Ornamental Horticulture
ISSN 2447-536X | WWW.ORNAMENTALHORTICULTURE.COM.BR

SBFPO Sociedade Brasileira de Floricultura e Plantas Ornamentais

Article

Postharvest conservation of *Thaumatophyllum bipinnatifidum* foliage grown in semi-arid conditions under different doses of salicylic acid

Conservação pós-colheita de folhagens de *Thaumatophyllum bipinnatifidum* cultivadas em condições semiáridas sob diferentes doses de ácido salicílico

João Victor Martins Bamberg[1,*], Lucivânia Rodrigues Amorim[1], Dayara Miranda da Silva[1], Heberte Fernandes de Figueredo[2], Lucas Gomes de Lima[3], Ben-Hur Mattiuzzo[4], Claudia Fabrino Machado Mattiuz[5], and Márkilla Zunete Beckmann-Cavalcante[1]

[1] Universidade Federal do Vale do São Francisco (UNIVASF), Petrolina-PE, Brasil.
[2] Universidade Federal Rural de Pernambuco (UFRPE), Recife-PE, Brasil.
[3] Universidade Federal de Santa Maria (UFSM), Santa Maria-RS, Brasil.
[4] Universidade Estadual Paulista (UNESP), Instituto de Biociências, Rio Claro-SP, Brasil.
[5] Universidade de São Paulo, Escola de Agricultura "Luiz de Queiroz", Piracicaba-SP, Brasil.

Abstract

Cultivation of tropical foliage plants, such as *lacy tree philodendron* (*Thaumatophyllum bipinnatifidum)*, in semi-arid regions may be limited by high solar irradiance, which promotes the occurrence of abiotic stresses capable of compromising postharvest quality. In this context, the application of mitigating substances, such as salicylic acid, may contribute to maintaining foliage quality, although studies on its effects under these conditions remain scarce. This study aimed to evaluate the postharvest longevity and quality of *T. bipinnatifidum* leaves grown under full-sun conditions in a semi-arid region and treated with different doses of salicylic acid. The experimental design was completely randomized, with three replications and four leaves per experimental unit. Leaves 40 cm wide were collected from random plants within the treatment. Treatments consisted of cultivation under full sun (control), applications of salicylic acid at doses of 80, 160, 240, and 320 mg L^{-1}, and cultivation under shade conditions. Vase life, final water absorption, solution electrical conductivity, fresh mass, transpiration, total chlorophyll content, and colorimetric parameters (L*, C*, and Hue angle) were evaluated. *Lacy tree philodendron* leaves exhibited extended longevity and maintained their visual quality throughout the evaluation period. Furthermore, the application of different salicylic acid doses did not significantly affect the evaluated postharvest parameters. Therefore, it can be concluded that *Thaumatophyllum bipinnatifidum* cultivated under semi-arid conditions has high potential for commercialization as cut foliage, regardless of salicylic acid application.

Keywords: Araceae, photoprotection mechanisms, lacy tree philodendron, foliage longevity, ornamental plants.

Resumo

O cultivo de folhagens tropicais, como o guaimbê (*Thaumatophyllum bipinnatifidum)*, em regiões semiáridas pode ser limitado pela elevada irradiância solar, que favorece a ocorrência de estresses abióticos capazes de comprometer a qualidade pós-colheita. Nesse contexto, a aplicação de substâncias mitigadoras, como o ácido salicílico, pode contribuir para a manutenção da qualidade das folhagens, embora ainda sejam escassos os estudos sobre seus efeitos nessas condições. Objetivou-se avaliar a longevidade e qualidade pós-colheita de folhas de *T. bipinnatifidum* cultivadas a pleno sol em região semiárida sob aplicação de diferentes doses de ácido salicílico. O delineamento experimental foi inteiramente casualizado, com três repetições e quatro folhas por unidade experimental. Folhas com 40 cm de largura foram coletadas de plantas escolhidas ao acaso dentro do tratamento. Os tratamentos consistiram em cultivo a pleno sol (controle), aplicações de ácido salicílico nas doses de 80, 160, 240 e 320 mg L^{-1} e cultivo sob sombra. Avaliou-se o tempo de vida de vaso, absorção final de água, condutividade elétrica da água, massa fresca, transpiração, teor de clorofila total e parâmetros de colorimetria (L*, C* e ºHue). As folhas de guaimbê apresentaram elevada longevidade e mantiveram a qualidade visual ao longo do período de avaliação. Além disso, a aplicação de diferentes doses de ácido salicílico não promoveu alterações significativas nos parâmetros pós-colheita avaliados. Assim, conclui-se que *T. bipinnatifidum* cultivado em condições semiáridas apresenta elevado potencial para comercialização como folhagem de corte, independentemente da aplicação de ácido salicílico.

