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# Biometry of Seeds of *Jatropha mollissima* (Pohl) Baill. and *Cnidoscolus urens* (L.) Arthur (Euphorbiaceae) from Different Matrices in the Semi-Arid Region of Brazil

**Maria Pereira de Araújo**[1]*
https://orcid.org/0000-0002-8072-0387

**Francisca Maria Barbosa**[2]
https://orcid.org/0000-0002-6273-0979

**Luzia Batista Moura**[1]
https://orcid.org/0000-0002-3721-2328

**Alecksandra Vieira de Lacerda**[3]
https://orcid.org/0000-0002-9703-3997

**Romário de Sousa Almeida**[1]
https://orcid.org/0000-0003-3405-6937

[1]Universidade Federal de Lavras, Departamento de Engenharia Agrícola, Lavras, Minas Gerais, Brasil; [2]Instituto Nacional de Ciência e Tecnologia, João Pessoa, Paraíba Brasil; [3]Universidade Federal de Campina Grande, Centro de Desenvolvimento Sustentável do Semiárido, Sumé, Paraíba, Brasil.

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*Correspondence: mary_araujo2016@outlook.com; Tel.: +55-83-996231594 (M.P.A)

**HIGHLIGHTS**

- The seeds of *J. mollissima* showed a biometric pattern.
- *C. urens*, there is a lack of works for mutual comparison.
- The research provides data on biometric characteristics of the species.

**Abstract:** This study aimed to evaluate the biometric characteristics of seeds of *Jatropha mollissima* (Pohl) Baill. and *Cnidoscolus urens* (L.) Arthur from different matrices in the semi-arid region of Brazil. For biometric evaluation, the length, width, and thickness dimensions and mass of 100 seeds of each species. The data were analysed by univariate statistics, corresponding to the position (mean, minimum and maximum values) and dispersion (standard deviation and coefficient of variation) measurements. In addition, histograms were constructed to analyse the frequency distribution pattern of biometric characteristics. *J. mollissima* seeds had an average length of 1.278 cm, width of 0.823 cm, thickness of 0.697 cm, and mass of 0.2220 g. The low standard error values indicated that the sampling accurately reflects the population. The frequency distribution analysis showed length between 1.240 and 1.321 cm, width between 0.787 and 0.886 cm, thickness intervals from 0.691 to 0.709 and from 0.653 to 0.671 cm, and mass of seeds concentrated between 0.1684 and 0.2477 g. For *C. urens* seeds, the registered biometric data were: average length of 0.789 cm, width of 0.238 cm, thickness of 0.405 cm, and mass of 0.0248 g. The sampling also accurately reflects the population as low standard error values were obtained. The frequency distribution analysis showed length between 0.768 and 0.835 cm, width between 0.234 and 0.251 cm, thickness from 0.408 and 0.423 cm, and seed mass ranging from 0.0215 to 0.0240 g. Therefore, the information provided contributes to the identification of species, and diagnosis of their genetic variability.

**Keywords:** Caatinga Biome; biometric characteristics; pinhão-bravo; urtiga; native species.

## INTRODUCTION

The Caatinga biome in the semi-arid region of Brazil comprises a wide diversity of species and a high incidence of endemism [1]. Considering the caatinga species richness, Euphorbiaceae is one of the most representative families in this biome and is classified as one of the most important groups of angiosperms [2] including more than 300 genera and about 8,000 species [3].

Among these species, the genus *Jatropha* stands out, comprising about 170 species [4]. *Jatropha mollissima* (Pohl) Baill., popularly known as “pinhão-bravo”, is particularly widely distributed in the Brazilian semi-arid region [5]. Due to its adaptation to little fertile or degraded soils, *J. mollissima* is an easy-to-grow and drought-tolerant plant, thus being a relevant species in semi-arid areas [6].

*Cnidoscolus* is another genus belonging to the same family, including about 50–75 species, native to Brazil [7]. Among these species, *Cnidoscolus urens* (L.) Arthur has the widest distribution, being popularly known as “cansanção” nettle or “urtiga branca”; a very common herbaceous plant in the Caatinga [8]. *C. urens* occurs throughout the year, with greater flowering and fruiting in April and June, making this species an important food resource [9], for pollinators who benefit from their flowering and fruiting.

