



# Pequi (*Caryocar coriaceum* Wittm., Caryocaraceae) Oil Production: A strong economically influenced tradition in the Araripe region, northeastern Brazil

Maria Clara Bezerra Tenório Cavalcanti, Leticia Zenóbia de Oliveira Campos, Rosemary da Silva Sousa, and Ulysses Paulino Albuquerque

## Research

### Abstract

The extraction of **pequi** (*Caryocar coriaceum* Wittm.) oil is a traditional activity that occurs between December and March. This extraction is performed by communities from the Araripe region, northeastern Brazil, and is very important to the local economy and culture. However, this practice has never been described in the literature. Thus, this photographic essay presents a description of this activity. The fruit are collected inside Araripe-Apodi National Forest (FLONA); oil production occurs in temporary settlements near FLONA, and oil marketing occurs on the highway and public markets in cities nearby this location. The **Pequi** Collectors' Ranch Festival ends the process when typical **pequi** meals are made and sold and a Catholic mass is performed to give thanks for the harvest. In addition to being a significant cultural and economic practice, **pequi** oil production is an important part of local people's lives. Therefore, we must encourage its socioecological sustainability.

### Resumo

**A extração do óleo de Pequi (*Caryocar coriaceum* Wittm.) é uma atividade tradicional importante na economia e cultura locais que ocorre entre dezembro e março, sendo realizada pelas comunidades da região do Araripe, nordeste do Brasil. Esta prática nunca foi descrita na literatura. Assim, este ensaio fotográfico apresenta uma descrição desta atividade. Os frutos são coletados dentro da Floresta Nacional do Araripe-Apodi (FLONA); a produção de óleo ocorre em acampamentos temporários próximos à FLONA e sua comercialização ocorre nas rodovias e mercados públicos de cidades próximas. A Festa do Rancho dos Pequizeiros finaliza o processo: comidas típicas feitas com Pequi são vendidas e uma missa católica é**

**realizada para dar graças pela colheita. Além de ser uma prática de significado cultural e econômico, a produção de óleo de Pequi é uma parte importante da vida das pessoas locais. Portanto, a sustentabilidade socioecológica desta prática deve ser incentivada.**

### Introduction

This ethnographic essay portrays the processing of a non-timber forest product (NTFP) that is largely used in the vicinity of Araripe-Apodi National Forest (FLONA), in northeastern Brazil. The final product created by this process is the oil from *Caryocar coriaceum* Wittm. fruit, known locally as **pequi**, which is highly appreciated in the entire region.

**Pequi** oil production has a regional significance as a part of local culture and contributor of economic value. This product is largely sold during the **pequi** harvest months, which usually occur between December and March. The oil constitutes or supplements the main income of local human communities.

### Correspondence

Maria Clara Bezerra Tenório Cavalcanti, Leticia Zenóbia de Oliveira Campos, Rosemary da Silva Sousa, Ulysses Paulino Albuquerque, Universidade Federal Rural de Pernambuco, Departamento de Biologia, Laboratório de Etnobiologia Aplicada e Teórica, Rua Dom Manuel de Medeiros s/n, Dois Irmãos, Recife, Pernambuco, BRAZIL 52171-030.  
mclara.btc@gmail.com

Ethnobotany Research & Applications 14:437-452 (2015)

Published: 25 December 2015

<http://dx.doi.org/10.17348/era.14.0.437-452>

The area selected for this research was a settlement belonging to a rural community in the vicinity of Araripe-Apodi FLONA. FLONA is an important protected area created in Brazil in 1946 by N. 9,226 decree-law. The forest is in an environmental protection area in the Araripe Plateau (Figure 1A). It covers 38,262.32 ha (IBAMA 2004), including the municipalities of Crato, Barbalha, and Jardim in the state of Ceará, northeastern Brazil (Austregésilo Filho *et al.* 2001, Lima *et al.* 1984).

The climate of this region is rainy tropical with an average temperature of 25°C, annual mean rainfall of approximately 1090 mm, and an average relative moisture of 64% (IPECE 2004). The plant physiognomy includes a **cerrado sensu strictu** type of savanna (**cerrado**), forested savanna (**cerradão**), steppe savanna (**carrasco**), and an evergreen seasonal forest (**floresta estacional perenifolia**) (IBGE 2012).

