ESCALA FENOLÓGICA DE *HELICONIA PSITTACORUM* L.F. EM CHAPADINHA, MARANHÃO, BRASIL

PHENOLOGICAL SCALE OF Heliconia psittacorum L.F. IN CHAPADINHA, MARANHÃO, BRAZIL

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Resumo

Introdução: *Heliconia* é um gênero de angiospermas de origem tropical pertencente à família Heliconiaceae, da ordem Zingiberales. É o único gênero dessa família, e popularmente conhecido como “bananeira-de-jardim”. Dentre as espécies de *Heliconia* nativas do Brasil, destaca-se *Heliconia psittacorum* L.f., com valor comercial no mercado de floricultura devido às suas cores vibrantes e inflorescências duráveis. Objetivo: Este trabalho descreve a escala fenológica da espécie nativa *H. psittacorum*, proveniente do povoado Chapadão, localizado no município de Chapadinha, MA. Metodologia: O experimento foi conduzido em uma casa de vegetação entre agosto de 2019 e junho de 2020, no Centro de Ciências de Chapadinha (CCCh). Mudas de *H. psittacorum* foram plantadas em duas fileiras com espaçamento de 1 m entre cada espécime. A escala fenológica foi avaliada com base nas seguintes variáveis: início da brotação, floração, altura da planta, diâmetro da planta, comprimento do caule floral e senescência. Resultados: A altura e o diâmetro médios máximos foram de 30 cm e 17,08 cm, respectivamente. O primeiro perfilho emergiu, em média, aproximadamente 29 dias após o plantio, e a emergência da primeira inflorescência ocorreu em média aos 117,09 dias. As hastes florais atingiram um comprimento médio de 33,45 cm, e a longevidade média das inflorescências foi de 42 dias. Conclusão: Nas condições da região de Chapadinha, sob cultivo a pleno sol,

H. psittacorum apresentou crescimento lento e porte reduzido, mostrando-se adequada para uso em canteiros baixos e em arranjos paisagísticos.

Palavras-chave: Escala fenológica; Vegetação nativa; Potencial ornamental

Abstract

Introduction: *Heliconia* is a genus of tropical angiosperms belonging to the Heliconiaceae family within the order Zingiberales. It is the only genus in this family and is commonly known as "garden banana". Among the *Heliconia* species native to Brazil, *Heliconia psittacorum* L.f. stands out due to its commercial value in the floriculture market for its vibrant colors and durable inflorescences. **Objective:** This study describes the phenological scale of the native species *H. psittacorum*, originating from the village of Chapadão, located in the municipality of Chapadinha, MA. **Methodology:** The experiment was conducted in a greenhouse from August 2019 to June 2020, at the Centro de Ciências de Chapadinha (CCCh). Seedlings of *H. psittacorum* were planted in two rows with 1-meter spacing between each specimen. The phenological scale was evaluated based on the following variables: onset of sprouting, flowering, plant height, plant diameter, floral stem length, and senescence. **Results:** The maximum average height and diameter were 30 cm and 17.08 cm, respectively. The first tiller emerged, on average, approximately 29 days after planting, and the first inflorescence appeared around 117.09 days after planting. The floral stems reached an average length of 33.45 cm, and the average inflorescence longevity was 42 days. **Conclusion:** Under the conditions in the Chapadinha region and full sun cultivation, *H. psittacorum* showed slow growth and a small stature, making it suitable for use in low flower beds and landscape arrangements.

Keywords: Phenological scale, Native vegetation, Ornamental potential.

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1. Introduction

Heliconia L. is a genus of tropical angiosperms in the family Heliconiaceae, order Zingiberales, and represents the only genus within this family[1]. This genus includes around 200 to 250 species, primarily found across the Americas, with 28 species occurring in Brazil[2]. They are

colloquially known, among other names, as “paquevira”, “garden banana”, “monkey banana”, and “bush banana”[1,2].

