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Endogenous knowledge and farming methods for *Jatropha curcas* L. in southern Chad

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To assess the level of knowledge of the farming population and the ecological importance of *Jatropha curcas*, ethnobotanical surveys were carried out among the local population in three villages in the province of Logone Oriental, namely Bébédjia, Miandoum and Komé. A total of 250 people of different sexes were surveyed. The results of these surveys showed the socio-economic importance of this species for the local population. Some of the people surveyed have a very good botanical knowledge of the species and its qualities, and have developed systems for managing the species in agrosystems that could facilitate its domestication and conservation. In addition to its medicinal uses, the plant is used in agrosystems as a hedge, to combat erosion and as firewood. In medicine and traditional pharmacopoeia, various plant parts are used to treat several illnesses.

Key words: *Jatropha curcas*, ethnobotany, farming, Chad.

INTRODUCTION

Various relationships are maintained between humans and plants, depending on their uses (Kumar and Lalramnghinglova, 2011). These relationships may concern medicinal plants, edible plants, plants with cultural significance or for craft use and plants for domestic use (firewood, charcoal and construction wood, etc.) (Ake-assi et al., 2010; Perumal and Bhaskaran, 2010). Paradoxically, despite the importance of these trees, the degradation of ecosystems and species is increasingly perceptible due to climate change, demographic pressure and human activities that contribute to the loss of biodiversity (Dadjo, 2011). Given this bleak picture, it is vital to quantify the level of importance and the use of local species by local populations. The local assessment in southern Chad focuses mainly on *Jatropha curcas*, a species of interest to various development organizations in tropical and subtropical regions because of its adaptability, even in semi-arid zones (Datta et al., 2007). *J. curcas*, a plant in the Euphorbiaceae family that produces oil seeds, is an interesting alternative to food crops. Firstly, because it is not edible and therefore does not compete with the food sector. Another advantage is that *J. curcas* can be grown on difficult soils that are unsuitable for other crops, helping to combat desertification. In addition to this environmental aspect, the development of biofuels contributes to and creates new agricultural sectors and could offer new growth niches for farmers in developing

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countries: Wood, fibres, plant and animal food products for the diet and pharmacopoeia (Berchmans and Hirata, 2008). Another advantage is that *J. curcas* can be grown on difficult soils that are unsuitable for other crops, helping to combat desertification. However, the cultivation of biofuels cannot be to the detriment of agricultural production because of the competition for fertile land and water, otherwise it would contribute to increasing famine in the world (Abdoul, 2013). This plant is used in villages and the countryside to erect hedges to protect crops, demarcate areas and act as a corridor for livestock (Kabé et al., 2020). The Jatropha system covers four main aspects of rural development: (i) poverty reduction (crop protection, sale of seeds, oil and soap); (ii) promotion of women (soap production); (iii) erosion control (hedge planting, humus, moisture retention); household energy supply (candle making and oil lamp lighting). The lack of information on the available potential, particularly the different species and varieties of *J. curcas*, is a major handicap to the promotion of this material. Therefore, to improve the propagation of *J. curcas*, it would be necessary to determine some of the characteristics of the plant's vegetative and germinative reproduction systems. *J. curcas* is a highly allogamous plant. The disadvantage of propagating *J. curcas* by sowing or transplanting spontaneous wild plants into the field is that it produces heterogeneous plants with a seed oil content ranging from 4 to 40% (Chang-Wei et al., 2007). It is in this context that this study was conducted, with the general objective of analyzing the traditional use of *J. curcas* in agrosystems in the Province of Logone Oriental. Specifically, the aim is to: (i) identify *J. curcas* acquisition methods, (ii) assess local perceptions of *J. curcas* phenology, (iii) evaluate *J. curcas* exploitation and management strategies adopted locally for the conservation of shea resources.

