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Seed oils of Euphorbiaceae from the Caatinga, a Brazilian tropical dry forest

Suzene I. Silva [a], Antonio Fernando M. Oliveira [b], Giuseppina Negri [c], Antonio Salatino [d,*]

[a] Department of Biology, Federal Rural University of Pernambuco, Av. Dom Manoel de Medeiros s/n, Dois Irmãos, 52171-900 Recife, PE, Brazil

[b] Department of Botany, Federal University of Pernambuco, Av. Prof. Moraes Rego s/n, Cidade Universitária, 50.670-901, Recife, PE, Brazil

[c] Department of Psychobiology (CEBRID), Federal University of São Paulo, UNIFESP/EPM, Rua Botucatu 862, Ed. Ciências Biomédicas, 1° andar, 04023-062 São Paulo, SP, Brazil

[d] Department of Botany, Institute of Biosciences, University of São Paulo, Rua do Matão 277, Cidade Universitária, 05508-090 São Paulo, SP, Brazil

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ABSTRACT

The oil content and fatty acid profiles of Euphorbiaceae from Caatinga, totaling 100 specimens, 33 species and 26 localities were determined. Intraspecific variation of fatty acid profiles were observed in some species. Many samples are potential sources of seed oil with a variety of potential industrial uses. Large seeds with high oil yields characterize species of *Cnidoscolus*, *Croton*, *Jatropha* and *Manihot*. Most samples contain linoleic acid as main seed oil constituent. Oils with oxidation stability due to high contents of palmitic and oleic acids were obtained from samples of *Sebastiania*. Samples of *Chamaesyce* and *Euphorbia* stand out by high contents of linolenic acid. Some samples of *Croton* contain substantial contents of azelaic acid.

1. Introduction

The Caatinga ("white forest") is a semi-arid ecosystem of the Brazilian northeastern region, with deciduous, thorny scrubs and dry forests [1]. It corresponds to 10% of the Brazilian territory and 60% of the northeastern region. Its annual average rainfall ranges from 240 to 1500 mm, restricted to three consecutive months [1]. None of the main crops produced in Brazil (coffee, soybean, sugar-cane, orange) is cultivated in the semi-arid. Caatinga habitats are inhospitable, and thus may be deemed as marginal. On the other hand, species of the Caatinga are potentially useful as seed oil sources [2]. The Caatinga was formerly considered a biome with scarce plant species and thus unworthy of conservation measures. However, there are 510 genera and 5344 species of vascular plants in the Caatinga, among which 18 genera and 318 species are

* Corresponding author.
E-mail address: asalatin@ib.usp.br (A. Salatino).
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endemic [3]. Areas of Caatinga have undergone strong human influence for centuries [4]. The combination of aridity and anthropic pressure has led to extreme degradation of large extents of Caatinga, giving rise to the so called desertification nuclei. Hence, means of preservation of the Caatinga biodiversity and development of sustainable strategies are urgent.

The Euphorbiaceae are among the largest families of flowering plants, comprising 229 genera and 6511 accepted species names (The Plant List 2010, available at http://www.theplantlist.org/browse/A/Euphorbiaceae/, accessed on December 12, 2012). The family has been ranked as the third in number of species in the Caatinga, with an estimate of 73 species, after Fabaceae (320 species) and Convolvulaceae (103 species) [3]. Many Euphorbiaceae species have oleaginous seeds. Examples of Euphorbiaceae commercially valuable for their seed oils are *Ricinus communis* (the castor oil plant) and species of *Aleurites* (tung oil trees). Kleiman et al. [5] analyzed the seed oils of 58 species of Euphorbiaceae. Seeds of five shrubby species of Euphorbiaceae from arid and semi-arid environments of north-western Argentina (*Jatropha macrocarpa*, *Jatropha hieronymi*, *Jatropha excisa*, *Cnidoscolus tubulosus* and *Manihot guaranitica*) are promising sources of triglycerides for biodiesel production [6].

Given the frequent high oleaginous content of seed oils of Euphorbiaceae and the common occurrence of species of the family in arid and semi-arid environments, the aim of the present work was to evaluate the potentiality of Euphorbiaceae from the Caatinga as primary sources of seed oil with promising commercial value.