Among the *Heliconia* species native to Brazil, *H. psittacorum* L.f., a native Brazilian species, stands out stands out in ornamental cultivation due to its adaptability to full sunlight, vibrant bracts, prolonged flowering period, rapid growth from rhizomes, durable inflorescences, and ease of propagation through clump division[3,4]. *Heliconia* species are perennial, herbaceous, monocotyledonous, erect, and vary in height according to species[2,5]. For optimal development, plants within the *Heliconia* genus require a high input of nutrients, primarily potassium and nitrogen[6], in addition to high amounts of manganese and magnesium[7].

Floriculture contributes to the consolidation of agribusiness through the production of flowers, foliage, and other elements for ornamental use. It is increasingly gaining space in the Brazilian market, being a promising activity for the economy of the country. The climatic diversity of Brazil can be influential for floriculture, so there is a need for focused studies into the floricultural conditions in local regions[8,9].

Floriculture has seen prominent advances in development, in terms of the expansion of productivity, and use of new technologies that aim at the marketing and distribution of plants[10]. This is of great relevance in social and economic spheres, as it can improve the valorization of the “agriculture family” business model, in turn generating employment and income[11]. The genus *Heliconia* has great potential for floricultural commercialization, owing to its exotic characteristics, resistance to transport, longevity, production of continuous flowers and exuberant beauty[5].

To obtain knowledge on the cultivation of ornamental species, research on phenology is extremely important. Through this, it may be possible to find information on the general ecology of a plant, as well as its maintenance needs, growth period, reproduction, and types of pollinators[12]. In this context, studies that aim to describe plant phenology can identify the period in which flowering, fruiting, and senescence of the plant occur[13]. In addition, understanding plant phenology can contribute to the conservation of native species, as this would allow the clarification of cultivation requirements.

In view of the above, studying the phenology of the species *Heliconia psittacorum* L.f. will enable us to improve the efficiency of its cultivation by increasing its potential for exploitation in the tropical floriculture market. Therefore, this study aimed to describe the phenological scale of the native species *Heliconia psittacorum* from the village of Chapadão, located in the municipality of Chapadinha, Maranhão, Brazil.

2. Methodology

Study Site

The experiment was conducted in a greenhouse, in the period from August 2019 to June 2020, at the Center of Agrarian and Environmental Sciences (CCAA) of the Federal University of Maranhão (UFMA), located in the municipality of Chapadinha, Maranhão, Brazil (coordinates 03°44'17" S and 43°20'29" W, 107 m altitude). The soil of the experimental area is classified as Dystrophic Yellow Latosol[14], and the region experiences a humid tropical climate, with the annual rainfall ranging from 1,600 to 2,000 mm[15], and the average

annual temperature being above 27 °C[16].

Data Collection and Experimental Procedures

72 seedlings of the species *H. psittacorum* L.f. were collected in the village Chapadão (coordinates 3°40'15.4"S and 43°22'19.0"W), approximately 9.1 km from the city of Chapadinha. Soon after, the specimens were transplanted to the definitive experimental site in the field for full sun conditions. Each transplantation pit conformed to the dimensions proposed by[17], being 20 cm wide and 20 cm deep, and only one seedling was planted in each, leaving only the pseudostem exposed. Two rows of seedlings were planted, with 1 m spacing between each specimen. When planting, the same substrate extracted when digging the pits was used for back-filling.

Fertilization was performed using 20g of NPK 4-14-8 per plant, mixed directly into the soil substrate. Following this, the plants were crowned with a layer of Carnauba straw, an organic fertilizer. A drip irrigation system was used with emitters spaced every 1 m, and irrigation was performed daily in the early hours of the morning. Weed removal was carried out manually whenever weeds appeared. Daily observations were conducted in the experimental area to define the phenological scale, to enable detailed monitoring of plant development. The recorded phenological stages were as follows: A - sprouting; B - vegetative growth; C - beginning of flowering; D - full flowering; and E - senescence.

The analyzed parameters were: number of days until the emergence of the first tiller; height of the plant (cm), measured weekly with a graduated tape measure from the ground to apex; diameter of the stem at the base of the plant (mm), measured weekly using a digital pachymeter; length of the floral stem, measured weekly using a graduated tape measure; number of days until the emergence of the first inflorescence; and the longevity of the inflorescence, measured in days. A descriptive analysis of the data was performed, and these were presented in the form of graphs or tables, built with the Excel computer program.