Palavras-chave: Araceae, mecanismos de fotoproteção, guaimbê, longevidade da folhagem, plantas ornamentais.

Introduction

The flower and ornamental plant market represents a significant segment of the global agribusiness sector, with emphasis on the production of tropical foliage widely used in floral arrangements and landscaping (Medeiros and Favero, 2024). In this context, *lacy tree philodendron* (*Thaumatophyllum bipinnatifidum* (Schott ex Endl.) Sakur., Calazans & Mayo) it stands out for the high ornamental value of its large, decorative leaves. This arborescent, heliophytic species, endemic to South America, has a hemiepiphytic habit and is commonly found in humid tropical forests, it also thrives in diverse locations, such as rocky habitats and coastal regions (Sakuragui et al., 2018).

Despite its rusticity, the cultivation of this species under conditions of high solar radiation, such as those found in semi-arid regions, may induce abiotic stress that affects the physiological performance of the plants and the postharvest quality of the foliage (Fiorucci and Fankhauser, 2017). High light conditions combined with other stressors can antagonistically influence the functioning of photosystem II (PSII), inhibiting their photosynthetic functions, in addition to promoting oxidative damage resulting from the overproduction of reactive oxygen species (ROS), such as hydrogen peroxide and singlet oxygen (Shi et al., 2022). These conditions lead to the destruction of structures such as cell membranes and chloroplasts, as well as a reduction in stomatal conductance and the activity of enzymes involved in photosynthesis (Balfagón et al., 2024). These effects can manifest as accelerated senescence and a reduction in the commercial shelf life of the plant material.

Cut foliage holds importance in the international arena representing an estimated value of approximately US$ 1.4 million for the ornamental sector (Faust and Dole, 2021). However, maintaining its quality after harvest remains one of the major challenges of the production chain, since cut leaves can exhibit increased transpiration, accelerating wilting when water absorption does not meet demand, in addition to occurring cellular degradation and electrolyte leakage, reducing tissue turgor and promoting water imbalance (Trivellini et al., 2025; Li et al., 2025a). Considering that postharvest quality depends on maintaining longevity, preserving weight,

*Corresponding author: jvm.bamberg@gmail.com | https://doi.org/10.1590/2447-536X.v32.e323139 | Editor: Leosane Cristina Bosco, Universidade Federal de Santa Catarina, Brasil | Received: May 30, 2026 | Accepted: July 29, 2026 | Available online: 2026 |

and the visual characteristics of the foliage, considerable efforts have been devoted to developing alternatives that minimize economic losses and preserve these favorable post-harvest conditions.

The application of stress-mitigating substances, such as salicylic acid, has been reported as an effective strategy to enhance plant tolerance to adverse conditions by regulating physiological responses, activating antioxidant mechanisms, and maintaining cellular integrity (Sangwan et al., 2022; Nguyen et al., 2024; Teixeira et al., 2024). The effect of salicylic acid (SA) stems from its role as a signaling molecule, inducing the expression of genes related to defense mechanisms and the regulation of plant senescence. Its antioxidant action promotes the scavenging of reactive oxygen species (ROS), contributing to cell membrane stability and delaying cell death (Abd et al., 2026). Furthermore, SA delays leaf senescence by inhibiting ethylene biosynthesis through the control of the enzymes 1-aminocyclopropane-1-carboxylate (ACC) synthase and ACC oxidase (Kumar et al., 2021). When applied exogenously, salicylic acid promotes thermotolerance, contributes to the maintenance of Ca^{2+} homeostasis, reduces electrolyte leakage, and prolongs the vase life of ornamental species (Banaee et al., 2013; Sangwan et al., 2022), as demonstrated for statice (*Limonium sinuatum*), carnation (*Dianthus caryophyllus*), lisianthus (*Eustoma grandiflorum*), and yarrow (*Achillea gypsicola*) (Khandan-Mirkohi et al., 2021; Dehestani-Ardakani et al., 2022; Kwon et al., 2024; Akif-Açikgöz, 2025). These effects can contribute to the preservation of postharvest quality by influencing processes such as transpiration, respiration, and pigment degradation (Wang et al., 2021; Gondor et al., 2022).