MATERIALS AND METHODS

Study area

This study was conducted in the Logone Oriental region in the extreme south of Chad (Figure 1). It covers an area of 28,035 km^2. Geographically, it lies between 7° 20' and 9° 10' north latitude, and between 15° 20' and 17° 15' east longitude (Mbaiyetom et al., 2020). Four types of soil can be distinguished according to topography: Hydromorphic soils, weakly desaturated leached tropical ferruginous soils on sandy-clay materials, erosion soils on crystalline rocks and the upper parts of the plateaux, known as "Koro", are sandy and sometimes covered with lateritic armour. The climate in Logone Oriental is tropical, hot and semi-humid. The vegetation is of the Sudano-Guinean type (Madjigoto, 1999). Annual rainfall varies between 950 and 1350 mm and lasts six to seven months (April-November). The average maximum temperature is around 38°C in March and April, and the average minimum is around 20°C. The drainage system in Logone Oriental is fed by two main rivers, the Logone and the Pendé, and a number of secondary rivers (Mbaiyetom et al., 2020). The vegetation in Logone Oriental is made up of wooded savannah, wooded savannah and forest galleries inhabited mainly by the following species: *Parkia biglobosa*, *Pterocarpus lucens*, *Vitellaria paradoxa*, *Prosopis africana*, *Swartzia madagascarensis*, *Daniellia oliveri* and *Isoberlinia doka*. The undergrowth is well stocked with shrubs such as *Annona senegalensis*, *Bauhinia reticulata*, *Bridelia ferruginea*, *Combretum*, *Grewia mollis*, *Gardenia* sp, *Guiera senegalensis*, *Hymenocardia acida*, *Sclerocarya birrea*, *Securidaca longepedonculata*, *Strychnos* sp, *Terminalia* sp, *Detarium microcarpum* and others. These species and many others give rhythm to the African countryside with their protective silhouette (Mapongmetsem 2007). Four forest reserves known as "classified forests" were created in the 1950s in Logone Oriental. These are the Timbéri forest (64,000 ha), Larmanaye (Lagnié 521 ha), Siagon-Yamodo (46 ha) and Ndokaga (521 ha).

Surveys of farmers

The study began with an exploratory survey to identify the target villages and groups. This was followed by an in-depth survey using a survey form. The main part of the field investigation was carried out by interview using a questionnaire administered face-to-face and comprising various types of questions: Open questions that allowed farmers to answer deliberately, closed questions to which farmers answered yes or no, and guided questions in which respondents chose one or two of the proposed answers. A total of 150 people was interviewed in three villages (Bébédjia, Miandoum and Komé), that is, 50 people per village, broken down by main function. The information sought concerned how *Jatropha curcas* was acquired, perceptions of *J. curcas* phenology, methods of propagation and maintenance of *J. curcas* and how *Jatropha curcas* is farmed. The interviews were conducted with the help of translators.

Data analysis and processing

The survey data was analyzed manually, then entered and processed in Excel version 2019. The ethnobotanical data were analyzed by calculating response frequencies. For a given parameter, the frequency of responses is determined by the quotient, expressed as a percentage of the number of people who gave the answer by the total number of respondents.

RESULTS AND DISCUSSION

Socio-economic characteristics of farmers

The total sample is made up of 33.33% of farmers under 30 years of age. They are followed by those aged between 30 and 45 with a percentage of 30%. Last in line were farmers aged over 45 (26.66). Concerning the different village groupings, the above trend is maintained in Miandoum and Komé about the dominant age group (Figure 1). Bébédjia has a high proportion of farmers (55%) aged between 30 and 45. This result could be explained by the many awareness campaigns organized by the Chad Jatropha Network. Analysis of the marital status of the farmers shows that 73.33% of the farmers surveyed are monogamous compared with 14.16 who are polygamous. This general trend was maintained in all the villages. This high rate of monogamy compared with polygamy could be explained by the population's awareness of the increasingly high cost of living following