3. Results and Discussion

The plants exhibited relatively small sizes, reaching a maximum average height of approximately 30 cm. The rate of growth was slow, at approximately 3 cm per month (FIGURE 1).

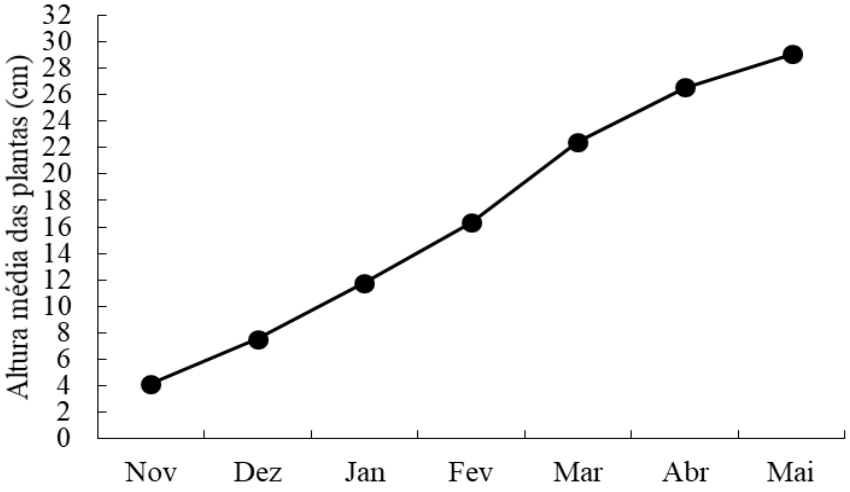

FIGURE 1 - Average height of *Heliconia psittacorum* L.f. cultivated in full sun in the period from November 2019 to May 2020 in Chapadinha, Maranhão, Brazil

For *H. psittacorum*, the most commonly reported height in the literature ranges from 0.70 to 1 m, under full sun cultivation and adequate water and nutrient supply[18]. The climatic conditions of the region dominantly controlled the plant height; Chapadinha has a high temperature throughout the year, and two well-defined seasons. The rainy season occurs between the months of November and April, with the rest of the year being relatively dry. Nevertheless, the rainy season coincides with the period of the greatest vegetative growth of *H. psittacorum*, due to the high availability of water (FIGURE 2; FIGURE 3).

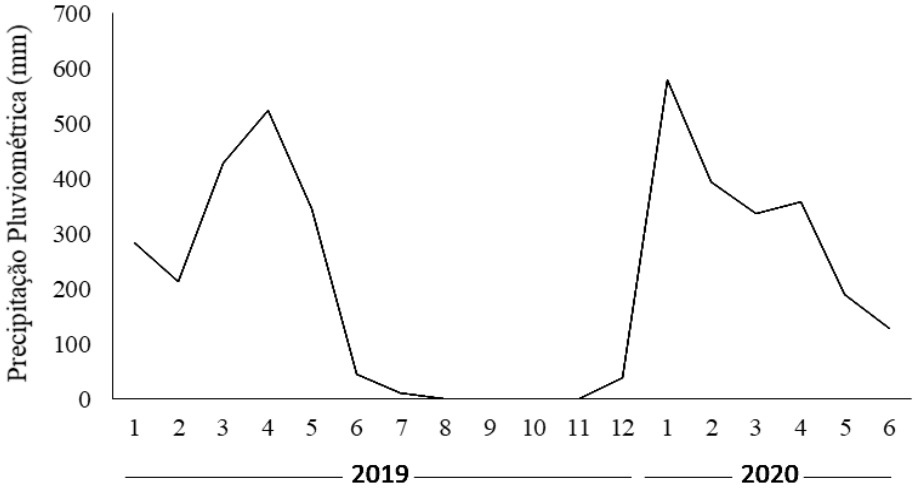

FIGURE 2 - Rainfall data from January 2019 to June 2020 in Chapadinha, Maranhão, Brazil. Obtained from the weather station of Chapadinha.