Despite this potential, studies evaluating the postharvest behavior of lacy tree philodendron cultivated under high irradiance, as well as the species' response to the exogenous salicylic acid application, remain scarce.

Therefore, the present study aimed to evaluate the longevity and postharvest quality of *Thaumatophyllum bipinnatifidum* leaves cultivated under full-sun conditions in a semi-arid region and subjected to different doses of salicylic acid.

Material and Methods

For the postharvest experiment, leaves were selected from treatments of a field experiment conducted at the Federal University of the São Francisco Valley (UNIVASF), in Petrolina, Pernambuco, Brazil (09°19′16.6″ S, 40°32′44.6″ W; 387 m altitude). The average temperature during the field phase was 27.6 °C, with maximums of 38.8°C in full sun and 36.9 °C under 50% shading. Relative humidity ranged from 36%-81% in full sun and 35%-82% under shading. Maximum global solar radiation reached 30 MJ m^{-2} day^{-1}, with an average of 26.9 MJ m^{-2} day^{-1}. The field experiment was conducted for one year in a randomized complete block design, including soil preparation, installation of a microsprinkler irrigation system, and basal and topdressing fertilization. Foliar sprays containing salicylic acid solution (water, salicylic acid, 80% ethyl alcohol, and Tween surfactant) with the final application taking place one week before harvest.

Leaves were harvested from *Thaumatophyllum bipinnatifidum* plants one year after field transplanting, with an average of ten leaves per plant, cultivated under full sun, with or without different doses of salicylic acid, as well as under shaded conditions. The leaves had a minimum width of 40 cm, according to the commercial standards established by Cooperflora from Brazil. Harvesting was carried out in the morning by cutting the petiole at its base. Immediately after harvest, the leaves were dry packed in cardboard boxes and transported for approximately 2,200 km in a refrigerated truck at 10 °C to the Laboratory of Ornamental Plants and Landscaping at the Luiz de Queiroz College of Agriculture (ESALQ/USP), in Piracicaba, São Paulo, Brazil. At the laboratory, the leaves were weighed, standardized to a petiole length of 35 cm, and kept in containers filled with tap water.

The leaves were maintained under environmental conditions of 21 ± 2 °C, relative humidity between 60% and 80%, and continuous artificial illumination from LED lamps (± 225 lux). Throughout the experimental period, neither the water was replaced nor the petioles recut.

The experiment was arranged in a completely randomized design consisting of six treatments, three experimental units (replicates) per treatment, and four leaves per experimental unit (subsamples). The treatments consisted in full-sun cultivation (control), foliar application of salicylic acid at concentrations of 80, 160, 240, and 320 mg L^{-1}, and shaded cultivation (reference treatment). For the variables fresh mass, transpiration, total chlorophyll content, and colorimetric parameters, a factorial arrangement was adopted, considering the factors management condition and evaluation time (0, 7, 14, and 21 days after harvest).

The postharvest evaluations included vase life, final water absorption, transpiration, electrical conductivity of the water, fresh mass, total chlorophyll content, and colorimetric parameters (L*, C*, and °Hue).

Vase life was determined when 50% of the leaves in each replicate showed a loss of commercial quality, characterized by the occurrence of spotting, necrosis, darkening, wilting, or leaf yellowing.

Final water uptake was determined by the difference between the solution volume present at the beginning and at the end of the experiment (Khenizy et al., 2014). Transpiration was estimated from changes in the mass of the entire system (leaf + container + solution), with the containers sealed using plastic film to minimize evaporative water loss (Degif and Woltering, 2015).

Electrical conductivity and pH of the water were measured on the first and last days of the experiment using a benchtop conductivity meter and a digital pH meter. Leaf fresh mass was determined throughout the postharvest period using a semi-analytical balance, and the results were expressed in grams.