One of the characteristics of native species is the high genetic variability, which is remarkable in the morphology and size of fruits and seeds and is often associated with environmental factors, in addition to biotic and abiotic factors that directly influence the development of fruits and seeds, thus modifying their biometry [10,11]. In this context, research focused on the morphology of fruits and seeds provides information on their structures, as well as important data on the biological cycle of the species [12,13].

Therefore, studies on the biometric characterisation of fruits and seeds are of great importance to assess the difference between species in the field and observe the genetic variability of the same species within population [14], and the relationships between this variability and environmental factors, providing information for the exploitation of economic and conservation resources [15]. Moreover, biometric analysis is used to differentiate the physiological quality of different plant species [16], thus significantly contributing to the distinction of species belonging to the same family.

Thus, the application of biometric analysis provides important information that contributes to expanding the knowledge of native species biology [17]; in addition, it can be used as a strategy to standardise seedling emergence in the field, classifying seeds by size or by mass, selecting those with the greatest vigour. In addition to assisting in breeding programs and in the formation of germplasm banks [18]. Therefore, this study aimed to evaluate the biometric characteristics of *J. mollissima* and *C. urens* seeds from different matrices in the semi-arid region of Brazil.

## MATERIAL AND METHODS

### Study area

This research was carried out in the municipality of Sumé, localised in the western Cariri micro-region in Paraíba (Figure 1). The climate in the region is characterised by a dry period from June to January, mean annual temperature around 24 °C, average annual insolation index of 2,800 hours, air relative humidity of 50%, and average evaporation rates of approximately 2,000 mm/year [19]. According to [20], the hyperxerophilic caatinga vegetation predominates in the region and the soils are mostly well-developed chromic luvisols, in gently undulating relief.

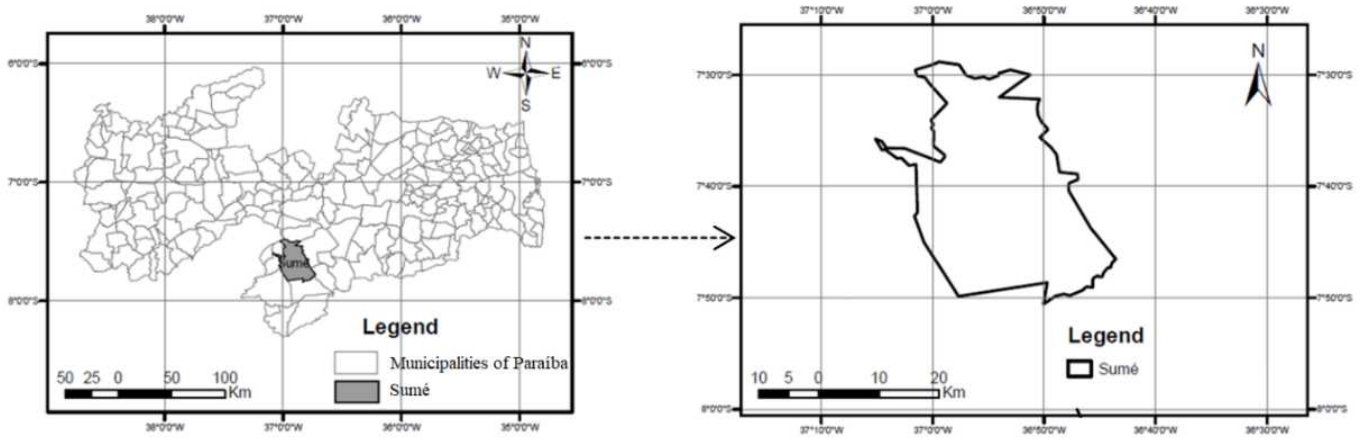


**Figure 1.** Geographic location of the municipality of Sumé (Paraíba, Brazil) [21].

## Data collection and analysis

Ripe fruits of *J. mollissima* and *C. urens* in the dispersion stage were collected in Sumé (Paraíba, Brazil). The first species' fruits were collected in April 2018, directly from 30 adult matrices localised in the Experimental Area Reserved for Studies on Ecology and Dynamics of the Caatinga (Area II) of the Laboratory of Ecology and Botany (LAEB/CDSA/UFCG) (7°39′42.03″ S and 36°53′46.61″ W; 528 m altitude). The fruits of the second species were collected from 30 adult matrices in the rural area of Sumé (07º40′18″ S, 36º52′48″ W, 532 m altitude), in April 2018. After collection, the fruits were taken to the LAEB, for seed extraction.

