Acta Biológica Catarinense
2020 Out-Dez;7(4):58-64

Morphometry of fruits, seeds and seedlings of *Vitex megapotamica* (Lamiaceae)

Morfometria de frutos, sementes e plântulas de Vitex megapotamica *(Lamiaceae)*

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ABSTRACT
The present study evaluated the morphology and biometry of tarumã fruits and seeds. The experiment was conducted at the Federal University of Pelotas and the fruits were collected in two matrices located in Quedas do Iguaçu – Paraná, in March 2018. The length, width and thickness of fruits and seeds were determined using a digital caliper. For biometric assessments, the arithmetic mean, standard deviation, variation coefficient and the amplitude of the values obtained were calculated. The seed germination process started in approximately 32 days. Throughout the hypocotyl, a color transition was verified. It was observed that the values of length and width of the fruits varied from 15 to 22 mm and 12 to 18 mm, respectively. Regarding the biometry of the seeds, it can be verified that the length, width and thickness of the seeds varied from 5 to 13 mm, 4 to 10 mm and 3 to 7 mm, respectively. As for morphology, it was identified that the species has germination of the epigeal type with protected cotyledon seedlings (phanerocotyledons).

Keywords: forest seeds; initial growth; morphobiometry; tarumã.

RESUMO
O presente estudo avaliou a morfologia e a biometria de frutos e sementes de tarumã. O experimento foi conduzido na Universidade Federal de Pelotas e os frutos foram coletados em duas matrizes localizadas em Quedas do Iguaçu – Paraná, em março de 2018. O comprimento, a largura e a espessura dos frutos e das sementes foram determinados utilizando paquímetro digital. Para as avaliações biométricas, calcularam-se a média aritmética, o desvio padrão, o coeficiente de variação e a amplitude dos valores obtidos. O processo de germinação das sementes começou em aproximadamente 32 dias. Ao longo do hipocótilo, foi verificada uma transição de coloração. Observou-se que os valores de comprimento e largura dos frutos variaram de 15 a 22 mm e 12 a 18 mm, respectivamente. Com relação à biometria das sementes, o comprimento, a largura e espessura das sementes variaram de 5 a 13 mm, 4 a 10 mm e 3 a 7 mm, respectivamente. Quanto à morfologia, identificou-se que a espécie possui germinação do tipo epígea com mudas de cotilédones protegidos (fanerocotiledonares).

Palavras-chave: crescimento inicial; morfobiometria; sementes florestais; tarumã.

Recebido em: 31 mar. 2019
Aceito em: 8 ago. 2020

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INTRODUCTION

The Lamiaceae family is composed of 295 genera and about 7,775 species, and is constituted of herbaceous to scrubby plants (BRAMLEY *et al.*, 2009). Among these, we can find the genus *Vitex,* which is characterized by physiotherapeutic potential, acting with anti-microbial, anti-inflammatory, analgesic and hypnotic properties (SÁ-BARRETO *et al.*, 2009).

The species *Vitex megapotamica*, popularly known as Tarumã (*V. megapotamica*), is indicated in the recovery plans of degraded riparian forest (CURCIO *et al.*, 2007). Although presenting slow growth, the species is able to reach large size, with up to 25 m of height and 120 cm of diameter (CARVALHO, 2007).

The species presents a distribution that crosses the northeast of Argentina, the east of Paraguay, Uruguay and is commonly found in the south of Brazil (BRUM *et al.*, 2013).

The process of identification and characterization of a species, analyzing the geographic distribution, is usually done through the use of exsicates of archives in herbaria but, generally, this do not evaluate the field studies that describe the morphological and morphometric patterns from fresh material (HOWARD, 1981).

Knowledge of seed morphology helps in the process of identifying seed quality in succession and regeneration studies of ecosystems (OLIVEIRA & PEREIRA, 1984). Information on quality and characteristics are essential to evaluate and separate the different species in the seed banks (BELTRATI, 1984).

In addition to the morphological attributes of seeds, fruits and seedlings, characteristics of cotyledons such as size, function and position in initial seedling development may be crucial in the capture of environmental resources, which may contribute to decrease mortality and increase adaptation (IBARRA-MANRÍQUEZ *et al.*, 2001).

Due to the limited literature on the morphological aspects and economic potential of Tarumã (*V. megapotamica*) cultivation, the present study aimed to investigate aspects of germination process morphology and seedling differentiation of this species, in addition to fruit and seed biometry.

MATERIAL AND METHODS

The experiment was conducted in the seed analysis laboratory of the Universidade Federal de Pelotas – RS. The fruits of Tarumã (*Vitex megapotamica*) were collected from two matrix trees located in a forest remnant located in the city of Quedas do Iguaçu, State of Paraná, Brazil, in March 2018. At the time of collection, the fruits were black and they were grouped into a single batch.

A sample of 200 fruits was analyzed and the length and the width were determined. Then the fruits were beneficiated manually and the pulp removed. The pulp removal process occurred through the friction of the fruits against a metal sieve, since the pulp is strongly adhered to the pyrene (endocarp + seed). Afterwards, the seeds remained for a few hours resting in shade, for a natural drying to occur. Next, the length, width and thickness of 200 seeds were determined. The biometry was performed with a digital caliper MTX 150 mm stainless steel.