According to IBAMA (2004), by permitting the sustainable harvest of NTFPs, this protected area guarantees the subsistence of many families that live in its vicinity. In addition to *C. coriaceum*, many species are harvested for medicinal, commercial, and fuel purposes, such as **jana-guba** (*Himatanthus drasticus* (Mart.) Plumel), **fava d'anta** (*Dimorphandra gardneriana* Tul.), and **murici vermelho** (*Byrsonima sericea* DC.), respectively (IBAMA 2004). Notably, the Araripe region is important not only for its biological richness but also for its cultural richness, which is outstanding in religious demonstrations, handmade prod-

ucts, home medicines using NTFP harvesting, and commercialization. Dry wood logging in FLONA is also allowed once a week for family use (IBAMA 2004).

The collectors who collaborated with this research belong to the Horizonte community (S07°29'36.9"; W39°22'02.6"), which is located in the municipality of Jardim, Ceará, and is home to 250 families (data from the Brazilian Program of Family Health in 2012) (Figure 1B). This community was chosen for its historical dependence on FLONA products—especially **pequi**, the species most collected and valued by the community. In addition to its commercialization, people also extract oil both from pulp and nuts (seeds) in their houses or in settlements near to FLONA.

#### Description of settlements

During the crop period, people who use **pequi** as food, for both oil production and fresh fruit sales, move to settlements in the vicinity of FLONA to be closer to the collecting areas. Families from Horizonte and other municipalities of the Araripe region move to four existing settlements: Barreiro Novo, Estoque, Barreiro de Maria Cheque, and Siriqueira. These places house around 40 families every year. Each family usually gathers relatives and friends in the same settlement.

The type of construction found in those settlements consists of wood and clay and is usually thatched unless made with bricks (Figure 2). There is no electricity or waterworks



**Figure 1.** Araripe National Forest in the municipalities of Jardim, Barbalha, and Crato intermediations (A) and the Horizonte community (B) inside the municipality of Jardim, state of Ceará, northeastern Brazil.





**Figure 2.** Temporary houses built for the **pequi** (*Caryocar coriaceum* Wittm.) harvest between January and March in the Barreiro Novo settlement that belongs to the Horizonte community, municipality of Barbalha, state of Ceará, north-eastern Brazil

in these places; the sole source of potable water is a water truck that passes through every fifteen days. Due to its localization along the CE-060 roadside, which is an important highway that crosses the southeastern FLONA, Barreiro Novo is the most visible settlement. In addition, it can be considered the most representative one with regards to the number of households and natural products sold (including *C. coriaceum* oil and fruit, other native fruit, and honey). Although Estoque is also near this same highway, it has a smaller number of resident families and a less active local trade. Barreiro de Maria Cheque is the smallest and the least visible settlement. Siriqueira also houses a great number of families like Barreiro Novo, but it is located in a barely accessible area between many rural properties and the forest.

#### **General and ecological features of *Caryocar coriaceum***

*Caryocar coriaceum* is commonly named as **pequi**, **piqui**, or **pequiá** (Lorenzi 1992). The tree is approximately 7 to 15 m high and has twisted branches that can grow to the sides of the plant or near the ground (Figure 3A). Its leaves are opposite and trifoliate. The flowers are hermaphroditic with five reddish-green sepals and five white and yellow petals (Figure 3B). Birds and bats are its main pollinators. Its fruit are drupes with a peel formed by a green exocarp and an external mesocarp (Figure 3C). It is easily separated from the external mesocarp when ripe (Oliveira *et al.* 2008). The endocarp comprises a set of

thorns in its interior that protect the seed or almond, which is also edible (Vera *et al.* 2005).

**Pequi** flowers from June to October, and its fruit usually ripen from October to February. A majority of fruit is produced between January and April. This species is found in the **cerrado** of the Brazilian northeast and is registered to the states of Bahia, Piauí, Ceará, Pernambuco, and Maranhão (Silva & Medeiros-Filho 2006).