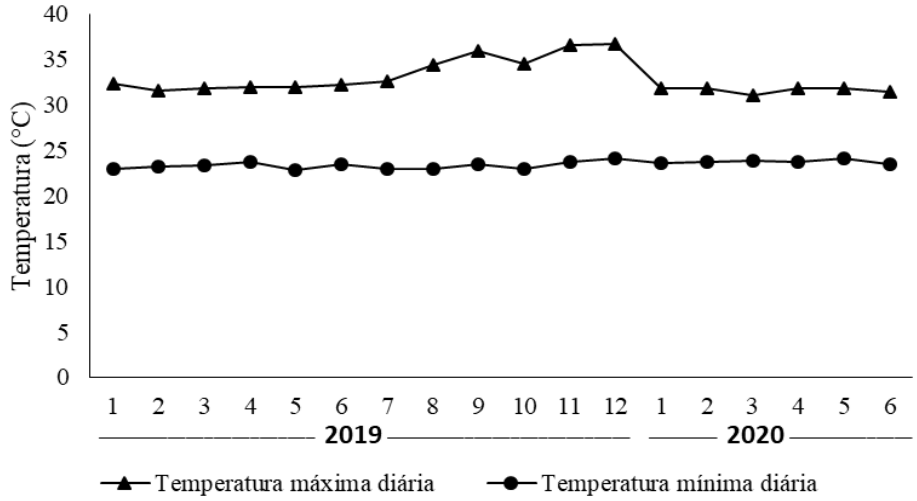

FIGURE 3 - Maximum and minimum daily temperatures from January 2019 to June 2020 in Chapadinha, Maranhão, Brazil. Obtained from the weather station of Chapadinha.

High temperatures and luminosity are associated with low water availability. Low water availability can lead to reduced crop growth, causing an increase in transpiration and respiratory activity rates, which can induce the closure of stomata. This would lead to a reduction in carbon fixation, increasing the consumption of photosynthetic products[19,20].

The highest growth rate of *Heliconia* was observed in the rainy season, which can be attributed to the reduction in the incidence of light caused by the greater cloudiness, as well as the greater availability of water in the growing region. *Heliconia* species require substantial amounts of water for their full development, so water supplementation is necessary in regions with water deficits[21].

Plant stem diameters showed more accelerated growth between the months of December and January, increasing from 4.6 to 10.4 cm during this period. This period coincides with the beginning of the rainy season, which may have influenced this result. The final average stem diameter of the plants was 17.08 mm (FIGURE 4).

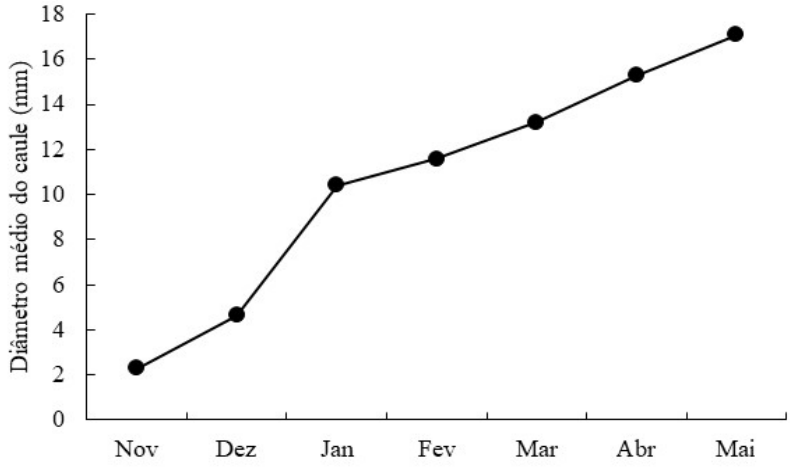

FIGURE 4 - Mean stem diameter, measured from the base of the stem, for Heliconia Psittacorum L.f. cultivated in full sun in the period from November 2019 to May 2020 in Chapadinha, Maranhão, Brazil

The percentage of plants that produced floral stems was low, at approximately 14%, However, the differences in floral senescence demonstrate the characteristically long flowering period of this species, an important characteristic for maintaining aesthetically appealing gardens (FIGURE 5).