Total relative chlorophyll content was assessed using a portable atLEAF® CHL Plus chlorophyll meter, with readings taken at the base, middle section, and apex of the leaves. The values obtained were converted to mg cm^{-2} based on the atLEAF CHL conversion and the relationship between relative chlorophyll content and SPAD units, following the linear model proposed by Zhu et al. (2012).

Colorimetric evaluations consisted of determining the L*, C*, and Hue angle (ºHue) parameters using a Konica Minolta colorimeter, model CR-400. The mean value for each leaf was obtained from three readings taken at predetermined regions (base, middle, and apex), and the results were expressed as dimensionless values corresponding to each colorimetric parameter.

The data were subjected to analysis of variance (ANOVA; $p < 0.05$), and the normality of residuals was assessed using the Shapiro–Wilk test. When significant differences were observed, the Scott–Knott test (5%) was applied for the production management factor, and regression analysis was used for the post-harvest duration factor. To further investigate the relationships among the response variables: vase life, final water absorption, electrical conductivity of the water, fresh mass, transpiration, total chlorophyll, and colorimetric parameters (L*, C*, and °Hue), Pearson correlation analyses were performed. Pearson's correlation coefficients were calculated among the response variables using RStudio 2026. Statistical analyses were performed using Sisvar® 5.8 software, and graphs were generated in SigmaPlot® 14.5.

Results

Visual assessment of the treatments throughout the evaluation period presented slight yellowing by the end of the evaluation period. The gradual progression of leaf senescence observed across all treatments indicates that *Thaumatophyllum bipinnatifidum* maintained its ornamental quality for an extended period after harvest, demonstrating its potential for use as cut foliage (Fig. 1). This behavior suggests that the species possesses intrinsic characteristics favorable for postharvest conservation, such as the maintenance of tissue integrity and visual quality.