2. Material and methods

2.1. Plant material

Seeds were harvested from Caatinga habitats during 15 expeditions to locations in the Brazilian Northeastern states Paraíba (PB) and Pernambuco (PE), between longitudes 34° 45′ 54″ and 41° 19′ 54″ W and latitudes 6° 02′ 12″ and 9° 28′ 18″ S (Fig. 1). The selection of sites was based on previous observation of Euphorbiaceae specimens from the Herbaria of the Agricultural Research Institute for the State of Pernambuco (IPA) and Federal Rural University of Pernambuco (HST).

The identification of the species was based on descriptions of Flora Brasiliensis [7] and Rogers and Appan [8], in addition to revisions and monographs about Euphorbiaceae. Seeds of 100 individuals were collected, corresponding to 33 species and eleven genera (Table 1). Voucher specimens were deposited in the HST Herbarium.

Specimens heights ranged from 0.2 m (*Chamaesyce opthalmica*) to 6.0 m (*Sapium glandulatum*), the habit of most specimens lying in the range 1–3 m. The shortest and the tallest habits were found in subfamily Euphorbioideae: *Ch. opthalmica* (0.2 m) and *Sa. glandulatum* (6.0 m), respectively (Table 1). Although lasting usually no more than three months, rainfall in the Caatinga may start in October and last until mid-April or beginning of May. Individuals of a large number of species in the Caatinga are leafless during a long part of the dry season (hence the whitish appearance of the vegetation and the name Caatinga – "white forest"). In the beginning of the rainy period, the leaf buds develop and the vegetation becomes green. Soon afterward the flower buds develop, and then the fruits appear. The plants are adapted to the short rainy period by a rapid development of buds, leaves, flowers and fruits. Flowers and fruits of all species collected were visible during the rainy period, i.e. not sooner than October and not later than May. Most species had flowers and fruits in February–March or March–April (Table 1). The fruit development is quick, the interval between blooming and fruiting lasting no more than one month (Table 1).

Length, width and weight of seeds were determined by calculation of the means of 20–50 seeds per individual. The seeds of some species are very small (e.g. *Ch. opthalmica*:

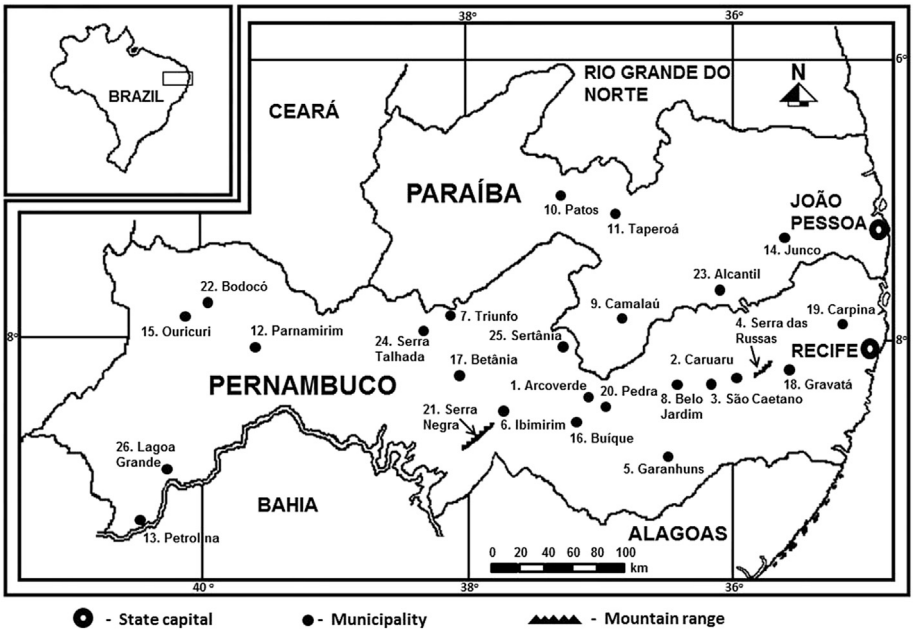

Fig. 1 – Localities in the states of Paraíba and Pernambuco (northeast Brazil) of collection of seeds of Euphorbiaceae for analysis of the respective oils.