



*Research Paper*

**BIOMETRY OF FRUIT AND SEEDS OF KIELMEYERA CORIACEA MART. & ZUCC AND KIELMEYERA GRANDIFLORA (WAWRA) SADDI OF TWO PROCEDURES**

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**Abstract**

*Kielmeyera coriacea* and *Kielmeyera grandiflora* are native species of the Brazilian Cerrado. The objective of the research was to evaluate the fruit and seed characteristics of *K. coriacea* and *K. grandiflora* from two different sources; Mato Grosso and the Federal District. The study was conducted at the Laboratory of Seed Analysis of the Faculty of Agronomy and Animal Science of the Federal University of Mato Grosso, Cuiabá-MT. Fifty fruits and 100 seeds of each species were evaluated, which were packed in kraft paper bags and stored in a refrigerated chamber at a temperature of  $18 \pm 2$  ° C. *K. coriacea* presents on average 12 to 15 fruits per plant, average length of the fruits, around 14 cm, width of 15 cm, with approximately 30 seeds. The fruits presented a fresh mass of 57 g of Mato Grosso and 101 g of the Federal District. The fruits of *K. grandiflora* were 17 cm long, 18 cm wide, with approximately 50 seeds. The fresh mass was 200 g per fruit. The seeds of *K. coriacea* were 4 cm long and 2 cm wide, and the seeds of *K. grandiflora*, 5 cm long and 2 cm wide. The two species *K. coriacea* and *K. grandiflora* had a strong and positive correlation of 0.70 to 0.90, while the variable width had moderate values, between  $r = 0.50$  and  $r = 0.60$ , respectively. The length, width and number of seeds between the species *K. coriacea* and *K. grandiflora* presented similar results. The biometric characteristics of the seeds vary less in relation to the fruits. The length, width and number of seeds between the species *K. coriacea* and *K. grandiflora* showed similar results. The biometric characteristics of the seeds vary less in relation to the fruits. The fresh fruit mass was the variable that showed the greatest difference between the species and provenances. There is a positive and strong correlation between fruit length and fresh mass, and moderate correlation between fruit width and fresh fruit mass.

Key words: Pau-santo, chubby, morphology, taxonomy, correlation of person.

## INTRODUCTION

The study of biometry is an important tool to detect genetic variability among populations of the same species and the relationships between this variability and environmental factors, providing important information for the characterization of ecological aspects such as dispersion type, dispersion agents and establishment of seedlings [1].

The genus *Kielmeyera* belongs to the family Calophyllaceae and comprises about 47 species distributed mainly in Brazil, in regions of low altitude [2]. They are usually low plants, trees, shrubs or sub-bushes. They have hermaphrodite or bisexual flowers (with rarely male flowers on the same plant), with a number varying from three to many. They have a white, pink or purplish coloration [2]. Its flowers are aromatic and pollination occurs by the action of the female bees, *Xylocopa hirsutissima* Maidl and *X. frontalis* (Olivier), due to their high frequency and efficiency in pollen collection [3].

There is great confusion among species of this genus when observed in the field by their similarities. [4] and [5] reported the existence of numerous incorrect identifications of the species belonging to the taxonomy of *K. coriacea* and *K. grandiflora*, some of them performed by Saddi himself, since *K. coriacea* appears in two lists and studies as one of the main components of the Cerrado, and great importance in the accomplishment of taxonomic and medicinal studies [6]

The biometric characterization of fruits and seeds can provide important subsidies for studies of forest species such as these, helps promote the genetic improvement of the population, assists in the standardization of tests in laboratories, as well as improving the conditions of seed storage and seedling production, besides being very useful in the identification and differentiation of species of the same genus in their natural environment.

There are many studies with the genus *Kielmeyera* on chemical composition and medicinal use, however, biometric studies of fruits and seeds are scarce. Thus, the objective of this work was to evaluate the biometric characteristics of *K. coriacea* and *K. grandiflora* from different populations and provenances in the year 2018.

## MATERIALS AND METHODS

The botanical material was collected in two areas of different origins, one in the state of Mato Grosso and the other in the Federal District. Both belonging to the Center-West region, with vegetation predominantly native to the Cerrado Biome.

The first provenance is located in the Condominium Florada da Serra, in the municipality of Chapada dos Guimarães-MT, between the coordinates S15°26'318 "to 716" and W 055°44'676 "to 800", in July 2018.

The second source is located in the Botanical Garden of Brasília, in the city of Brasília-DF, between coordinates S 15° 52 '460 to 925 "and W 047° 50' 385 to 598", in August 2018.