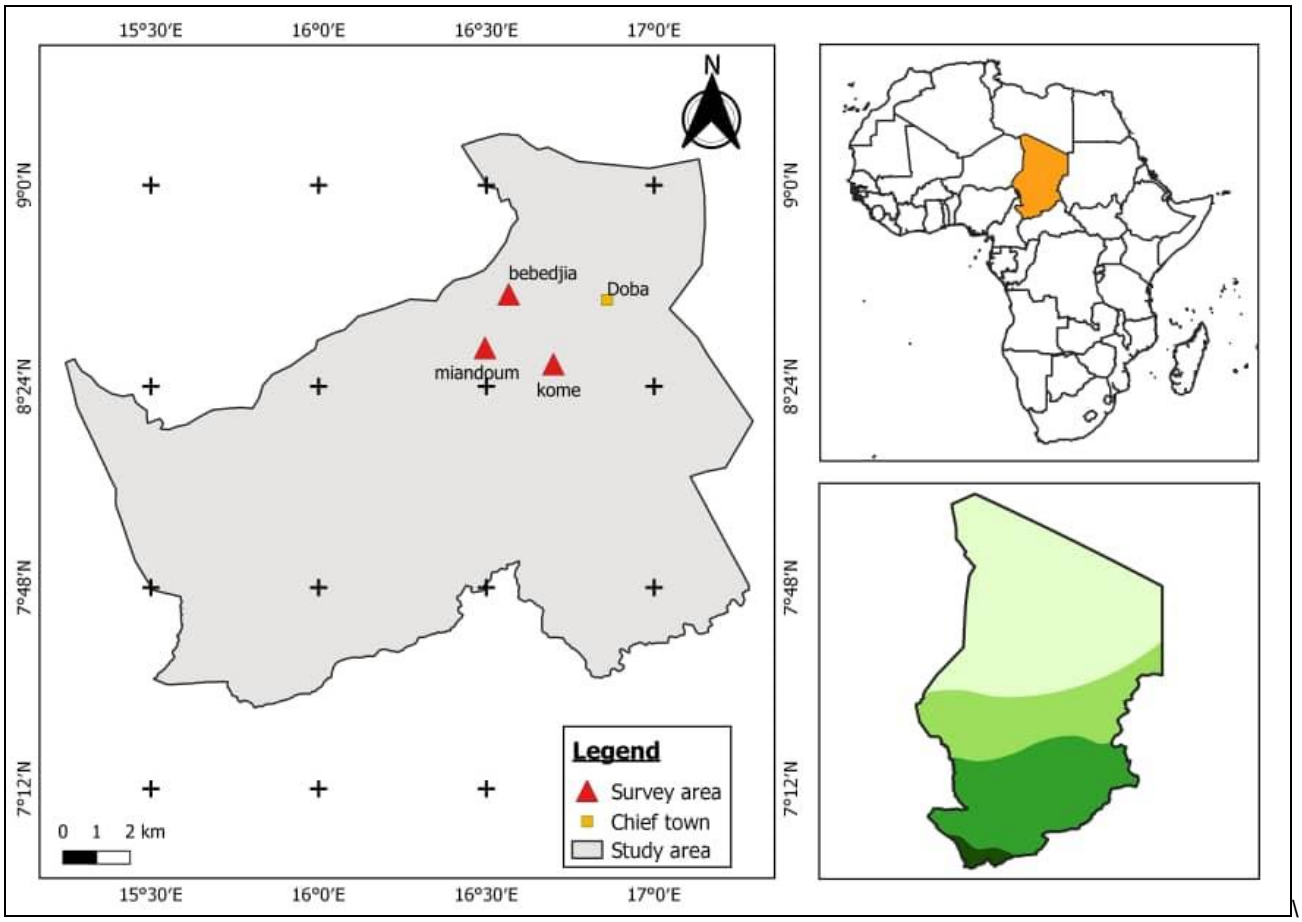

Figure 1. Map of study site locations.

the advent of oil. This result can also be explained by the similarity of cultures between these three villages. This work shows that 33.66% of the farmers surveyed have fewer than 5 people in their household. Families of between 5 and 10 people were in first place with a percentage of 39.16. The trend noted for the dominant class is respected within the different ethnic groups. The adoption of monogamy is thought to be one of the causes of low family size. This result is similar to that of Magin (2001) in southern Chad. Males accounted for 68.33% of the total sample. Between villages, the trend towards equality between men and women is not respected. These results show that women are not sufficiently involved in farm management in the same way as men. Overall, 63.8% of the farmers surveyed are farmers. The rest of the farmers are divided between traders, stockbreeders and other trades. The rest of the farmers are divided between traders, stockbreeders, and other trades. The trend for the dominant activity is the same in all three villages. To this group should be added the harvesters of non-timber forest products. These results show that these people do not essentially practice agriculture. The other activities practiced by the populations are merely complementary.

