitida* will contribute to reducing the greenhouse gas emission. It is therefore important to develop a management program for the sustainable use and trade of the species. This can offer more jobs and help in poverty alleviation in countries such as Cameroon where the species contributes to 12% of household income (Yakeu Djiam, 2012).

Various usages of *P. nitida* and loss of endogenous knowledge across both regions. For medicinal purposes, the *P. nitida* plant species have various usages across both regions. In the DG, for example, 24 uses of the organs of *P. nitida* including roots, bark, leaves, and seeds were cited by the respondents (Table 1). Out of that number, only seven uses were identified as credible (infectious diseases, angina, malaria, bellyaches, rituals, analgesic, and diabetes). The overall credibility of the uses was 75.94% in Benin and 70.94% in Togo implying that the use of the organs of the *P. nitida* is very important in the DG for healthcare. More importantly, the seeds were the most important organ used in the DG (79.16%) in Benin and (83.33%) in Togo). Consequently, the species is highly threatened since the removal of this organ causes the species death and this can lead to the extinction of wild populations of *P. nitida*, as already reported by Akabassi *et al.* (2017) and Assogbadjo *et al.* (2011b).

The credibility uses the value that was around 70.00% in both countries may imply that populations of the two countries have similar harvesting practices and utilizations of the specie for healthcare. For instance, Mina, Fon, and Ewe are the common ethnic groups that are encountered in both countries and they tend to share similar cultures and ancestral traditions native from the Tado kingdom in Dahomey (Kossi, 1990). The common practices observed may also be explained by the fact that the two countries neighboring countries that share the same borders and population of each country share common knowledge through ethnic groups cohabitation.

Focusing on the loss of endogenous knowledge and the drivers of species rarity, some factors have been highlighted. One of the key factors is related to harvesting practices that are based on the overuse of *P. nitida* organs. Adding to that abiotic factors such as climate and soil erosion could also explain the issue of resource scarcity.

All these factors have also contributed to weaken local knowledge about the species among local populations since fewer plant species means fewer usages as well. Overcoming such loss may call for developing the campaigns of information and

Table 1. Use frequency of *P. nitida* properties in the Dahomey Gap.

Organ	use	FUP (%)		IVO (%)	
		Benin	Togo	Benin	Togo
Root	-Diabetes	59.58	75.55		
	-Sexual weakness	15.83	-		
	-Hemorrhoid	31.25	33.27	28.57	22.22
	-Bellyaches	54.16	51.18		
	-Toothache	18.33	-		
	-Cough	31.25	37.30		
Bark	-Spleen Infection	15.00	12.00		
	-Sexual weakness	15.83	16.89	14.28	11.11
	-Infertility	17.91	-		
	-Analgesic	45.30	-		
	-Poisoning	30.45	-		
Leaves	-Diabetes	59.58	57.58		
	-Malaria	75.41	78.42	19.05	18.67
	-Cold	02.50	-		
	-Measles	06.66	05.45		
Seed	-Angina	100.00	100.00		
	-Diabetes	59.58	95.75		
	-Malaria	75.41	72.46		
	-Analgesic	66.66	66.66	80.95	83.33
	-Diarrhea	00.42	01.40		
	-Kwashiorkor	02.91	-		
	-Bellyaches	54.91	-		
	-Worms	23.33	21.73		
	-Measles	06.66	06.66		
	-Infertility	17.91	-		
	-Fever	07.91	06.91		
	-Cough	31.25	30.27		
	-weaning	30.41	30.43		
	-Good luck	12.08	-		
	-Sexual weakness	15.83	15.53		
	-Rituals	66.66	55.76		
	-Against abortion	07.50	05.50		
	-Infectious Diseases	85.50	83.50		
	-Hernia	20.25	15.25		

FUP, Use frequency of *P. nitida* properties; IVO, index value for useful organs.

sensitization about the importance of conserving and sustainably using and managing *P. nitida* in both regions.

In the GC region, 24 uses of the organs of *P. nitida* (roots, bark, leaves, seeds, fruits, and wood), were cited (Table 2). Only four uses were mentioned as credible (diabetes, malaria, fever, and sexual weakness). These results confirmed those of WHO (2011) which estimates that 90% of the recipes recorded in Africa are based on plants and 80% of local African populations depend on medicinal plants for their health care. Diabetes and malaria were the main diseases that cause more mortality in Africa WHO (2011) and moreover, the recent study predicted

Table 2. Use frequency of *P. nitida* properties in Guineo-Congolese region.

Organ	use	FUP (%)	IVO (%)
Root	-Sexual weakness	14.84	
	-Malaria	65.23	12.5
	-Jaundice	15.22	
Bark	-Jaundice	18.45	
	-Infertility	39.23	16.66
	-Hernia	24.45	
	-Gonorrhoea	17.88	
Leaves	-Malaria	70.65	
	-Vomiting	10.90	16.66
	-Otitis	22.60	
	-Measles	25.76	
Seed	-Malaria	80.02	
	-Analgesic	72.78	
	-Diarrhea	44.53	
	-Vomiting	06.03	
	-Cough	12.10	
	-Vermifuge	15.69	41.66
	-Pneumonia	16.92	
	-Abscess	27.60	
	-Sexual weakness	55.87	
Fruit	-Leucorrhoea	46.71	
	-Hernia	24.76	
	-Cough	45.55	
	-Fever	60.78	16.66
	-Poisoning	25.03	
Stem	-Diabetes	92.15	
	-Infectious diseases	40.34	
	-Paddles	07.34	
	-Weaving	10.90	
	-Shuttles	20.01	33.33
	-Dolls	12.35	
	-Combs	25.03	
	-Shovel handles	26.74	
	-Incense stands	23.45	

FUP, use frequency of *P. nitida* properties; IVO, index value for useful organs.

that there will be some 438 million diabetic patients in 2030, most of them living in developing countries (WHO, 2011). Therefore the use of medicinal plants remain important to fight against this diseases.

The overall credibility of the plant uses in the GC region was 60.85%, indicating that *P. nitida* was important in this region. The seed was the most important organ used in the Guinea-Congolese region followed by the wood, fruit, leaves, bark, and root (Table 2). Based on the results of these Table 1 & Table 2, it can be argued that the species is highly used in both regions for

healthcare purposes. Since the seeds constitute the regeneration organ of the plant species, the overuse of these organs can lead to genetic diversity and local knowledge loss.

In both regions, *P. nitida* was most frequently used against malaria, followed by measles, diabetes, worms, sexual weakness, hernia, fevers, infectious diseases, and diarrhea, as well as for shovel handles and spoons (Table 3). Shovel handles and spoons were a specific use in the GC region. Among these diseases,

malaria is a principal cause of mortality and poverty in Africa (WHO, 2011). The use of the organs of *P. nitida* to treat these diseases will contribute to reducing mortality and poverty in Africa.