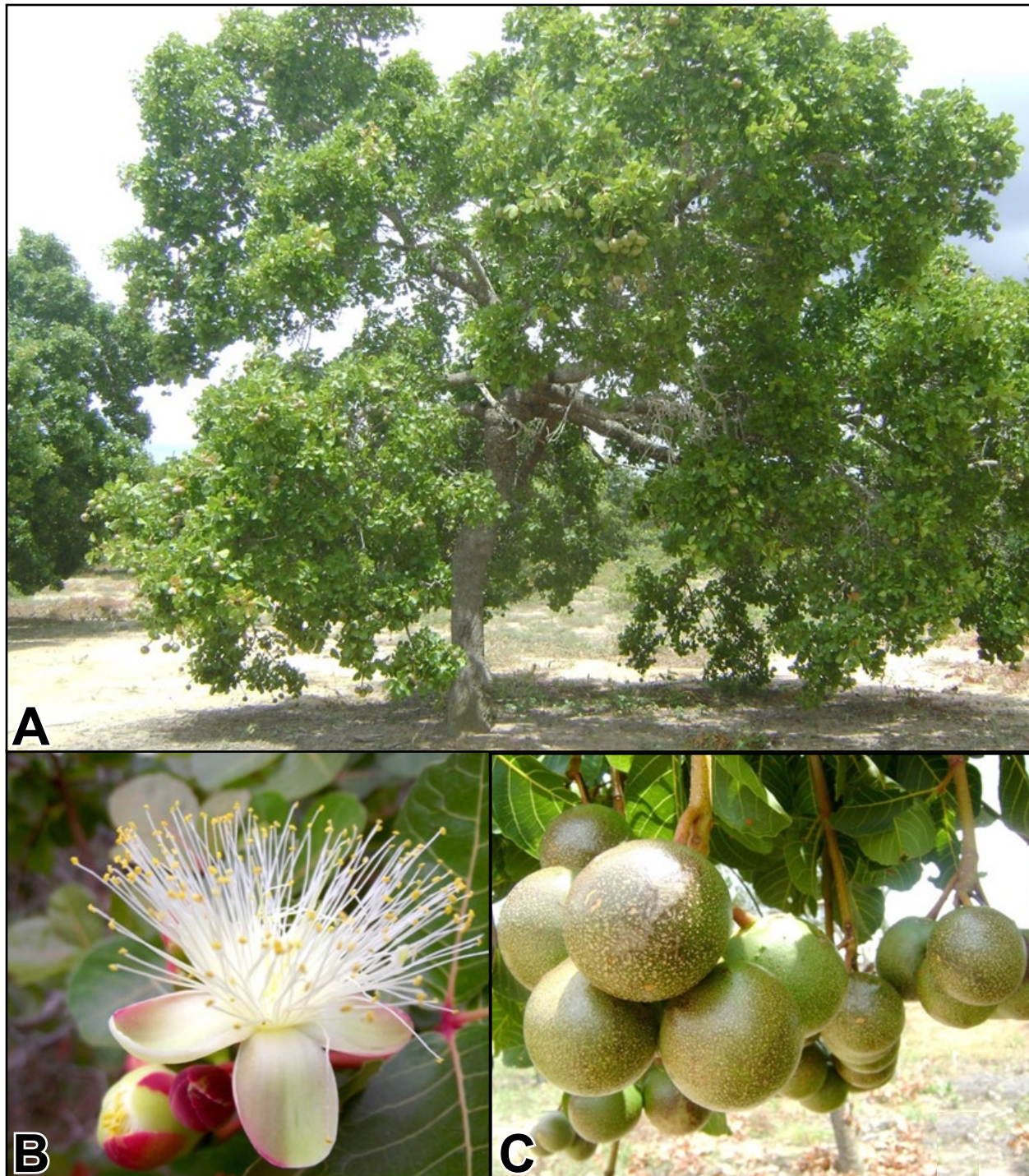
People use **pequi** fruit for many purposes. For example, **pequi** peel is used as fodder, and its pulp is used to prepare typical foods, such as **pequizada** or **pequi** with rice or with flour (Sousa Júnior *et al.* 2013). The oil is extracted from the pulp and almond (Oliveira 2009). Additionally, the timber is used in construction and as fuelwood (Cavalcanti *et al.* 2015). Many families in the communities located in the vicinity of Araripe National Forest are economically dependent on the harvest of **pequi**.