Of the total sample, 32.5% had not attended a modern school. Among the educated, the majority (46%) have only primary school education. Farmers with secondary education make up 25% of the total sample. Komé has a high under-education rate of 37%. Factors contributing to under-enrolment include the isolation of villages, the distance from schools and precarious economic conditions.

Acquisition of *J. curcas* L.

Despite its age, very little is known about the origin of the plant. The origin of the plant varies from one group to another. In Bébédjia, 46.66% of respondents said that the plant had been introduced by Europeans. Some respondents confirmed the plant's Latin American origin. According to the respondents, the species was acquired by inheritance, from the wild, or from neighbors. 5% of respondents did not know the origin of the species. This can be explained by the population's level of education and the many awareness and training campaigns

conducted by the Chad Jatropha Network.

Botanical characteristics of *J. curcas* L.

Phenology of J. curcas L.

It is not unusual to see ripe and unripe fruits and inflorescences on the same plant of *J. curcas*. The first flowering begins at the start of the rainy season, generally at the same time as leafing. Defoliation takes place in the dry season. It begins and alternates with short periods of foliage and flowering. The disparity in responses regarding fruiting time (52.5% for one year compared with 47.5% for two years) is due to the fact that not all branches flower at the same time. This same result was observed by Henning (2008) and Anguessin (2009). The plant's mode of reproduction by allogamy facilitates the diversity of biological types.

Propagation and care of J. curcas L.

Jatropha curcas is propagated by sowing, transplanting and cuttings. Cuttings are the most commonly used propagation technique. 56.66% of farmers use cuttings, compared with 35.83% who use transplants and only 7.5% who use seedlings. Propagation by cuttings is most common in Komé, followed by Miandoum. In Bébédjia, transplanting is the technique most often used because of the availability of seedlings produced by the Chadian Institute for Research and Development (ITRAD), which works in the region by providing farmers with seeds and young seedlings. These results are similar to those found by Heller (1996) in Rwanda, who assert that cuttings ensure easy, inexpensive installation and early productivity, making them accessible to the average farmer. The use of vegetative propagation can enable rapid multiplication of clones selected by farmers (Jepsen et al., 2006). However, for plant maintenance, pruning and trimming remain the most widely used techniques. They are generally carried out at the end of the seasons when the relative humidity allows the plant to develop. Deadheading generally takes place at the end of the dry season to encourage early branching and increase seed production.

Use of J. curacs L.

The uses to which the plant is put in the region vary according to the farmers' objectives. The plant is used as a medicine, to protect crops and to demarcate land.

Medicinal use

The various parts of the tree are used to treat a wide range of health problems. Almost all parts of the plant are suitable for medicinal use (leaves, stems, roots, seeds and sap). The main methods of preparation are maceration, decoction and infusion. The oil obtained by pressing and adding to shea or groundnut oil treats skin diseases such as scabies and ringworm. This oil is said to have antifungal properties (Rug and Ruppel, 2000; Jongschaap et al., 2007). *J. curcas* is used as a laxative, against skin diseases, for coughs, as an antiseptic, etc.). A decoction of the roots treats intestinal worms, particularly yeast, in children. Similarly, infusing the leaves as a drink and massaging the anus with the leaves treats "tandaou". This result is similar to that of Anguessin (2009) in North Cameroon. *J. curcas* is also used to treat sexually transmitted infections. Crushed and boiled *J. curcas* seeds mixed with porridge or hot water treat gonorrhoea. The sap and leaves are used as antiseptics. The leaves are crushed and heated, then glued to the wound to heal it. Similarly, sap applied directly to the wound heals it. In Côte d'Ivoire, *J. curcas* is used to treat high blood pressure and diabetes (Fézan et al., 2008).