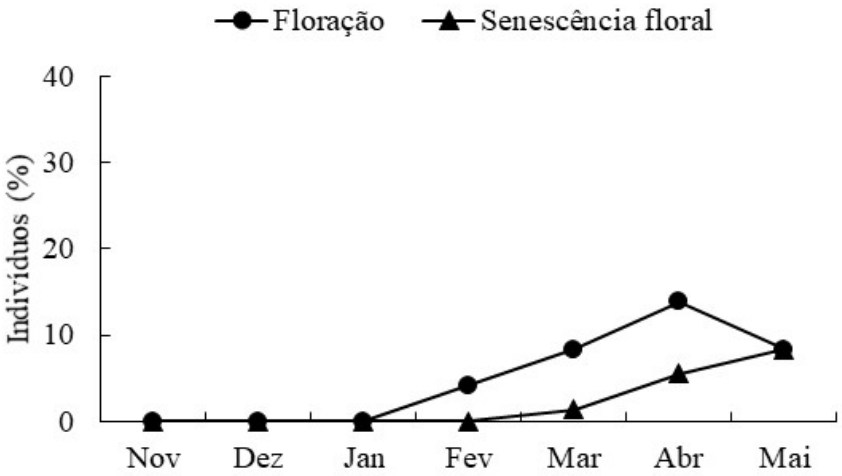

FIGURE 5 - Activity indices for flowering and senescence phases of *Heliconia psittacorum* cultivated in full sun from November 2019 to May 2020 in Chapadinha, Maranhão, Brazil.

When *H. psittacorum* L.f. begins to produce floral stems, they may continue to produce them throughout the year. Floral stems are erect, with varying numbers of terminal inflorescences, and with bracts of various colors. They can also be used as cut flowers; their light inflorescences and bracts arranged in the same plane are easy to pack in boxes and transport[22].

The mean emergence date of the first tiller was 29 days after planting, with the mode being 25 days after planting. The mean emergence date of the first inflorescence was 117.09 days after planting, and the mode was 143 days after planting (TABLE 1). Both parameters are similar to those reported in the literature for cultivars and commercial hybrids produced from *H. psittacorum*[23,24].

TABLE 1 - Growth and phenological data for Heliconia psittacorum cultivated in full sun from November 2019 to May 2020 in Chapadinha, Maranhão, Brazil. Shown are the mean and mode values for the days required for the emergence of the first tiller (EPP), days until the first inflorescence emerges (EPI), floral stem length (CHF, in cm), and inflorescence longevity (LI, in days).

Variable	Mean	Mode
EPP (days)	29.40	25
PPE (days)	117.09	143
CHF (cm)	33.45	28
LI (days)	42.00	35

The floral stems reached an average length of 33.45 cm, thus demonstrating an ideal size for decorative use in arrangements. Furthermore, inflorescences had an average longevity of 42 days, maintaining their visually appealing ornamental aspects for an average of 35 days.

The sprouting of *H. psittacorum* was characterized by the emergence of the first leaf. Vegetative growth includes the formation of the pseudostem with the growth of new leaves and overlapping of leaf sheaths. Vegetative growth ceases temporally after the emergence of the floral stem, which defines the beginning of flowering. This stage is followed by full bloom when the bracts fully form and open. The longevity of the inflorescences is high, and their senescence manifests as discoloration and drying (FIGURE 6A-E).