For the emergence process and the monitoring of the seedling growth, 100 seeds were seeded in 18 cm tubes filled with soil and sand (1:1) and irrigated daily as necessary, the material being kept in a greenhouse.

Photographic records of the development phases were carried out with the help of a Canon EOS Rebel XSi camera (Objetive HELIOS-44-2 2/58). In the laboratory, the morphology of the successive stages of initial development was observed, from seed, germination with radicle emission to seedling phase (prophylactic expansion).

For the biometric determinations of fruits and seeds, the arithmetic mean, standard deviation, coefficient of variation and range of the obtained values were calculated, and descriptive statistics were applied for seedling analysis.

The terms used to describe the morphological aspects of germination and seedlings were based on Barroso *et al.* (1999) and Vidal & Vidal (2003).

RESULTS AND DISCUSSION

FRUIT AND SEED BIOMETRY

Table 1 presents the biometric data of the analyzed *Vitex megapotamica* fruits, observing that the length and width values of the Tarumã fruits varied respectively from 15 to 22 mm and 12 to 18 mm.

Table 1 – Average, standard deviation, coefficient of variation (CV) and range of length and width of Tarumã fruits (*V. megapotamica*).

Determinations	Average (mm)	Standard deviation	CV (%)	Range of variation (mm)
Length	18,07	1,32	7,34	15 – 22
Width	15,87	1,19	7,54	12 – 18

The thickness could not be analyzed for the fruits, due to the circumference of these, causing all sides to be the same. The data of length and width resemble the results reported by Cosmo *et al.* (2009), where the mentioned authors found average values of 17.66 and 11.26 mm for fruits of *V. megapotamica* collected in Curitiba (PR).

According to Carvalho (2007), the ecological aspects of the species are closely related to the biometric data, since the size of the fruit will interfere in the type of dispersion, dispersing agents and establishment of seedlings. Biometrics also provide information for the conservation of the species, because it is possible to detect genetic variations within the population of a same species, the relationship between these variations and the environmental condition (CARVALHO, 2007).

With respect to seed biometry, it can be observed in table 2 that the length, width and thickness of the seeds ranged from 5 to 13 mm, 4 to 10 mm and 3 to 7 mm, respectively.

Table 2 – Average, standard deviation, coefficient of variation (CV) and range of length and width of Tarumã seeds (*V. megapotamica*).

Determinations	Average (mm)	Standard deviation	CV (%)	Range of variation (mm)
Length	10,02	0,93	9,30	5 - 13
Width	5,93	0,65	10,96	4 - 10
Thickness	4,89	0,41	8,48	3 – 7

In relation to table 2, the values found for seed biometry are lower than that reported by Cosmo *et al.* (2009), as the mentioned authors found, for the width, the average value of 8.09 and for thickness, 6.71. Such information shows that the environmental conditions can influence the seed formation process, as Curitiba presents/ displays an altitude and relief different from those present in Quedas do Iguaçu (PR).

The biometric data of the *V. megapotamica* specimens here analyzed showed different values, within the range, for both fruits and seeds. Macedo *et al.* (2009) verified that the variations present in fruits and seeds of Sapindaceae are associated with high population genetic variability and environmental factors during the flowering and development process. For *Senna spectabilis* (Fabaceae), Souza *et al.* (2007) verified that the biometry of the fruits varied according to the origin, thus asserting that the environment influences the biometrics. Moraes & Alves (2002) perceived a partial relationship between the environment and the genetic factors for Lauraceae.

To obtain cultivars that produce fruits of interest to the market and present a good propagation, breeding programs have to observe the biometric variation of fruits and seeds, in the sense of unifying or increasing the expressed characteristics (GONÇALVES *et al.*, 2013).

MORPHOLOGICAL ASPECTS OF GERMINATION

The seeds of Tarumã (*V. megapotamica*) present germination of the epigeal type and seedling-protected cotyledons (phanerocotiledons), as there is the release of the cotyledons from the integument of the seed. The germination process of the seeds began in around 32 days, where it was possible to perceive the presence of the small stem above the substrate.

Initially, the cotyledons presented a yellow-green coloration and, with the passage of the days, the cotyledons were totally exposed and changed the coloration to light green (figure 1). The cotyledons presented a rounded base, an apex and an entire margin, as described by Cosmo *et al.* (2009).