Land tenure

For most farmers, introducing J. curcas into their farming systems will solve the problem of land conflicts and landmarking (Photo 1). It is inexpensive and very easy to install, providing a barrier to animals roaming the fields. *J. curcas* is therefore often used as a border and boundary plantation (Kossouma, 2008). As a result, farmers use the plant to mark the boundary of fields between neighbors, thus marking ownership. The use of trees as a land base has been noted in several studies, including those by Mapongmetsem (2007) and Kossouma (2008) in Cameroon.

Windbreak plant fence

J. curcas surrounds houses and acts as a fence, protecting them from the wind. To this end, the plant acts as a windbreak and shelter curtain. *J. curcas* is used as a plant fence around fields of sorghum (*Sorghum* spp.), maize (*Zea mays*) and manioc (*Manihot esculentus*) to prevent stray animals from entering the fields (Photo 2). It is also used to fence off hut gardens, alone or in association with other species to protect fruit trees. This practice of using *J. curcas* as a fence has been reported in Madagascar, Central Africa, the Great Lakes, and West Africa (Üllenberg, 2007). The size of the tree in the different systems varies according to practice and farming system (Molenaar et al, 2013).

Erosion control and soil conservation

The plant's roots grow very close to the surface of the

Photo 1. Land boundary planted with *J. curcas.*

Photo 2. *J. curcas* used as a plant fence in a millet field.

soil, securing it in bunds or clods. These dikes slow down water run-off during rainstorms. This action leads to greater infiltration of water into the soil and increases crop yields. *J. curcas* has a root system that ensures a good supply of water (surface and deep) and helps to fix the soil and reduce erosion. This reduces organic matter

and nutrient losses to a tolerable level (Köning, 2007).

Firewood and candles

J. curcas is used by some farmers as firewood after pruning. However, some of the women interviewed thought that the wood gave off noxious smoke that interfered with cooking. However, *J. curcas* seeds are a good source of lighting at night, reducing farmers' financial losses and energy dependence. *J. curcas* seeds stacked one on top of the other in the form of a string, at the end of which a match stick is lit, ensure slow, smokeless combustion for several hours. This practice is recurrent throughout the zone and is a means of managing farmers' income, thus avoiding the expense of buying paraffin.

Conclusion

This study has enabled us to understand the uses and different management methods for natural resources. The variation in choices and preferences observed in the use of woody species is linked to the availability of plant resources. While some conservation strategies are being implemented through the maintenance and upkeep of *J. curcas*, very few significant actions are being taken to effectively combat the degradation of plant resources. Although local people are aware of the importance of local species in their daily lives, they are not accustomed to conserving them through plantations. This will require a behavior change. This will involve raising awareness of the need to produce local species, at least those that local people consider to be priorities and that are adapted to their environment. Less important species, because they are scarcely used have less chance of winning the approval of the local population. Despite their lesser importance, these species must also be protected to conserve biological diversity.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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REFERENCES

Abdoul HZ (2013). Entomofauna associated with *Jatropha curcas* (L.) in Niger and evaluation of the insecticidal activity of its oil (PhD thesis). Université de Liège-Gembloux Agro-Bio Technology, Belgium 126 p.

Ake-Assi Y, Biego GHM, Koffi KM, Kouame P, Achi L, Bonfoh B (2010). Validation de la méthode de détermination du Benzo (a) pyrène dans des poissons frais et fumés vendus et consommés en Côte d'Ivoire. *Revue Africaine de Santé et de Productions Animales*.

Anguessin B (2009). Botanical and ethnobotanical characterisation of the genus Jatropha in the Mayo-Louti Region (North Cameroon). Master's thesis, University of Ngaoundéré 49 p.

Chang-Wei L, Kun L, Yon C, Yong-Yu S (2007). Floral display and breeding system of *Jatropha curcas* L. Forestry Studies in China 9(2):114-119.

Dadjo CPAF (2011). Caractérisation ethnobotanique, morphologique et spatiale de Vitex doniana Sweet (Verbenaceae) au Sud-Bénin. *Mémoire d'ingénieur Agronome, Faculté des Sciences Agronomiques, Université d'Abomey-Calavi, Bénin. 81p*.

Datta K, McIlwaine C, Evans Y, Herbert J, May J, Wills J (2007). From coping strategies to tactics: London's low-pay economy and migrant labour. British Journal of Industrial Relations 45(2):404-432.

