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Seed germination and seedling emergence measurements of Brazilian native species

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Abstract - The objective of this paper was to present a survey of seed-producing Brazilian native species whose germination or emergence processes were evaluated by measurements of the dynamics of these processes (time, velocity, homogeneity, uncertainty and synchrony). The survey was restricted to publications from the 21st century. A total of 261 Brazilian species were surveyed, belonging to 52 families, with Fabaceae (50 spp.), Melastomataceae (29 spp.), Cactaceae (22 spp.), Bromeliaceae (17 spp.), Bignoniaceae (14 spp.), Malvaceae (13 spp.) and Asteraceae (11 spp.) as the most represented. The seeds of the surveyed species are very slow to fast and are also very asynchronous to very synchronous to germinate and emerge, which is compatible with the heterogeneity of the native species of the Brazilian flora. Seeds with very fast and very synchronous germination need smaller environmental windows to establish themselves than those with very slow and very asynchronous germination. Therefore, each environment, with its specific climate regime, must be carefully analyzed for the best choice of sowing season. This is important information to plan the conservation and management of native areas, as well as to restore or recover degraded areas.

Medidas de germinação de sementes e emergência de plântulas de espécies nativas brasileiras

Resumo - O objetivo deste trabalho foi apresentar um levantamento de espécies nativas brasileiras produtoras de sementes, cujos processos de germinação ou emergência foram avaliados por meio de medidas da dinâmica desses processos (tempo, velocidade, homogeneidade, incerteza e sincronia). O levantamento se restringiu às publicações do século XXI. Foram levantadas 261 espécies brasileiras, pertencentes a 52 famílias, com Fabaceae (50 spp.), Melastomataceae (29 spp.), Cactaceae (22 spp.), Bromeliaceae (17 spp.), Bignoniaceae (14 spp.), Malvaceae (13 spp.) e Asteraceae (11 spp.) como as mais representadas. As sementes das espécies levantadas são muito lentas a rápidas e também são muito assíncronas a muito síncronas para germinar e emergir, o que é compatível com a heterogeneidade das espécies nativas da flora brasileira. Sementes com germinação muito rápida e muito sincronizada precisam de pequenas janelas ambientais para se estabelecerem em relação àquelas com germinação muito lenta e muito assíncrona. Portanto, cada ambiente, com seu regime climático específico, deve ser cuidadosamente analisado para a melhor escolha da época de semeadura. Essas são importantes informações para planejar a conservação e o manejo de áreas nativas, bem como para restaurar ou recuperar áreas degradadas.

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Introduction

Brazil has the second largest forest area in the world with 524 million hectares of natural or planted forests which represents 61.5% of the total area of the country (Brazil, 2009). According to the survey presented by Kew (2016), there are 32,109 native species of seed-producing plants in Brazil, making it the richest country in biodiversity of this plant group. Despite this, we do not yet have a database of measurements of the germination of seeds and emergence of seedlings. Some of the particularities of the germination and emergence processes need to be known to ensure the success of conservation projects, since germination is the only way to preserve the variability of these plant species.

With the advent of computer science, a database should have been built, but unfortunately it wasn't. Now, it is very pretentious on our part to think that we could be able to track all published papers that have somehow measured germination and emergence processes, because the oldest are not scanned, which makes them barely accessible. Besides, some of the information still remains as dissertations, theses or small communications presented in scientific meetings.

The oldest reference to a germination measurement was that of De Candolle in 1865 about the time for the first germination. It seems that this feature caught the attention of the first researchers because it was studied again by Haberlandt in 1874 and in 1875. He also studied the mean germination time in 1875. The amplitude between the time for the first and last germination was discussed by Oudemans and De Vries in 1878. These were the oldest papers about germination measurements recovered by Santana & Ranal (2004) from the 19th century.

In the 20th century scientists returned to this theme, and the largest volume of information on germination was accumulated. Among the Brazilian researchers, Dr. Labouriau was the most famous because he revolutionized the approach of germination studies, providing important numerical tools to evaluate the dynamics of this process. Time, velocity, and uncertainty were the principal measurements that he used in his studies (Labouriau, 1970, 1972, 1977, 1983a, 1983b; Dau & Labouriau, 1974; Labouriau & Valadares, 1976; Labouriau & Pacheco, 1978, 1979; Labouriau & Osborn, 1984; Labouriau & Agudo, 1987; Labouriau & San José, 1987; Labouriau & Spillmann, 1989; Borghetti & Labouriau, 1994).

At the beginning of the 21st century it was necessary to rescue the original papers because diversification of the germination measurements was generating some confusion and difficulties for the interpretation and comparison of the results obtained by different laboratories. This fact stimulated Santana & Ranal (2004) to include one specific chapter in their book about measurements used to evaluate the germination process, and subsequently to publish a review about the same subject (Ranal & Santana, 2006). In these reviews the authors recovered the history of the original mathematical expressions, the mathematical sense of the expressions, and limitations of some germination measurements. To make it easier, especially for younger researchers, they explained in detail the construction of spreadsheets to calculate the main germination measurements (Ranal et al., 2009).

Currently, confusion regarding the calculation of some measurements still remains. Taking this reality into account, the objective of this paper was to present a list of Brazilian native species, whose germination and emergence processes were studied in the 21st century (2000 to 2020). We considered only the studies that clearly informed the mathematical expressions used to measure the time, velocity, homogeneity, uncertainty and synchrony of these processes and/or the authors of these measurements. Why were these measurements chosen? Because they were the most relevant measurements used in the 19th and 20th centuries (see Santana & Ranal, 2004; Ranal & Santana, 2006). In addition, they are used to express the dynamics of the germination and emergence processes, for laboratory, field and conservationist purposes (Ferreira et al., 2015; Ribeiro-Oliveira & Ranal, 2016; Silveira et al., 2019; Souza et al., 2020; Gonçalves-Magalhães et al., 2021; Ferreira et al., 2022).

Our main interest was to present an overview of the amplitude of these measurements of Brazilian native species in order to ensure the success of recovery or restoration projects of degraded areas, and conservation and management of native ones. By knowing the dynamics of the germination process, it is possible to make good choices regarding the sowing season, without risking the loss of seeds. The second important aim of this study was to complete some details related to the mathematical expressions and calculation of the germination and emergence measurements in order to minimize the confusion that still remains, especially

regarding time, uncertainty and synchrony of these processes. Finally, a database of this nature makes it easier to compare results from different laboratories of forest seeds.

Material and methods

For this survey, we selected only papers about Brazilian native species that took into consideration mean germination/emergence time, mean germination/emergence rate sensu Labouriau (understood as velocity of germination or emergence), coefficient of variation of germination/emergence time (homogeneity of germination or emergence), uncertainty of germination/emergence (the spreading of the processes over time) and/or synchrony of germination/emergence (overlap of events). All the mathematical expressions and references mentioned by the authors surveyed were checked. Besides, only papers published in the 21st century (2000 to 2020) and with online access to the full text were included in our survey.

Papers where the measurement evaluations were done in intervals greater than 24 h were discarded due to the impossibility of scaling at daily intervals. We also discarded those who proposed or used measurements that left doubts regarding their calculation or their meaning.

Although with some limitations, we also decided to keep the following three groups of papers. The first group was the one that did not mention the periodicity of the evaluations, but used the measurements proposed by Labouriau, collaborators and followers. As Labouriau made it clear in his work that evaluations should be daily and always carried out at the same time to avoid distortions, it is assumed that the authors who adhered to his expressions were attentive to this important recommendation. The second group was part of the set of papers that ended the experiments for convenience, that is, before the complete stabilization of seed germination or seedling emergence. It is important to remember that the uncertainty of the germination and seedling emergence processes is the measurement most affected by this early termination adopted by the authors of this group. The third group included papers with different germination criteria. Some of them considered the emission of the radicle, others the length of the radicle, others the geotropic curvature of the radicle and finally there were those that considered normal seedlings.

Only values of the control treatment were used. When the control treatment was not discriminated, the amplitude of the measurements was used.

The history and the detailed way of calculation of these germination/emergence measurements were presented previously by Santana & Ranal (2004), Ranal & Santana (2006) and Ranal et al. (2009). To avoid misunderstandings, some important details related to time, uncertainty and synchrony are presented in the sequence.

The expressions of the mean germination or emergence time and the mean germination or emergence velocity are presented in Equations 1 and 2, respectively.

$$\bar{t} = \sum_{i=1}^{k} n_i t_i \Big/ \sum_{i=1}^{k} n_i \qquad (1)$$

$$\bar{v} = \sum_{i=1}^{k} n_i \Big/ \sum_{i=1}^{k} n_i t_i \text{ , that is, } \bar{v} = 1/\bar{t} \qquad (2)$$

In these expressions, t_i is the time for seed germination or seedling emergence, from the first to the i^{th} observation; n_i is the number of seeds germinated or seedlings emerged in the time i, and k is the last time of seed germination or seedling emergence.

If the observations occur every 3 h, t_i will assume the values 3, 6, 9, 12, 15 and so on until the germinations or emergences are over. If the observations occur every 12 h, t_i will assume the values 12, 24, 36, 48, 60, 72 and so on until the germinations or emergences are over. In both cases, the unit of mean time is hour and the unit of velocity is h^{-1}. However, if the observations occur every 24 h, t_i will assume the values 1, 2, 3 and so on. The unit of mean time is day and the unit of velocity is day^{-1}. For observations made once a week, t_i assumes the values 7, 14, 21 and so on until the germinations or emergences are over. The unit of mean time is also day and the unit of velocity is day^{-1}. As Ranal & Santana (2006) highlighted, n_i is the number of seeds germinated or seedlings emerged in the time i (the number correspondent to the i^{th} observation), not the accumulated number up to this time.

The coefficient of variation of the time for seed germination or seedling emergence, that is, the homogeneity of the germination or emergence processes is presented in Equation 3. The variance and standard deviation of the mean time as a weighted mean was

presented by Ranal & Santana (2006), and can be easily calculated using the spreadsheet published by Ranal et al. (2009).

$$CV_t = (s_t/\bar{t})100 \quad (3)$$

In this expression, s_t is the standard deviation of the mean germination or emergence time, and $\bar{t}$ is the mean germination or emergence time. The unit of this measurement is percentage.

The expression of uncertainty associated to the distribution of the relative frequency of seed germination or seedling emergence is presented in Equation 4.

$$U = -\sum_{i=1}^{k} f_i \log_2 f_i, \text{ being } f_i = n_i / \sum_{i=1}^{k} n_i \quad (4)$$

In this uncertainty expression, f_i is the relative frequency of germination or emergence, $\forall n_i \geq 1$, if and only if $\sum_{i=1}^{k} n_i \geq 1$; n_i is the number of seeds germinated or seedlings emerged on day i, and k is the last day of germination or emergence.

This means that U will only have values when at least one seed germinates in the experiment. In this case, the value of U will be zero. A single seed that is faster or slower than the other seeds will affect the value of this measurement. Thus, it is so important to evaluate the experiment until the stabilization of the germination or emergence process. The censored assessments, with closure of the observations before such stabilization occurs compromise the accuracy of this measurement.

It is important to highlight that when all seeds germinate in the same time of observation, the U value is also zero, indicating the minimum uncertainty of the process, and it does not depend on how many days have passed after sowing. The most important thing is that in only one observation all seeds were germinated. On the contrary, the maximum uncertainty is observed when one seed germinates in each time of observation. Because of this the mathematical notation presented by Ranal & Santana (2006) for the limits of this measurement is $0 \leq U \leq \log_2 n$. The unit of this measurement is bit.

The synchrony of germination or emergence is calculate as presented in Equation 5.

$$Z = \sum_{i=1}^{k} C_{n_i,2} \Big/ N \quad (5)$$

being $C_{n_i}, 2 = n_1(n_1\text{-}1)/2$ and $N = \sum_{i=1}^{k} n_i \ (\sum_{i=1}^{k} n_1\text{-}1)/2$

In this expression, $C_{n_i}, 2$ is the combination of seeds germinated or seedlings emerged in time i, two by two, and n_i is the number of seeds germinated or seedlings emerged in time i.

This means that $C_{n_i}, 2$ will only have values when at least two seeds germinate at the same time. It is important to highlight that Z exists if and only if the N value is different from zero, that is, if and only if $\sum_{i=1}^{k} n_i \geq 2$. Thus, Z is equal to zero when only one seed germinates in each time of observation, and the maximum value is observed when all seeds germinate at the same time, that is, at the same observation. Thus, the limit of this measurement is $0 \leq Z \leq 1$ (Ranal & Santana, 2006). This measurement has no unit. It is a dimensionless number.

It is important to make it clear that when the germinability is zero, mathematically, the mean germination time, mean germination velocity, the coefficient of variation of time, uncertainty, and synchrony do not exist. See Ranal et al. (2009) for instructions about the statistical analysis for experiments containing plots with germinability equal to zero.

The accuracy of these measurements depends on the regularity and periodicity of the evaluations. Therefore, it is important that the beginning and end of the observations are mentioned in material and methods of all papers on germination, as well as the periodicity of the observations. It is also important to wait for the germination of all seeds, without the experiment being terminated for convenience, before some viable seeds could have the chance to germinate. It is up to the researcher to inform if at the end of the experiment there were viable seeds, indicating that the species would have to be studied again.

Germinability and percentage of emergence were not included in this survey because they are common in all germination papers and none of them leave doubts as to their calculation. Both of them show the potential of the

seeds to germinate and to form a seedling, respectively, being essential to evaluate the quality of the seed crop produced. Maguire's index was also excluded for its ambiguity (see Ranal & Santana (2006) for details about this measurement).

Results

We surveyed 261 Brazilian species studied in relation to the germination and/or the emergence dynamics (time, velocity and synchrony), belonging to 52 families (Table 1). Fabaceae (50 spp.), Melastomataceae (29 spp.), Cactaceae (22 spp.), Bromeliaceae (17 spp.), Bignoniaceae (14 spp.), Malvaceae (13 spp.) and Asteraceae (11 spp.) were the best represented families, considering these processes.

This survey showed that the native species of the Brazilian flora have very slow to fast germination and/or emergence, with values of velocity ($\bar{v}$) between 0.006 and 0.96 day^{-1} (92 spp. studied), with the first time for germination or emergence (t_f) between 1 and 147 days (75 spp. studied), with the last time for germination or emergence (t_l) between 3 and 424 days (72 spp. studied), and the mean time for germination or emergence ($\bar{t}$) between 1.04 and 231.89 days (221 spp. studied; see evaluated literature in Table 2). The uniformity around the mean time (CV_t) ranges from 5.20 to 475.7% (71 spp. studied). In relation to the values of uncertainty (U), they range from 0 to 12.24 bits (113 spp. studied) and the values of synchrony (Z) varied from zero to 0.9099, that is, from very asynchronous to very synchronous (85 spp. studied).

Table 1. Number of families and species (261 species) whose seed germination or seedling emergence processes were evaluated and measured using time, velocity, homogeneity, uncertainty and/or synchrony.

Family	Number of species	Family	Number of species
Acanthaceae	1	Malvaceae	13
Alismataceae	1	Melastomataceae	29
Anacardiaceae	5	Meliaceae	3
Annonaceae	1	Moraceae	2
Apocynaceae	2	Muntingiaceae	1
Aquifoliaceae	1	Myristicaceae	1
Araliaceae	1	Myrtaceae	9
Arecaceae	2	Picrodendraceae	1
Aristolochiaceae	1	Plantaginaceae	1
Asteraceae	11	Poaceae	9
Bignoniaceae	14	Polygonaceae	1
Bromeliaceae	17	Primulaceae	1
Cactaceae	22	Proteaceae	1
Calophyllaceae	2	Rhamnaceae	1
Cannabaceae	1	Rubiaceae	6
Capparaceae	1	Rutaceae	2
Combretaceae	3	Salicaceae	2
Cucurbitaceae	1	Sapindaceae	1
Dilleniaceae	1	Sapotaceae	2
Eriocaulaceae	9	Simaroubaceae	1
Euphorbiaceae	1	Solanaceae	2
Fabaceae	50	Styracaceae	1
Lamiaceae	2	Urticaceae	3
Lauraceae	2	Velloziaceae	5
Lecythidaceae	1	Vochysiaceae	1
Lythraceae	3	Xyridaceae	6

Table 2. Seed germination and/or seedling emergence measurements of some Brazilian native species (survey limited to the 21st century (2000 - 2020). The experimental conditions were omitted. Single values belong to the control treatment, when mentioned. Amplitudes belong to the set of treatments when the control treatment was not mentioned.