Fifty fruits were randomly collected from a population of approximately 50 adult matrices, in the same quantity for the two species and provenances. The matrices were identified and positioned by GPS (Global Positioning System).

Botanical specimens of the species were herborized in two Herbariums, one being, the Central Herbarium of the UFMT, whose registration number is 4.2470, and the other, Herbarium of the Botanic Garden of Brasilia, whose registration number is 2.6225.

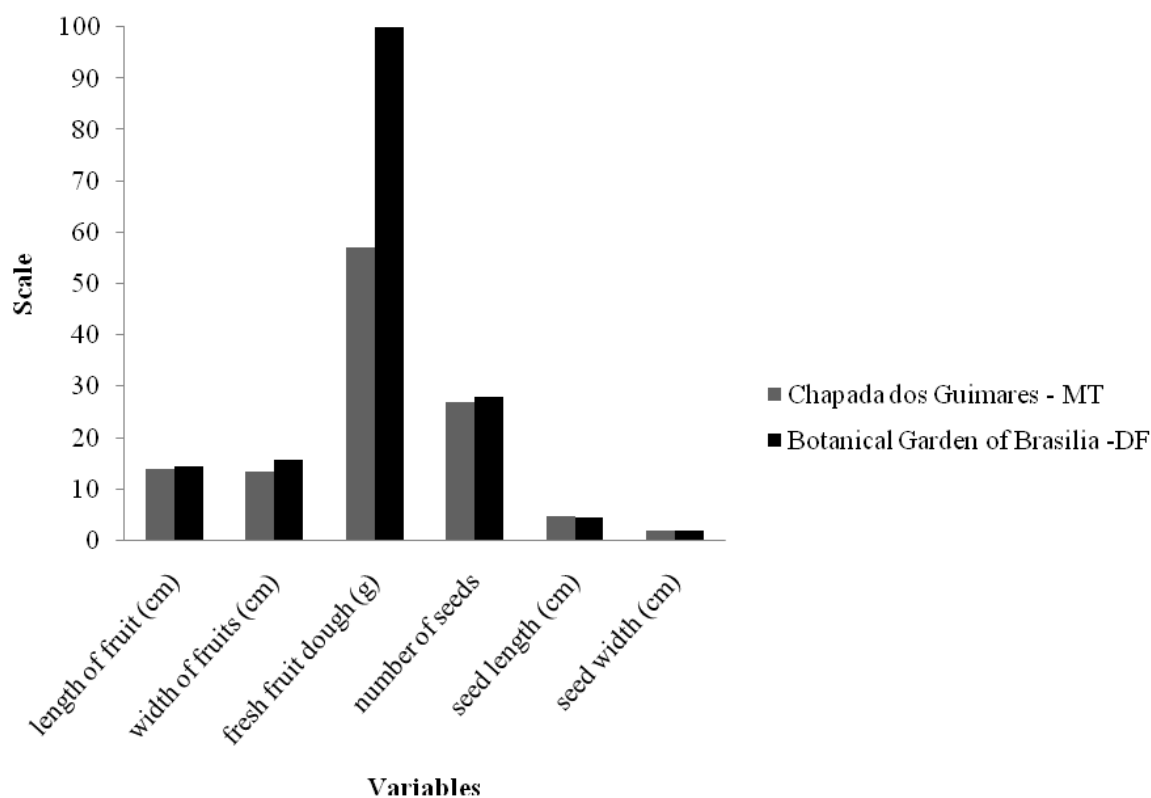
The study was conducted at the Laboratory of Seed Analysis of the Faculty of Agronomy and Animal Science of the Federal University of Mato Grosso (LAS / FAAZ / UFMT), Campus of Cuiabá-MT. The fruits were stored at room temperature, around 30 ° C, and from 7 to 10 days after collection began the opening. Seeds collected from these fruits were packed in kraft paper bags and stored in a refrigerated chamber with a temperature of  $18 \pm 2$  ° C and a relative humidity of  $63 \pm 4\%$ .

The water content of each sample was determined by the oven method at 105 ° C for 24 hours [7]. The biometric analyzes consisted in measuring with the aid of a ruler of length (cm) and width (cm) of both fruits and seeds. The fresh mass was determined by a precision scale (0.0001 g), and the mean number of seeds per fruit was counted.