To obtain the biometric data, *J. mollissima* and *C. urens* seeds were manually sorted, discarding those visibly damaged or with deformation, as seeds that had abnormal size, irregular shape and incomplete development. A mix was made to select a sample of 100 dispersal units of each species. Then, the following dimensions were analysed: length, determined on the region between the apex and the base; width, measured between the right and left sides; thickness, between the ventral and dorsal parts of the seeds. These analyses were performed using a 0.01 mm precision digital calliper. The seed mass was also determined, using a 0.0001 g precision analytical scale.

The data were analysed by univariate statistics, which corresponded to position (mean, minimum and maximum values) and dispersion (standard deviation and coefficient of variation) measurements, which were calculated using Microsoft Excel (version 2019) and BIOESTAT 5.0 softwares. In addition, histograms were constructed to analyse the frequency distribution pattern of biometric characteristics.

## RESULTS

### Biometric characterisation of *Jatropha mollissima* (Pohl) Baill. Seeds

The biometric data of *J. mollissima* seeds are shown in Table 1. The seeds of this species had an average length of 1.278 cm, width of 0.823 cm, thickness of 0.697 cm, and mass of 0.2220 g. The sampling accurately reflects the population, considering that low standard error values were found for all evaluated seed characteristics. Concerning the standard deviation values, the length had the highest sample variance (0.051). Concerning the coefficient of variation, the thickness had a greater mean variation in comparison with the other characteristics of seed dimensions. Seed mass had higher variation (33.5536%), compared to the mean value.

**Table 1.** Mean length, width, thickness, and mass of *J. mollissima* seeds.

| Biometric characteristics (*n*=100) | Maximum | Mean ± standard error | Minimum | SD | *CV* (%) |
|---|---|---|---|---|---|
| Length (cm) | 1.381 | 1.278 ± 0.005 | 1.013 | 0.051 | 3.990 |
| Width (cm) | 0.919 | 0.823 ± 0.004 | 0.736 | 0.039 | 4.698 |
| Thickness (cm) | 0.775 | 0.697 ± 0.004 | 0.604 | 0.040 | 5.787 |
| Mass (g) | 0.4259 | 0.2220 ± 0.0074 | 0.0690 | 0.0745 | 33.5536 |

*n*: sample size, SD: Standard Deviation, *CV*: coefficient of variation.

Through the frequency distribution analysis of *J. mollissima* seeds, the following dimensions were obtained: length between 1.240 and 1.321 cm, with an accumulated frequency of 63% seeds (Figure 2A); width ranging from 0.787 to 0.866 cm, with an accumulated frequency of 72% seeds (Figure 2B); thickness mainly in the intervals 0.691–0.709 cm and 0.653–0.671 cm, with frequencies of 22% and 18% seeds, respectively (Figure 2C). The seed mass was between 0.1684 and 0.2477 g, with an accumulated frequency of 51% seeds (Figure 2D).