Knowledge of the species was significantly greater than in the GC region (Figure 2). This difference may be explained by the affinity of the population to the resource and its availability and or accessibility in the DG compared to GC.

The different uses of the species mentioned in this paper could help local communities to benefit from programs related to the promotion of the use of medicinal plant species for healthcare purposes oriented mainly around malaria as it is of the common diseases encountered in both regions.

Some uses were specific to certain regions with good credibility as the case of the use of the seeds to treat tonsillitis in the DG. Moreover, the fact that some uses were specific to each climate zone will be relevant when defining for each zone a valorization program of the species. These results are corroborate with those of Fakeye *et al.*, 2000; Fakeye *et al.* (2004) who were showed the antimicrobial property of *P. nitida* stem bark extract in the pharmaceutical field.

In both climate zones (DG and GC regions), among the uses identified, 26 were of medicinal, three in medico-magic, and three cultural (Table 4). However, some specificities exist among each region as we will highlight in the section below. The medico-magic use was specifically reserve to the adult and old people. This difference of number of uses between these three fields of use

Table 3. Absolute global credibility of uses.

Use	Absolute global credibility (%)
Malaria	88.88
Measles	77.77
Diabetes	77.77
Infectious Diseases	55.55
Diarrhea	55.55
Deworming	77.77
Hernia	66.66
Fevers	66.66
Sexual stimulant	77.77
Shovel handles and spoons	55.55

Figure 2. Knowledge on *P. nitida* in Dahomey Gap and Guinea-Congolese region.

Table 4. Medicinal, medico-magic and cultural practices of *P. nitida* organs.

Medicinal practices	Medico-magic practices	Cultural practices
Malaria – Angina – Diabetes–Analgesic – Against abortion Diarrhea – Hemorrhoid – Measles – Fevers – Cough – Bellyaches – Infectious diseases Infertility –Painful period– Cancer – Disinfection – Tension- Toothache – Sexual weakness– Hernia – Jaundice – Vomiting	Inhumation rituals – Good luck – Paralysis	Weaning – Wedding ritual– Utensils -Initiation Rites in couvents of “Egoungoun and Oro” (traditional religions)

may be due to the fact that in Africa, certain knowledge, especially spiritual or magical, remains the property of the initiates and the elderly. This knowledge is difficult bequeathed to young people who do not yet have a high wisdom degree. The use of medicinal plants in the medico-magic field in black Africa is characterized by a set of local beliefs, strongly anchored in the founding myths of local communities and giving an important place to spirits, incantations and ancestors. These magico-religious beliefs are most often reserved for initiates and the elderly with a high wisdom degree because the results deriving from incantatory words are often irreversible.

In the DG, each of the above-mentioned uses as of use by local populations, whereas in the GC region, *P. nitida* was not considered for medico-magic use. The cultural differences and specific local population needs between the two climates zones may also explain this variation in use (Dadjo *et al.*, 2012).

In both climate zones (DG and GC regions), among the uses identified, 26 were of medicinal, three in medico-magic and three cultural (Table 4).

Distribution and density of *P. nitida* across both regions

Distribution and density of *P. nitida* in the DG region. During the investigation in Togo, *P. nitida* was found in the south-west of the country, 185 km from Lomé at 800 m altitudes in the “Danyi Dzogbégan” region at the monastery “Abbaye d’ascension”. This region is situated in ecological district IV, corresponding to dense semi-deciduous forests. *P. nitida* was not found in natural vegetation. The distribution map of the species elaborated by Adjanohoun *et al.* (1996) did not include Togo. This may be due to the lack of available information on the species in 1996 or the absence of the species in natural habitats. Moreover, the great number of individuals of the species observed in the monastery may be introduced after 1996.

In Benin, *P. nitida* was found in the forest in the phytogeographic zones of “Pobè and Vallée de l’Ouémé” located in the southeast of the country and characterized by the GC climate conditions. The occurrence of the species decreases either in latitude from the south or in longitude from the southeast. Besides, *P. nitida* was found in home gardens and home yards in the DG. However, the species is almost absent in the dry forests of the DG (Figure 4).

The DG is not a suitable habitat for the species because of the dry climate in this region. The occurrence of the species in this region may be the results of the long domestication process due to the importance of the species to the local populations. This may explain why some authors (Eyog *et al.*, 2006; Omino, 1996) do not consider the DG to be a distribution area of *P. nitida*.

Distribution of *P. nitida* in Guinea-Congolese region. In all the countries of the Guinea-Congolese region (Cameroon, Central African Republic, Congo Brazzaville, Côte d’Ivoire, Democratic Republic of Congo, Gabon, Ghana, Nigeria, and Uganda), *P. nitida* was found in the forests. In Cameroon, *P. nitida* occurred in forests (52%) and farms (30%) (Yakeu Djiam, 2012). The occurrence point of *P. nitida* can be qualified in two ways (Figure 3). In Upper Guinea (from Guinea and Sierra Leone to Ghana” Western Region”), the occurrence of *P. nitida* was average. In Lower Guinea (Nigeria and eastward; “West Central Region”), *P. nitida* had many occurrences that may be justified by the highest rainfall observed in this area, especially in western Cameroon, which experiences 3,000 mm of precipitation per year (Lefèvre, 1967).

Individual-level responses to the ethnobotanical survey and geographical distribution locations are available as Underlying data (Akabassi, 2020a; Akabassi, 2020b).

Local population perception on the drivers of the scarcity of the *P. nitida* species across both regions.

The main factors that contributed to the scarcity of the *P. nitida* species were the overuse, climate change, deforestation and endogenous knowledge loss. The overuse was the main driver of scarcity of the *P. nitida* species in the DG followed by climate change and endogenous knowledge loss. In the GC region, the main drivers of scarcity of the *P. nitida* species were deforestation, overuse and climate changes (Figure 4). Overexploitation, deforestation and changing climatic conditions contribute to the loss of indigenous plants and hence endanger traditional and biodiversity dependent community medicines. This result corroborated with those of Shanley & Luz (2003) who showed that forest degradation has diminished the availability of some widely used medicinal plant species and many of these medicinal plants have no botanical substitute, and pharmaceuticals do not yet exist for some of the diseases for which they are used.

Figure 3. Occurrences of *P. nitida* in Africa.

Figure 4. Main drivers of scarcity of the *P. nitida* species.