Species	Measurement	Process evaluated	Authors
Time to first germination/emergence (day)			
Acacia polyphylla DC. Fabaceae	1	Germination	Mendes-Rodrigues et al. (2019)
A. polyphylla	4	Emergence	Mendes-Rodrigues et al. (2019)
Aegiphila sellowiana Cham. Lamiaceae	147	Germination	Mendes-Rodrigues et al. (2019)
A. sellowiana	22	Emergence	Mendes-Rodrigues et al. (2019)
Alibertia sessilis (Vell.) K. Schum. Rubiaceae	9	Germination	Mendes-Rodrigues et al. (2019)
A. sessilis	24	Emergence	Mendes-Rodrigues et al. (2019)
Anacardium humile A. St.-Hil. Anacardiaceae	11	Emergence	Carvalho et al. (2005)
Anadenanthera colubrina (Vell.) Brenan Fabaceae	1 – 2.2	Germination	Dorneles et al. (2013)
A. colubrina	3 – 4.5	Emergence	Dorneles et al. (2013)
A. colubrina	1	Germination	Mendes-Rodrigues et al. (2019)
A. colubrina	3	Emergence	Mendes-Rodrigues et al. (2019)
A. colubrina	3.5 – 5	Germination	Rodrigues et al. (2007)
A. colubrina	3 – 10	Emergence	Rodrigues et al. (2007)
Anadenanthera peregrina (L.) Speg. Fabaceae	1	Germination	Mendes-Rodrigues et al. (2019)
A. peregrina	3	Emergence	Mendes-Rodrigues et al. (2019)
Aspidosperma cylindrocarpon Müll. Arg. Apocynaceae	29	Emergence	Mendes-Rodrigues et al. (2019)
Astronium fraxinifolium Schott Anacardiaceae	2	Germination	Mendes-Rodrigues et al. (2019)
A. fraxinifolium	9	Emergence	Mendes-Rodrigues et al. (2019)
Bombax ceiba L. Malvaceae	3	Germination	Mendes-Rodrigues et al. (2019)
B. ceiba	7	Emergence	Mendes-Rodrigues et al. (2019)
Borreria verticillata (L.) G. Mey. Rubiaceae	3	Germination	Ferreira & Rosa (2009)
B. verticillata	3	Emergence	Ferreira & Rosa (2009)
Bowdichia virgilioides Kunth Fabaceae	2.75 – 7.75	Germination	Ribeiro-Oliveira et al. (2013)
Cariniana estrellensis (Raddi) Kuntze Lecythidaceae	9	Germination	Mendes-Rodrigues et al. (2019)
C. estrellensis	16	Emergence	Mendes-Rodrigues et al. (2019)
Casearia mariquitensis Kunth Salicaceae	9	Emergence	Mendes-Rodrigues et al. (2019)
Cayaponia martiana (Cogn.) Cogn. Cucurbitaceae	12	Germination	Ferreira & Rosa (2009)
Cecropia pachystachya Trécul Urticaceae	6	Germination	Mendes-Rodrigues et al. (2019)
C. pachystachya	7.25 – 8.75	Germination	Ribeiro-Oliveira & Ranal (2016)
Cedrela fissilis Vell. Meliaceae	16	Emergence	Mendes-Rodrigues et al. (2019)
Ceiba speciosa (A. St.-Hil.) Ravenna Malvaceae	2	Germination	Mendes-Rodrigues et al. (2019)
C. speciosa	6	Emergence	Mendes-Rodrigues et al. (2019)
C. speciosa	2 – 3.75	Germination	Ribeiro-Oliveira & Ranal (2016)
Clarisia racemosa Ruiz & Pav. Moraceae	5 – 18	Germination	Ferraz & Varela (2003)
Clausena excavata Burm. f. Rutaceae	17 – 18	Emergence	Vieira et al. (2010)
Copaifera langsdorffii Desf. Fabaceae	18	Emergence	Mendes-Rodrigues et al. (2019)
Dipteryx alata Vogel Fabaceae	8	Emergence	Mendes-Rodrigues et al. (2019)
Echinodorus grandiflorus (Cham. & Schltr.) Micheli Alismataceae	3	Germination	Ferreira & Rosa (2009)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
E. grandiflorus	3	Emergence	Ferreira & Rosa (2009)
Enterolobium contortisiliquum (Vell.) Morong Fabaceae	10	Germination	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	12	Emergence	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	2.5 – 3.5	Germination	Ribeiro-Oliveira & Ranal (2016)
Eremanthus elaeagnus (Mart. ex DC.) Sch. Bip. Asteraceae	9 – 22	Germination	Velten & Garcia (2005)
Eremanthus glomerulatus Less. Asteraceae	19 – 37	Germination	Velten & Garcia (2005)
Eremanthus incanus (Less.) Less. Asteraceae	2 – 26	Germination	Velten & Garcia (2005)
Eriotheca gracilipes (K. Schum.) A. Robyns Malvaceae	< 8	Germination	Mendes-Rodrigues et al. (2011a)
Eriotheca pubescens (Mart. & Zucc.) Schott & Endl. Malvaceae	< 5.5	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	13	Emergence	Mendes-Rodrigues et al. (2011a)
Genipa americana L. Rubiaceae	17	Emergence	Mendes-Rodrigues et al. (2019)
Guarea guidonia (L.) Sleumer Meliaceae	70	Emergence	Mendes-Rodrigues et al. (2019)
Guazuma ulmifolia Lam. Malvaceae	3	Germination	Mendes-Rodrigues et al. (2019)
G. ulmifolia	32	Emergence	Mendes-Rodrigues et al. (2019)
G. ulmifolia	1 – 1.75	Germination	Ribeiro-Oliveira & Ranal (2016)
Handroanthus avellanedae (Lorentz ex Griseb.) Mattos Bignoniaceae	10	Emergence	Mendes-Rodrigues et al. (2019)
Handroanthus roseoalbus (Ridl.) Mattos Bignoniaceae	8	Emergence	Mendes-Rodrigues et al. (2019)
Handroanthus serratifolius (Vahl) S. Grose Bignoniaceae	5	Germination	Mendes-Rodrigues et al. (2019)
H. serratifolius	18	Emergence	Mendes-Rodrigues et al. (2019)
Heterotis rotundifolia (Sm.) Jacq. Fel. Melastomataceae	8	Germination	Mendes-Rodrigues et al. (2019)
Hymenaea courbaril L. Fabaceae	7	Emergence	Mendes-Rodrigues et al. (2019)
Inga laurina (Sw.) Willd. Fabaceae	11	Emergence	Mendes-Rodrigues et al. (2019)
Inga sessilis (Vell.) Mart. Fabaceae	11	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda cuspidifolia Mart. Bignoniaceae	5	Germination	Mendes-Rodrigues et al. (2019)
J. cuspidifolia	48	Emergence	Mendes-Rodrigues et al. (2019)
Lafoensia pacari A. St.-Hil. Lythraceae	4 – 7	Germination	Ribeiro-Oliveira & Ranal (2016)
Lithraea molleoides (Vell.) Engl. Anacardiaceae	6	Germination	Mendes-Rodrigues et al. (2019)
L. molleoides	8	Emergence	Mendes-Rodrigues et al. (2019)
Luehea divaricata Mart. & Zucc. Malvaceae	4	Germination	Mendes-Rodrigues et al. (2019)
L. divaricata	29	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium aculeatum Raddi Fabaceae	30	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium acutifolium Vogel Fabaceae	28	Emergence	Mendes-Rodrigues et al. (2019)
Matayba guianensis Aubl. Sapindaceae	2	Germination	Mendes-Rodrigues et al. (2019)
M. guianensis	11	Emergence	Mendes-Rodrigues et al. (2019)
Miconia albicans (Sw.) Triana Melastomataceae	6	Germination	Mendes-Rodrigues et al. (2019)
Miconia ferruginata DC. Melastomataceae	7	Germination	Mendes-Rodrigues et al. (2010)
Microlicia fasciculata Mart. ex Naudin Melastomataceae	6.67 – 11	Germination	Ranal et al. (2016)
Myracrodruon urundeuva M. Allemão Anacardiaceae	8	Emergence	Mendes-Rodrigues et al. (2019)
Myrsine umbellata Mart. Primulaceae	17	Emergence	Mendes-Rodrigues et al. (2019)
Ocimum selloi Benth. Lamiaceae	3	Germination	Ferreira & Rosa (2009)
O. selloi	6	Emergence	Ferreira & Rosa (2009)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Ormosia arborea (Vell.) Harms Fabaceae	8	Germination	Mendes-Rodrigues et al. (2019)
O. arborea	57	Emergence	Mendes-Rodrigues et al. (2019)
Pachira glabra Pasq. Malvaceae	2 – 4	Germination	Mendes-Rodrigues et al. (2019)
P. glabra	10 – 12	Emergence	Mendes-Rodrigues et al. (2019)
Piptadenia gonoacantha (Mart.) J.F. Macbr. Fabaceae	1	Germination	Mendes-Rodrigues et al. (2019)
Plantago australis Lam. Plantaginaceae	3	Germination	Ferreira & Rosa (2009)
P. australis	6	Emergence	Ferreira & Rosa (2009)
Plathymenia reticulata Benth. Fabaceae	2	Germination	Mendes-Rodrigues et al. (2019)
P. reticulata	22	Emergence	Mendes-Rodrigues et al. (2019)
Platypodium elegans Vogel Fabaceae	17	Emergence	Mendes-Rodrigues et al. (2019)
Polygonum hydropiperoides Michx. Polygonaceae	3	Germination	Ferreira & Rosa (2009)
P. hydropiperoides	9	Emergence	Ferreira & Rosa (2009)
Pouteria torta (Mart.) Radlk. Sapotaceae	40	Emergence	Mendes-Rodrigues et al. (2019)
Pseudobombax longiflorum (Mart.) A. Robyns Malvaceae	4.5	Germination	Mendes-Rodrigues et al. (2011b)
Pseudobombax tomentosum (Mart.) A. Robyns Malvaceae	7.75	Germination	Mendes-Rodrigues et al. (2011b)
Schefflera morototoni (Aubl.) Maguire, Steyerm. & Frodin Araliaceae	38.20 – 41.75	Germination	Anastácio et al. (2010)
S. morototoni	26.75 – 56.75	Germination	Ribeiro-Oliveira & Ranal (2016)
Senna silvestris (Vell.) H.S. Irwin & Barneby Fabaceae	10	Emergence	Mendes-Rodrigues et al. (2019)
Solanum lycocarpum A. St.-Hil. Solanaceae	6 – 7	Germination	Souza et al. (2020)
Sterculia striata A. St.-Hil. & Naudin Malvaceae	18	Emergence	Mendes-Rodrigues et al. (2019)
Syagrus oleracea (Mart.) Becc. Arecaceae	100	Emergence	Mendes-Rodrigues et al. (2019)
Tabebuia aurea (Silva Manso) Benth. & Hook. f. ex S. Moore Bignoniaceae	9	Emergence	Mendes-Rodrigues et al. (2019)
Tapirira guianensis Aubl. Anacardiaceae	1	Germination	Mendes-Rodrigues et al. (2019)
T. guianensis	10	Emergence	Mendes-Rodrigues et al. (2019)
Terminalia argentea Mart. & Zucc. Combretaceae	61	Emergence	Mendes-Rodrigues et al. (2019)
Terminalia brasiliensis (Cambess.) Eichler Combretaceae	28	Emergence	Mendes-Rodrigues et al. (2019)
Tibouchina granulosa (Desr.) Cogn. Melastomataceae	5	Germination	Mendes-Rodrigues et al. (2019)
Tibouchina pulchra Cogn. Melastomataceae	9	Germination	Mendes-Rodrigues et al. (2019)
Trema micrantha (L.) Blume Cannabaceae	36	Germination	Mendes-Rodrigues et al. (2019)
Virola sebifera Aubl. Myristicaceae	16	Germination	Mendes-Rodrigues et al. (2019)
V. sebifera	46	Emergence	Mendes-Rodrigues et al. (2019)
Waltheria douradinha A. St.-Hil. Malvaceae	3	Germination	Ferreira & Rosa (2009)
W. douradinha	6	Emergence	Ferreira & Rosa (2009)
Time to last germination/emergence (day)			
Acacia polyphylla	15	Germination	Mendes-Rodrigues et al. (2019)
A. polyphylla	21	Emergence	Mendes-Rodrigues et al. (2019)
Aegiphila sellowiana	203	Germination	Mendes-Rodrigues et al. (2019)
A. sellowiana	69	Emergence	Mendes-Rodrigues et al. (2019)
Alibertia sessilis	44	Germination	Mendes-Rodrigues et al. (2019)
A. sessilis	33	Emergence	Mendes-Rodrigues et al. (2019)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Anacardium humile	17	Emergence	Carvalho et al. (2005)
Anadenanthera colubrina	5 – 12.8	Germination	Dorneles et al. (2013)
A. colubrina	10.5 – 18.8	Emergence	Dorneles et al. (2013)
A. colubrina	15	Germination	Mendes-Rodrigues et al. (2019)
A. colubrina	24	Emergence	Mendes-Rodrigues et al. (2019)
A. peregrina	7	Germination	Mendes-Rodrigues et al. (2019)
A. peregrina	10	Emergence	Mendes-Rodrigues et al. (2019)
Aspidosperma cylindrocarpon	70	Emergence	Mendes-Rodrigues et al. (2019)
Astronium fraxinifolium	12	Germination	Mendes-Rodrigues et al. (2019)
A. fraxinifolium	22	Emergence	Mendes-Rodrigues et al. (2019)
Bombax ceiba	9	Germination	Mendes-Rodrigues et al. (2019)
B. ceiba	15	Emergence	Mendes-Rodrigues et al. (2019)
Borreria verticillata	21	Emergence	Ferreira & Rosa (2009)
Bowdichia virgilioides	10.25 – 20.50	Germination	Ribeiro-Oliveira et al. (2013)
Cariniana estrellensis	42	Germination	Mendes-Rodrigues et al. (2019)
C. estrellensis	39	Emergence	Mendes-Rodrigues et al. (2019)
Casearia mariquitensis	38	Emergence	Mendes-Rodrigues et al. (2019)
Cayaponia martiana	33	Germination	Ferreira & Rosa (2009)
Cecropia pachystachya	11	Germination	Mendes-Rodrigues et al. (2019)
C. pachystachya	22 – 37	Germination	Ribeiro-Oliveira & Ranal (2016)
Cedrela fissilis	47	Emergence	Mendes-Rodrigues et al. (2019)
Ceiba speciosa	17	Germination	Mendes-Rodrigues et al. (2019)
C. speciosa	17	Emergence	Mendes-Rodrigues et al. (2019)
C. speciosa	12.50 – 36	Germination	Ribeiro-Oliveira & Ranal (2016)
Clarisia racemosa	13.5 – 44.5	Germination	Ferraz & Varela (2003)
Clausena excavata	36 – 35	Emergence	Vieira et al. (2010)
Copaifera langsdorffii	56	Emergence	Mendes-Rodrigues et al. (2019)
Dipteryx alata	19	Emergence	Mendes-Rodrigues et al. (2019)
Echinodorus grandiflorus	24	Germination	Ferreira & Rosa (2009)
E. grandiflorus	15	Emergence	Ferreira & Rosa (2009)
Enterolobium contortisiliquum	102	Germination	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	93	Emergence	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	5 – 7.75	Germination	Ribeiro-Oliveira & Ranal (2016)
Eriotheca gracilipes	< 70	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	< 30	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	23	Emergence	Mendes-Rodrigues et al. (2011a)
Genipa americana	71	Emergence	Mendes-Rodrigues et al. (2019)
Guarea guidonia	99	Emergence	Mendes-Rodrigues et al. (2019)
Guazuma ulmifolia	424	Germination	Mendes-Rodrigues et al. (2019)
G. ulmifolia	175	Emergence	Mendes-Rodrigues et al. (2019)
G. ulmifolia	12.75 – 23.25	Germination	Ribeiro-Oliveira & Ranal (2016)
Handroanthus avellanedae	22	Emergence	Mendes-Rodrigues et al. (2019)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
H. roseoalbus	19	Emergence	Mendes-Rodrigues et al. (2019)
H. serratifolius	34	Germination	Mendes-Rodrigues et al. (2019)
H. serratifolius	35	Emergence	Mendes-Rodrigues et al. (2019)
Heterotis rotundifolia	219	Germination	Mendes-Rodrigues et al. (2019)
Hymenaea courbaril	284	Emergence	Mendes-Rodrigues et al. (2019)
Inga laurina	53	Emergence	Mendes-Rodrigues et al. (2019)