For all data obtained, the mean, minimum and maximum values, standard deviation and coefficient of variation were determined. The other data were submitted to analysis of variance (ANOVA) and Pearson's (r) linear correlation analysis, testing its significance with the t test at the 5% probability level, using the SISVAR Statistical Program [8]

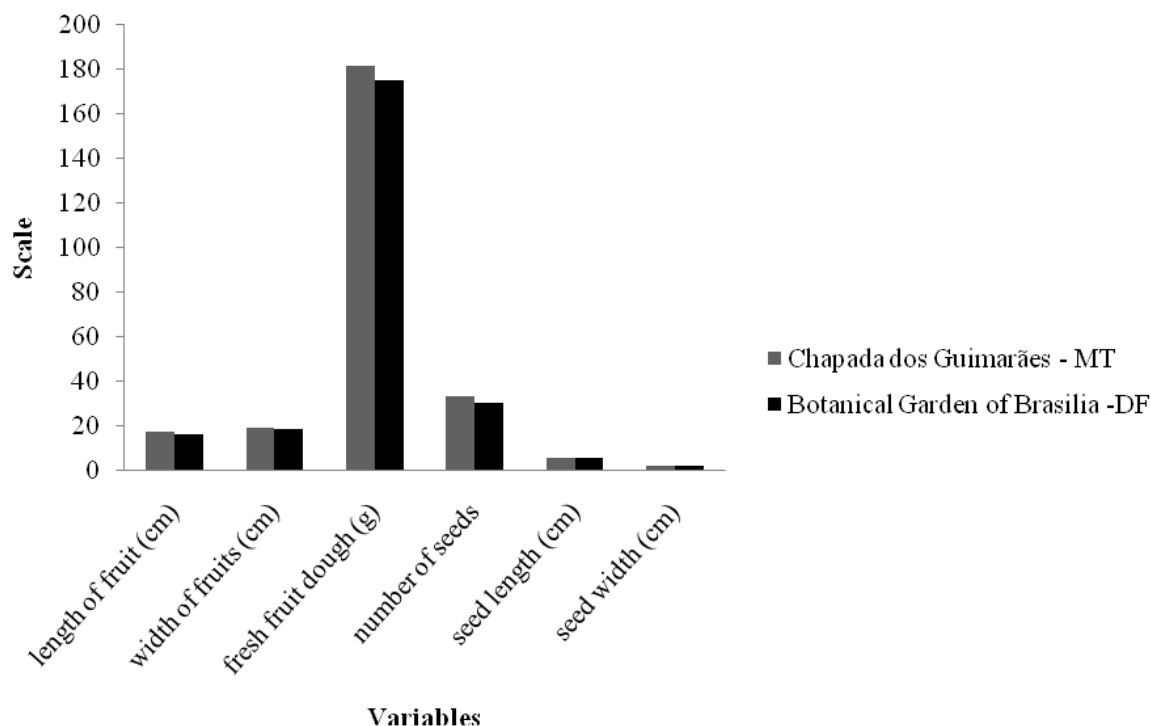
## RESULTS

The fruits of the genus *Kielmeyera* are of the dry type, dehiscent, have elliptical shape, brown color, of verrucous aspect. They open completely only when they are very dry, they have three slits that aid the dispersion of the seeds, which occurs with the aid of the wind. *K. coriacea* presents on average 12 to 15 fruits per plant, average length of fruits, around 14 cm, width of 15 cm, with approximately 30 seeds per fruit. The values of fresh mass, was the variable of greater difference. The fruits present a fresh mass, averaging 57 g of the origin of Mato Grosso and 101 g of the origin of the Federal District (Figure 1).



**Figure 1.** Biometric characteristics of *Kielmeyera coriacea* in 2018.

The biometric variables were all similar for *K. grandiflora* regardless of origin, but the largest difference occurred in the fresh fruit mass, as was also observed in *K. coriacea*. The fruits of *K. grandiflora* are larger, on average 17 cm in length, 18 cm in width, with about 50 seeds. The fresh mass was, on average, 200 g per fruit (Figure 2).



**Figure 2.** Biometric characteristics of *Kielmeyera grandiflora* in 2018.

The seeds of *K. coriacea* present on average 4 cm in length and 2 cm in width, as well as the seeds of *K. grandiflora*, present values very close, about 5 cm in length, having the same width, about 2 cm, independent of their origin.

The number of seeds per fruit between the two species was as follows: *K. coriacea* in MT and DF had the same value, on average 30 seeds, whereas, *K. grandiflora* had on average 60 seeds.

Strong correlations were found for the length and fresh mass characteristics of the fruit for the evaluated species.