Conclusion

The organs of *P. nitida* (seed, bark, and fruit) are sold in the DG and GC region at various forms and prices. This stresses out the issue of lack of standardization methods to estimate efficiently the economic value of NTFP as well as the difficulty of cross-region comparison. The species has a total of 24 uses in medicine, medico-magic, and culture in the Dahomey gap and GC region with more credible uses and knowledge in the DG. *P. nitida* is rarer in the DG than in the GC region. The overuse, endogenous knowledge loss and deforestation appeared the main driver of scarcity of the species in both climatic zones. The Seeds was the most important organ used around the study area. The Adapted management strategies are needed for the sustainable use and conservation of the species in the two climatic zones.

Recommendations

To ensure sustainability of the species, it is necessary to:

- carry out forest inventory and resource capacity in both regions in order to know the exact distribution areas and preference ecology of the species;
- set up a domestication program for sustainable use and management of the species;
- assess the effect of climate and habitat on morphological characteristics and fruit production of *Picralima nitida* in order to know the mains causes of the scarcity of the species in Dahomey Gap;
- evaluate the natural seed germination and seedling growth of *Picralima nitida*.

Data availability

Underlying data

This study contains the following underlying data:

The Knowledge Network for Biocomplexity: Database Economic value, endogenous knowledge and distribution of *Picralima nitida* (Stapf) T. Durand & H. Durand in Africa. 2020. Ethnobotanical and Geospacial data. <https://doi.org/10.5063/F189146R> (Akabassi, 2020a).

This project contains the pooled responses of participants and GPS data of where *P. nitida* samples were identified in Benin and Togo

The Knowledge Network for Biocomplexity: Dataset detailed of ethnobotanical study on *Picralima nitida* (Stapf) T. Durand and H. Durand. <https://doi.org/10.5063/F1TX3CQ9> (Akabassi, 2020b).

This project contains the individual-level responses of participants from Benin and Togo.

Extended data

Knowledge Network for Biocomplexity: Blank questionnaire of ethnobotanical study on *Picralima nitida* in Dahomey Gap, West Africa, 2020. <https://doi.org/10.5063/F1P84987> (Akabassi, 2020c).

This project contains a blank copy of the ethnobotanical survey used in this study.

The Knowledge Network for Biocomplexity: Blank copy of the questions, Ethnobotanical study on *Picralima nitida* in Dahomey Gap (Benin and Togo). <https://doi.org/10.5063/F1SX6BKX> (Akabassi, 2020d).

This project contains a blank copy of the questions that were asked to the individuals in Togo and Benin related to ethnobotanical study on *Picralima nitida*.

Data are available under the terms of the [Creative Commons Public Domain “No rights reserved” data waiver](#) (CC0 1.0 Publicdomain dedication).

Acknowledgements

We thank the local communities of the Dahomey Gap for sharing their knowledge on the species.