I. sessilis	52	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda cuspidifolia	34	Germination	Mendes-Rodrigues et al. (2019)
J. cuspidifolia	101	Emergence	Mendes-Rodrigues et al. (2019)
Lafoensia pacari	13.5 – 18.5	Emergence	Ribeiro-Oliveira & Ranal (2016)
Lithraea molleoides	217	Germination	Mendes-Rodrigues et al. (2019)
L. molleoides	48	Emergence	Mendes-Rodrigues et al. (2019)
Luehea divaricata	82	Germination	Mendes-Rodrigues et al. (2019)
L. divaricata	105	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium aculeatum	100	Emergence	Mendes-Rodrigues et al. (2019)
M. acutifolium	60	Emergence	Mendes-Rodrigues et al. (2019)
Matayba guianensis	9	Germination	Mendes-Rodrigues et al. (2019)
M. guianensis	97	Emergence	Mendes-Rodrigues et al. (2019)
Miconia albicans	72	Germination	Mendes-Rodrigues et al. (2019)
M. ferruginata	45	Germination	Mendes-Rodrigues et al. (2010)
Microlicia fasciculata	10.67 – 14.33	Germination	Ranal et al. (2016)
Myracrodruon urundeuva	16	Emergence	Mendes-Rodrigues et al. (2019)
Myrsine umbellata	92	Emergence	Mendes-Rodrigues et al. (2019)
Ocimum selloi	15	Germination	Ferreira & Rosa (2009)
O. selloi	21	Emergence	Ferreira & Rosa (2009)
Ormosia arborea	86	Germination	Mendes-Rodrigues et al. (2019)
O. arborea	145	Emergence	Mendes-Rodrigues et al. (2019)
Pachira glabra	10 – 18	Germination	Mendes-Rodrigues et al. (2019)
P. glabra	24 – 30	Emergence	Mendes-Rodrigues et al. (2019)
Paepalanthus chiquitensis Herzog Eriocaulaceae	23.3	Germination	Gonçalves-Magalhães et al. (2021)
Plantago australis	9	Germination	Ferreira & Rosa (2009)
P. australis	15	Emergence	Ferreira & Rosa (2009)
Plathymenia reticulata	169	Germination	Mendes-Rodrigues et al. (2019)
P. reticulata	143	Emergence	Mendes-Rodrigues et al. (2019)
Platypodium elegans	70	Emergence	Mendes-Rodrigues et al. (2019)
Polygonum hydropiperoides	15	Germination	Ferreira & Rosa (2009)
P. hydropiperoides	21	Emergence	Ferreira & Rosa (2009)
Pouteria torta	99	Emergence	Mendes-Rodrigues et al. (2019)
Pseudobombax longiflorum	18.25	Germination	Mendes-Rodrigues et al. (2011b)
P. tomentosum	16.75	Germination	Mendes-Rodrigues et al. (2011b)
Schefflera morototoni	63.05 – 65.5	Germination	Anastácio et al. (2010)
S. morototoni	77.75 – 188.50	Germination	Ribeiro-Oliveira & Ranal (2016)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Senna silvestris	89	Emergence	Mendes-Rodrigues et al. (2019)
Solanum lycocarpum	14 – 16	Germination	Souza et al. (2020)
Sterculia striata	80	Emergence	Mendes-Rodrigues et al. (2019)
Syagrus oleracea	144	Emergence	Mendes-Rodrigues et al. (2019)
Tabebuia aurea	25	Emergence	Mendes-Rodrigues et al. (2019)
Tapirira guianensis	3	Germination	Mendes-Rodrigues et al. (2019)
T. guianensis	25	Emergence	Mendes-Rodrigues et al. (2019)
Terminalia argentea	110	Emergence	Mendes-Rodrigues et al. (2019)
T. brasiliensis	45	Emergence	Mendes-Rodrigues et al. (2019)
Tibouchina granulosa	23	Germination	Mendes-Rodrigues et al. (2019)
T. pulchra	45	Germination	Mendes-Rodrigues et al. (2019)
Trema micrantha	36	Germination	Mendes-Rodrigues et al. (2019)
Virola sebifera	44	Germination	Mendes-Rodrigues et al. (2019)
V. sebifera	66	Emergence	Mendes-Rodrigues et al. (2019)
Waltheria douradinha	18	Germination	Ferreira & Rosa (2009)
W. douradinha	21	Emergence	Ferreira & Rosa (2009)
Mean germination/emergence time (day)			
Acacia polyphylla	8.1 – 19.3	Germination	Araújo Neto et al. (2003)
A. polyphylla	3.80	Germination	Mendes-Rodrigues et al. (2019)
A. polyphylla	6.17	Emergence	Mendes-Rodrigues et al. (2019)
Acca sellowiana (O. Berg) Burret Myrtaceae	20.42 – 33.08	Germination	Santos et al. (2004)
Aechmea nudicaulis (L.) Griseb. Bromeliaceae	4.3	Germination	Mantovani & Iglesias (2010)
A. nudicaulis	< 25	Germination	Marques et al. (2014)
A. nudicaulis	74.94 – 356.76 h	Germination	Pinheiro & Borghetti (2003)
Aegiphila sellowiana	170.73	Germination	Mendes-Rodrigues et al. (2019)
A. sellowiana	31.94	Emergence	Mendes-Rodrigues et al. (2019)
Aldama arenaria (Baker) E. E. Schill. & Panero Asteraceae	5.01 – 10.86	Germination	Bombo et al. (2015)
Aldama filifolia (Sch. Bip. ex Baker) E. E. Schill. & Panero Asteraceae	10.05 – 23.73	Germination	Bombo et al. (2015)
Aldama linearifolia (Chodat) E. E. Schill. & Panero Asteraceae	12.79 – 21.75	Germination	Bombo et al. (2015)
Aldama robusta (Gardner) E. E. Schill. & Panero Asteraceae	7.55 – 24.71	Germination	Bombo et al. (2015)
Aldama trichophylla (Dusén) Magenta Asteraceae	5.85 – 10.48	Germination	Bombo et al. (2015)
Alibertia sessilis	13.28	Germination	Mendes-Rodrigues et al. (2019)
A. sessilis	26.34	Emergence	Mendes-Rodrigues et al. (2019)
Amburana cearensis (Allemão) A. C. Sm. Fabaceae	10.6	Emergence	Santos & Meiado (2017)
Anacardium humile	19.27	Emergence	Carvalho et al. (2005)
Anadenanthera colubrina	3.2 – 4.2	Germination	Dorneles et al. (2013)
A. colubrina	6.1 – 7.5	Emergence	Dorneles et al. (2013)
A. colubrina	4.07	Germination	Mendes-Rodrigues et al. (2019)
A. colubrina	7.53	Emergence	Mendes-Rodrigues et al. (2019)
A. colubrina	4.87	Emergence	Oliveira et al. (2012b)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
A. colubrina	4.45 – 6.41	Germination	Rodrigues et al. (2007)
A. colubrina	3.60 – 10.7	Emergence	Rodrigues et al. (2007)
Anadenanthera colubrina var. *cebil* (Griseb.) Altschul Fabaceae	1.7 – 2.7	Germination	Nogueira et al. (2014)
Anadenanthera falcata (Benth.) Speg. Fabaceae	29.6 h	Germination	Ribeiro & Borghetti (2013)
A. peregrina	4.5	Germination	Mendes-Rodrigues et al. (2019)
A. peregrina	4.06	Emergence	Mendes-Rodrigues et al. (2019)
Andropogon leucostachyus Kunth Poaceae	17	Germination	Kolb et al. (2016)
Andropogon virgatus Desv. Poaceae	20	Germination	Kolb et al. (2016)
Annona emarginata (Schltdl.) H. Rainer Annonaceae	21 – 25.5	Germination	Corsato et al. (2012)
Aristida megapotamica var. *brevipes* Henrard Poaceae	12.5	Germination	Kolb et al. (2016)
Aristida torta (Nees) Kunth Poaceae	12.16	Germination	Le Stradic et al. (2015)
Aristolochia galeata Mart. & Zucc. Aristolochiaceae	290.7 – 512.1 h	Germination	Silva et al. (2011)
Arthrocereus glaziovii (K. Schum.) N.P. Taylor & Zappi Cactaceae	15 – 20	Germination	Cheib & Garcia (2012)
Arthrocereus melanurus (K. Schum.) Diers et al. Cactaceae	5 – 55	Germination	Cheib & Garcia (2012)
Aspidosperma cylindrocarpon	43.22	Emergence	Mendes-Rodrigues et al. (2019)
Astronium fraxinifolium	3.23	Germination	Mendes-Rodrigues et al. (2019)
A. fraxinifolium	12.30	Emergence	Mendes-Rodrigues et al. (2019)
Avicennia schaueriana Stapf & Leechm. ex Moldenke Acanthaceae	5.3 – 7.9	Germination	Cavalcanti et al. (2007)
Axonopus siccus (Nees) Kuhlm. Poaceae	9.2	Germination	Kolb et al. (2016)
Bauhinia dumosa Benth. Fabaceae	9.1 – 11.7	Germination	Zirondi et al. (2019)
B. dumosa	< 15	Germination	Zupo et al (2016)
Bauhinia forficata subsp. *pruinosa* (Vogel) Fortunato & Wunderlin Fabaceae	39.0 – 40.6	Germination	Souza & Válio (2001)
Bombax ceiba	4.82	Germination	Mendes-Rodrigues et al. (2019)
B. ceiba	9.54	Emergence	Mendes-Rodrigues et al. (2019)
Bowdichia virgilioides	6.81 – 10.36	Germination	Ribeiro-Oliveira et al. (2013)
B. virgilioides	2.1	Germination	Silva et al. (2001)
Caesalpinia echinata Lam. Fabaceae	2.5 – 3.3	Germination	Zanotti et al. (2012)
Caesalpinia ferrea Mart. ex Tul. Fabaceae	3.50 – 6.49	Germination	Lima et al. (2006)
Calophyllum brasiliense Cambess. Calophyllaceae	7.73 – 33.46	Germination	Nery et al. (2007)
Calycophyllum spruceanum (Benth.) K. Schum. Rubiaceae (non-flooded)	9.2	Emergence	Conserva et al. (2017)
C. spruceanum (flooded)	10.4	Emergence	Conserva et al. (2017)
Cambessedesia hilariana (Kunth) DC. Melastomataceae	10.3 – 18.8	Germination	Zirondi et al. (2019)
Campomanesia guazumifolia (Cambess.) O. Berg Myrtaceae	102.5 – 167.3	Germination	Santos et al. (2004)
Campomanesia xanthocarpa (Mart.) O. Berg Myrtaceae	8.65 – 17.77	Germination	Santos et al. (2004)
Cariniana estrellensis	16.42	Germination	Mendes-Rodrigues et al. (2019)
C. estrellensis	30.69	Emergence	Mendes-Rodrigues et al. (2019)
Casearia mariquitensis	14.67	Emergence	Mendes-Rodrigues et al. (2019)
Cassia excelsa Schrad. Fabaceae	5.47 – 19.87	Germination	Jeller & Perez (2003)
Cecropia glaziovii Snethl. Urticaceae	2.47 – 4.17	Germination	Godoi & Takaki (2005)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
C. pachystachya	7.19	Germination	Mendes-Rodrigues et al. (2019)
C. pachystachya	10.83 – 13.90	Germination	Ribeiro-Oliveira & Ranal (2016)
C. pachystachya	7.8	Germination	Souza & Válio (2001)
Cedrela fissilis	24.91	Emergence	Mendes-Rodrigues et al. (2019)
Cedrela odorata L. Meliaceae (non-flooded)	7.3	Emergence	Conserva et al. (2017)
C. odorata (flooded)	12.3	Emergence	Conserva et al. (2017)
Ceiba speciosa	6.76	Germination	Mendes-Rodrigues et al. (2019)
C. speciosa	9.48	Emergence	Mendes-Rodrigues et al. (2019)
C. speciosa	2.29 – 2.81	Germination	Ribeiro-Oliveira & Ranal (2016)
Cereus jamacaru DC. Cactaceae	6.4 – 10	Germination	Abud et al. (2013)
C. jamacaru	4.3 – 11.3	Germination	Alencar et al. (2012)
C. jamacaru	5.5 – 18.6	Germination	Meiado et al. (2010)
Chaetostoma armatum (Spreng.) Cogn. Melastomataceae	25.3 – 51.8	Germination	Ribeiro et al. (2015)
C. armatum	< 20	Germination	Silveira et al. (2012b)
Chamaecrista viscosa (Kunth) H. S. Irwin & Barneby Fabaceae	4.7 – 11.8	Germination	Zirondi et al. (2019)
Chorisia speciosa	4.7 – 5.1	Germination	Souza & Válio (2001)
Chresta sphaerocephala DC. Asteraceae	19 – 41	Germination	Cury et al. (2010)
Clarisia racemosa	7.1 – 22.3	Germination	Ferraz & Varela (2003)
Clausena excavata	5.00 – 10.27	Germination	Vieira et al. (2010)
Clidemia urceolata DC. Melastomataceae	17.8 – 27.5	Germination	Silveira (2012c)
Collaea cipoensis Fortunato Fabaceae	< 8	Germination	Nativel et al. (2015)
Colubrina glandulosa Perkins Rhamnaceae	18.3	Emergence	Cavalheiro et al. (2007)
Comolia sertularia (DC.) Triana Melastomataceae	< 25	Germination	Silveira et al. (2012b)
C. sertularia	20.5	Germination	Zirondi et al. (2019)
Copaifera langsdorffii	20.7	Emergence	Bezerra et al. (2002)
C. langsdorffii	27.01	Emergence	Mendes-Rodrigues et al. (2019)
C. langsdorffii	11.09	Germination	Noleto et al. (2010)
C. langsdorffii	51.07	Emergence	Noleto et al. (2010)
C. langsdorffii	37.48 – 37.57	Emergence	Pereira et al. (2009)
C. langsdorffii	210.6 h	Germination	Ribeiro & Borghetti (2013)
C. langsdorffii	408 h	Germination	Saboya & Borghetti (2012)
Crataeva tapia L. Capparaceae	8.4 – 12.7	Germination	Melo et al. (2015)
Cryptanthus schwackeanus Mez Bromeliaceae	< 20	Germination	Marques et al. (2014)
Curatella americana L. Dilleniaceae	35.2	Germination	Oliveira et al. (2012a)
Dalbergia densiflora Benth. Fabaceae	94.1 h	Germination	Ribeiro & Borghetti (2013)
Dalbergia miscolobium Benth. Fabaceae	134.3 – 148.9 h	Germination	Ribeiro et al. (2007)
Dimorphandra mollis Benth. Fabaceae	96.4 h	Germination	Ribeiro & Borghetti (2013)
Diplusodon hirsutus (Cham. & Schltdl.) A. DC. Lythraceae	6 – 27.48	Germination	Silveira et al. (2012a)
Diplusodon orbicularis Koehne Lythraceae	3.25 – 22.36	Germination	Silveira et al. (2012a)
Dipteryx alata	10.85	Emergence	Mendes-Rodrigues et al. (2019)
D. alata	139.2 h	Germination	Saboya & Borghetti (2012)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Discocactus bahiensis Britton & Rose Cactaceae	5.2 – 9.5	Germination	Nascimento et al. (2018)
Discocactus zehntneri subsp. *petr-halfarii* (Zachar) M.R. Santos & M.C. Machado Cactaceae	4.1 – 12.5	Germination	Nascimento et al. (2018)
Discocactus zehntner Britton & Rose subsp. *zehntneri* Cactaceae	4.9 – 6.8	Germination	Nascimento et al. (2018)
Duroia duckei Huber Rubiaceae (non-flooded)	72.1	Emergence	Conserva et al. (2017)
D. duckei (flooded)	69.7	Emergence	Conserva el at. (2017)
Dyckia saxatilis Mez Bromeliaceae	< 30	Germination	Marques et al. (2014)
Dyckia tuberosa (Vell.) Beer Bromeliaceae	3.72 – 40.51	Germination	Vieira et al. (2007)
Enterolobium contortisiliquum	44.4	Germination	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	41.92	Emergence	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	3.72 – 4.90	Germination	Ribeiro-Oliveira & Ranal (2016)
Enterolobium gummiferum (Mart.) J.F. Macbr. Fabaceae	882.5 h	Germination	Ribeiro et al. (2007)
Epiphyllum oxypetalum (DC.) Haw. Cactaceae	4.33 – 19.14	Germination	Ortiz et al. (2014)
Eriotheca gracilipes	< 35	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	< 15	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	16.2	Emergence	Mendes-Rodrigues et al. (2011a)
E. pubescens	116.7 h	Germination	Ribeiro & Borghetti (2013)
Esenbeckia leiocarpa Engl. Rutaceae	11.9 – 12.6	Germination	Souza & Válio (2001)