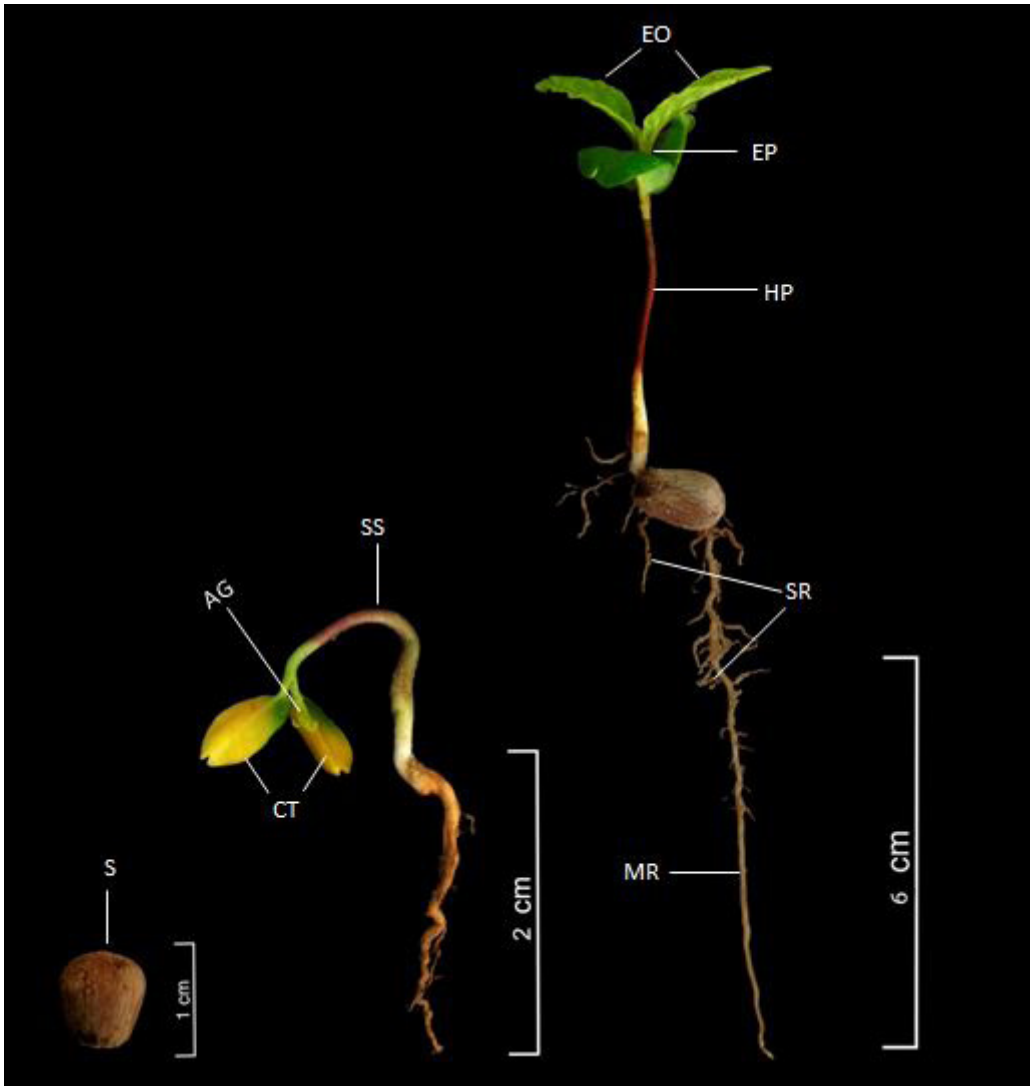

Figure 1 – Stages of development of *Vitex megapotamica* (Spreng.) Moldenke (Lamiaceae) seedling. S: seed; CT: cotyledon; SS: small stem; HP: hypocotyl; MR: main root; SR: secondary root; EP: epicotyl; EO: eophile; AG: apical gem.

The lap presents a white coloration, while a rapid color transition takes place, and the hypocotyl becomes purple/ burgundy, and the region of the cotyledon petiole is green (figure 1). Thus, along the hypocotyl, a transition of several colors occurs, a fact not described by Cosmo *et al.* (2009).

The root system was characterized by the presence of the axial long root and secondary roots, which are not the plant attachment (figure 1).

The characteristics described for the cotyledons, hypocotyl, epicotyl and primary leaves corroborate the work of Cosmo *et al.* (2009). The new information regarding the color transition of the hypocotyl is not mentioned in any previous work.

The epicotyl is herbaceous, short, straight, of green color. The primary leaves are simple, elliptical, with acute base and apex and serrated margin (figure 2). The adult plant was characterized by presenting compound leaves with whole margins (REITZ *et al.*, 1983).

Figure 2 – Serrated edge in leaves of *Vitex megapotamica* seedlings. SE: serrated edge; CT: cotyledon.

The knowledge of the seedling structure is extremely important, and can help the field identification, collaborating for the selection of useful species and/ or favoring the control of invasive species (DUKE & POLHILL, 1981).

CONCLUSION

The seeds of Tarumã (*V. megapotamica*) presented biometric data of fruits and seeds with a great variation, which shows that the environmental conditions could influence the process of formation.

The germination of the seeds is of the epigeal type, with protected cotyledons (phanerocotiledon) seedling.

The analyzed morphological characteristics help in the recognition of the plant in the field, besides helping in the knowledge of the ecology of the species.

ACKNOWLEDGEMENTS

The present work was carry out with the support of the Coordination of Improvement of Higher Education Personnel – Brazil (CAPES).

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