References

- Adjanohoun EJ, Aoubakar N, Dramane K, *et al.*: **Traditional medicine and pharmacopoeia: contribution to ethnobotanical and floristic studies in Cameroon.** Porto-Novo, Benin: CNPMS, 1996.
Reference Source
- Aguwa CN, Ukwé CV, Inya-Agha SI, *et al.*: **Antidiabetic effect of *Picralima nitida* aqueous seed extract in experimental rabbit model.** *J Nat Remedies.* 2001; **1**(2): 135–139.
Reference Source
- Akabassi GC: **Database Economic value, endogenous knowledge and distribution of *Picralima nitida* (Stapf) T. Durand & H. Durand in Africa. 2020. Ethnobotanical and Geospatial data.** *Knowledge Network for Biocomplexity.* 2020a.
<http://www.doi.org/10.5063/F189146R>
- Akabassi GC: **Dataset detailed of ethnobotanical study on *Picralima nitida* (Stapf) T. Durand and H. Durand.** urn:nod:KNB. 2020b.
<http://www.doi.org/10.5063/F1TX3CQ9>
- Akabassi GC: **Blank questionnaire of ethnobotanical study on *Picralima nitida* in Dahomey Gap, West Africa, 2020.** urn:nod:KNB.53263 2020c.
<http://www.doi.org/10.5063/F1P84987>
- Akabassi GC: **Blank copy of the questions, Ethnobotanical study on *Picralima nitida* in Dahomey Gap (Benin and Togo).** *Knowledge Network for Biocomplexity.* 2020d.
<http://www.doi.org/10.5063/F1SX6BKX>
- Akabassi GC, Padonou EA, Assogbadjo AE: **Connaissances et variabilité phénotypique de *Picralima nitida*. au Bénin.** *Editions universitaires européennes Germany.* 2018; 84.
Reference Source
- Akabassi GC, Padonou EA, Chadare FJ, *et al.*: **Importance ethnobotanique et valeur d'usage de *Picralima nitida* (stapf) au Sud-Bénin (Afrique de l'Ouest).** *Int J Biol Chem Sci.* 2017; **11**(4): 1979–1993.
Publisher Full Text
- Akabassi GC, Padonou EA, Koko D, *et al.*: **Ecophenotypic variation of fruits, natural seed germination and seedling growth of *Picralima nitida* in Dahomey Gap: implication for conservation and valorization.** *Environment Development and Sustainability.* 2020; **22**(6).
Publisher Full Text
- Akoègninou A, Van der Burg WJ, Van der Maesen LJG: **Flore analytique du Bénin.** Backhuys Publishers. 2006.
Reference Source
- Akpagana K, Kudzo AG, Koami A: **Espèces d'Angiospermes nouvelles pour la flore du Togo.** *Acta Bot Gallica.* 1994; **141**(6–7): 781–787.
Publisher Full Text
- Assogbadjo AE, Glèlè Kakai R, Adjallala FH, *et al.*: **Ethnic differences in use value and use patterns of the threatened multipurpose scrambling shrub (*Caesalpinia bonduc* L.) in Benin.** *J Med Plants Res.* 2011a; **5**(9): 1549–1557.
Reference Source
- Assogbadjo AE, Glèlè Kakai R, Vodouhè GF, *et al.*: **Specific Richness and Cultural Importance of Wild Edible Trees in Benin. II International Symposium on Underutilized Plant Species: Crops for the Future-Beyond Food Security.** 2011b; **979**: 255–261.
Publisher Full Text
- Betti JL: **An ethnobotanical study of medicinal plants among the Baka pygmies in the Dja biosphere reserve, Cameroon.** 2004.
Publisher Full Text
- Betti JL: **Medicinal plants sold in Yaoundé markets, Cameroon.** *African Study Monographs.* 2002; **23**(2): 47–64.
Reference Source
- Betti JL, Iponga DM, Yongo OD, *et al.*: **Ethnobotanical study of medicinal plants of the Ipassa-Makokou Biosphere Reserve, Gabon: Plants used for treating malaria.** *J Med Plants Res.* 2013; **7**(31): 2300–2318.
Publisher Full Text
- Bickii J, Tchouya GRF, Tchouankeu JC, *et al.*: **Antimalarial activity in crude extracts of some Cameroonian medicinal plants.** *Afr J Tradit Complement Altern Med.* 2007; **4**(1): 107–111.
PubMed Abstract | Publisher Full Text | Free Full Text
- Bongers FJ, Poorter L, Hawthorne WD: **The forests of Upper Guinea: gradients in large species composition.** In Poorter L, Bongers F, Kouame FN, Hawthorne WD (eds.), *Biodiversity of West African Forests: An Ecological Atlas of Woody Plant Species.* CABI publishing, Wallingford, UK, 2004; 41–52.
Reference Source
- Camou-Guerrero A, Reyes-García V, Martínez-Ramos M, *et al.*: **Knowledge and use value of plant species in a Rarámuri community: a gender perspective for conservation.** *Hum Ecol.* 2008; **36**: 259–272.
Publisher Full Text
- Church RJ: **West Africa: a study of the environment and of man's use of it: Longman's, Green and Co., Ltd.** 1966.
Reference Source
- Dadjo C, Assogbadjo AE, Fandohan B, *et al.*: **Uses and management of black plum (*Vitex doniana* Sweet) in Southern Benin.** *Fruits.* 2012; **67**(4): 239–248.
Publisher Full Text
- Dagnelie P: **Statistiques théoriques et appliquées, de Boeck et Larcier.** Brux Belg. 1998.
- Eyog Matig O, Ndoye O, Kengue J, *et al.*: **Les Fruitiers Forestiers Comestibles du Cameroun.** *IPGRI.* 2006; 220.
Reference Source
- Fakeye TO, Awe SO, Odelola HA, *et al.*: **Evaluation of valuation of toxicity profile of an alkaloidal fraction of the stem bark of *Picralima nitida* (fam. Apocynaceae).** *J Herb Pharmacother.* 2004; **4**(3): 37–45.
PubMed Abstract | Publisher Full Text
- Fakeye TO, Itiola OA, Odelola HA: **Evaluation of the antimicrobial property of the stem bark of *Picralima nitida* (Apocynaceae).** *Phytother Res.* 2000; **14**(5): 368–370.
PubMed Abstract | Publisher Full Text
- Gbadamosi AE: **Effect of watering regimes and water quantity on the early seedling growth of *Picralima nitida* (Stapf).** *Sustainable Agriculture Research.* 2014; **3**(2): 35.
Publisher Full Text
- GBIF.org: **GBIF Occurrence Download.** 2018.
Publisher Full Text
- Holaly GE, Simplicie KD, Charlemagne G, *et al.*: **[Ethnobotanical Study of Plants Used in the Treatment of Diabetes in the Traditional Medicine of Maritime Region, Togo].** *Pan Afr Med J.* 2015; **20**: 437.
PubMed Abstract | Publisher Full Text | Free Full Text
- Kossi KE: **La structure socio-politique et son articulation avec la pensée religieuse chez les Aja-Tado du Sud-Est Togo.** Stuttgart, Franz Steiner Verlag. 1990.
Reference Source
- Lefèvre R: **Aspect de la pluviométrie dans la région du mont Cameroun.** *ORSTOM sér Hydrol.* 1967; **4**(4): 15–43.
Reference Source
- Odebiyi OO, Sofowora EA: **Phytochemical screening: Nigeria Medicinal plants.** *Lloydia.* 1978; **41**(3): 234–235.
PubMed Abstract
- Omino EA: **A contribution to the leaf anatomy and taxonomy of Apocynaceae in Africa.** *Wageningen Agricultural University Papers* 96–1. Wageningen Agricultural University, Wageningen, Netherlands. 1996; 178.
Reference Source
- Shanley P, Luz L: **The Impacts of Forest Degradation on Medicinal Plant Use and Implications for Health Care in Eastern Amazonia.** *BioScience.* 2003; **53**(6): 573–584.
Publisher Full Text
- World Health Organization: **Agir pour réduire l'impact mondial des maladies tropicales négligées: premier rapport de l'OMS sur les maladies tropicales négligées.** Rome, 2011.
Reference Source
- Teugwa CM, Mejiato PC, Zofou D, *et al.*: **Antioxidant and antidiabetic profiles of two African medicinal plants: *Picralima nitida* (Apocynaceae) and *Sonchus oleraceus* (Asteraceae).** *BMC Complement Altern Med.* 2013; **13**: 175.
PubMed Abstract | Publisher Full Text | Free Full Text
- Yakeu Djiam SE: **Local knowledge and socio-economic values of *Picralima nitida* ((stapf) Th. & H. Durand) in the humid forest zone of Cameroon.** M.Sc. thesis, Faculty of Bioscience Engineering, Ghent University, Belgium, 2012; 94.
Reference Source

Open Peer Review

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Christian Mikolo Yobo

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At this stage the paper cannot be indexed as it contains still many insufficiencies, especially at the methodological section, results, and the associated discussion. The authors fail to clarify the step by step methodology (**preliminary and main ethnobotanical survey related to key informant accessed and interviewed and household levels accessed and interviewed**) and **plant species inventory (field sampling design for data collection and analysis)**. In addition, the results appear to have a broad focus for the most part rather than focusing on the specificity of each country (Benin and Togo). To overcome such weaknesses, I suggest a new structure of the results and discussion. Although, this is just indicative but not mandatory.

Reviewer note: The authors should not rush to send back the paper to the AAS Open Journal for review, but should rather take their time to respond step by step to questions raised by the reviewer. This is very important to advance or improve the review of the paper.

Abstract:

- I did not check since the result and discussion sections still need to be restructured profoundly.

Introduction:

- After few inputs, the introduction section appears to be fine to me now. I have removed all sections related to the **Guinea-Congolese region as the comparative study did not fit well into the paper content**. As a result, the paper focuses only **on the Dahomey Gap Region (DG), especially in Benin and Togo regions** as field data have been collected in **both regions rather than the Guinea-Congolese region wherein no field work was carried out**. To polish up the introduction, the authors still need to add few key references and accept all the inputs added.
- Please have a look at the annotated manuscript linked [here](#) for further comments.