Eugenia inundata DC. Myrtaceae	9.7 – 10.3	Germination	Melo et al. (2015)
Eugenia rostrifolia D. Legrand Myrtaceae	17.53 – 55.66	Germination	Santos et al. (2004)
Eustachys distichophylla (Lag.) Nees Poaceae	5.6	Germination	Kolb et al. (2016)
Euterpe edulis Mart. Arecaceae	17.3 – 38.9	Germination	Roberto & Habermann (2010)
E. edulis	21.3 – 51.5	Germination	Roberto et al. (2011)
Ficus guaranitica Chodat Moraceae	7.9 – 12.8	Germination	Souza & Válio (2001)
Genipa americana	21.5 – 21.6	Germination	Melo et al. (2015)
G. americana	28.5	Emergence	Mendes-Rodrigues et al. (2019)
Godmania dardanoi (J.C. Gomes) A.H. Gentry Bignoniaceae	3.31 – 5.04	Germination	Ferreira et al. (2017c)
Guarea guidonia (non-flooded)	49.7	Emergence	Conserva et al. (2017)
G. guidonia (flooded)	73.1	Emergence	Conserva et al. (2017)
G. guidonia	81.83	Emergence	Mendes-Rodrigues et al. (2019)
Guazuma ulmifolia	159.37	Germination	Mendes-Rodrigues et al. (2019)
G. ulmifolia	88.87	Emergence	Mendes-Rodrigues et al. (2019)
G. ulmifolia	3.52	Germination	Ribeiro-Oliveira & Ranal (2016)
Gymnopogon foliosus (Willd.) Nees Poaceae	4.02	Germination	Kolb et al. (2016)
Handroanthus avellanedae	12.71	Emergence	Mendes-Rodrigues et al. (2019)
Handroanthus barbatus (E.Mey.) Mattos Bignoniaceae (non-flooded)	55.6	Emergence	Conserva et al. (2017)
H. barbatus (flooded)	32.2	Emergence	Conserva et al. (2017)
Handroanthus impetiginosus (Mart. ex DC.) Mattos Bignoniaceae	86.4 h	Germination	Ribeiro & Borghetti (2013)
H. roseoalbus	9.49	Emergence	Mendes-Rodrigues et al. (2019)
H. serratifolius	8.30	Germination	Mendes-Rodrigues et al. (2019)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
H. serratifolius	21.09	Emergence	Mendes-Rodrigues et al. (2019)
Handroanthus spongiosus (Rizzini) S. Grose Bignoniaceae	2 – 6.77	Germination	Ferreira et al. (2017b)
H. spongiosus	2.53 – 3.05	Germination	Ferreira et al. (2017a)
Harpalyce sp. Fabaceae	14.7 – 17.3	Germination	Zirondi et al. (2019)
Heterotis rotundifolia	77.85	Germination	Mendes-Rodrigues et al. (2019)
Himatanthus sucuuba (Spruce ex Müll. Arg.) Woodson Apocynaceae	10 – 11	Emergence	Ferreira et al. (2009)
Hymenaea courbaril	48.68	Emergence	Mendes-Rodrigues et al. (2019)
H. courbaril	20.0 – 23.3	Germination	Souza & Válio (2001)
Ilex inundata Poepp. ex Reissek Aquifoliaceae (non-flooded)	94.6	Emergence	Conserva et al. (2017)
I. inundata (flooded)	99.3	Emergence	Conserva et al. (2017)
Inga laurina	1.04 – 1.41	Germination	Mendes-Rodrigues et al. (2007)
I. laurina	20.77	Emergence	Mendes-Rodrigues et al. (2019)
I. sessilis	2.51	Germination	Mendes-Rodrigues et al. (2007)
I. sessilis	16.23	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda cuspidifolia	10.79	Germination	Mendes-Rodrigues et al. (2019)
J. cuspidifolia	74.31	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda puberula Cham. Bignoniaceae	206.3 h	Germination	Ribeiro & Borghetti (2013)
Kielmeyera coriacea Mart. & Zucc. Calophyllaceae	213.4 h	Germination	Ribeiro & Borghetti (2013)
K. coriacea	260 h	Germination	Saboya & Borghetti (2012)
K. coriacea	2.76 – 7.68	Germination	Santana et. al. (2010)
K. coriacea	11.69 – 20.74	Emergence	Santana et. al. (2010)
Laetia corymbulosa Spruce ex Benth. Salicaceae (non-flooded)	18.3	Emergence	Conserva et al. (2017)
L. corymbulosa (flooded)	12.2	Emergence	Conserva et al. (2017)
L. corymbulosa	58.7 – 72.8	Germination	Melo et al. (2015)
Lafoensia pacari	8.39 – 11.22	Germination	Ribeiro-Oliveira & Ranal (2016)
Laguncularia racemosa (L.) C.F. Gaertn. Combretaceae	5.9 – 12.3	Germination	Cavalcanti et al. (2007)
Lessingianthus bardanoides (Less.) H. Rob. Asteraceae	36 – 78	Germination	Cury et al. (2010)
Lessingianthus linearifolius (Less.) H. Rob. Asteraceae	5.99	Germination	Le Stradic et al. (2015)
Lithraea molleoides	12.49 – 118.81	Germination	Berger et al. (2014)
L. molleoides	12.42 – 48.24	Emergence	Berger et al. (2014)
L. molleoides	88.72	Germination	Mendes-Rodrigues et al. (2019)
L. molleoides	21	Emergence	Mendes-Rodrigues et al. (2019)
Luehea divaricata	22.02	Germination	Borges et al. (2007)
L. divaricata	55.36 – 62.88	Emergence	Borges et al. (2007)
L. divaricata	22.71	Germination	Mendes-Rodrigues et al. (2019)
L. divaricata	62.47	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium aculeatum	41.16	Emergence	Mendes-Rodrigues et al. (2019)
M. acutifolium	39.8	Emergence	Mendes-Rodrigues et al. (2019)
Marcetia taxifolia (A. St.-Hil.) DC. Melastomataceae	1.77 – 32.73	Germination	Silveira et al. (2004)
Matayba guianensis	4.37	Germination	Mendes-Rodrigues et al. (2019)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
M. guianensis	25.71	Emergence	Mendes-Rodrigues et al. (2019)
Melocactus sergipensis N.P. Taylor & M.V. Meiado Cactaceae	6.94	Germination	Meiado (2016)
Miconia albicans	14.57	Germination	Mendes-Rodrigues et al. (2019)
M. albicans	< 18	Germination	Sales et al. (2013)
M. albicans	10.4 – 17.8	Germination	Silveira (2012c)
Miconia alborufescens Naudin Melastomataceae	8.6 – 11.4	Germination	Silveira (2012c)
Miconia corallina Spring Melastomataceae	< 15	Germination	Silveira et al. (2012b)
M. ferruginata	9.50 – 17.62	Germination	Mendes-Rodrigues et al. (2010)
M. ferruginata	11.1 – 20.1	Germination	Silveira (2012c)
Miconia ibaguensis (Bonpl.) Triana Melastomataceae	14 – 20.3	Germination	Silveira (2012c)
Miconia irwinii Wurdack Melastomataceae	12.1 – 13.9	Germination	Silveira (2012c)
Miconia ligustroides (DC.) Naudin Melastomataceae	19.5 – 26.3	Germination	Silveira (2012c)
M. ligustroides	29	Germination	Silveira et al. (2013)
Miconia pepericarpa DC. Melastomataceae	22.8	Germination	Silveira et al. (2013)
Miconia stenostachya DC. Melastomataceae	16.6 – 22.5	Germination	Silveira (2012c)
Microlicia fasciculata	9.47 – 12.44	Germination	Ranal et al. (2016)
Microlicia sp. Melastomataceae	8.1 – 13	Germination	Zirondi et al. (2019)
Mimosa calodendron Mart. ex Benth. Fabaceae	7 – 26.3	Germination	Dayrell et al. (2015)
Mimosa echinocaula Benth. Fabaceae	4.6 – 6.2	Germination	Zirondi et al. (2019)
Mimosa foliolosa Benth. Fabaceae	< 15	Germination	Nativel et al. (2015)
M. foliolosa	< 15	Germination	Silveira et al. (2014)
M. foliolosa	7.2 – 9.6	Germination	Zirondi et al. (2019)
Mimosa leiocephala Benth. Fabaceae	8.4 – 9.8	Germination	Zirondi et al. (2019)
M. leiocephala	< 20	Germination	Zupo et al. (2016)
Mimosa maguirei Barneby Fabaceae	< 3	Germination	Nativel et al. (2015)
Mimosa pteridifolia Benth. Fabaceae	9 – 10.2	Germination	Zirondi et al. (2019)
Mimosa somnians Humb. & Bonpl. ex Willd. Fabaceae	6.5 – 6.7	Germination	Zirondi et al. (2019)
Muntingia calabura L. Muntingiaceae	7 – 20.47	Germination	Leite & Takaki (2001)
Myracrodruon urundeuva	9.45 – 11.04	Emergence	Berger et al. (2007)
M. urundeuva	1.75 – 2.78	Germination	Dorneles et al. (2005)
M. urundeuva	10.28	Emergence	Mendes-Rodrigues et al. (2019)
M. urundeuva	4.8	Germination	Mota et al. (2015)
M. urundeuva	2 – 15.9	Germination	Silva et al. (2002)
M. urundeuva	1.43 – 7.32	Germination	Virgens et al. (2012)
Myrcianthes pungens (O. Berg) D. Legrand Myrtaceae	20.52 – 44.38	Germination	Santos et al. (2004)
Myroxylon peruiferum L. f. Fabaceae	10.2 – 11.4	Germination	Souza & Válio (2001)
Myrsine umbellata	68.76	Emergence	Mendes-Rodrigues et al. (2019)
Neoregelia bahiana (Ule) L. B. Sm. Bromeliaceae	< 20	Germination	Marques et al. (2014)
Neoregelia cruenta (R. Graham) L.B. Sm. Bromeliaceae	3.5	Germination	Mantovani & Iglesias (2010)
Ocotea cymbarum Kunth Lauraceae (non-flooded)	37.2	Emergence	Conserva et al. (2017)
O. cymbarum (flooded)	23.1	Emergence	Conserva et al. (2017)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Ormosia arborea	25.69	Germination	Mendes-Rodrigues et al. (2019)
O. arborea	80.42	Emergence	Mendes-Rodrigues et al. (2019)
Pachira glabra	4.31 – 6.73	Germination	Mendes-Rodrigues et al. (2019)
P. glabra	17 – 19.05	Emergence	Mendes-Rodrigues et al. (2019)
Pachystroma longifolium (Nees) I. M. Johnst. Euphorbiaceae	9.2 – 9.8	Germination	Souza & Válio (2001)
Paepalanthus chiquitensis	15.8	Germination	Gonçalves-Magalhães et al. (2021)
Parkia discolor Spruce ex Benth. Fabaceae	5.2	Germination	Melo et al. (2015)
Paspalum cordatum Hack. Poaceae	16.2	Germination	Kolb et al. (2016)
Paspalum hyalinum Nees ex Trin. Poaceae	15.5	Germination	Kolb et al. (2016)
Peltophorum dubium (Spreng.) Taub. Fabaceae	2.65 – 3.86	Germination	Perez et al. (2001)
Pereskia grandifolia Haw. Cactaceae	5.1 – 5.3	Germination	Oliveira et al. (2017)
Pilosocereus catingicola (Gürke) Byles & Rowley Cactaceae	3.7 – 6.8	Germination	Lima & Meiado ((2017)
Pilosocereus gounellei (F.A.C. Weber) Byles & Rowley Cactaceae	5 – 7.7	Germination	Abud et al. (2012)
P. gounellei	12.4	Germination	Gomes et al. (2016)
Piptadenia gonoacantha	4.6 – 5.5	Germination	Souza & Válio (2001)
Piranhea trifoliata Baill. Picrodendraceae (non-flooded)	22.9	Emergence	Conserva et al. (2017)
P. trifoliata (flooded)	8.8	Emergence	Conserva et al. (2017)
Plathymenia reticulata	16.24	Germination	Mendes-Rodrigues et al. (2019)
P. reticulata	47.06	Emergence	Mendes-Rodrigues et al. (2019)
P. reticulata	352.4 – 468.1 h	Germination	Ribeiro et al. (2007)
Platypodium elegans	27.25	Emergence	Mendes-Rodrigues et al. (2019)
Pleroma cardinale (Bonpl.) Triana Melastomataceae	6.9 –15.0	Germination	Zirondi et al. (2019)
Pleroma frigidulum (Schrank et Mart. ex DC.) Triana Melastomataceae	7.8 – 15.4	Germination	Zirondi et al. (2019)
Pleroma stenocarpum (Schrank et Mart. ex DC.) Triana Melastomataceae	9.7 – 10.9	Germination	Zirondi et al. (2019)
Pouteria glomerata (Miq.) Radlk. Sapotaceae	154.5 – 188.5	Germination	Melo et al. (2015)
P. torta	61.63	Emergence	Mendes-Rodrigues et al. (2019)
Pseudananas sagenarius (Arruda) Camargo Bromeliaceae	13.5 – 23.73	Germination	Vieira & Silveira (2010)
Pseudobombax grandiflorum (Cav.) A. Robyns Malvaceae	7.1 – 7.5	Germination	Souza & Válio (2001)
P. longiflorum	12.17	Germination	Mendes-Rodrigues et al. (2011b)
Pseudobombax munguba (Mart.) Dugand Malvaceae (non-flooded)	5.5	Emergence	Conserva et al. (2017)
P. munguba (flooded)	7.6	Emergence	Conserva et al. (2017)
P. munguba	2.2 – 7.1	Germination	Melo et al. (2015)
P. tomentosum	11.68	Germination	Mendes-Rodrigues et al. (2011b)
Psidium cattleyanum Sabine Myrtaceae	32.91 – 44.55	Germination	Santos et al. (2004)
Psidium guineense Sw. Myrtaceae	10 – 42.25	Germination	Santos et al. (2015)
P. guineense	21.5 – 41.9	Germination	Santos et al. (2016)
Psychotria vellosiana Benth. Rubiaceae	22 – 88	Germination	Araújo & Cardoso (2006)
Pyrostegia venusta (Ker Gawl.) Miers Bignoniaceae	< 25	Germination	Rossatto & Kolb (2010)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Qualea grandiflora Mart. Vochysiaceae	245 h	Germination	Ribeiro & Borghetti (2013)
Racinaea aerisincola (Mez) M.A. Spencer & L.B. Sm. Bromeliaceae	< 25	Germination	Marques et al. (2014)
Rhipsalis floccosa Salm-Dyck ex Pfeiff. Cactaceae	4.86 – 16.09	Germination	Lone et al. (2016)
Rhipsalis pilocarpa Loefgr. Cactaceae	13.61 – 19.49	Germination	Lone et al. (2016)
Rhipsalis teres (Vell.) Steud. Cactaceae	9.50 – 18.29	Germination	Lone et al. (2016)
Roupala montana Aubl. Proteaceae	529.3 h	Germination	Ribeiro & Borghetti (2013)
Schefflera morototoni	48.40 – 51.41	Germination	Anastácio et al. (2010)
S. morototoni	47.13 – 116.96	Germination	Ribeiro-Oliveira & Ranal (2016)
Schizolobium parahyba (Vell.) Blake Fabaceae	5.5 – 6.4	Germination	Souza & Válio (2001)
Senna macranthera (DC. ex Collad.) H.S. Irwin & Barneby Fabaceae	2.17 – 19.60	Germination	Cassaro-Silva (2001)
S. macranthera	43.7 -71.5	Germination	Souza & Válio (2001)
S. silvestris	35.97	Emergence	Mendes-Rodrigues et al. (2019)
Simaba guianensis Aubl. Simaroubaceae	59.8 – 110.8	Germination	Melo et al. (2015)
Solanum granuloso-leprosum Dunal Solanaceae	66.4	Germination	Souza & Válio (2001)
S. lycocarpum	10 – 12	Germination	Souza et al. (2020)
Sterculia striata	29.20	Emergence	Mendes-Rodrigues et al. (2019)
Streptocalyx floribunda (Mart. ex Schult. & Schult. f.) Mez Bromeliaceae	106.73 – 364.91 h	Germination	Pinheiro & Borghetti (2003)
Stryphnodendron adstringens (Mart.) Coville Fabaceae	113.8 – 120.2 h	Germination	Ribeiro et al. (2007)
Styrax camporum Pohl Styracaceae	27.3 – 103.7	Germination	Simão et al. (2013)
S. camporum	34.5 – 44.8	Emergence	Simão et al. (2013)
Syagrus oleracea	117.40	Emergence	Mendes-Rodrigues et al. (2019)
Tabebuia aurea	2.03 – 7.13	Germination	Cabral et al. (2003)
T. aurea	13.63	Emergence	Mendes-Rodrigues et al. (2019)
T. aurea	56.7 h	Germination	Ribeiro & Borghetti (2013)
Tachigali rubiginosa (Mart. ex Tul.) Oliveira-Filho Fabaceae	150.8 h	Germination	Ribeiro & Borghetti (2013)