#### **Production of Pequi Fresh Fruit and Oil**

##### **The collection of pequi fruit**

There are certain rules that must be respected by the collectors when harvesting the **pequi** fruit. The most important rule is that the fruit should be collected only after they have fallen naturally on the ground, which signals that the fruit is ripe and ready for consumption. Unripe **pequi** fruit





**Figure 3.** Pequi (*Caryocar coriaceum* Wittm.) tree (A), flower (B), and fruit (C) available in Araripe National Forest, northeastern Brazil.

do not exhibit a good flavor; furthermore, such premature collection can cause social conflicts between collectors.

The collection period begins as soon as the first fruit begin to fall. During the harvest, collectors begin to search for **pequi** fruit early in the morning at approximately

4:00 a.m. All family members participate in the activity; however, women, who are usually housekeepers, collect in areas that are closer to the family camps. They walk to the settlements with full bags of fruit on the top of their heads (Figure 4A) or carry them on a bicycle. Meanwhile, men and boys collect in more remote areas and transport



## Tenório Cavalcanti *et al.* - Pequi (*Caryocar coriaceum* Wittm., Caryocaraceae) 441 Oil Production

the **pequi** on motorcycles, cars or bicycles (Figure 4B). It is also typical for people to leave fruit bags in strategic places to be transported by local traders. The collected fruit are stored in nylon sacks or straw baskets

made with dry plant material, commonly palm leaves, that are used to store and transport provisions, such as fruit, vegetables, and cereal (Figure 5A,B).



**Figure 4.** Transportation of **pequi** (*Caryocar coriaceum* Wittm.) fruit: (A) a local woman carrying a bag filled of **pequi** on the top of her head and (B) two men and a child emptying a car that had already transported an amount of **pequi** to Barreiro Novo settlement during its harvest period in Araripe National Forest, northeastern Brazil.



**Figure 5.** Post-collection-stored **pequi** (*Caryocar coriaceum* Wittm.) fruit (A, B) that are awaiting processing into oil in settlements near Araripe National Forest, northeastern Brazil.



During the day, collectors use a variety of native forest species they find on their way as food, including **pequi**. The diet of the collectors during the harvest period consists of **araçá** (*Psidium* sp.), **muricis** (*Byrsonima* sp.), **araticum** (*Annona coriacea* Mart.), **mangaba** (*Hancornia speciosa* Gomes), **cajuí** (*Anacardium occidentale* L.) and **cambuí** (*Myrciaria* sp.) fruit, which have the same harvest period as the **pequi**. Many collectors only return to their settlements when they have filled all the bags they carried to the forest.

#### Removing pequi peels

The process of peeling **pequi** fruit with a knife to obtain its pit, or the splice of internal mesocarp and endocarp, is locally named **pequi** “rolling.” This “rolling” is a popular name given to the action of moving an object over a

surface by turning it around itself. The **pequi** fruit, which is oval, is moved over the hands of collectors, and a knife circles around the fruit to cut it in the middle. During this process, fruit are sorted according degree of maturation. Immature fruit are first sold in local or regional markets or to people who extract **pequi** oil in their backyards in the community. If these fruit are not sold and become very mature, families use them in oil production and separate them to be rolled. Finally, the fruit that are nearly rotten are thrown in piles outside of the settlements.

The removal of **pequi** peels (Figure 6A, B) begins when families harvest a sufficient amount of fruit to extract the oil. At that time, families gather to improve the efficiency of the process. Relatives and friends also help these families in return for receiving part of the final product. During this process, people usually talk about their everyday life



**Figure 6.** People peeling **pequi** (*Caryocar coriaceum* Wittm.) fruit with a knife in settlements near Araripe National Forest, northeastern Brazil. This process is locally called “rolling” of **pequi** (A, B). Peeled fruit waiting for oil production (C, D).



## Tenório Cavalcanti *et al.* - Pequi (*Caryocar coriaceum* Wittm., Caryocaraceae) 443 Oil Production

in the settlement and the oil production process (such as what time to make the oil, who is collecting **pequi** fruit, whether fuelwood has been collected yet, or if someone is cooking), tell jokes, and listen to stories from elders.

Collectors must use attention, good technique, and caution when handling the knife to avoid accidents, such as cutting their hands. Children are usually excluded from this activity, but they still can watch and learn from the older people. At the end of this process, the pits are placed in boxes, straw baskets, and plastic bowls until time for oil preparation (Figure 6C, D).