Methodology:

There is a major concern in this section as many key issues were encountered. Thus, the authors failed to clearly describe clearly the methods used to allow other scholars to replicate a similar work as I pointed out in the section below:

1. The context is more general and not specific to Benin and Togo as part of the Dahomey Gap region. I suggest that **the key characteristics and or differences and or similarities of Benin and Togo** are clearly mentioned (sociodemographic profile of the people, culture & traditions related to the use of the medicinal plant species, the drivers of decline of the plant species; past and current management initiatives related to safeguarding the medicinal plant species; livelihood benefits generated from the plant species, drivers of plant species decline, the issue of erosion of local knowledge, forest profile, etc);
 - **Preliminary survey based key informants and household survey** (description of the sampling process, data collection and analysis phases), and what were the findings (and or weaknesses) upon which you capitalize to finally carry out the main survey;
 - **Main survey based key informants and household survey** (description of the sampling process, data collection and analysis phases);
 - **Forest inventory sampling to collect data on the density and geographical distribution of the medicinal plant species** (description of the field sampling design, data collection, etc.

Based on the above comments, it is crucial to clarify the ethnobotanical survey (**preliminary and main survey related to key informant and household level**) and **plant species inventory (sampling approach and data collection) to allow other scholars to replicate a similar work elsewhere. Please pay particular attention on that aspect.**

Results:

For the most part, the results provided are more general and not specific to Benin and Togo as a part of the Dahomey Gap region. It is very important to show clearly the findings coming from each country to advance knowledge on medicinal plant usages related to *P. nitida*, their density and geographical distribution as well as perceptions of the drivers of their scarcity, and endogenous knowledge loss. Achieving that will contribute to suggesting conservation and management opportunities for the threatened traded plant species for each country. Benin and Togo (rather than suggesting a broad recommendations).

To overcome such weaknesses, here are my suggestions to improve the structure of the results section;_

1) Importance and usages of *P. nitida* plant species in Benin and Togo:

- Knowledge dynamics of selling price and sold amount of *P. nitida* in Benin and Togo (**Result 1**).
- Usages of *P. nitida* in Benin and Togo (**Result 2**).
- Knowledge on medicinal, medico-magic, and cultural practices of *P. nitida* in Benin and Togo

(Result 3).

2) Density and mapping the geographical distribution of the population of *P. nitida* in Benin and Togo:

- Density of the population of *P. nitida* in Benin and Togo ([Result 4](#)).
- Geographical distribution of the population of *P. nitida* in Benin and Togo ([Result 5](#)).

3) Perceptions of the drivers of the plant species scarcity, loss of endogenous knowledge in Benin and Togo:

- Perceptions of the drivers of the plant scarcity in Benin and Togo ([Result 6](#)).
- Endogenous knowledge loss in Benin and Togo ([Result 7](#)).

Discussion section:

Focusing on the discussion section, here are my suggestions based on the structure of the results suggested above:

1. Importance and usages of *P. nitida* plant species in Benin and Togo.
2. Density and geographical distribution of the population of *P. nitida* in Benin and Togo.
3. Perceptions of the drivers of the plant species scarcity, loss of endogenous knowledge and opportunities for sustainable use-management of the plant species in Benin and Togo.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 09 February 2021

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Martin J. Potgieter

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The authors have sufficiently corrected the third version manuscript to address all concerns from version 2 of the paper.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Biodiversity, ecology, phytomedicine, ethnobotany

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 2

Reviewer Report 28 October 2020

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Reviewer's comments:

Overall conclusion about the paper:

At the current status, the paper still needs further improvements, especially the results section. Two key results still need to be integrated in the manuscript, especially:

1. About the drivers of local/endogenous knowledge loss across both regions; and
2. About the drivers of the scarcity of the resource across both regions.

The paper cannot be indexed.

The title of the article has changed as follows: The price, amounts sold dynamic, endogenous knowledge loss and distribution of *Picralima nitida* (Stapf) T. Durand and H. Durand across the Dahomey Gap and Guinea-Congolese regions.

Questions needed to be clarified:

About the drivers of endogenous knowledge loss across both regions:

Do you have any data on local knowledge/endogenous knowledge loss (or the drivers of) about the *Picralima nitida* (Stapf) T. Durand and H. Durand across both regions?

1. If yes, please provide such data to back up the idea about documenting such an important local know how for the populations of both regions?
2. If not, the objective of the paper may need a bit of twist or change. It is up to the availability of the data.

About the drivers of the scarcity of the resource across both regions:

Do you have any data on the drivers of the scarcity of the *Picralima nitida* (Stapf) T. Durand and H. Durand across both regions?

1. If yes, please provide such data to back up the idea about the current distribution of the plant species across both regions?
2. If not, it might be a bit difficult to argue about the causes driving the scarcity of the plant species across both regions unless you discuss only the current distribution of the plant species on the light of the available literature. This is only in the case that you did not gather data on the drivers of plant species scarcity.

Overall summary:

The summary of the paper has been improved. Please have a look at the annotated manuscript itself (available [here](#)) for further assessment.

Introduction:

- The introduction of the paper has also been improved and the general objective of the paper as well. The latter point has been changed as follow “This paper aims at assessing the price dynamic economic value of *P. nitida* (Stapf) T. Durand and H. Durand, document the endogenous knowledge on the plant species, and sheds a light on the drivers of species scarcity, and its distribution in Dahomey Gap (DG) and Guinea-Congolese (GC) regions through mix approaches”.
- In this objective, there is a need to provide data on the drivers of local/endogenous knowledge loss as well as the information about the drivers of plant species decline across the Dahomey Gap (DG) and the Guinea-Congolese (GC) region.
- Additional information has been added to the annotated manuscript itself (available [here](#)). Please have a look for further assessment.

Material and methods:

Some remarks have been directly added into the annotated manuscript itself (available [here](#)). Please have a look and respond accordingly.

Results and discussion

Results (The missing key results):

These two results need to be added in the paper to tackle the issue at stake in this paper:

1. About the drivers of local/ endogenous knowledge loss across both regions; and
2. About the drivers of the scarcity of the resource across both regions.

Discussion:

1. The importance of endogenous knowledge on plants used to treat various diseases across both regions,
2. The factors causing the erosion/loss of local knowledge;
3. The factors affecting the current distribution of the plant species across both regions, and
4. The opportunity to overturn the issue of endogenous knowledge's loss and approaches to slow down the loss of the scarce plant species while ensuring its sustainable management across both regions.

Additional information has been added to the annotated manuscript itself (available [here](#)). Please

have a look for further assessment.

Conclusion:

In this section, please assess whether the paper has contributed to answer to the following aspects of your research paper (the specific objectives of the paper):

- The price and selling amounts dynamics of *P. nitida* (Stapf) T. Durand and H. Durand across both regions;
- Documenting the various uses of the plant species and the drivers of loss of local/endogenous knowledge about usages of that plant species across both regions;
- Shed a light on the drivers of species scarcity, and its distribution across both regions.