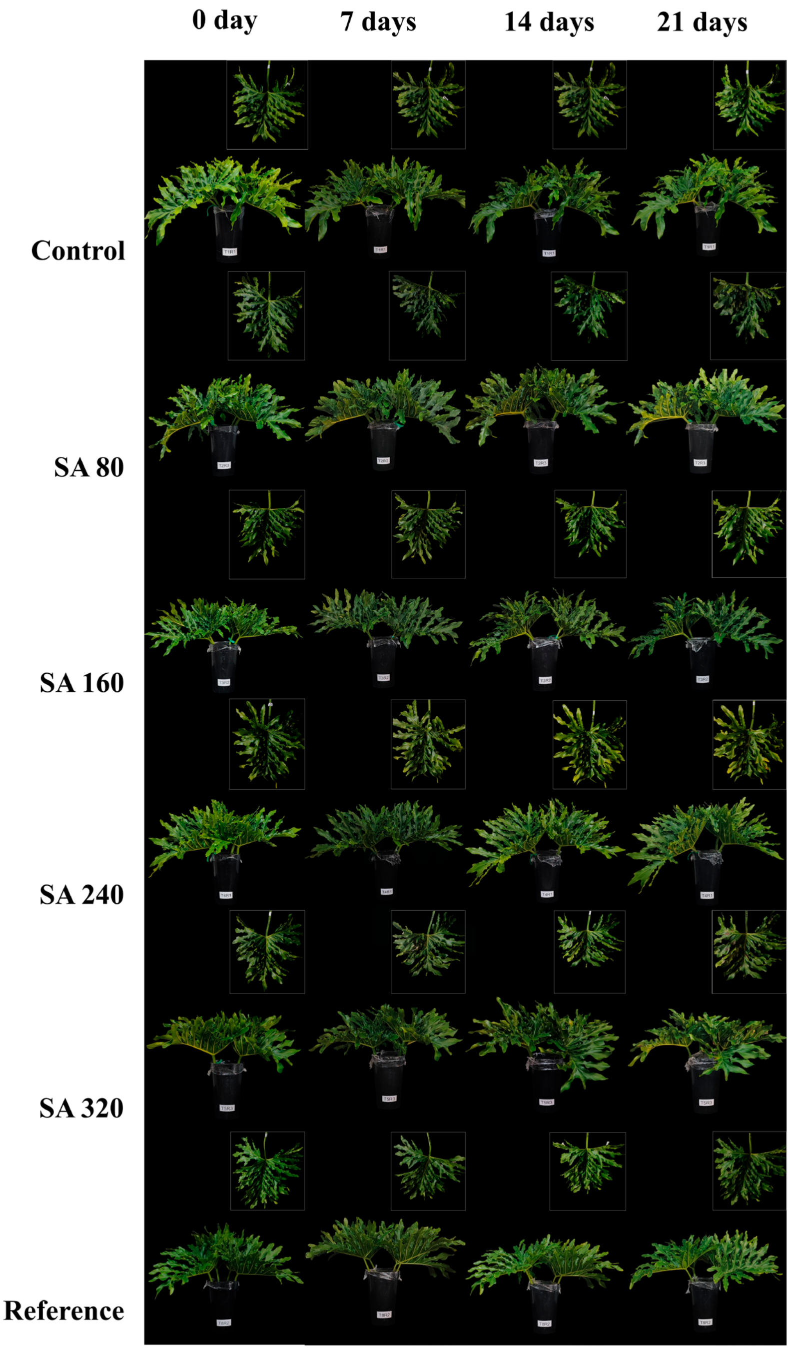

Fig. 1. Visual appearance of *T. bipinnatifidum* leaves subjected to control, salicylic acid application (SA 80, SA 160, SA 240, and SA 320 mg L^{-1}), and reference (shade) treatments, stored for 21 days.

There was no statistically significant difference, at the 5% probability level, among the production management treatments for the parameters vase life and FWA. Regarding the electrical conductivity of the water (ECw), it was observed that the treatments Control, SA 240, SA 320, and Reference presented higher values than those observed in the managements SA 80 and SA 160 (Table 1).

The treatments conducted under full sun conditions (Control, SA 80, SA 160, SA 240, and SA 320) presented higher fresh mass means when compared to the Reference treatment, with Control, SA 80, and SA 240 standing out (Fig. 2A). Regarding the behavior of fresh mass throughout the postharvest evaluation period, a quadratic adjustment was observed, with an increase in values until approximately the third day, followed by a slight reduction throughout the evaluated period (Fig. 2B). The initial increase can be attributed to the rehydration of leaf tissues following harvest and transport, whereas the subsequent reduction reflects the gradual progression of senescence and water loss during the storage period.

The transpiration of *T. bipinnatifidum* leaves presented a quadratic adjustment, with a progressive initial increase until approximately the fifteenth day, followed by a subsequent reduction in this parameter (Fig. 3).

Table 1. Postharvest parameters of *Thaumatophyllum bipinnatifidum* leaves produced in the field in response to control, salicylic acid application (SA 80, SA 160, SA 240, and SA 320 mg L^{-1}), and reference (shade) treatments.

Treatments	Vase life (days)	FWA (g H_2O)	ECw (µS cm^{-1})
Control	23.3 a	365.9 a	388.5 a
SA 80 mg L^{-1}	24.0 a	375.2 a	361.6 b
SA 160 mg L^{-1}	19.0 a	349.8 a	365.4 b
SA 240 mg L^{-1}	26.0 a	369.8 a	385.7 a
SA 320 mg L^{-1}	21.3 a	427.5 a	390.5 a
Reference	24.0 a	314.5 a	389.2 a
Test F	0.746 ns	0.449 ns	0.028*
CV (%)	26.81	17.22	3.06

*Means per column with different letters are significant by the Scott-Knott test ($p < 0.05$); ns = not significant; FWA = Final water absorption and ECw = Electrical conductivity of the water.