### **Fuelwood collection**

Wood collection is an important step of the traditional production of **pequi** oil. The final product is obtained from the process of burning fuelwood and, consequently, cooking the fruit. A few families use liquid petroleum gas, but they only usually extract a small amount of oil in their own homes.

At settlements, wood extraction is primarily performed by strong men who are the main family households and by their older sons. As the fruit become very mature, it is necessary to cook them. The collectors leave the settlement by bike and carry an axe to gather wood. The species chosen for use depends on the preferences of each collector. However, finding dry fuelwood is essential because the collection of green wood is prohibited in the forest, and green wood does not ignite. Collectors usually collect branches and trunks from many species that have fallen on the ground. They make bundles of wood that vary in size and weight depending on collector's strength and needs. Bundles are carried back to the settlements (Figure 7) where collectors and their families prepare the boilers to cook all the **pequi** fruit.

### **Preparing boilers**

The **pequi** seeds/pits are placed in boilers after the peels are removed. The boilers are often a common refrigerator structure, 113 cm × 42 cm × 67 cm (length, height,



**Figure 7.** A man carrying a bundle of dry wood on a bike to be used for **pequi** (*Caryocar coriaceum* Wittm.) oil production in a settlement in Araripe National Forest, northeastern Brazil.



and width, respectively) (Figure 8A). The amount of **pequi** placed in the boilers varies according to the quantity that each family is about to cook (between 5000 and 15,000 fruit in general).

After filling the boilers with **pequi**, water is added until all fruit are covered. The collected pieces of wood are then placed under the boilers in holes in the ground (Figure 8B). A fire is lit with matches using straw, plastic, and sticks to keep the fire burning. Lastly, the **pequi** fruit are left braising for many hours. In this period fuelwood is added to the fire to ensure that the fire lasts through the end of the cooking process (Figure 8C, D).

#### Cooking: Step one

Initially, the **pequi** fruit are cooked until they obtain a darker brownish color and the pulp becomes soft (Figure 9A). The total duration of this step varies according to each

family; however, **pequi** fruit usually reaches an ideal cooking state after an average of five hours.

The next step is “grating,” in which the **pequi** fruit are rubbed over a rough surface, separating the pulp from the other fruit parts (Figure 9B). A grater consists of a stick of wood (usually from *C. coriaceum*) attached on one end to a metal cylinder full of sharp points. This tool abrades all of the **pequi** fruit inside the boiler through front-back repetitive movements (Figure 9C) until all of the pulp has been removed from the “almond.” This removal gives the water a pasty consistency and a dark brown color. Additionally, this step is performed by men, as it requires much strength.

At the end of the grating procedure, the non-pulped almonds are removed from the boiler by a skimmer made of a wood stick attached to a metal spade full of holes (Figure 9D). This is also performed by men (Figure 10A). The almonds are washed with water to remove any excess



**Figure 8.** The process of preparing the boilers for cooking **pequi** (*Caryocar coriaceum* Wittm.) fruit and producing oil in a settlement in Araripe National Forest, northeastern Brazil: (A) a boiler in which **pequi** fruit are going to be cooked; (B) a hole in which wood will be put; (C) firewood for cooking **pequi** fruit; (D) types of boilers.





**Figure 9.** The first steps of cooking **pequi** (*Caryocar coriaceum* Wittm.) fruit to produce oil in a settlement in Araripe National Forest, northeastern Brazil: (A) fruit being cooked; (B, C) the **pequi** grating process to take off the pulp; (D) removal of non-pulped “almonds” from the boiler.

mixture back to the boiler before they are discarded. The washing is performed by a woman, frequently a matriarch (Figure 10B). The almonds are removed from the boiler in a plastic box and are discarded immediately in areas next to the settlement (Figure 10C, D). The leftover mixture inside the boiler, which now contains only water and **pequi** pulp, is then cooked again ensuring the agglutination of the oil (Figure 10E).