Recommendations:

As key recommendations, the authors should suggest some solutions to safeguard the loss of local/endogenous knowledge and approaches for sustainable management of the plant species around across both regions.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 27 October 2020

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Martin J. Potgieter

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The authors seem intent on doing the minimum to get this paper through as quickly as possible. This minimum effort is achieved via the following strategies:

1. No correcting or addressing issues raised.
2. Removing/deleting controversial issues rather than comprehensively addressing them, thereby uplifting the quality of the paper. Removing these issues just leads to unconnected parts – the Abstract is an excellent example of this strategy and its unintended consequences.
3. Addressing discussion issues via one or two non-referenced low-quality non-scientific sentences.

4. The paper cannot proceed forward with this amount of unprofessional grammar/editorial issues. It also makes it extremely difficult to review and judge the quality and value of the scientific content.
5. The authors indicate Ethical approval was not sought for this study, as the study was deemed by the researchers to be low risk, as it did not record any identifying information of participants; was not an interventional- or clinical-based study. However, it is currently industry standard to seek and obtain ethical clearance from the research institution (in this case University of Abomey, University Félix Houphouët Boigny, and National University of Agriculture).

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Biodiversity, ecology, phytomedicine, ethnobotany

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Version 1

Reviewer Report 10 August 2020

<https://doi.org/10.21956/aasopenres.14183.r27676>

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The paper deals with the importance of *Picralima nitida* (Stapf) T. Durand and H. Durand, known as an important African medicinal plant species in Dahomey Gap region in general and in Togo in particular, especially at the glance of its: i) economic value, ii) endogenous knowledge and distribution. However, the paper failed to take into consideration several aspects such as i) poor knowledge about the exact distribution of the *Picralima nitida* plant species, ii) the issue of erosion of local knowledge and the need for its safeguard; iii) the causes of plant species (*Picralima nitida*) rarity, and iv) any available initiatives/interventions that have been carried out to address the issue along with any available policy and available regulations in place to guide sustainable management of biodiversity in general and *Picralima nitida* medicinal plant species in particular. Undermining such background knowledge has contributed to lowering the quality and strength of the paper. As a result, in its current stage, the paper could not be accepted for indexing, unless important ameliorations are made.

Please see my detailed comments in the PDF file found [here](#).

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: NTFP Socioeconomics, Livelihood assessment, Ethnobotany, NTFP value chains assessment, NTFP resource management, and policy and regulation assessment

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 06 Oct 2020

Ghislain AKABASSI, African Center of Excellence for Climate Change, Biodiversity and Sustainable Agriculture, Cocody, Cote d'Ivoire

Answer to Reviewer 2: Christian Mickolo Y.

Introduction

R: I would rather suggest that the authors focus on the background of his paper as follows: In Dahomey Gap's region or West African region, they should point out the following...

A: *This recommendation has been taken into account in the indicated part of the manuscript.*

R: I think that this general objective does not capture the full content of the paper as a result I suggest the following one "This paper aims at assessing the economic value, document the endogenous knowledge on the plant species, and sheds a light on the distribution of *Picralima nitida* (Stapf) T. Durand and H. Durand in Dahomey Gap's region by talking the following research questions:

1. What is the economic value of the *Picralima nitida* species around the study area? 2. To what extent local communities know about the ethnobotanical values of the species? 3. What are the drivers of species rarity around the study area? 4. What is the current distribution of the species around the study area?

A: *All questions addressed here have been considered in the introduction of this new version.*

R: What solutions can be suggested to overturn the issue of species rarity around the study area?

A: *No data has been collected about this recommendation.*

Study area:

All questions and recommendations suggested by the reviewer about of the study area have been considered and integrated in this new version of the manuscript.

Data collection:

Preliminary survey:

R: How many respondents did you approach regarding the ethnobotanical uses, economic value, and distribution of the plant species around both selected study areas?

A: *Based on preliminary surveys among 90 individuals randomly sampled among various ethnic groups in DG on the use of the species.*

R: What were the results regarding the ethnobotanical uses, economic value, and distribution of the plant species during such a phase?

A: *It was found that 85% in Benin and 83% in Togo of respondents had knowledge of at least one use for the species.*

Main survey:

R: In both countries, how did you access and sample the 120 key informants? • Are the local languages used in both countries different or similar? In the case that they are different, there might be also differences in uses and practice of local knowledge so how did you do to capture such differences? What are the reasons that drove you to select the following two phytodistricts (Pobè and Vallée de l'Ouéomé) in Benin? The same question holds for the case of Togo. • What are also the other criteria for selecting the key informants in the survey? What are the other data collection approaches did you use such as transect walk, field observation, group discussion, etc, especially to cross- check information gathered?

A: *Individual interviews were conducted in Togo and Benin with a total of 120 (60 per country) key informants. The main local languages interviewed were Fon, Goun, Nago, Yorouba, Adja in Benin and Mina, Ewe, Kotafon in Togo. The survey has been piloted prior to its use. In Benin, the survey covered two phytodistricts (Pobè and Vallée de l'Ouéomé) and 30 informants were selected in each phytodistricts. These two phytodistricts were selected because it were the only presence areas of *P. nitida* in Benin (Akoègninou et al. 2006). In Togo, the survey covered Danyi located in ecological district IV (only presence area of the species in Togo (Akpagana et al. 1994) and 60 informants were selected. The survey was performed between January and July 2018 and conducted in the local language using a questionnaire (see Extended data). The survey was carried out through the households using a local guide. The local guide approached households*

*in person and participants aged 18 and over were considered regardless of education level, ethnicity and gender. Households were selected at random, however, households with sellers of medicinal plants were systematically selected. After this Approach, a focus group discussion has been performed in each country to cross-check information gathered. In Benin, 45 people indicated their willingness to participate at the focus group discussion while 42 people volunteered in Togo. Most informants were selected from localities with at least one *P. nitida* individual. These localities were Ifangni, Sakété, Adja-Wèrè, Ikpinlè, Kétou, Avrancou, Adjarra, in Benin and Kouma, Danyi, Akposso-Akébou, Kpalimé-Atakpamé in Togo. Data were collected on the economic and socio-cultural values of the species, the uses and organs used, the frequency of use and main threats of the species.*

Literature search:

R: How many articles were obtained? • How much refinement was made to remove nonrelevant articles? • And how many articles remain now?