Tacinga inamoena (K. Schum.) N.P. Taylor & Stuppy Cactaceae	18.9	Germination	Nascimento et al. (2015)
Tapirira guianensis	2.03	Germination	Mendes-Rodrigues et al. (2019)
T. guianensis	15.83	Emergence	Mendes-Rodrigues et al. (2019)
Terminalia argentea	73.14	Emergence	Mendes-Rodrigues et al. (2019)
T. brasiliensis	35	Emergence	Mendes-Rodrigues et al. (2019)
Tibouchina cardinalis (Humb. & Bonpl.) Cogn. Melastomataceae	< 30	Germination	Silveira et al. (2012b)
T. granulosa	9.83	Germination	Mendes-Rodrigues et al. (2019)
Tibouchina melastomoides (Naudin) Cogn. Melastomataceae	11.9 – 25.4	Germination	Zirondi et al. (2019)
T. pulchra	13.77	Germination	Mendes-Rodrigues et al. (2019)
Tillandsia gardneri Lindl. Bromeliaceae	< 10	Germination	Marques et al. (2014)
Tillandsia stricta Sol. Bromeliaceae	< 10	Germination	Marques et al. (2014)
Trema micrantha	231.89	Germination	Mendes-Rodrigues et al. (2019)
T. micrantha	67.8	Germination	Souza & Válio (2001)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Vellozia caruncularis Mart. ex Seub. Velloziaceae	5.28	Germination	Le Stradic et al. (2015)
Vellozia epidendroides Mart. ex Schult. & Schult. f. Velloziaceae	9.1 – 25.0	Germination	Garcia et al. (2007)
V. epidendroides	13.93	Germination	Le Stradic et al. (2015)
Vellozia leptopetala Goethart & Henrard Velloziaceae	11.1 – 42.2	Germination	Garcia et al. (2007)
Vellozia resinosa Mart. ex Schult. & Schult. f. Velloziaceae	7.04	Germination	Le Stradic et al. (2015)
Vellozia variabilis Mart. ex Schult. & Schult. f. Velloziaceae	5.86	Germination	Le Stradic et al. (2015)
Virola sebifera	24.03	Germination	Mendes-Rodrigues et al. (2019)
V. sebifera	57.73	Emergence	Mendes-Rodrigues et al. (2019)
Vriesea bituminosa Wawra Bromeliaceae	< 25	Germination	Marques et al. (2014)
Vriesea crassa Mez Bromeliaceae	< 15	Germination	Marques et al. (2014)
Vriesea friburgensis Mez Bromeliaceae	< 5	Germination	Marques et al. (2014)
Vriesea minarum L. B. Sm. Bromeliaceae	< 15	Germination	Marques et al. (2014)
Vriesea neoglutinosa Mez Bromeliaceae	3.1	Germination	Mantovani & Iglesias (2010)
Vriesea pardalina Mez Bromeliaceae	< 20	Germination	Marques et al. (2014)
Xyris cipoensis L.B. Sm. & Downs Xyridaceae	9 – 14.9	Germination	Abreu & Garcia (2005)
Xyris longiscapa L.A. Nilsson Xyridaceae	7.7 – 18.4	Germination	Abreu & Garcia (2005)
Xyris obtusiuscula L. A. Nilsson Xyridaceae	15.51	Germination	Le Stradic et al. (2015)
Xyris pilosa Kunth Xyridaceae	10.24	Germination	Le Stradic et al. (2015)
Xyris platystachya L. A. Nilsson ex Malme Xyridaceae	5.6 – 16.2	Germination	Abreu & Garcia (2005)
Xyris trachyphylla Mart. Xyridaceae	5.7 – 17.6	Germination	Abreu & Garcia (2005)
Coefficient of variation of germination/emergence time (%)			
Acacia polyphylla	58.75	Germination	Mendes-Rodrigues et al. (2019)
A. polyphylla	45.5	Emergence	Mendes-Rodrigues et al. (2019)
Aegiphila sellowiana	16	Germination	Mendes-Rodrigues et al. (2019)
A. sellowiana	26.93	Emergence	Mendes-Rodrigues et al. (2019)
Alibertia sessilis	33.56	Germination	Mendes-Rodrigues et al. (2019)
A. sessilis	7.78	Emergence	Mendes-Rodrigues et al. (2019)
Anacardium humile	34.33	Emergence	Carvalho et al. (2005)
Anadenanthera colubrina	29.5 – 58.8	Germination	Dorneles et al. (2013)
A. colubrina	28.5 – 54.9	Emergence	Dorneles et al. (2013)
A. colubrina	45.42	Germination	Mendes-Rodrigues et al. (2019)
A. colubrina	32.05	Emergence	Mendes-Rodrigues et al. (2019)
A. peregrina	25.18	Germination	Mendes-Rodrigues et al. (2019)
A. peregrina	38.95	Emergence	Mendes-Rodrigues et al. (2019)
Aspidosperma cylindrocarpon	17.03	Emergence	Mendes-Rodrigues et al. (2019)
Astronium fraxinifolium	40.46	Germination	Mendes-Rodrigues et al. (2019)
A. fraxinifolium	18.24	Emergence	Mendes-Rodrigues et al. (2019)
Bombax ceiba	22.45	Germination	Mendes-Rodrigues et al. (2019)
B. ceiba	18.85	Emergence	Mendes-Rodrigues et al. (2019)
Calycophyllum spruceanum (non-flooded)	24.3	Emergence	Conserva et al. (2017)
C. spruceanum (flooded)	12	Emergence	Conserva et al. (2017)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Cariniana estrellensis	34.09	Germination	Mendes-Rodrigues et al. (2019)
C. estrellensis	11.85	Emergence	Mendes-Rodrigues et al. (2019)
Casearia mariquitensis	22.43	Emergence	Mendes-Rodrigues et al. (2019)
Cecropia pachystachya	15.43	Germination	Mendes-Rodrigues et al. (2019)
C. pachystachya	14.16 – 33.41	Germination	Ribeiro-Oliveira & Ranal (2016)
Cedrela fissilis	16.47	Emergence	Mendes-Rodrigues et al. (2019)
C. odorata (non-flooded)	27.7	Emergence	Conserva et al. (2017)
C. odorata (flooded)	21.3	Emergence	Conserva et al. (2017)
Ceiba speciosa	32.65	Germination	Mendes-Rodrigues et al. (2019)
C. speciosa	19.49	Emergence	Mendes-Rodrigues et al. (2019)
C. speciosa	40.36 – 77.76	Germination	Ribeiro-Oliveira & Ranal (2016)
Copaifera langsdorffii	30.71	Emergence	Mendes-Rodrigues et al. (2019)
C. langsdorffii	12.70 – 13.81	Emergence	Pereira et al. (2009)
Dipteryx alata	26.47	Emergence	Mendes-Rodrigues et al. (2019)
Duroia duckei (non-flooded)	38.5	Emergence	Conserva et al. (2017)
D. duckei (flooded)	34.2	Emergence	Conserva et al. (2017)
Enterolobium contortisiliquum	79.21	Germination	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	63.79	Emergence	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	16.28 – 20.66	Germination	Ribeiro-Oliveira & Ranal (2016)
Eriotheca gracilipes	< 50	Germination	Mendes-Rodrigues et al. (2011a)
Eriotheca pubescens	< 55	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	21.7	Emergence	Mendes-Rodrigues et al. (2011a)
Genipa americana	31.04	Emergence	Mendes-Rodrigues et al. (2019)
Guarea guidonia (non-flooded)	37	Emergence	Conserva et al. (2017)
G. guidonia (flooded)	11.4	Emergence	Conserva et al. (2017)
G. guidonia	14.3	Emergence	Mendes-Rodrigues et al. (2019)
Guazuma ulmifolia	76.87	Germination	Mendes-Rodrigues et al. (2019)
G. ulmifolia	45.5	Emergence	Mendes-Rodrigues et al. (2019)
G. ulmifolia	89.41 – 475.66	Germination	Ribeiro-Oliveira & Ranal (2016)
Handroanthus avellanedae	23.78	Emergence	Mendes-Rodrigues et al. (2019)
H. barbatus (non-flooded)	34.2	Emergence	Conserva et al. (2017)
H. barbatus (flooded)	21.6	Emergence	Conserva et al. (2017)
H. roseoalbus	20.09	Emergence	Mendes-Rodrigues et al. (2019)
H. serratifolius	41.94	Germination	Mendes-Rodrigues et al. (2019)
H. serratifolius	12.82	Emergence	Mendes-Rodrigues et al. (2019)
Heterotis rotundifolia	43.44	Germination	Mendes-Rodrigues et al. (2019)
Hymenaea courbaril	126.33	Emergence	Mendes-Rodrigues et al. (2019)
Ilex inundata (non-flooded)	7.1	Emergence	Conserva et al. (2017)
I. inundata (flooded)	10.7	Emergence	Conserva et al. (2017)
Inga laurina	34.52	Germination	Mendes-Rodrigues et al. (2007)
I. laurina	35.83	Emergence	Mendes-Rodrigues et al. (2019)
I. sessilis	24.21	Germination	Mendes-Rodrigues et al. (2007)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
I. sessilis	37.77	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda cuspidifolia	49.7	Germination	Mendes-Rodrigues et al. (2019)
J. cuspidifolia	14.49	Emergence	Mendes-Rodrigues et al. (2019)
Kielmeyera coriacea	25.40 – 56.01	Germination	Santana et. al. (2010)
K. coriacea	17.52 – 27.68	Emergence	Santana et. al. (2010)
Laetia corymbulosa (non-flooded)	17.7	Emergence	Conserva et al. (2017)
L. corymbulosa (flooded)	19.8	Emergence	Conserva et al. (2017)
Lafoensia pacari	22.98 – 100	Germination	Ribeiro-Oliveira & Ranal (2016)
Lithraea molleoides	31.51 – 87.43	Germination	Berger et al. (2014)
L. molleoides	28.36 – 70.63	Emergence	Berger et al. (2014)
L. molleoides	50.95	Germination	Mendes-Rodrigues et al. (2019)
L. molleoides	44.84	Emergence	Mendes-Rodrigues et al. (2019)
Luehea divaricata	88	Germination	Borges et al. (2007)
L. divaricata	22.27 – 43.59	Emergence	Borges et al. (2007)
L. divaricata	73.51	Germination	Mendes-Rodrigues et al. (2019)
L. divaricata	22.71	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium aculeatum	24.11	Emergence	Mendes-Rodrigues et al. (2019)
M. acutifolium	17.34	Emergence	Mendes-Rodrigues et al. (2019)
Matayba guianensis	37.25	Germination	Mendes-Rodrigues et al. (2019)
M. guianensis	86.89	Emergence	Mendes-Rodrigues et al. (2019)
Miconia albicans	52.82	Germination	Mendes-Rodrigues et al. (2019)
M. ferruginata	18.48 – 50.19	Germination	Mendes-Rodrigues et al. (2010)
Microlicia fasciculata	5.20 – 29.57	Germination	Ranal et al. (2016)
Myracrodruon urundeuva	11.20 – 20.71	Emergence	Berger et al. (2007)
M. urundeuva	22.38 – 32.98	Germination	Dorneles et al. (2005)
M. urundeuva	14.14	Emergence	Mendes-Rodrigues et al. (2019)
Myrsine umbellata	24.62	Emergence	Mendes-Rodrigues et al. (2019)
Ocotea cymbarum (non-flooded)	40.2	Emergence	Conserva et al. (2017)
O. cymbarum (flooded)	33.6	Emergence	Conserva et al. (2017)
Ormosia arborea	60.76	Germination	Mendes-Rodrigues et al. (2019)
O. arborea	21.3	Emergence	Mendes-Rodrigues et al. (2019)
Pachira glabra	34.75 – 35.52	Germination	Mendes-Rodrigues et al. (2019)
P. glabra	26.37 – 30.84	Emergence	Mendes-Rodrigues et al. (2019)
Paepalanthus chiquitensis	66	Germination	Gonçalves-Magalhães et al. (2021)
Piranhea trifoliata (non-flooded)	17.5	Emergence	Conserva et al. (2017)
P. trifoliata (flooded)	36	Emergence	Conserva et al. (2017)
Plathymenia reticulata	151.12	Germination	Mendes-Rodrigues et al. (2019)
P. reticulata	46.94	Emergence	Mendes-Rodrigues et al. (2019)
Platypodium elegans	44.61	Emergence	Mendes-Rodrigues et al. (2019)
Pouteria torta	19.29	Emergence	Mendes-Rodrigues et al. (2019)
Pseudobombax longiflorum	30.17	Germination	Mendes-Rodrigues et al. (2011b)
P. munguba (non-flooded)	35.2	Emergence	Conserva et al. (2017)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
P. munguba (flooded)	24.4	Emergence	Conserva et al. (2017)
P. tomentosum	22.25	Germination	Mendes-Rodrigues et al. (2011b)
Schefflera morototoni	12.92 – 14.30	Germination	Anastácio et al. (2010)
S. morototoni	28.08 – 38.48	Germination	Ribeiro-Oliveira & Ranal (2016)
Senna silvestris	60.26	Emergence	Mendes-Rodrigues et al. (2019)
Solanum lycocarpum	82.13	Germination	Souza et al. (2020)
Sterculia striata	29.45	Emergence	Mendes-Rodrigues et al. (2019)
Syagrus oleracea	8.92	Emergence	Mendes-Rodrigues et al. (2019)
Tabebuia aurea	24.26	Emergence	Mendes-Rodrigues et al. (2019)
Tapirira guianensis	10.53	Germination	Mendes-Rodrigues et al. (2019)
T. guianensis	15.97	Emergence	Mendes-Rodrigues et al. (2019)
Terminalia argentea	14.52	Emergence	Mendes-Rodrigues et al. (2019)
T. brasiliensis	15.91	Emergence	Mendes-Rodrigues et al. (2019)
Tibouchina granulosa	42.65	Germination	Mendes-Rodrigues et al. (2019)
T. pulchra	56.04	Germination	Mendes-Rodrigues et al. (2019)
Virola sebifera	23.30	Germination	Mendes-Rodrigues et al. (2019)
V. sebifera	10.25	Emergence	Mendes-Rodrigues et al. (2019)
Mean germination/emergence velocity (day^{-1})			
Acca sellowiana	0.030 – 0.049	Germination	Santos et al. (2004)
Aechmea nudicaulis	0.23	Germination	Mantovani & Iglesias (2010)
A. nudicaulis	0.0028 – 0.0133 h^{-1}	Germination	Pinheiro & Borghetti (2003)
Amburana cearensis	0.09	Emergence	Santos & Meiado (2017)
Anacardium humile	0.0519	Emergence	Carvalho et al. (2005)
Anadenanthera colubrina	0.2363 – 0.3153	Germination	Dorneles et al. (2013)
A. colubrina	0.1331 – 0.1643	Emergence	Dorneles et al. (2013)
Bowdichia virgilioides	0.56	Germination	Silva et al. (2001)
Calycophyllum spruceanum (non-flooded)	0.110	Emergence	Conserva et al. (2017)
C. spruceanum (flooded)	0.099	Emergence	Conserva et al. (2017)
Campomanesia guazumifolia	0.006 – 0.012	Germination	Santos et al. (2004)
C. xanthocarpa	0.056 – 0.110	Germination	Santos et al. (2004)
Cecropia glaziovii	0.245 – 0.521	Germination	Godoi & Takaki (2005)
Cecropia hololeuca Miq. Urticaceae	< 0.07	Germination	Godoi & Takaki (2004)
C. pachystachya	0.0725 – 0.0900	Germination	Ribeiro-Oliveira & Ranal (2016)
Cedrela odorata (non-flooded)	0.138	Emergence	Conserva et al. (2017)
C. odorata (flooded)	0.082	Emergence	Conserva et al. (2017)
Ceiba speciosa	0.1325 – 0.1975	Germination	Ribeiro-Oliveira & Ranal (2016)
Cereus fernambucensis Lem. Cactaceae	0.074 – 0.104	Germination	Almeida et al. (2009)
Cereus pernambucensis Lem. Cactaceae	0.078 – 0.150	Germination	Socolowski et al. (2010)
Clausena excavata	0.08 – 0.24	Germination	Vieira et al. (2010)
C. excavata	0.0429 – 0.0424	Emergence	Vieira et al. (2010)
Coleocephalocereus fluminensis (Miq.) Backeb. Cactaceae	0.100 – 0.118	Germination	Almeida et al. (2009)
Copaifera langsdorffii	0.0267 – 0.0268	Emergence	Pereira et al. (2009)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Dalbergia nigra (Vell.) Allemão ex Benth. Fabaceae	< 0.13	Germination	Ferraz-Grande & Takaki (2001)