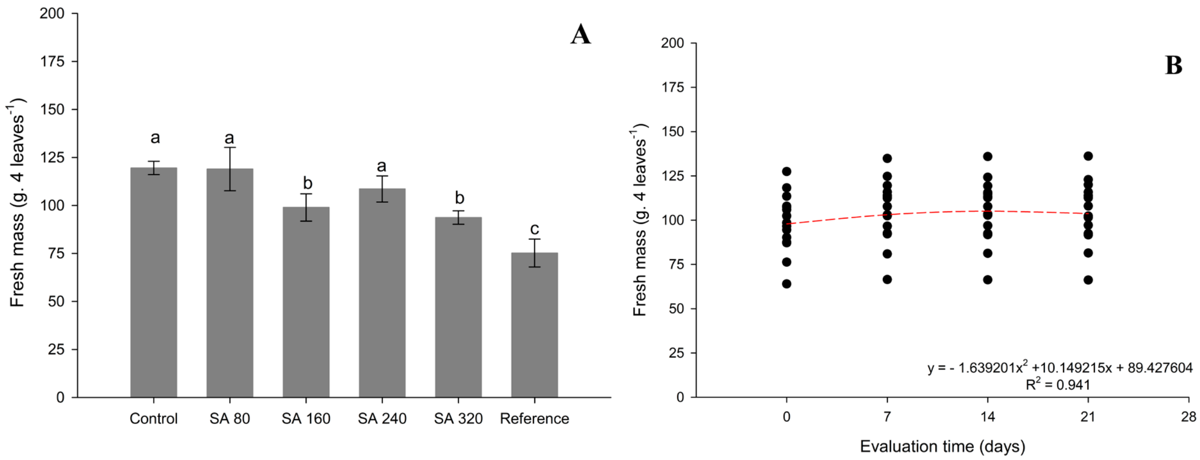

Fig. 2. Means among treatments (A) and Trend curve (B) of the fresh mass of *T. bipinnatifidum* leaves. (A) Means followed by different letters indicate significant differences between treatments by Tukey test ($p < 0.05$). Bars indicate standard error ($n = 3$). (B) The fitted regression model was significant ($p < 0.05$). Control = under full sun; SA 80 = salicylic acid at doses of 80 mg L-1; SA 160 = salicylic acid (160 mg L-1); SA 240 = salicylic acid (240 mg L-1); SA 320 = salicylic acid (240 mg L-1); Reference = under shade conditions.

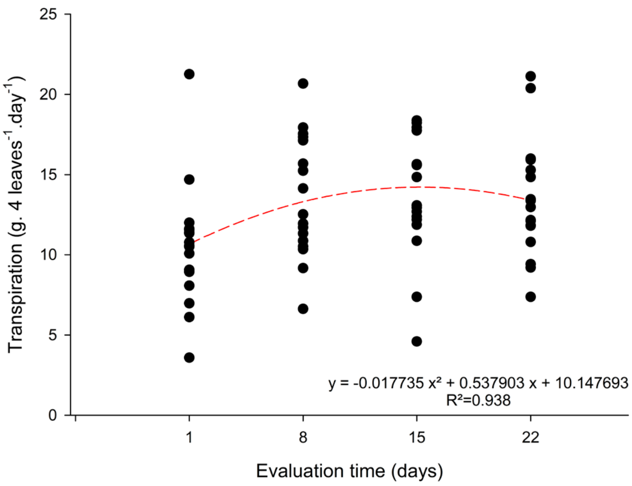

Fig. 3. Regression curve of the transpiration of *T. bipinnatifidum* leaves as a function of the postharvest evaluation period. The fitted regression model was significant ($p < 0.05$).

The treatments conducted under full-sun conditions (Control, SA 80, SA 160, SA 240, and SA 320) showed higher mean total chlorophyll values compared with the Reference treatment (Fig. 4).

When analyzing the behavior of the L* and C* parameters throughout the postharvest evolution period, statistical significance was observed (Figs. 5A and 5B).

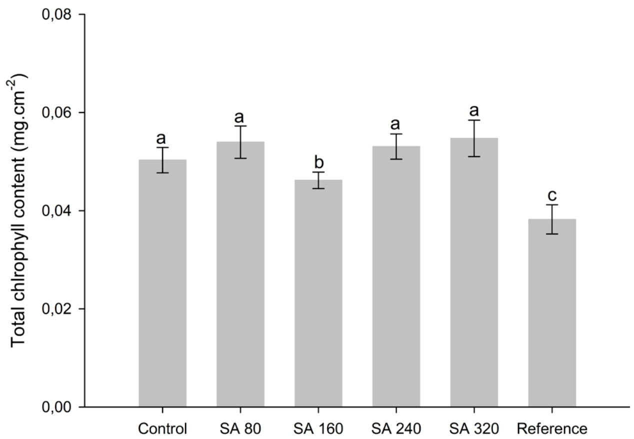

Fig. 4. Means total chlorophyll content of *T. bipinnatifidum* leaves subjected to different production managements.
Means followed by different letters indicate significant differences between treatments by Tukey test ($p < 0.05$). Bars indicate standard error ($n = 3$).
Control = under full sun; SA 80 = salicylic acid at doses of 80 mg L-1; SA 160 = salicylic acid (160 mg L-1); SA 240 = salicylic acid (240 mg L-1); SA 320 = salicylic acid (240 mg L-1); Reference = under shade conditions.