A: *In the typical GC region, data were collected on *P. nitida* through a literature search. The original articles obtained from various databases including Google Scholar (www.scholar.google.fr), ScienceDirect (www.sciencedirect.com), Scopus, PubMed Central and African Journals Online (www.ajol.info) in addition to reports and thesis. Biodiversity databases (www.prota.org and GBIF.org) were used to gather information on the importance and occurrence coordinates of the species. The main research theme used were: "Economic value" AND "*Picralima nitida*"; "Endogenous knowledge" AND "*Picralima nitida*"; "Distribution" AND "*Picralima nitida*"; "Togo" AND "*Picralima nitida*"; "Benin" AND "*Picralima nitida*". A total of 66 published articles were obtained and 31 published articles between 1996 and November 2018 were selected based on their relevant for the topic. All articles not dealing with ethnobotanical importance and distribution of *P. nitida* were excluded. Letters, encyclopaedia, case-reports, manuals and guidelines were also excluded. The data that were extracted from selected articles were the socio-economic importance, the different traditional uses of *P. nitida* organs, mode of preparation, dosage and coordinates of study location.*

Competing Interests: N/A

Reviewer Report 08 July 2020

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Martin J. Potgieter

Department of Biodiversity, University of Limpopo, Sovenga, South Africa

General issues:

- The grammar of this paper needs serious professional proofreading before a next submission.

Title:

- The title indicates: "Economic value, endogenous knowledge and distribution of *Picralima nitida* (Stapf) T. Durand and H. Durand *in Africa*" – However, this study was only confined to DG, Togo and Benin. Thus, vast areas of the distribution range of *P. nitida* are excluded from this study (e.g. South Africa). This implies that the title needs to be reformulated to indicate the localities of DG, Benin and Togo.

Abstract:

- Background: Effect of climate gradient on distribution is presented as an aim, but not captured in the title.
- Methods: threats not captured in title, no result presented on it – remove?
- Methods: density not listed, yet features in results/discussion section.
- Results: Treatments (human and/or veterinary?).
- Results: species had *low* density in Dahomey Gap – what constitutes *low* density?
- Results: No information presented on "Effect of climate gradient on distribution".
- Results: no information presented on threats, yet it features in methodology.
- Conclusions: Adapted management strategies are needed for the sustainable use and conservation of the species. – this is a recommendation, not conclusion – remove.

Introduction:

- Remove: It is a small tree which reaches 4–35 m in height. Its wood is pale yellow, hard, elastic and fine-grained with a high polish. *P. nitida* bears white flowers (about 3 cm long) with yellowish ovoid fruits at maturity. The leaves are broad and oblong with tough tiny lateral nerves of 14–24 pairs. This section is out-of-place.
- "In addition to its medicinal uses, *P. nitida* provides an income to millions of households in Africa." How so? Explain via an additional sentence.
- "The species is known as a febrifuge and a cure for infectious disease, malaria, diabetes and pain (Aguwa et al., 2001; Akabassi et al., 2017; Betti et al., 2013; Teugwa et al., 2013)". - The issue of string citation (listing multiple authors at end of sentence) is a pervasive problem in this manuscript. By placing multiple consulted sources at the end of a sentence implies all information in that sentence can be attributed to those authors – thus per implication they (authors) stated exactly the same information – in which case why cite more than one, when the most authoritative would suffice? This issue must be corrected by placing sources immediately after used fact inside the sentence, when dealing with multiple authors in a sentence, so as to explicitly attribute a specific fact to a specific source. Correct throughout the manuscript.
- Figure 1: does not show the full distribution range of the species, especially in southern

Africa.

- "There is a need to dispel the ambiguity over the distribution areas of this species *and to document the important threats to its conservation.*" Where is the threat analysis and discussion?

Materials and Methods

- Study area:
 - "The study areas were typical GC regions (Cameroon, Central African Republic, Congo Brazzaville, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Ghana, Nigeria and Uganda" – incorrect. The study area was confined to DG countries, Togo and Benin – rephrase.
 - Figure 2: "...characterized by *rainforests* with a rainfall of up to 2500 mm, and the DG region (Benin and Togo) characterized by *savannas* that extend down to the coast *with a mosaic of rainforest* (Figure 2)." Figure 2 does not show mosaic of rainforests or savannas.
- Economic value and endogenous knowledge:
 - "A preliminary survey was conducted in DG on the use of the species." Indicate (1) reasons for preliminary survey, (2) how many people surveyed and how.
- Data collection:
 - Indicate how key informants were selected.
 - Gender and age?
 - Indicate how households were selected.
 - Indicate themes of questionnaire.
 - Threats? No reporting of it in Results/discussion section.
- Literature search:
 - "The data that were extracted from selected articles were ... GPS coordinates of the individuals of the species." This is extremely strange (and unlikely) that GPS coordinates of individual plants are presented in the literature. Relook this.
- Ethics and consent:
 - Individuals involved in the study can only give consent, not ethical approval. Ethical approval was sought and given by which university? Indicate ethical clearance certificate number.
- Effect of climate gradient on species density and distribution:
 - "...in the typical GC region, data on the species density and distribution were collected using a literature review. This is extremely strange (and unlikely) that density of individual plants is presented in the literature. How old are the sources consulted? Still valid/relevant for period of this study? How complete was the information gathered via literature review? How was literature review done? Relook this.
- Results/Discussion

Economic value:

- "P. nitida seeds were dried, powdered, encapsulated and sold as "Picap capsules" that cost between US\$12.99 and US\$225 depending on the quantity..." – For which region/country is this? How old is this information? How scientifically correct is the information that is derived from a non-peer-reviewed web-based source.
- (<https://thegradekratom.com/product/akuamma-seeds/>). – web addresses not to be included in text – relocate to reference section.
- "P. nitida products were *more* expensive in the DG." – more than?
- "The domestication of non-timber forest species like P. nitida is an opportunity to alleviate poverty with positive benefits on the environment, since new plantations of P. nitida will contribute to reduce the greenhouse gas emission."- this is such a general statement as to apply to any plant species - relook.
- "It is therefore important to develop a management program for the sustainable use of the species." On the contrary, no information has been provided to indicate *unsustainable* use or harvesting. So why is a management program necessary? Because it is rare? But could be due to abiotic factors such as climate and soil, not necessary due to adverse anthropogenic actions. Relook.

Endogenous knowledge:

- Bark – is this stem bark or root bark?
- Bellyaches – replace with stomach aches.
- "This indicated that P. nitida is very important in the the DG." – this is a prime example of some of the many unprofessional editorial issues abound in this paper.
- Table 1 and Table 2: Why are leaves presented in plural, but other organs in singular?
- Table 1 and Table 2: Indicate if the fruit is mature and ripe, or not.
- Table 1 and Table 2: Stem – does this include wood+bark?
- "The seed was the most important organ used in the DG (79.16% in Benin and 83.33% in Togo)." Why and what would be the conservation impact/population sustainability impact? Discussion needed.
- "The seed was the most important organ used in the Guineo-Congolese region followed by the wood, fruit, leaves, bark and root (Table 2)." - Why and what would be the conservation impact/population sustainability impact? Discussion needed.
- "In the DG and GC regions, P. nitida was most frequently used against malaria, followed by measles, diabetes, worms, sexual weakness, hernia, fevers, infectious diseases and diarrhoea, ..." Are there any biochemical/microbiology papers found that scientifically validate these claims? Discussion needed.