Duroia duckei (non-flooded)	0.014	Emergence	Conserva et al. (2017)
D. duckei (flooded)	0.014	Emergence	Conserva et al. (2017)
Dyckia tuberosa	0.02 – 0.32	Germination	Vieira et al. (2007)
Enterolobium contortisiliquum	0.2025 – 0.2750	Germination	Ribeiro-Oliveira & Ranal (2016)
Epiphyllum phyllanthus (L.) Haw. Cactaceae	< 0.5	Germination	Simão et al. (2010b)
Eremanthus elaeagnus	0.023 – 0.056	Germination	Velten & Garcia (2005)
E. glomerulatus	0.07 – 0.034	Germination	Velten & Garcia (2005)
E. incanus	0.010 – 0.167	Germination	Velten & Garcia (2005)
Erythrina verna Vell. Fabaceae	0.06 – 0.14	Germination	Demuner et al. (2008)
Eugenia rostrifolia	0.018 – 0.057	Germination	Santos et al. (2004)
Euterpe edulis	0.024 – 0.058	Germination	Roberto & Habermann (2010)
E. edulis	0.019 – 0.06	Germination	Roberto et al. (2011)
Guarea guidonia (non-flooded)	0.020	Emergence	Conserva et al. (2017)
G. guidonia (flooded)	0.014	Emergence	Conserva et al. (2017)
Guazuma ulmifolia	0.2025 – 0.3850	Germination	Ribeiro-Oliveira & Ranal (2016)
Handroanthus barbatus (non-flooded)	0.019	Emergence	Conserva et al. (2017)
H. barbatus (flooded)	0.031	Emergence	Conserva et al. (2017)
Hylocereus setaceus (Salm-Dyck) R. Bauer Cactaceae	< 0.4	Germination	Simão et al. (2007)
H. setaceus	< 0.35	Germination	Simão et al. (2010a)
Ilex inundata (non-flooded)	0.011	Emergence	Conserva et al. (2017)
I. inundata (flooded)	0.010	Emergence	Conserva et al. (2017)
Inga laurina	0.68 – 0.96	Germination	Mendes-Rodrigues et al. (2007)
I. sessilis	0.40	Germination	Mendes-Rodrigues et al. (2007)
Jacaranda mimosifolia D. Don Bignoniaceae	< 0.30	Germination	Socolowski & Takaki (2004)
Laetia corymbulosa (non-flooded)	0.056	Emergence	Conserva et al. (2017)
L. corymbulosa (flooded)	0.881	Emergence	Conserva et al. (2017)
Lafoensia pacari	0.0900 – 0.0975	Germination	Ribeiro-Oliveira & Ranal (2016)
Lithraea molleoides	0.0084 – 0.0839	Germination	Berger et al. (2014)
L. molleoides	0.0207 – 0.8320	Emergence	Berger et al. (2014)
Luehea divaricata	0.048	Germination	Borges et al. (2007)
L. divaricata	0.015 – 0.018	Emergence	Borges et al. (2007)
Macroptilium atropurpureum (Sessé & Moc. ex DC.) Urb. Fabaceae	< 0.9	Germination	Lima et al. (2018)
Miconia albicans	0.05 – 0.13	Germination	Carreira & Zaidan (2007)
M. ferruginata	0.056 – 0.108	Germination	Mendes-Rodrigues et al. (2010)
Miconia langsdorffii Cogn. Melastomataceae	0.04 – 0.05	Germination	Carreira & Zaidan (2007)
Miconia rubiginosa (Bonpl.) DC. Melastomataceae	0.02 – 0.10	Germination	Carreira & Zaidan (2007)
M. stenostachya	0.06 – 0.14	Germination	Carreira & Zaidan (2007)
Miconia theaezans (Bonpl.) Cogn. Melastomataceae	0.034 – 0.118	Germination	Godoi & Takaki (2007)
Microlicia fasciculata	0.08 – 0.11	Germination	Ranal et al. (2016)
Muntingia calabura	< 0.2	Germination	Leite & Takaki (2001)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Myracrodruon urundeuva	0.0907 – 0.1025	Emergence	Berger et al. (2007)
M. urundeuva	0.362 – 0.578	Germination	Dorneles et al. (2005)
M. urundeuva	< 0.50	Germination	Silva et al. (2002)
M. urundeuva	0.137 – 0.702	Germination	Virgens et al. (2012)
Myrcianthes pungens	0.022 – 0.049	Germination	Santos et al. (2004)
Neoregelia cruenta	0.27	Germination	Mantovani & Iglesias (2010)
Ocotea cymbarum (non-flooded)	0.027	Emergence	Conserva et al. (2017)
O. cymbarum (flooded)	0.046	Emergence	Conserva et al. (2017)
Ocotea pulchella (Nees & Mart.) Mez Lauraceae	< 0.06	Germination	Pires et al. (2009)
Peltophorum dubium	0.26 – 0.38	Germination	Perez et al. (2001)
Pereskia grandifolia	0.19	Germination	Oliveira et al. (2017)
Pilosocereus arrabidae (Lem.) Byles & Rowley Cactaceae	0.119 – 0.170	Germination	Almeida et al. (2009)
Pilosocereus ulei (K. Schum.) Byles & G.D. Rowley Cactaceae	0.118 – 0.153	Germination	Almeida et al. (2009)
Piranhea trifoliata (non-flooded)	0.044	Emergence	Conserva et al. (2017)
P. trifoliata (flooded)	0.115	Emergence	Conserva et al. (2017)
Pseudobombax longiflorum	0.08	Germination	Mendes-Rodrigues et al. (2011b)
P. munguba (non-flooded)	0.180	Emergence	Conserva et al. (2017)
P. munguba (flooded)	0.135	Emergence	Conserva et al. (2017)
P. tomentosum	0.09	Germination	Mendes-Rodrigues et al. (2011b)
Psidium cattleyanum	0.022 – 0.030	Germination	Santos et al. (2004)
Psidium guajava L. Myrtaceae	0.033 – 0.107	Germination	Sugahara & Takaki (2004)
P. guineense	0.01 – 0.05	Germination	Santos et al. (2015)
P. guineense	0.027 – 0.059	Germination	Santos et al. (2016)
Racinaea aerisincola	< 0.2	Germination	Duarte et al. (2018)
Schefflera morototoni	0.0085 – 0.0229	Germination	Ribeiro-Oliveira & Ranal (2016)
Schizocentron elegans (Schltdl.) Meisn. Melastomataceae	0.04 – 0.09	Germination	Carreira & Zaidan (2007)
Senna macranthera	0.04 – 0.46	Germination	Cassaro-Silva (2001)
Senna spectabilis (DC.) H.S. Irwin & Barneby Fabaceae	Near to 0.32	Germination	Jeller & Perez (2001)
Solanum lycocarpum	0.05 – 0.10	Germination	Souza et al. (2020)
Streptocalyx floribunda	0.0027 – 0.0094 h^{-1}	Germination	Pinheiro & Borghetti (2003)
Styrax camporum	< 0.04	Germination	Simão et al. (2013)
S. camporum	0.022 – 0.029	Emergence	Simão et al. (2013)
Syngonanthus aciphyllus (Bong.) Ruhland Eriocaulaceae	< 0.2	Germination	Oliveira & Garcia (2011)
Syngonanthus anthemidiflorus (Bong.) Ruhland Eriocaulaceae	< 0.3	Germination	Oliveira & Garcia (2011)
Syngonanthus bisulcatus (Körn.) Ruhland Eriocaulaceae	< 0.1	Germination	Oliveira & Garcia (2011)
Syngonanthus caulescens (Poir.) Ruhland Eriocaulaceae	< 0.05	Germination	Oliveira & Garcia (2011)
Syngonanthus elegantulus Ruhland Eriocaulaceae	0.046 – 0.111	Germination	Oliveira & Garcia (2005)
Syngonanthus gracilis (Bong.) Ruhland Eriocaulaceae	< 0.3	Germination	Oliveira & Garcia (2011)
Syngonanthus vernonioides (Kunth) Ruhland Eriocaulaceae	< 0.1	Germination	Oliveira & Garcia (2011)
Syngonanthus verticillatus (Bong.) Ruhland Eriocaulaceae	< 0.3	Germination	Oliveira & Garcia (2011)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Tabebuia aurea	0.31 – 0.50	Germination	Cabral et al. (2003)
Tabebuia rosea (Bertol.) Bertero ex A. DC. Bignoniaceae	< 0.32	Germination	Socolowski & Takaki (2007)
Tecoma stans (L.) Juss. ex Kunth Bignoniaceae	< 0.5	Germination	Socolowski et al. (2008)
Tibouchina mutabilis (Vell.) Cogn. Melastomataceae	< 0.08	Germination	Simão & Takaki (2008)
Tillandsia gardneri	< 0.4	Germination	Duarte et al. (2018)
Vriesea bituminosa	< 0.2	Germination	Duarte et al. (2018)
V. friburgensis	< 0.8	Germination	Duarte et al. (2018)
V. neoglutinosa	0.31	Germination	Mantovani & Iglesias (2010)
V. pardalina	< 0.2	Germination	Duarte et al. (2018)
	Uncertainty (bit)		
Acacia polyphylla	2.70	Germination	Mendes-Rodrigues et al. (2019)
A. polyphylla	2.69	Emergence	Mendes-Rodrigues et al. (2019)
Aechmea nudicaulis	1.66	Germination	Mantovani & Iglesias (2010)
A. nudicaulis	1.53 – 1.87	Germination	Marques et al. (2014)
Aegiphila sellowiana	2.11	Germination	Mendes-Rodrigues et al. (2019)
A. sellowiana	4.24	Emergence	Mendes-Rodrigues et al. (2019)
Alibertia sessilis	3.10	Germination	Mendes-Rodrigues et al. (2019)
A. sessilis	2.63	Emergence	Mendes-Rodrigues et al. (2019)
Anacardium humile	3.715	Emergence	Carvalho et al. (2005)
Anadenanthera colubrina	1.5 – 2.4	Germination	Dorneles et al. (2013)
A. colubrina	2 – 2.6	Emergence	Dorneles et al. (2013)
A. colubrina	1.93	Germination	Mendes-Rodrigues et al. (2019)
A. colubrina	2.78	Emergence	Mendes-Rodrigues et al. (2019)
A. peregrina	1.90	Germination	Mendes-Rodrigues et al. (2019)
A. peregrina	1.85	Emergence	Mendes-Rodrigues et al. (2019)
Annona emarginata	2.34 – 2.92	Germination	Corsato et al. (2012)
Aristida torta	0.40	Germination	Le Stradic et al. (2015)
Aspidosperma cylindrocarpon	3.55	Emergence	Mendes-Rodrigues et al. (2019)
Astronium fraxinifolium	1.76	Germination	Mendes-Rodrigues et al. (2019)
A. fraxinifolium	2.83	Emergence	Mendes-Rodrigues et al. (2019)
Bombax ceiba	1.93	Germination	Mendes-Rodrigues et al. (2019)
B. ceiba	2.45	Emergence	Mendes-Rodrigues et al. (2019)
Cariniana estrellensis	3.80	Germination	Mendes-Rodrigues et al. (2019)
C. estrellensis	3.47	Emergence	Mendes-Rodrigues et al. (2019)
Casearia mariquitensis	3.05	Germination	Mendes-Rodrigues et al. (2019)
Cecropia pachystachya	1.61	Germination	Mendes-Rodrigues et al. (2019)
Cedrela fissilis	3.68	Emergence	Mendes-Rodrigues et al. (2019)
Ceiba speciosa	3.05	Germination	Mendes-Rodrigues et al. (2019)
C. speciosa	2.72	Emergence	Mendes-Rodrigues et al. (2019)
Cereus jamacaru	1.5 – 3.4	Germination	Meiado et al. (2010)
C. pernambucensis	2.290 – 3.622	Germination	Socolowski et al. (2010)
Clausena excavata	2.20 – 2.88	Germination	Vieira et al. (2010)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
C. excavata	3.10 – 3.30	Emergence	Vieira et al. (2010)
Collaea cipoensis	< 1.5	Germination	Nativel et al. (2015)
Copaifera langsdorffii	3.74	Emergence	Mendes-Rodrigues et al. (2019)
C. langsdorffii	3.1067 – 3.1199	Emergence	Pereira et al. (2009)
Cryptanthus schwackeanus	1.83	Germination	Marques et al. (2014)
Dyckia saxatilis	1.31	Germination	Marques et al. (2014)
Dipteryx alata	2.91	Emergence	Mendes-Rodrigues et al. (2019)
Discocactus bahiensis	2.4 – 3.0	Germination	Nascimento et al. (2018)
D. zehntneri subsp. *petr-halfarii*	0.1 – 3.0	Germination	Nascimento et al. (2018)
D. zehntner subsp. *zehntneri*	1.4 – 2.4	Germination	Nascimento et al. (2018)
Dyckia saxatilis	1.31	Germination	Marques et al. (2014)
D. tuberosa	1.7003 – 4.9243	Germination	Vieira et al. (2007)
Enterolobium contortisiliquum	1.92	Germination	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	3.42	Emergence	Mendes-Rodrigues et al. (2019)
Epiphyllum phyllanthus	1.5 – 2.9	Germination	Simão et al. (2010b)
Erythrina verna	2.89 – 3.97	Germination	Demuner et al. (2008)
Euterpe edulis	1.30 – 3.79	Germination	Roberto & Habermann (2010)
E. edulis	2.8 – 3.1	Germination	Roberto et al. (2011)
Genipa americana	4.41	Emergence	Mendes-Rodrigues et al. (2019)
Godmania dardanoi	0.37 – 2.18	Germination	Ferreira et al. (2017c)
Guarea guidonia	1.92	Emergence	Mendes-Rodrigues et al. (2019)
Guazuma ulmifolia	6.58	Germination	Mendes-Rodrigues et al. (2019)
G. ulmifolia	5.21	Emergence	Mendes-Rodrigues et al. (2019)
Handroanthus avellanedae	2.91	Emergence	Mendes-Rodrigues et al. (2019)
H. roseoalbus	2.13	Emergence	Mendes-Rodrigues et al. (2019)
H. serratifolius	2.78	Germination	Mendes-Rodrigues et al. (2019)
H. serratifolius	2.87	Emergence	Mendes-Rodrigues et al. (2019)
H. spongiosus	0.138 – 1.638	Germination	Ferreira et al. (2017b)
H. spongiosus	0.90 – 1.42	Germination	Ferreira et al. (2017a)
Heterotis rotundifolia	6.36	Germination	Mendes-Rodrigues et al. (2019)
Hylocereus setaceus	0.5 – 3.5	Germination	Simão et al. (2007)
Hymenaea courbaril	4.58	Emergence	Mendes-Rodrigues et al. (2019)
Inga laurina	0.69	Germination	Mendes-Rodrigues et al. (2007)
I. laurina	4.30	Emergence	Mendes-Rodrigues et al. (2019)
I. sessilis	1.23	Germination	Mendes-Rodrigues et al. (2007)
I. sessilis	3.70	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda cuspidifolia	3.44	Germination	Mendes-Rodrigues et al. (2019)
J. cuspidifolia	4.60	Emergence	Mendes-Rodrigues et al. (2019)
Kielmeyera coriacea	1.80 – 2.65	Germination	Santana et al. (2010)
K. coriacea	2.30 – 3.30	Emergence	Santana et al. (2010)
Lessingianthus linearifolius	0.87	Germination	Le Stradic et al. (2015)
Lithraea molleoides	3.19 – 5.13	Germination	Berger et al. (2014)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
L. molleoides	2.77 – 4.59	Emergence	Berger et al. (2014)
L. molleoides	6.51	Germination	Mendes-Rodrigues et al. (2019)
L. molleoides	4.71	Emergence	Mendes-Rodrigues et al. (2019)
Luehea divaricata	4.81	Germination	Mendes-Rodrigues et al. (2019)
L. divaricata	5.19	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium aculeatum	3.79	Emergence	Mendes-Rodrigues et al. (2019)
M. acutifolium	3.95	Emergence	Mendes-Rodrigues et al. (2019)
Matayba guianensis	2.45	Germination	Mendes-Rodrigues et al. (2019)
M. guianensis	3.37	Emergence	Mendes-Rodrigues et al. (2019)
Melocactus sergipensis	2.02	Germination	Meiado (2016)
Miconia albicans	4.31	Germination	Mendes-Rodrigues et al. (2019)
M. albicans	< 3	Germination	Sales et al. (2013)
M. ferruginata	0 – 3.02	Germination	Mendes-Rodrigues et al. (2010)
M. pepericarpa	1.1	Germination	Silveira et al. (2013)
M. theaezans	1.88 – 3.27	Germination	Godoi & Takaki (2007)
Microlicia fasciculata	0.92 – 2.59	Germination	Ranal et al. (2016)
Mimosa foliolosa	< 1	Germination	Nativel et al. (2015)