#### **The final cooking**

Informants continue to stir the mixture of water and **pequi** pulp with a wooden stick for approximately five hours while it is being cooked (Figure 11A). At this stage of cooking, families attend closely to the oil for two main reasons:

(1) they must ensure that the oil is not overcooked, and (2) they must prevent people from putting the evil eye (a person intentionally giving others bad luck) on their oil. This second reason has a strong cultural meaning among all families, as they usually report that someone’s evil eye had spoiled their production. In order to avoid this situation, families frequently add to the mixture a **pinhão roxo** (*Jatropha gossypifolia* L.) branch (Figure 11B, C), two pieces of charcoal, or even a small amount of sand taken from the place in which the evil-eyed person had stepped. These are cultural amulets commonly used in the Horizonte community.

During the cooking stage, little yellow points are observed coming together and forming an oil stratum on the water’s





**Figure 10.** Cooking pequi (*Caryocar coriaceum* Wittm.) fruit to produce oil in Araripe National Forest, northeastern Brazil: (A, B) “almonds” being washed and removed from the boiler; (C, D) almonds being discarded in areas next to the settlements; (E) pequi pulp being cooked again to ensure the agglutination of oil.



Tenório Cavalcanti *et al.* - Pequi (*Caryocar coriaceum* Wittm., Caryocaraceae) 447  
Oil Production



**Figure 11.** Cooking **pequi** (*Caryocar coriaceum* Wittm.) fruit to produce oil in Araripe National Forest, northeastern Brazil: (A) five-hour cooking of water and **pequi** pulp; (B, C) a branch of **pinhão roxo** (*Jatropha gossypifolia* L.) added to the broth as a cultural protection amulet.





**Figure 12.** The last steps of **pequi** (*Caryocar coriaceum* Wittm.) oil cooking in Araripe National Forest, northeastern Brazil: (A) separation of water and oil; (B, C) oil being removed from the boiler to be (D) cooked in another container for approximately two hours on a gas stove.

surface (Figure 12A). At this point, the oil is separated from the rest of the mixture. It is gently removed from the boiler and spilled into a pan (Figure 12B, C, D). After the oil is completely removed from the mixture, it is taken to a wood or gas stove, and the leftover mixture is discarded.

After almost two hours, the **pequi** oil is removed from the pan and filtered through a piece of tissue to remove any remaining residue (Figure 13A). The oil is eventually bottled, after which it can be sold or used by the producers themselves (Figure 13B).

#### **Selling fruit and pequi oil**

The placement of the Barreiro Novo and Estoque settlements next to the highway allows people from different communities and municipalities to contact each other. This placement is also important for stimulating the com-

mercialization of **pequi** fruit and oil, honey, and **macaúba** (*Acrocomia intumescens* Drude) and **maracujá peroba** (*Passiflora silvestres* Vell.) fruit. Men and women commonly sell these products on the roadside while collecting and producing **pequi** oil in some intervals (Figure 14).

Many families sell oil during the harvest of **pequi** to complement family incomes and to buy other subsistence items. Others save the **pequi** oil in their homes to sell it in the off season when this product is more commercially valued. According to Silva (2014), the price of one liter of **pequi** oil varies between R\$ 20.00 during the harvest and R\$ 40.00 when the harvest is over. Pilgrimages usually occur in September every year and increase the demand for **pequi** oil in the municipality of Juazeiro do Norte, which is also in the state of Ceará. During this period, hundreds of pilgrims from all over Brazil buy **pequi** oil for medicinal, food, and commercial purposes. **Pequi** oil is greatly val-





**Figure 13.** Filtration and bottling of **pequi** (*Caryocar coriaceum* Wittm.) fruit oil in a settlement in Araripe National Forest, northeastern Brazil: (A) post-cooking filtering of **pequi** fruit oil to remove residues; (B) oil being bottled.

ued even in national and international markets, and some regions in Brazil export the oil to cosmetic industries.

#### **Cultural events**

An important popular celebration called the **Pequi** Collectors' Ranch Festival occurs at the end of **pequi** harvest in the Barreiro Novo settlement (Cavalcanti *et al.* 2015, Sousa 2014). During this festival, people from other municipalities and communities gather to celebrate the end of the harvest. Many types of local traditional food such as rice with **pequi**, **pequizada** (**pequi** with milk and condiments), and **munguzá** (a mush with beans, meat, corn, condiments, and **pequi**) are sold (Figure 15A).