- "... uses were specific to certain regions with good credibility as the case of the use of the seeds to treat tonsillitis in the DG." Is there any biochemical/microbiology papers found that scientifically validate these claims? Discussion needed.
- "The different uses of the species mentioned in this paper could help local communities to benefit from the medicinal values of the species." – how so? Statement not clarified. Explanation needed.

Effect of climate gradient on density and distribution:

- *P. nitida* was found at very low density in the DG (0.020 ind./km² and 1.75 ind./village in Togo and 0.022 ind./km² and 1.87 ind./village in Benin). Is this information coming from literature (not cited). If not, then how was this determined? Individuals per village are meaningless – we do not know how large the village is. Density must only be expressed as individuals per km².

Distribution of *P. nitida* in Guineo-Congolese region:

- "In the Upper Guinea (from Guinea and Sierra Leone to Ghana" Western Region)", the occurrence of *P. nitida* was *average*. What constitutes *average*? Occurrence categories not presented in Materials and Methods section.
- In Lower Guinea (Nigeria and eastward; "West Central Region"), *P. nitida* had *many* occurrences ..."- What constitutes *many* occurrences? Occurrence categories not presented in Materials and Methods section.
- "... in western Cameroon, which experiences 3000 mm of precipitation per year (Lefèvre, 1967). This rainfall of 3000 mm per annum comes from 53 ago (1967). Rainfall data not reflective for the study period of this paper. Climate change in the last 50 odd years has significantly altered the numbers. Use more up-to-date sources and data.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Biodiversity, ecology, phytomedicine, ethnobotany

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 13 Jul 2020

Ghislain AKABASSI, African Center of Excellence for Climate Change, Biodiversity and Sustainable Agriculture, Cocody, Cote d'Ivoire

Dear reviewer,

We provide below the Answer (A) to the Remark, recommendation and question (R) addressed.

Title:

R: The title indicates: "Economic value, endogenous knowledge and distribution of *Picralima nitida* (Stapf) T. Durand and H. Durand in Africa" – However, this study was only confined to DG, Togo and Benin. Thus, vast areas of the distribution range of *P. nitida* are excluded from this study (e.g. South Africa). This implies that the title needs to be reformulated to indicate the localities of DG, Benin and Togo.

A: This study involves in addition to DG (Benin and Togo) the Guineo-Congolese region which include the Upper Guinea (from Guinea and Sierra Leone to Ghana" Western Region") and the Lower Guinea (Nigeria and eastward; "West Central Region"). *Picralima nitida* is native from the Guineo-Congolese region. According to Bongers *et al.* 2004, Poorter *et al.* 2004, Church, 1966, and White, 1983, the Guineo-Congolese region does not include South Africa. Moreover, there is no occurrence of the species in South Africa on GBIF database. I will be very pleased if you could update the occurrence of the species on GBIF with the reference points in South Africa. This will help to improve the distribution map of the species.

Abstract

R: Methods: threats not captured in title, no result presented on it – remove?

A: The threats on the species were addressed based on the overexploitation of its organs. The section on Endogenous knowledge of *P. nitida* in the results provides information on the exploitation of the organs of the species. The seed was the most important organ used in the Guineo-Congolese region followed by the wood, fruit, leaves, bark and root"; "The seed was the most important organ used in the DG (79.16% in Benin and 83.33% in Togo)". The overexploitation of the seeds, bark and root (vital organ of the plant) are an important threat on the conservation of the species. Other threat of the species in the article is the climate gradient. The species is scarce in DG compared to Guineo-Congolese region.

Introduction:

R: Figure 1: does not show the full distribution range of the species, especially in southern

Africa.

A: This figure is provided by Adjanohoun et al. (1996). If the species is also present in South Africa, it will be good to update the occurrence of the species that will contribute to update the figure in future publication

R: "There is a need to dispel the ambiguity over the distribution areas of this species and to document the important threats to its conservation." Where is the threat analysis and discussion?

A: In this study the threats were mainly assessed in relation to the importance of the species for the local populations. The use of the various organs (especially the seeds) of the species without any form of sustainable management constitutes a threat to the sustainability of the species.

In addition, the second part of this study dealing with threats to the species is its frequency according to the climate gradient. In this study, we found that in both DG countries. For instance, in Benin the occurrence of the species decreases either in latitude from the south or in longitude from the southeast. Its presence is reduced to a few isolated individuals found in home gardens. In the Guineo-congolese zone the density of the species is high in the zones with high rainfall such as the Democratic Republic of Congo, Cameroon (Please consult GBIF website). These different results showed the effect of climate gradient on the distribution of *P. nitida*.

Materials and Methods

R: Figure 2: "...characterized by rainforests with a rainfall of up to 2500 mm, and the DG region (Benin and Togo) characterized by savannas that extend down to the coast with a mosaic of rainforest (Figure 2)." Figure 2 does not show mosaic of rainforests or savannas.

A: Figure 2 showed the DG and Guineo-Congolese regions. In the figure, the Guinean-Congolese part has been marked green. The two green parts have been separated by the Dahomey Gap. According to literature (Adomou, 2005, Akoegninou et al., 2006, Church, 1966) the Guineo-Congolese region is forest area characterized by rainforests with a rainfall of up to 2500 mm, and the DG region (Benin and Togo) characterized by savannas that extend down to the coast with a mosaic of rainforest.

Economic value and endogenous knowledge:

R: "A preliminary survey was conducted in DG on the use of the species." Indicate (1) reasons for preliminary survey, (2) how many people surveyed and how.

A: A preliminary survey was conducted in DG on the use of the species to calculate the sample size to be used in the full study, according to the formula of Dagnelie (1998).

Data collection:

R: Indicate how key informants were selected, Gender and age? Indicate how households were selected.

A: Please see this section of methodology "The survey was carried out through the households using a local guide. The local guide approached households in person and participants aged 18 and over were considered regardless of education and gender. Most informants were selected from localities with at least one *P. nitida* individual. Data were collected on the economic and socio-cultural values of the species, the uses and organs used, the frequency of use and main threats of the species.

Ethics and consent:

R: Individuals involved in the study can only give consent, not ethical approval. Ethical approval was sought and given by which university? Indicate ethical clearance certificate number.

A: Ethical approval was not sought for this study. The study is deemed by the researchers to be low risk, as it did not record any identifying information of participants; was not an interventional- or clinical-based study. However, a consent has been received from community leaders and participants of the DG and ensured informed consent was received for data collection and analysis.

Competing Interests: N/A