The two species *K. coriacea* and *K. grandiflora* from the provenances of TM and DF, presented strong values of 0.70 to 0.90 indicating positive and proportional correlations of the variables. While the variable width presented moderate values, between  $r = 0.50$  and  $r = 0.60$ , respectively (Table 1).

**Table 1. Pearson correlation (r) for the variables of Length (cm), Width (cm), Fresh Fruit Mass (MFF), Number of seeds (NS); Fresh Seed Mass (MFS) of *Kielmeyera coriacea* and *Kielmeyera grandiflora* of the two provenances in 2018.**

Species	Chapada dos Guimaraes-MT					Botanical Garden of Brasilia-DF					
	Length	Width	MFF	NS	MFS	Length	Width	MFF	NS	MFS	
<i>K. coriacea</i>	Comp.		0,54**	0,78**	0,02	0,18		0,49**	0,54**	0,30*	0,40**
	Larg.	0,54**		0,48**	0,16	0,15	0,49**		0,62**	0,24	0,33*
	MFF	0,78**	0,48**		-0,07	0,14	0,54**	0,62**		0,41**	0,49**
	NS	0,02	0,16	-0,07		0,81**	0,30*	0,24	0,41**		0,75**
	MFS	0,18	0,15	0,14	0,81**		0,40**	0,33*	0,49**	0,75**	
<i>K. grandiflora</i>	Comp.		0,60**	0,79**	0,03	0,57**		0,66**	0,67**	-0,04	0,27
	Larg.	0,60**		0,71**	0,16	0,60**	0,66**		0,91**	-0,04	0,46**
	MFF	0,79**	0,71**		0,10	0,50**	0,67**	0,91**		0,05	0,60**
	NS	0,03	0,16	0,10		0,60**	-0,04	-0,04	0,05		0,60**
	MFS	0,57**	0,60**	0,50**	0,60**		0,27	0,46**	0,60**	0,60**	

\* The correlation is significant at the 0,01

\*\* The correlation is significant at the 0,05

The only characteristic that the correlation is very weak below 0.16 is the number of seeds with the width in the days species and provenances. Fruit length, width and fresh fruit mass are not necessarily proportional to the number of seeds, this variation was well independent of the species and origin.

## DISCUSSION

The variation observed in the fruit dry mass according to the provenance may be mainly associated to environmental factors during flowering and plant development, possibly related to the availability and storage of water by the fruit [9].

According [10], the fresh mass of the fruits of *Senna spectabilis* varied with the origin, demonstrating the influence of the environment, as it happened in *Kielmeyera*.

Studies of [11] with *Qualea grandiflora* Mart. (pau-terra) woody species of great importance in the Cerrado, and with similar morphology to *K. coriacea*, present very similar results ranging from 3.22 cm to 4.62 cm of length of the seeds. Research [12] evaluating the genus *Kielmeyera* show similar results, with a mean of 32 seeds per fruit, whereas the [13] found that the number of seeds of *K. coriacea* was greater between 60 and 80 units per fruit.

This variation between seed quantity per fruit is explained by the genetic variability of each species and the availability of water during the period of fruit formation [14]; [15]. The presence of wing in the seed constitutes an adaptation of the species to the anemocoric dispersion. Second [3], this type of dispersion can be verified in approximately 41% of Cerrado and Cerradão species. Pearson's correlation ( $r$ ) between two characteristics shows the relationship between them. Their values vary from -1 to 1. When the value ( $r$ ) is positive it shows that the characteristics under study increase in the same direction and when it is negative indicates that when one characteristic increases the other it decreases and if it is null there is no connection between the features [16].

For [17] they point to a classification:  $r = 0.10$  up to  $0,30$  (weak);  $r = 0.40$  to  $0.6$  (moderate);  $r = 0.70$  to  $1$  (strong). They observed a high correlation between the fresh fruit mass of *Byrsonima verbascifolia* Rich. Ex A. Juss., with the length of the fruits. [18] analyzing biometric parameters of *Butia archeri* fruits, also observed a strong linear and positive correlation between fresh mass and fruit length. On the other hand, [19] did not observe relationship between the number of seeds per fruit and the size of fruits of *Couratari stellata* A. C. Smith.

The length, width and number of seeds between the species *K. coriacea* and *K. grandiflora* presented similar results. The biometric characteristics of the seeds vary less in relation to the fruits. The fresh fruit mass was the variable that showed the greatest difference between the species and provenances. There is a positive and strong correlation between fruit length and fresh mass, and moderate correlation between fruit width and fresh fruit mass.