On Sunday morning, there is a Catholic mass to give thanks for the **pequi** harvest. During this celebration, people offer both **pequi** oil and fruit to God as a symbol of gratefulness (Figure 15B). Other activities also occur during the festival, such as the "Father Cícero horseback riding" competition.

#### **Conclusion**

**Pequi** oil production is mainly a rustic activity. It has the same initial patterns of production and has persisted for many decades in the region. This activity is important not only for the economy but also to the local culture and is intrinsically related to the identity of local communities. Nevertheless, families have their own methods of preparing the oil, and many social conflicts frequently arise from this issue. As such, the quality of the final product is not guaranteed, and an increase in trade has been delayed.

#### **Acknowledgments**

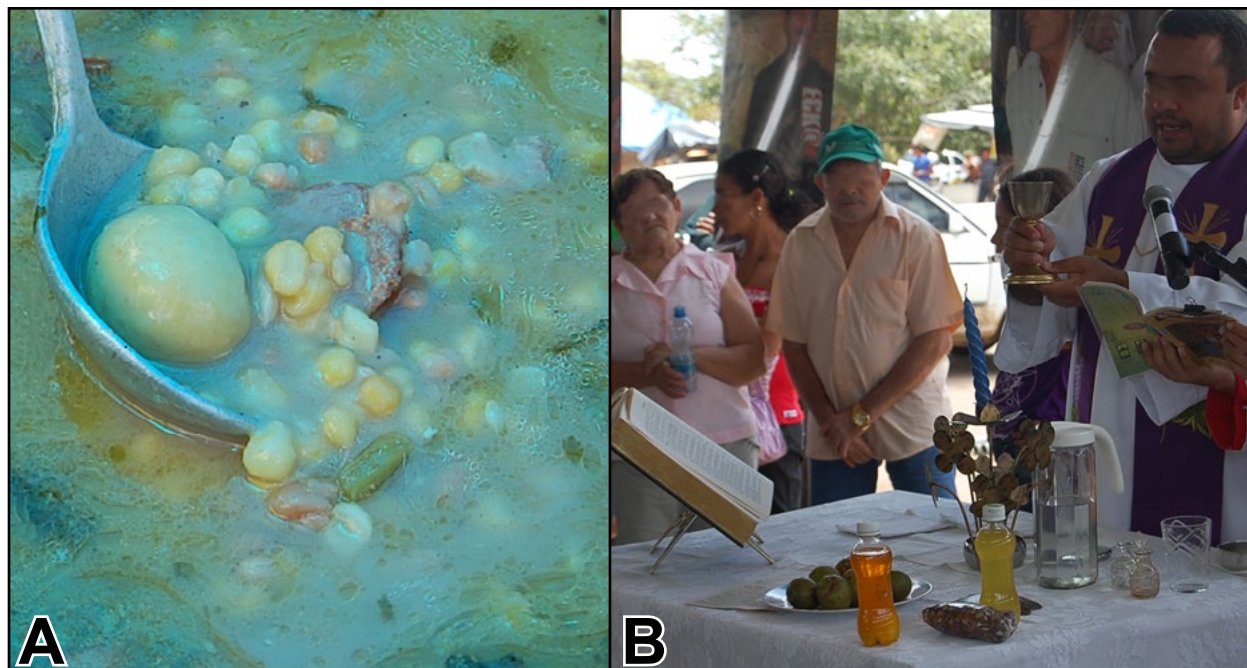
We would like to thank all the **pequi** collectors from the Horizonte community for their attention, receptivity, and participation in this research. We also thank to the Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (FACEPE); Programa Nacional de Pós Doutorado (PNPD/CAPES); Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), and the team of the Laboratório de Etnobiologia Aplicada e Teórica from the





**Figure 14.** Natural products being sold on the roadside of CE-060, which crosses Araripe National Forest, in the state of Ceará, northeastern Brazil. (A) A wheelbarrow with bottles of honey and **pequi** (*Caryocar coriaceum* Wittm.) oil and sacks containing **pequi** fruit next to the highway. (B) Sellers of **pequi** oil stay in stalls made of straw and wood all day long to facilitate the commercialization of their products.