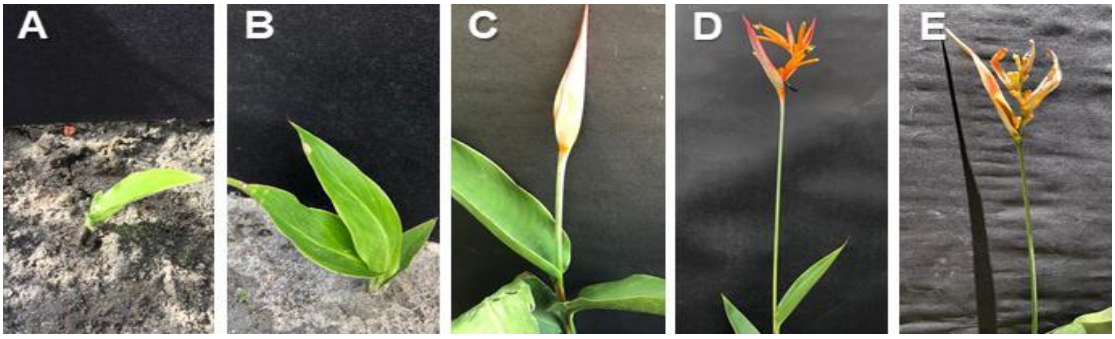

FIGURE 6 - Phenological stages of *Heliconia psittacorum* cultivated in full sun from November 2019 to May 2020 in Chapadinha, Maranhão, Brazil. The figure illustrates the sequential development stages: A - Sprouting (initial emergence of shoots from the rhizome); B - Vegetative growth (active growth phase, with development of leaves and height increase); C - Beginning of flowering (first signs of inflorescence development); D - Full flowering (peak flowering period, with full bloom of inflorescences); and E - Senescence (final stage marked by the decline and aging of plant structures).

Commercialization of native Brazilian vegetation presents a great possibility to increase the generation of local jobs, especially because native plants are well for the climate of the region, meaning that they are likely to thrive[25]. Morphological and phenological knowledge of plants is important to distinguish how to effectively grow and maintain crops. Due to their adaptation to the local environment, cultivating native plants has a comparatively lower environmental impact, as fewer additional maintenance measures need to be employed[26].

The genus *Heliconia* is widely used for garden ornamentation and its use could be extended for sale as cut plants. In view of this, it represents a high commercial value driven by its exotic characteristics, diverse colors, and distinctive forms. Appeals for its production include its great resistance to climate and transport and low maintenance cost[11]. The use of native vegetation in ornamental landscaping is very important for improving the social value of endemic species. Thus, the conservation of plants that have a commercial value can prevent the degradation of native flora[27].

After morphological analysis, *H. psittacorum* was described as having green, smooth, coriaceous leaves that are alternately distichous, penni-parallel-veined, and oval-lanceolate in shape[20]. Inflorescences are cymose with a tubular shape, and have zygomorphic symmetry and orange color; dichlamydeous with free sepals among themselves; there are 2–7 boat-shaped bracts, red-orange in color, with dark green eye-shaped spots at the apex; bracts are shiny and waxy, with two sexes in the same flower; there are more stamens than petals; the ovary is tricarpellate and trilocular, with basal placentation, ovary adherent to the receptacle; and other verticils are above the gynoecium. This is corroborated by the Zingiberales Guide of the PPBio sites in the Brazilian Western Amazon for the species *H. psittacorum*[28].

5. Conclusion

In the conditions of the Chapadinha region, which experiences a high temperature throughout the year with a short rainy period, *H. psittacorum* presents slow growth and remains relatively short when cultivated in full sun. The plant shows a brief intensification of growth during the rainy season but does not reach the typical size reported for this species.

The flowering period is concentrated between February and April. The flower stems are elongated and visible, rising above the leaves and creating an attractive ornamental contrast between the orange bracts and deep green foliage. These flowering stems remain visually appealing for more than 30 days, highlighting *H. psittacorum*'s potential for creating low bedding arrangements in landscaping.

These results suggest that *H. psittacorum* has notable potential for commercial landscaping and ornamental cultivation in tropical climates, as its prolonged flowering and vibrant display can enhance visual appeal in various horticultural applications.

For future research, we recommend investigating the adaptation of *H. psittacorum* under different climatic conditions and within more controlled cultivation systems, including various levels of shading and irrigation. Additionally, exploring the effects of different fertilization strategies on phenological and ornamental development could contribute to optimizing the cultivation and commercialization of this species for landscaping and floriculture.

6. Conflict of Interest Statement

The authors declare that there is no conflict of interest in the development and writing of this work.

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