Fézan H, Trab G., Irié K., N'gaman C, Mohou C (2008). Études de quelques plantes thérapeutiques utilisées dans le traitement de l'hypertension artérielle et du diabète: deux maladies émergentes en Côte d'Ivoire. Science Naturelle 5 :39-48.

Heller J (1996). Physic nut. *Jatropha curcas L.* Promoting the conservation and use of underutilized and neglected crops. 1. Institute of Plant Genetics and Crop Plant Research, Gatersleben, International Plant Genetic Resources Institute, Rome 66 p.

Henning RK (2008). Identification, selection and multiplication of high yielding *Jatropha curcas* L. plants and economic key points for viable Jatropha oil production costs. International Consultation on Pro-Poor Jatropha Development pp. 10-11.

Jepsen JK, Henning RK, Nyati B (2006). Generative propagation of *Jatropha curcas* L. on Kalahari San. GTZ Reports, Weissensberg Germany pp. 13-17.

Jongschaap REE, Corre WJ, Brindraban PS, Brandenburg WA (2007). Claims and Fact on *Jatropha curcas* L. Global *Jatropha curcas* evaluation, breeding and propagation program. Plant Research International B.V, Stichting Het Groene Woudt. 66p.

Kabé HK, Megueni C, Tchobsala, Schinzoumka PA, Tchuenteu L, Njintang YN (2020). Endogenous knowledge of *Jatropha curcas* in the province of Tandjile in southern of Chad. *International Journal of Advanced Research in Biological Sciences.* 7(9):84-96.

Köning D (2007). L'agriculture écologique agro-forestière : une stratégie intégrée de conservation des sols au Rwanda. Bulletin. *Réseau Erosion* 12:130-139.

Kossouma LN (2008). De la mobilité à la sédentarisation : Gestion des ressources naturelles et des territoires par les éleveurs Mbororo au Nord du Cameroun, Thèse de Doctorat, Université Paul Valéry-Montpellier III, 284 p.

Kumar P, Lalramnghinglova H (2011). India with special reference to an Indo-Burma hotspot region. Ethnobotany Research and Applications 9:379-420.

Madjigoto R (1999). Le Logone oriental à l'aube de l'ère pétrolière: état des lieux. Mémoire de DEA. Université Paris179 p.

Magin G (2001). Le sud du Tchad en mutation. Des champs de coton à la sirène de l'or noir. Paris, Sépia-CIRAD 179 p.

Mapongmetsem PM (2007). Agroforêts tropicales et conservation de la biodiversité : Cas des savanes soudano-guinéennes du Cameroun. *Ecol-Biogéographie*/ Centre de recherche en Biodiversité /Université de Louvain La neuve, Belgique 19 p.

Mbaiyetom H, Tientcheu MLA, Ngankam MT, Taffo JBW, Tanougong AD. 2020. Dynamique spatio-temporelle de l'occupation du sol et du couvert végétal des parcs arborés du Département de la Nya, Sud du Tchad. International Journal of Innovation and Applied Studies 31(2):370-379.

Mbaiyetom H, Tientcheu MLA, Ngankam MT, Taffo JBW, Tanougong AD. 2020. Dynamique spatio-temporelle de l'occupation du sol et du couvert végétal des parcs arborés du Département de la Nya, Sud du Tchad. International Journal of Innovation and Applied Studies 31(2):370-379.

Molenaar JW, Kessler JJ, Blackmore E, Vorley B, Gorter J, Simons L (2013). Building a roadmap to sustainability in agro-commodity production. Aidenvironment, NewForesight, IIED.

Perumal K, Bhaskaran R (2010). Supervised classification performance

of multispectral images. arXiv preprint arXiv:1002.4046.
Rug M, Ruppel A (2000). Toxic activities of the plant *Jatropha curcas* against *Volume 5* intermediate snail hosts and larvae of schistosomes. Tropical Medicine and International Health 6:423-430.
Üllenberg A (2007). *Jatropha curcas* à Madagascar- Rapport sur l'état actuel du secteur-Gesellschaft für Technische Zusammenarbeit (GTZ) Madagascar 32 p.