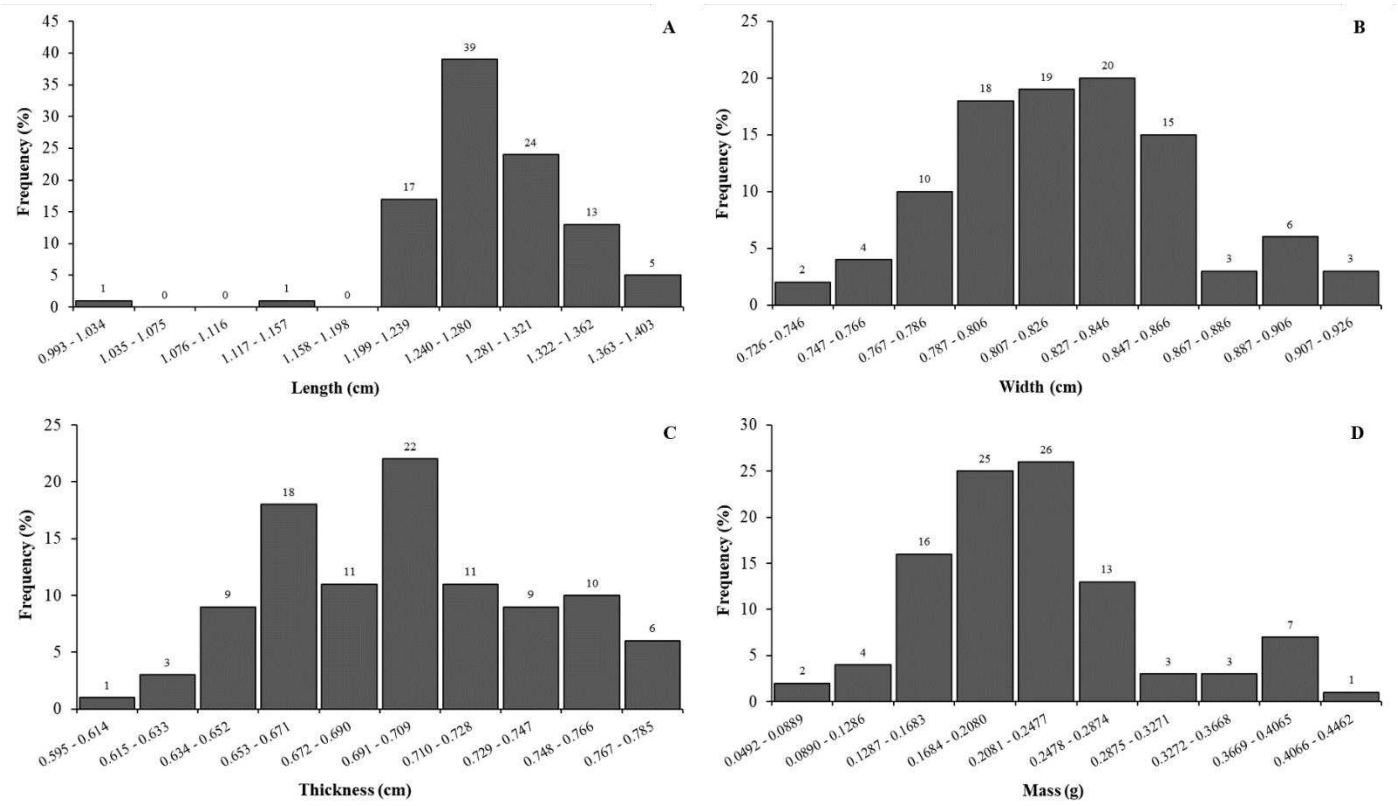


**Figure 2**. Percentage of frequency of length (A), width (B), thickness (C), and mass (D) of *J. mollissima* seeds.

## Biometric characterisation of *Cnidoscolus urens* (L). Arthur seeds

Regarding *C. urens* seeds (Table 2), the following biometric data were recorded: average length of 0.789 cm, width of 0.238 cm, thickness of 0.405 cm, and mass of 0.0248 g. The sampling also accurately reflects the population, considering the low standard error values found for all analysed seed characteristics. Regarding the standard deviation, the length had the highest sample variance (0.033) among the other dimension characteristics analysed. The seed mass had a low standard deviation value (0.0053). As for the coefficient of variation, the width had the highest mean variation (6.291) among the other dimension characteristics. The seed mass had a high variation (21.2649%), in comparison with the average value.

**Table 2.** Mean length, width, thickness, and mass of *C. urens* seeds.

| Biometric characteristics (*n*=100) | Maximum | Mean ± standard error | Minimum | SD | *CV* (%) |
|---|---|---|---|---|---|
| Length (cm) | 0.858 | 0.789 ± 0.003 | 0.707 | 0.033 | 4.217 |
| Width (cm) | 0.281 | 0.238 ± 0.001 | 0.201 | 0.015 | 6.291 |
| Thickness (cm) | 0.433 | 0.405 ± 0.002 | 0.363 | 0.016 | 3.899 |
| Mass (g) | 0.0383 | 0.0248 ± 0.0005 | 0.0149 | 0.0053 | 21.2649 |

*n*: sample size, SD: Standard Deviation, *CV*: coefficient of variation.

Analysing the frequency distribution of *C. urens* seeds, we found length between 0.768 and 0.835 cm, with an accumulated frequency of 66% seeds (Figure 3A); width ranging from 0.234 to 0.251 cm, with an accumulated frequency of 54% seeds (Figure 3B); and thickness mainly in the interval 0.408 – 0.423 cm, with an accumulated frequency of 48% seeds (Figure 3C). Seed mass significantly concentrated in the interval 0.0215 – 0.0240 g, corresponding to 32% of seeds (Figure 3D).