M. maguirei	< 0.6	Germination	Nativel et al. (2015)
Myracrodruon urundeuva	1.56 – 2.61	Emergence	Berger et al. (2007)
M. urundeuva	1.10 – 1.16	Germination	Dorneles et al. (2005)
M. urundeuva	2.32	Emergence	Mendes-Rodrigues et al. (2019)
Myrsine umbellata	4.51	Emergence	Mendes-Rodrigues et al. (2019)
Neoregelia bahiana	1.82 – 1.99	Germination	Marques et al. (2014)
N. cruenta	1.13	Germination	Mantovani & Iglesias (2010)
Ormosia arborea	5.02	Germination	Mendes-Rodrigues et al. (2019)
O. arborea	5.24	Emergence	Mendes-Rodrigues et al. (2019)
Pachira glabra	2.20 – 2.89	Germination	Mendes-Rodrigues et al. (2019)
P. glabra	2.32 – 3.69	Emergence	Mendes-Rodrigues et al. (2019)
Paepalanthus chiquitensis	3.20	Germination	Gonçalves-Magalhães et al. (2021)
Peltophorum dubium	1 – 1.76	Germination	Perez et al. (2001)
Pereskia grandifolia	0.26 – 0.28	Germination	Oliveira et al. (2017)
Pilosocereus gounellei	2.68	Germination	Gomes et al. (2016)
Plathymenia reticulata	4.04	Germination	Mendes-Rodrigues et al. (2019)
P. reticulata	4.45	Emergence	Mendes-Rodrigues et al. (2019)
Platypodium elegans	3.79	Emergence	Mendes-Rodrigues et al. (2019)
Pouteria torta	3.93	Emergence	Mendes-Rodrigues et al. (2019)
Pseudobombax longiflorum	3.29	Germination	Mendes-Rodrigues et al. (2011b)
P. tomentosum	2.81	Germination	Mendes-Rodrigues et al. (2011b)
Pyrostegia venusta	< 4	Germination	Rossatto & Kolb (2010)
Racinaea aerisincola	0.76 – 1.37	Germination	Marques et al. (2014)
Schefflera morototoni	2.75 – 3.12	Germination	Anastácio et al. (2010)
Senna macranthera	2.84 – 12.24	Germination	Cassaro-Silva (2001)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
S. silvestris	4.41	Emergence	Mendes-Rodrigues et al. (2019)
S. spectabilis	0.92	Germination	Jeller & Perez (2001)
Solanum lycocarpum	2.5 – 3	Germination	Souza et al. (2020)
Sterculia striata	2.79	Emergence	Mendes-Rodrigues et al. (2019)
Styrax camporum	1.43 – 4.2	Germination	Simão et al. (2013)
S. camporum	1.80 – 2.35	Emergence	Simão et al. (2013)
Syagrus oleracea	4	Emergence	Mendes-Rodrigues et al. (2019)
Tabebuia aurea	3.21	Emergence	Mendes-Rodrigues et al. (2019)
T. rosea	1.325 – 3.23	Germination	Socolowski & Takaki (2007)
Tacinga inamoena	1.5	Germination	Nascimento et al. (2015)
Tapirira guianensis	0.30	Germination	Mendes-Rodrigues et al. (2019)
T. guianensis	3.23	Emergence	Mendes-Rodrigues et al. (2019)
Tecoma stans	0.8 – 2.97	Germination	Socolowski et al. (2008)
Terminalia argentea	3.82	Emergence	Mendes-Rodrigues et al. (2019)
T. brasiliensis	2.93	Emergence	Mendes-Rodrigues et al. (2019)
Tibouchina granulosa	3.04	Germination	Mendes-Rodrigues et al. (2019)
T. pulchra	3.90	Germination	Mendes-Rodrigues et al. (2019)
Tillandsia gardneri	0.52 – 0.58	Germination	Marques et al. (2014)
T. stricta	0.91 – 1.34	Germination	Marques et al. (2014)
Trema micrantha	4.31	Germination	Mendes-Rodrigues et al. (2019)
Vellozia caruncularis	1.56	Germination	Le Stradic et al. (2015)
V. epidendroides	2.57	Germination	Le Stradic et al. (2015)
V. resinosa	1.92	Germination	Le Stradic et al. (2015)
V. variabilis	1.55	Germination	Le Stradic et al. (2015)
Virola sebifera	3.99	Germination	Mendes-Rodrigues et al. (2019)
V. sebifera	2.66	Emergence	Mendes-Rodrigues et al. (2019)
Vriesea bituminosa	1.19 – 2.24	Germination	Marques et al. (2014)
V. crassa	1.05 – 1.85	Germination	Marques et al. (2014)
V. friburgensis	0.82 – 1.01	Germination	Marques et al. (2014)
V. minarum	1.55 – 1.65	Germination	Marques et al. (2014)
V. neoglutinosa	0.67	Germination	Mantovani & Iglesias (2010)
V. pardalina	1.29 – 2.17	Germination	Marques et al. (2014)
Xyris obtusiuscula	1.53	Germination	Le Stradic et al. (2015)
X. pilosa	2.22	Germination	Le Stradic et al. (2015)
	Synchrony		
Acacia polyphylla	0.1804	Germination	Mendes-Rodrigues et al. (2019)
A. polyphylla	0.1797	Emergence	Mendes-Rodrigues et al. (2019)
Aegiphila sellowiana	0.2095	Germination	Mendes-Rodrigues et al. (2019)
A. sellowiana	0.0558	Emergence	Mendes-Rodrigues et al. (2019)
Alibertia sessilis	0.1447	Germination	Mendes-Rodrigues et al. (2019)
A. sessilis	0.1923	Emergence	Mendes-Rodrigues et al. (2019)
Anacardium humile	0.0601	Emergence	Carvalho et al. (2005)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Anadenanthera colubrina	0.2170 – 0.3812	Germination	Dorneles et al. (2013)
A. colubrina	0.1683 – 0.2526	Emergence	Dorneles et al. (2013)
A. colubrina	0.3352	Germination	Mendes-Rodrigues et al. (2019)
A. colubrina	0.1732	Emergence	Mendes-Rodrigues et al. (2019)
A. peregrina	0.3697	Germination	Mendes-Rodrigues et al. (2019)
A. peregrina	0.3671	Emergence	Mendes-Rodrigues et al. (2019)
Aspidosperma cylindrocarpon	0.1455	Emergence	Mendes-Rodrigues et al. (2019)
Astronium fraxinifolium	0.3185	Germination	Mendes-Rodrigues et al. (2019)
A. fraxinifolium	0.1532	Emergence	Mendes-Rodrigues et al. (2019)
Bauhinia dumosa	0.14– 0.22	Germination	Zirondi et al. (2019)
Bombax ceiba	0.3090	Germination	Mendes-Rodrigues et al. (2019)
B. ceiba	0.2098	Emergence	Mendes-Rodrigues et al. (2019)
Calycophyllum spruceanum (non-flooded)	0.199	Emergence	Conserva et al. (2017)
C. spruceanum (flooded)	0.364	Emergence	Conserva et al. (2017)
Cambessedesia hilariana	0 – 0.23	Germination	Zirondi et al. (2019)
Cariniana estrellensis	0.0729	Germination	Mendes-Rodrigues et al. (2019)
C. estrellensis	0.0960	Emergence	Mendes-Rodrigues et al. (2019)
Casearia mariquitensis	0.1707	Emergence	Mendes-Rodrigues et al. (2019)
Cecropia pachystachya	0.4473	Germination	Mendes-Rodrigues et al. (2019)
C. pachystachya	0.0800 – 0.1461	Germination	Ribeiro-Oliveira & Ranal (2016)
Cedrela fissilis	0.0972	Emergence	Mendes-Rodrigues et al. (2019)
C. odorata (non-flooded)	0.235	Emergence	Conserva et al. (2017)
C. odorata (flooded)	0.120	Emergence	Conserva et al. (2017)
Ceiba speciosa	0.1373	Germination	Mendes-Rodrigues et al. (2019)
C. speciosa	0.1811	Emergence	Mendes-Rodrigues et al. (2019)
C. speciosa	0.1140 – 0.2101	Germination	Ribeiro-Oliveira & Ranal (2016)
Chamaecrista viscosa	0 – 0.49	Germination	Zirondi et al. (2019)
Comolia sertularia	0	Germination	Zirondi et al. (2019)
Copaifera langsdorffii	0.0943	Emergence	Mendes-Rodrigues et al. (2019)
C. langsdorffii	0.1035 – 0.1053	Emergence	Pereira et al. (2009)
Dipteryx alata	0.1616	Emergence	Mendes-Rodrigues et al. (2019)
Duroia duckei (non-flooded)	0.053	Emergence	Conserva et al. (2017)
D. duckei (flooded)	0.045	Emergence	Conserva et al. (2017)
Enterolobium contortisiliquum	0.1000	Germination	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	0.0152	Emergence	Mendes-Rodrigues et al. (2019)
E. contortisiliquum	0.3450 – 0.4600	Germination	Ribeiro-Oliveira & Ranal (2016)
Eriotheca gracilipes	< 0.03	Germination	Mendes-Rodrigues et al. (2011a)
Eriotheca pubescens	< 0.06	Germination	Mendes-Rodrigues et al. (2011a)
E. pubescens	0.12	Emergence	Mendes-Rodrigues et al. (2011a)
Genipa americana	0.0548	Emergence	Mendes-Rodrigues et al. (2019)
Guarea guidonia (non-flooded)	0.006	Emergence	Conserva et al. (2017)
G. guidonia (flooded)	0	Emergence	Conserva et al. (2017)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
G. guidonia	0.1333	Emergence	Mendes-Rodrigues et al. (2019)
Guazuma ulmifolia	0.0042	Germination	Mendes-Rodrigues et al. (2019)
G. ulmifolia	0.0176	Emergence	Mendes-Rodrigues et al. (2019)
G. ulmifolia	0.1250 – 0.3400	Germination	Ribeiro-Oliveira & Ranal (2016)
Handroanthus avellanedae	0.1574	Emergence	Mendes-Rodrigues et al. (2019)
H. barbatus (non-flooded)	0.013	Emergence	Conserva et al. (2017)
H. barbatus (flooded)	0.044	Emergence	Conserva et al. (2017)
H. roseoalbus	0.2816	Emergence	Mendes-Rodrigues et al. (2019)
H. serratifolius	0.1780	Germination	Mendes-Rodrigues et al. (2019)
H. serratifolius	0.1554	Emergence	Mendes-Rodrigues et al. (2019)
Harpalyce sp.	0.07 – 0.50	Germination	Zirondi et al. (2019)
Heterotis rotundifolia	0.0148	Germination	Mendes-Rodrigues et al. (2019)
Hymenaea courbaril	0.0315	Emergência	Mendes-Rodrigues et al. (2019)
Ilex inundata (non-flooded)	0.063	Emergence	Conserva et al. (2017)
I. inundata (flooded)	0.269	Emergence	Conserva et al. (2017)
Inga laurina	0.68	Germination	Mendes-Rodrigues et al. (2007)
I. laurina	0.0553	Emergence	Mendes-Rodrigues et al. (2007)
I. sessilis	0.45	Germination	Mendes-Rodrigues et al. (2007)
I. sessilis	0.0906	Emergence	Mendes-Rodrigues et al. (2019)
Jacaranda cuspidifolia	0.1004	Germination	Mendes-Rodrigues et al. (2019)
J. cuspidifolia	0.0572	Emergence	Mendes-Rodrigues et al. (2019)
Kielmeyera coriacea	0.14 – 0.32	Germination	Santana et. al. (2010)
K. coriacea	0.07 – 0.18	Emergence	Santana et. al. (2010)
Laetia corymbulosa (non-flooded)	0.105	Emergence	Conserva et al. (2017)
L. corymbulosa (flooded)	0.077	Emergence	Conserva et al. (2017)
Lithraea molleoides	0.0048 – 0.1414	Germination	Berger et al. (2014)
L. molleoides	0.0214 – 0.1983	Emergence	Berger et al. (2014)
L. molleoides	0.0069	Germination	Mendes-Rodrigues et al. (2019)
L. molleoides	0.0434	Emergence	Mendes-Rodrigues et al. (2019)
Luehea divaricata	0.026	Germination	Borges et al. (2007)
L. divaricata	0.019 – 0.045	Emergence	Borges et al. (2007)
L. divaricata	0.0350	Germination	Mendes-Rodrigues et al. (2019)
L. divaricata	0.0323	Emergence	Mendes-Rodrigues et al. (2019)
Machaerium aculeatum	0.1049	Emergence	Mendes-Rodrigues et al. (2019)
M. acutifolium	0.0565	Emergence	Mendes-Rodrigues et al. (2019)
Matayba guianensis	0.2125	Germination	Mendes-Rodrigues et al. (2019)
M. guianensis	0.0857	Emergence	Mendes-Rodrigues et al. (2019)
Miconia albicans	0.0565	Germination	Mendes-Rodrigues et al. (2019)
M. ferruginata	0.067– 0.333	Germination	Mendes-Rodrigues et al. (2010)
Microlicia fasciculata	0.11 – 0.38	Germination	Ranal et al. (2016)
Microlicia sp.	0.53 – 0.58	Germination	Zirondi et al. (2019)
Mimosa echinocaula	0 – 0.20	Germination	Zirondi et al. (2019)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
M. foliolosa	0 – 0.13	Germination	Zirondi et al. (2019)
M. leiocephala	0	Germination	Zirondi et al. (2019)
M. pteridifolia	0.11 – 0.18	Germination	Zirondi et al. (2019)
M. somnians	0.32 – 0.50	Germination	Zirondi et al. (2019)
Myracrodruon urundeuva	0.16 – 0.41	Emergence	Berger et al. (2007)
M. urundeuva	0.49 – 0.50	Germination	Dorneles et al. (2005)
M. urundeuva	0.2498	Emergence	Mendes-Rodrigues et al. (2019)
Myrsine umbellata	0.0318	Emergence	Mendes-Rodrigues et al. (2019)
Ocotea cymbarum (non-flooded)	0.061	Emergence	Conserva et al. (2017)
O. cymbarum (flooded)	0.118	Emergence	Conserva et al. (2017)
Ormosia arborea	0.0345	Germination	Mendes-Rodrigues et al. (2019)
O. arborea	0.0279	Emergence	Mendes-Rodrigues et al. (2019)
Pachira glabra	0.1500 – 0.2703	Germination	Mendes-Rodrigues et al. (2019)
P. glabra	0 – 0.0843	Emergence	Mendes-Rodrigues et al. (2019)
Paepalanthus chiquitensis	0.106	Germination	Gonçalves-Magalhães et al. (2021)
Piranhea trifoliata (non-flooded)	0.113	Emergence	Conserva et al. (2017)
P. trifoliata (flooded)	0.070	Emergence	Conserva et al. (2017)
Plathymenia reticulata	0.0855	Germination	Mendes-Rodrigues et al. (2019)
P. reticulata	0.0465	Emergence	Mendes-Rodrigues et al. (2019)
Platypodium elegans	0.0700	Emergence	Mendes-Rodrigues et al. (2019)
Pleroma cardinale	0 – 0.38	Germination	Zirondi et al. (2019)
P. frigidulum	0.14 – 0.30	Germination	Zirondi et al. (2019)
P. stenocarpum	0.24 – 0.33	Germination	Zirondi et al. (2019)
Pouteria torta	0.0555	Emergence	Mendes-Rodrigues et al. (2019)
Pseudobombax longiflorum	0.08	Germination	Mendes-Rodrigues et al. (2011b)
P. munguba (non-flooded)	0.195	Emergence	Conserva et al. (2017)
P. munguba (flooded)	0	Emergence	Conserva et al. (2017)
P. tomentosum	0.14	Germination	Mendes-Rodrigues et al. (2011b)
Schefflera morototoni	0.070 – 0.071	Germination	Anastácio et al. (2010)
S. morototoni	0.1000 – 0.1875	Germination	Ribeiro-Oliveira & Ranal (2016)
Senna silvestris	0.0237	Emergence	Mendes-Rodrigues et al. (2019)
Solanum lycocarpum	~ 0.10	Germination	Souza et al. (2020)
Sterculia striata	0.2164	Emergence	Mendes-Rodrigues et al. (2019)
Syagrus oleracea	0.0620	Emergence	Mendes-Rodrigues et al. (2019)
Tabebuia aurea	0.1139	Emergence	Mendes-Rodrigues et al. (2019)
Tapirira guianensis	0.9099	Germination	Mendes-Rodrigues et al. (2019)
T. guianensis	0.1224	Emergence	Mendes-Rodrigues et al. (2019)
Terminalia argentea	0.0571	Emergence	Mendes-Rodrigues et al. (2019)
T. brasiliensis	0.0897	Emergence	Mendes-Rodrigues et al. (2019)
Tibouchina granulosa	0.1034	Germination	Mendes-Rodrigues et al. (2019)
T. melastomoides	0.17 – 0.23	Germination	Zirondi et al. (2019)
T. pulchra	0.0989	Germination	Mendes-Rodrigues et al. (2019)