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## REFERENCES

- [1] Matheus, M. T.; Lopes, J. C., 2007, Fruit, seed and seedling morphology and seed germination of *Erythrina variegata* L. Brazilian Seed Journal, v. 29, n. 3, p. 8-17.
- [2] Saddi, N. A, 1982, Taxonomic revision of the genus *Kielmeyera* Martius (Guttiferae). Doctoral thesis. University of Reading.

- [3] De Oliveira, P. E. A. M.; Moreira, A. G., 1992, Anemocoria in Cerrado and gallery forest species of Brasília, DF. Brazilian Journal. Bot, v. 15, n. 2, p. 163-174.
- [4] Caddah, M. K. et al., 2011, Species limits in the *Kielmeyera coriacea* complex (Calophyllaceae) a multidisciplinary approach. Botanical Journal of the Linnean Society, v. 168, n. 1, p. 101-115.
- [5] Cabral, F. N et al. 2011. As Clusiaceae Lindl.(Guttiferae Juss) ss, Calophyllaceae J. Agardh e Hypericaceae Juss. in the National Park of Viruá (Roraima) and reproductive biology of *Clusia* sp (*Clusia nitida* Bittrich, ined).
- [6] Silva, R. MG et al., 2012, Antitumor and cytotoxic activity of *Kielmeyera coriacea* mart. Zucc. and *Pyrostegia venusta* (ker-gawl.) Miers extracts. Journal of Medicinal Plants Research, v. 6, n. 24, p. 4142-4148.
- [7] Brazil, 2009, MINISTRY OF AGRICULTURE, LIVESTOCK AND SUPPLY. SECRETARY OF AGRICULTURAL DEFENSE. Rules for seed analysis.
- [8] Ferreira, D. F. Sisvar, 2014, a Guide for its Bootstrap procedures in multiple comparisons. Science and agro-technology, v. 38, n. 2, p. 109-112.
- [9] Barros, M. A. G. 2002. Synchronous flowering and reproductive systems in four species of *Kielmeyera* Mart. (Guttiferae). Acta Botânica Brasília, Feira de Santana, v. 16, n. 1, p. 113-122.
- [10] De Souza, S.C. A. et al., 2007, Fruit biometry and seed predation of *Senna spectabilis* (DC) Irwin et Barn. (Fabaceae-Caesalpinioideae) from three localities in northern Minas Gerais. Brazilian Journal of Biosciences, v. 5, n. S1, p. 864-866.
- [11] Ferreira, R. A; Davide, A. C; Tonetti, O. A.O., 2001, Seed and seed morphology (*Qualea grandiflora* Mart.-Vochysiaceae). Brazilian Journal of Seeds, Brasília, v. 23, n. 1, p. 116-122.
- [12] Ranieri, B. D. et al., 2012, Reproductive phenology, seasonality and germination of *Kielmeyera regalis* Saddi (Clusiaceae), a species endemic to rock outcrops in the Espinhaço Range, Brazil. Acta Botânica Brasília, v. 26, n. 3, p. 632-641.
- [13] De Mesquita Matos, J. M. et al., 2014, Seedling Morphology *Kielmeyera Coriacea* Mart. Heringeriana, v. 5, n. 2, p. 47-54.
- [14] Pereira, S. R. et al., 2011, Size of fruits and seeds and their influence on the germination of jatobá-do-cerrado (*Hymenaea stigonocarpa* var. *Stigonocarpa* Mart.



- Ex Hayne, Leguminosae-Caesalpinoideae). Brazilian Journal of Seeds, v. 33, n. 1, p. 141-148.
- [15] Marcos Filho, J. 2015, Seed vigor testing: an overview of the past, present and future perspective. Scientia Agricola, v. 72, n. 4, p. 363-374.
- [16] Figueiredo Filho, O.; Dalson B.; Silva Junior, J., 2009, Unraveling the Mysteries of Pearson's Correlation Coefficient (r).
- [17] Dancey, C.; Reidy, J., 2006, Mathematical Statistics for Psychology: Using SPSS for Windows. Porto Alegre, Artmed.
- [18] Pacheco, F. A.; Pedron, J.; De Menezes, M. N. L., 2004, Biometric parameters of fruit, endocarp and butiaceous seed. Rural Science, v. 34, n. 2, p. 585-586.
- [19] Cruz, E.D.; Martins, F.O.; Carvalho, J.E.U., 2001, Fruit and seed biometry and germination of jatobá-curuba (*Hymenaea intermedia* Ducke, Leguminosae - Caesalpinioideae). Brazilian Journal of Botany, v.24, n.2, p.161-165.