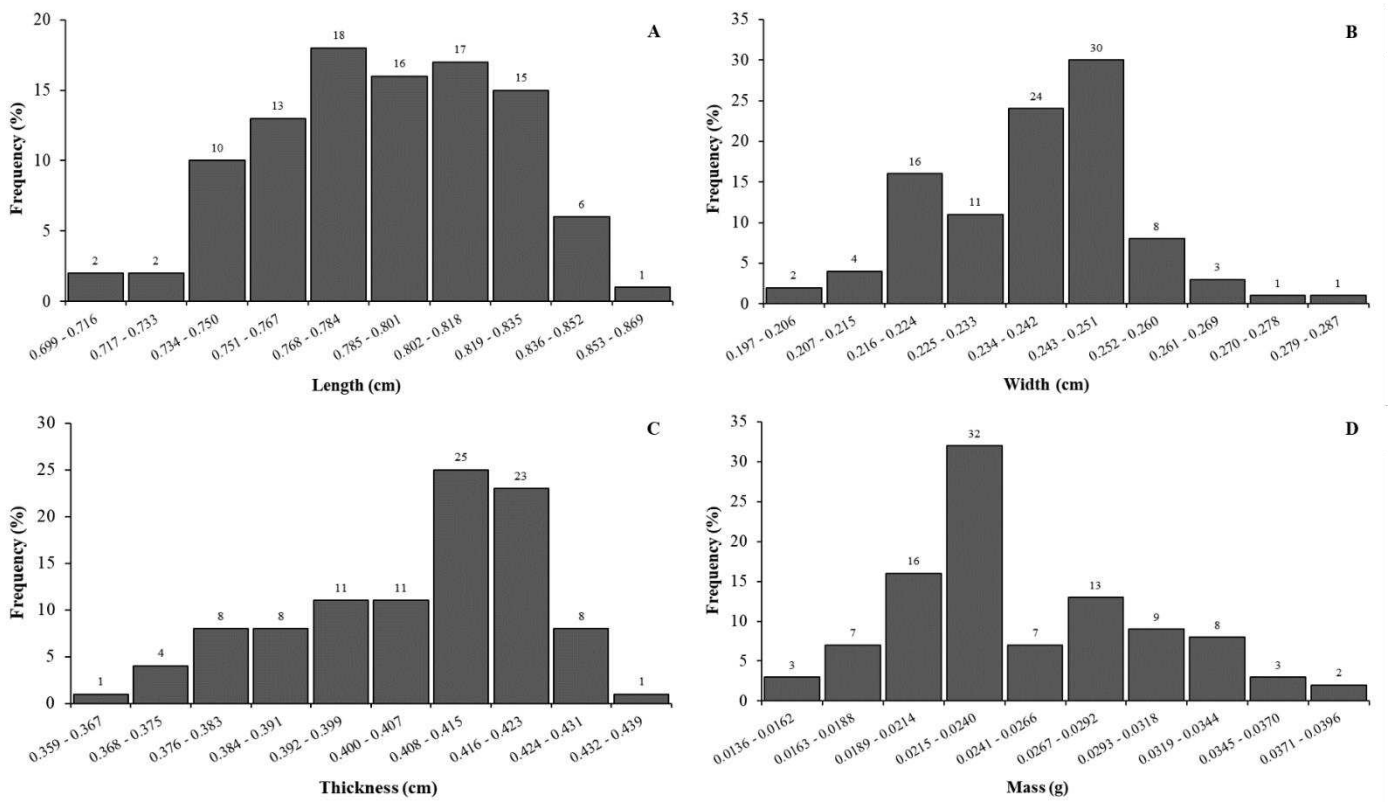


**Figure 3.** Percentage of frequency of length (A), width (B), thickness (C), and mass (D) of *C. urens* seeds.

## DISCUSSION

The length, width, and thickness of *J. mollissima* seeds found in our research corroborate the values (1.27 cm, 0.84 cm, and 0.66 cm, respectively) recorded by [22] when analysing the seed morphological characteristics in the same species, on the coast of Ceará State. [5], measuring *J. mollissima* seeds from the rural area of Petrolina (Pernambuco, Brazil), obtained length of 1.37 cm, width of 0.88 cm, and thickness of 0.71 cm. Therefore, only the length had little difference (only 0.092 cm) when compared to the value found by the last authors. This may be related to the variation in the environmental conditions in the areas where the matrices are found. The other analysed characteristics had no representative differences when compared to the above-mentioned studies.