**Figure 15.** Pequi (*Caryocar coriaceum* Wittm.) harvest-ending celebrations in Araripe National Forest, northeastern Brazil. (A) Munguzá, a typical dish from the Araripe region, being sold during the festival. (B) Father's blessing on pequi fruit and oil during a Catholic mass performed in the Siriqueira settlement to thank God for the harvest of pequi.

Universidade Federal Rural de Pernambuco for their support during the field work.

## Literature Cited

Austregésilo Filho, P.T., J.A.A. Silva, I.M.J. Meunier & R.L.C. Ferreira. 2001. Fisionomias da cobertura vegetal da Floresta Nacional do Araripe, estado do Ceará. *Brasil Florestal* 71:13–21.

Cavalcanti, M.C.B.T., M.A. Ramos, E.L. Araújo & U.P. Albuquerque. 2015. Implications from the use of non-timber forest products on the consumption of wood as a fuel source in human-dominated semiarid landscapes. *Environmental Management* 56:389–401. [dx.doi.org/10.1007/s00267-015-0510-4](https://doi.org/10.1007/s00267-015-0510-4)

IBAMA. 2004. *Plano de Manejo da Floresta Nacional do Araripe*. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, Brasília, Brasil.

IBGE. 2012. *Manual Técnico da Vegetação Brasileira*. 2 ed. Instituto Brasileiro de Geografia e Estatística. [http://geoftp.ibge.gov.br/documentos/recursos\\_naturais/manuais\\_tecnicos/manual\\_tecnico\\_vegetacao\\_brasileira.pdf](http://geoftp.ibge.gov.br/documentos/recursos_naturais/manuais_tecnicos/manual_tecnico_vegetacao_brasileira.pdf). Accessed 25 September 2013.

IPECE. 2004. *Perfil Básico Municipal*. Instituto de Pesquisa e Estratégia Econômica do Ceará, Crato, Fortaleza, Brasil.

Lima, M.F., F.A.M. Lima & M.M.S. Teixeira. 1984. Mapeamento e demarcação definitiva da Floresta Nacional Araripe, Ceará, Brasil. *Ciência Agrônômica* 15:59–69.

Lorenzi, H. 1992. *Árvores Brasileiras: Manual de identificação e cultivo de plantas arbóreas nativas do Brasil*. Plantarium, Nova Odessa, Brasil.

Oliveira, M.E.B., N.B. Guerra, L.M. Barros & L.E. Alves. 2008. *Aspectos Agrônômicos e de Qualidade do Pequi*. Embrapa Agroindústria Tropical, Fortaleza, Brasil.

Oliveira, W.L. 2009. *Ecologia Populacional e Extrativismo de Frutos de Caryocar brasiliense Camb. no Cerrado do Norte de Minas Gerais*. Dissertação de Mestrado. Universidade de Brasília, Brasília, Brasil.

Silva, M.A.P. & S. Medeiros Filho. 2006. Emergência de plântulas de Pequi (*Caryocar coriaceum* Wittm). *Revista Ciência Agrônômica* 37:381–385.

Silva, R.R.V. 2014. *Relações Socioambientais do Negócio Extrativista na Região da Floresta Nacional do Araripe-Apodí, Nordeste do Brasil*. Tese de doutorado. Uni-



versidade Federal Rural de Pernambuco, Dois Irmãos, Recife, Brasil.

Sousa Júnior, J.R., U.P. Albuquerque & N. Peroni. 2013. Traditional knowledge and management of *Caryocar coriaceum* Wittm. (pequi) in the Brazilian Savanna, North-eastern Brazil. *Economic Botany* 67:225–233. [dx.doi.org/10.1007/s12231-013-9241-8](https://doi.org/10.1007/s12231-013-9241-8)

Sousa, R.S. 2014. *Espécies-Chave Culturais: Uma análise dos critérios de identificação e de preditores so-*

*cioeconômicos*. Tese de Doutorado. Universidade Federal Rural de Pernambuco, Dois Irmãos, Recife, Brasil.

Vera, R., R.V. Naves, J.L. Nascimento, L.J. Chaves, W.M. Leandro & E.R.B. Souza. 2005. Caracterização física de frutos do pequizeiro (*Caryocar brasiliense* Camb.) no Estado de Goiás. *Pesquisa Agropecuária Tropical* 35:71–79.