Table 2. Continuation

Species	Measurement	Process evaluated	Authors
Virola sebifera	0.0651	Germination	Mendes-Rodrigues et al. (2019)
V. sebifera	0.0909	Emergence	Mendes-Rodrigues et al. (2019)

< indicates that the number was inferred from graphics. t_f: time to first germination/emergence; t_l: time to last germination/emergence; $\bar{t}$: mean germination/emergence time (some authors presented their data in hours); CV_t: coefficient of variation of germination/emergence time; $\bar{v}$: mean germination/emergence velocity (some authors presented their data in h^{-1}); *U*: uncertainty; *Z*: synchrony. Species authors primarily according to Flora do Brasil (2020) and, when necessary, according to The Plant List (2020), IPNI (2020) or Tropicos (2020). The family name and species author were mentioned in the first mention of the species in the table. According to the Flora do Brasil (2020), *Aegiphila sellowiana* Cham. is a synonym of *Aegiphila integrifolia* (Jacq.) Moldenke, *Alibertia sessilis* (Vell.) K. Schum. is a synonym of *Cordiera sessilis* (Vell.) Kuntze, *Anadenanthera falcata* (Benth.) Speg. is a synonym of *Anadenanthera peregrina* var. *falcata* (Benth.) Altschul, *Aristolochia galeata* Mart. & Zucc. is a synonym of *Aristolochia labiata* Willd., *Bombax ceiba* L. is a synonym of *Bombax malabaricum* DC., *Caesalpinia echinata* Lam. is a synonym of *Paubrasilia echinata* (Lam.) Gagnon, H.C. Lima & G.P. Lewis, *Caesalpinia ferrea* Mart. ex Tul. is a synonym of *Libidibia ferrea* (Mart. ex Tul.) L.P. Queiroz, *Cassia excelsa* Schrad. is a synonym of *Senna spectabilis* var. *excelsa* (Schrad.) H.S. Irwin & Barneby, *Chorisia speciosa* A. St.-Hil. is a synonym of *Ceiba speciosa* (A. St.-Hil.) Ravenna, *Comolia sertularia* (DC.) Triana is a synonym of *Fritzschia sertularia* (Schrank & Mart. ex DC.) M.J.R. Rocha & P.J.F. Guim., *Cryptanthus schwackeanus* Mez is a synonym of *Hoplocryptanthus schwackeanus* (Mez) Leme, S. Heller & Zizka, *Miconia langsdorffii* Cogn. is a synonym of *Miconia paucidens* DC., *Myracrodruon urundeuva* M. Allemão is a synonym of *Astronium urundeuva* (M. Allemão) Engl., *Ocimum selloi* Benth. is a synonym of *Ocimum carnosum* (Spreng.) Link & Otto ex Benth., *Schefflera morototoni* (Aubl.) Maguire, Steyerm. & Frodin is a synonym of *Didymopanax morototoni* (Aubl.) Decne. & Planch., *Schizocentron elegans* (Schltdl.) Meisn. is a synonym of *Heterocentron elegans* (Schltdl.) Kuntze, *Syngonanthus aciphyllus* (Bong.) Ruhland is a synonym of *Comanthera aciphylla* (Bong.) L.R. Parra & Giul., *Syngonanthus bisulcatus* (Körn.) Ruhland is a synonym of *Comanthera bisulcata* (Körn.) L.R. Parra & Giul., *Syngonanthus elegantulus* Ruhland is a synonym of *Comanthera elegantula* (Ruhland) L. R. Parra & Giul., *Syngonanthus vernonioides* (Kunth) Ruhland is a synonym of *Paepalanthus vernonioides* Kunth, *Streptocalyx floribunda* (Mart. ex Schult. & Schult. f.) Mez is a synonym of *Aechmea floribunda* Mart. ex Schult. & Schult. f., *Terminalia brasiliensis* (Cambess.) Eichler is a synonym of *Terminalia glabrescens* Mart., *Tibouchina cardinalis* (Humb. & Bonpl.) Cogn. is a synonym of *Pleroma cardinale* (Bonpl.) Triana, *Tibouchina granulosa* (Desr.) Cogn. is a synonym of *Pleroma granulosum* (Desr.) D. Don, *Tibouchina mutabilis* (Vell.) Cogn. is a synonym of *Pleroma mutabile* (Vell.) Triana, *Vellozia leptopetala* Goethart & Henrard is a synonym of *Vellozia epidendroides* Mart. ex Schult. & Schult.f., *Waltheria douradinha* A. St.-Hil. is a synonym of *Waltheria communis* A. St.-Hil.

Discussion

The predominance of seven families in this survey simply means that there were researchers interested in studying the germination process of the seeds available where they were working. The 261 species surveyed represent 0.81% of the 32,109 native species of seed-producing plants in Brazil, catalogued by the Kew (2016).

The broad amplitude of all measurements surveyed shows the heterogeneity of the Brazilian native flora. This means that there are species that need environmental windows (gaps; environmental filters; seasonality in relation to water, gases, quality and quantity of light and temperature; biotic relationships) that range from small to large, to establish themselves. This information is compatible with the diversity of Brazilian habitats, and this represents important reference points for the conservation or restoration of altered areas. Species with larger amplitudes for time, with lower velocity and synchrony and higher uncertainty need larger environmental windows than species that are faster and more synchronized. Species whose seeds are able to germinate using wider environmental windows, spread germination over time through some type of dormancy, which ensures their survival. On the other hand, if the seeds are large, they are more likely to be consumed by animals, especially if their coats are soft or softened by soil water, bacterial or fungal activity. Species whose seeds germinate under specific conditions that are present in small environmental windows need to be dispersed in the place and time where these conditions are present. This puts them at greater risk because the duration of these windows is usually short.

How many seeds can germinate or how many seedlings can emerge, in a certain time (if the work has a practical nature, because this measurement shows on which day after sowing the stand will have its maximum potential), with what velocity (if the work has a biochemical nature, because this measurement expresses the metabolic velocity of the processes), and what synchrony are questions that should not fail to be answered in a work that evaluates the potential of the seed for the maintenance of the species.

Taking advantage of the opportunity, it is worth mentioning that it is up to the researcher to evaluate the best measurement for the species under study. For example, the mean germination time does not always

correspond to the peak germination, as it is the case of *Lithraea molleoides* diaspores (Berger et al., 2014). The diaspores of this species have high asynchrony, and the mean germination time is not the best measurement to characterize the species. As was suggested by Berger et al. (2014), the time amplitude, the relative frequency of germination through time or the survival analysis can be the best solution for this species and for others with the same germination pattern.

It is also important to make it very clear that the frequency of evaluations affects all measurements. For seeds with very fast germination, which complete the process in less than 24 h, as *Inga laurina*, it may seem that the germination of the seeds is homogeneous and synchronized when the first evaluation takes place 24 h after sowing (Mendes-Rodrigues et al., 2007). However, if smaller intervals were adopted, asynchrony would be evident, even for this species with very fast germination.

In relation to the terminology, Ranal & Santana (2006) maintained the original nomenclature given by the authors who proposed each one of the measurements, respecting priority. However, this survey suggests that it is interesting to propose a few changes to minimize some confusion that still occurs. For example, germination rate used by Labouriau and collaborators for germination velocity is being confused with germinability (percentage of germination), because rate is synonymous of percentage. In the site of the AGROVOC Multilingual Thesaurus (2022) the term germination rate is considered a synonym of germinability. Germinability, as the name indicates, is the ability of one seed to germinate. When several seeds are in the same experimental condition, the percentage of germination expresses the ability of this set to germinate in these conditions. The meaning of this term (germinability) is expressed in Labouriau (1983a) and Bewley et al. (2013).

As mentioned by Ranal & Santana (2006), the first idea of germination velocity was expressed by Kotowski (1926), and the author named this measurement as coefficient of velocity. The change to germination rate proposed by Labouriau (1983a) occurred because the calculation is a frequency, like the well-known concept of Hertz. In this sense, the mean germination rate is a frequency that is obtained by the reciprocal of the mean germination time, being expressed as h^{-1} or day^{-1} like Hertz, that is expressed by s^{-1} (Ranal & Santana, 2006). This sense of mean germination rate is the same used to measure velocity of chemical reactions (molecules per time). However, to avoid further confusion between germination rate (originally proposed as velocity) and germinability (percentage of germination), we are proposing mean germination velocity from the expression presented by Kotowski (1926), recovering his original idea of velocity.

This survey also showed us the degree of confusion that remains regarding germination measurements. The use of indirect references seemed to us to be the main reason for this confusion. Thus, we recommend that authors access the original papers of the proponents of mathematical expressions, or papers that clearly show how to calculate each expression presented. Great help usually comes from participation of mathematicians or statisticians in the team, with their numerical simulations. It is necessary that the data obtained are compatible with what was observed in the laboratory or field conditions, that is, the numbers need to have a biological sense, and simulations help us to understand the sense and fragilities of the measurements.

Another point that deserves to be highlighted is that there is no standardization regarding the criteria adopted, both for germination and seedling emergence. There is also no consensus regarding the beginning and end of the evaluations or its periodicity. Much of this difficulty in standardization is associated with the biological rhythm of the species and also with technical difficulties of the laboratories. All this makes it difficult to compare the results obtained.

Final considerations

This small sample of papers published in these first two decades of the 21st century clearly expresses the need for consensus among researchers on how to best measure the dynamics of germination and emergence processes. Given the world scenario of fragmentation of native areas and destruction of natural environments, there is high risk of loss of biodiversity. Thus, the more accurate the information regarding seed germination, the more efficient will be the conservation and management of native areas, as well as the recovery and restoration of degraded areas.

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Conflict of interest

The authors have no conflict of interest to declare.

Authors' contributions

Marli A. Ranal: Conceptualization, formal analysis, investigation , methodology, supervision, writing – original draft, writing – review & editing.

Wanessa Resende Ferreira:Conceptualization, formal analysis, investigation, methodology, supervision, writing – original draft, writing – review & editing.

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