The mean mass of *J. mollissima* seeds found in our research was lower than that (0.44 g) obtained by [23] when analysing *Jatropha curcas* L. seeds, in the municipality of Macaíba (Rio Grande do Norte, Brazil). However, it was higher than that found by [24] in the species *Jatropha gossypiifolia* L. (0.056 g) and *Jatropha podagrica* Hook. (0.152 g), in the municipality of Boa Vista (Roraima, Brazil).

The high sample variance evidenced by length, high coefficient of variation found for thickness, and high variation in the mass of *J. mollissima* seeds may be related to the genetic and edaphoclimatic conditions in the areas of origin. In this sense, the genetic conditions of matrix trees and the interaction of these individuals with edaphic and microclimate variations can result in higher coefficients of variation for the phenotypic characteristics of matrix trees in natural populations [25,26].

These intervals with the highest record in terms of frequency of length, width, thickness, and mass of seeds were close to or even above the average values obtained from the biometric evaluation, indicating a remarkable characteristic of *J. molissima* seeds in semi-arid environments. Seed size analysis is relevant as, in some species, this characteristic is used as an indicator of physiological quality, considering that within the

same group, small seeds result in lower germination and vigour values in comparison with those of medium and large sizes, which is related to the environment where the mother plant is inserted [27,28].

Regarding *C. urens* seeds, no records related to their biometric characteristics were found in the literature, for data comparison based on the same species. However, the length, width, thickness, and mass of *C. urens* seeds recorded in our research are lower than the values (1.45 cm, 0.83 cm, 0.56 cm, and 0.36 g, respectively) found by [29] when performing biometric characterisation of seeds of "faveleira" with thorns (*Cnidosculus phyllacanthus* (Mart.) Pax. et K. Hoffm.), in the municipality of Santa Luzia (Paraíba State). Considering the means obtained for *J. mollissima*, the values were also lower, which may be related to genetic factors characteristic of each species above-mentioned, resulting in different sizes.

*C. urens* seeds had standard deviation values lower than those found for *J. mollissima* seeds in all analysed biometric characteristics. However, in the coefficient of variation analysis, this species had higher variability in terms of length and width. These seed biometric variations are related to the genotypic diversity of the populations and may contribute to different phenotypic characteristics since the environmental effect on the development of seeds mainly occurs through variations in size, mass, and physiological and sanitary potential [30,31].

The intervals with the most representative frequencies of length, width, thickness, and mass of *C. urens* seeds were close to or even above the respective averages obtained from the biometric analysis of this species, highlighting its population size in its natural environment. The seeds of *J. mollissima* and *C. urens* were distributed in the same number of intervals; however, the first species had three intervals with no record of the percentage of length frequency.

The importance of biometric analysis in the evaluation of seed quality is highlighted, allowing a precise monitoring of its characteristics [32], taking into account that it can be used as a tool for detecting genetic variability in the same species, in addition to the relationships found in this variability [18]. Therefore, such analysis is of great importance for germination and seedling production studies, contributing to cultivation techniques [33], because for some species the size and weight of the seeds are indicative of their physiological quality.

It is added that, the seeds of the same species can exhibit intraspecific variations, which can influence the biometric measurements and the interpretation of the results [34]. Moreover, improper handling of seeds can cause physical damage, such as mechanical damage, breakage or crushing, affecting the biometric characteristics and impairing the quality assessment [35]. Thus, information such as these is essential for species recorded in the Brazilian semi-arid region, due to the lack of information on their production.

## CONCLUSION

*J. mollissima* seeds showed a biometric pattern with little significant mean differences, in comparison with other studies on the same species from different areas of the semi-arid region of Brazil. Regarding *C. urens*, although there is a lack of information for mutual comparison, it had means higher than those found for another species of the same genus (*C. phyllacanthus*).

The frequency distribution of *J. mollissima* and *C. urens* revealed that the most representative intervals in terms of seed length, width, thickness, and mass were close to or even above the mean values observed in the biometric analysis, indicating a remarkable characteristic of these species in their natural environments.

Therefore, this study brings important information about seeds of two native species that occur in the Caatinga, contributing to the identification of species and diagnosis of their genetic variability, being the basis for their qualified plant production, since they have great socioeconomic and environmental potential, and for one of the species the data are unpublished.

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**Conflicts of Interest:** The authors declare no conflict of interest.

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