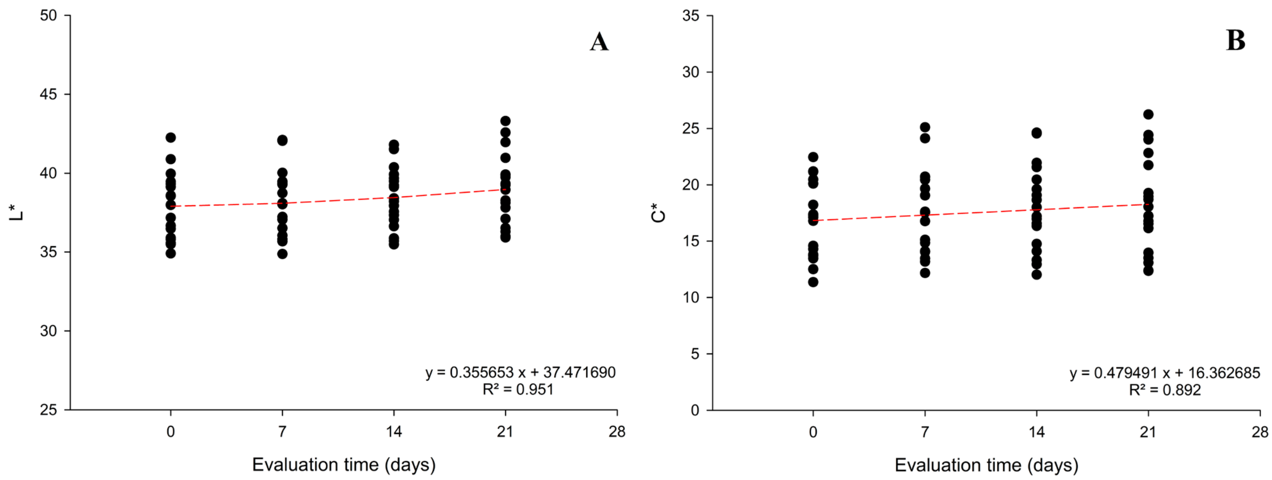

Fig. 5. Regression curve of the lightness (L*) parameter (A) and chromaticity parameter (C*) (B) of *T. bipinnatifidum* leaves as a function of postharvest evolution time.
The fitted regression model was significant ($p < 0.05$).

An increase in L* and C* values was noted in *Thaumatophyllum bipinnatifidum* leaves throughout the post-harvest period, as evidenced by the linear regressions shown in the Figure 5. No significant effects of treatments or storage period were observed for the hue angle (h°), which represents color of leaves. Values ranged from 123,37° to 130,56°, indicating that the green coloration was maintained throughout the storage period.

Vase life did not show strong correlations with any of the evaluated postharvest variables (all $|r| < 0.60$). Similar behavior was observed for electrical conductivity of the water, which also did not exhibit significant correlations with the other parameters (Fig. 6). In contrast, final water absorption showed a positive correlation with fresh mass (r = 0.64-0.67) and transpiration (r = 0.47-0.79), with this association being more evident after 21 days of storage. Fresh mass, in turn, was positively correlated with total chlorophyll content (r = 0.60-0.74). Total chlorophyll content showed a positive correlation with hue angle (°Hue) (r = 0.65-0.73) and a negative correlation with lightness (L) (r = -0.75 to -0.83) and chroma (C) (r = -0.76 to -0.83).

Furthermore, L* and C* showed a very strong positive correlation with each other, while both were negatively correlated with hue angle (°Hue). These results demonstrate that variables related to leaf water status represented primarily by water absorption, fresh mass, and transpiration are associated with one another, as are parameters related to visual quality, represented by chlorophyll content and colorimetric parameters (Fig. 6).

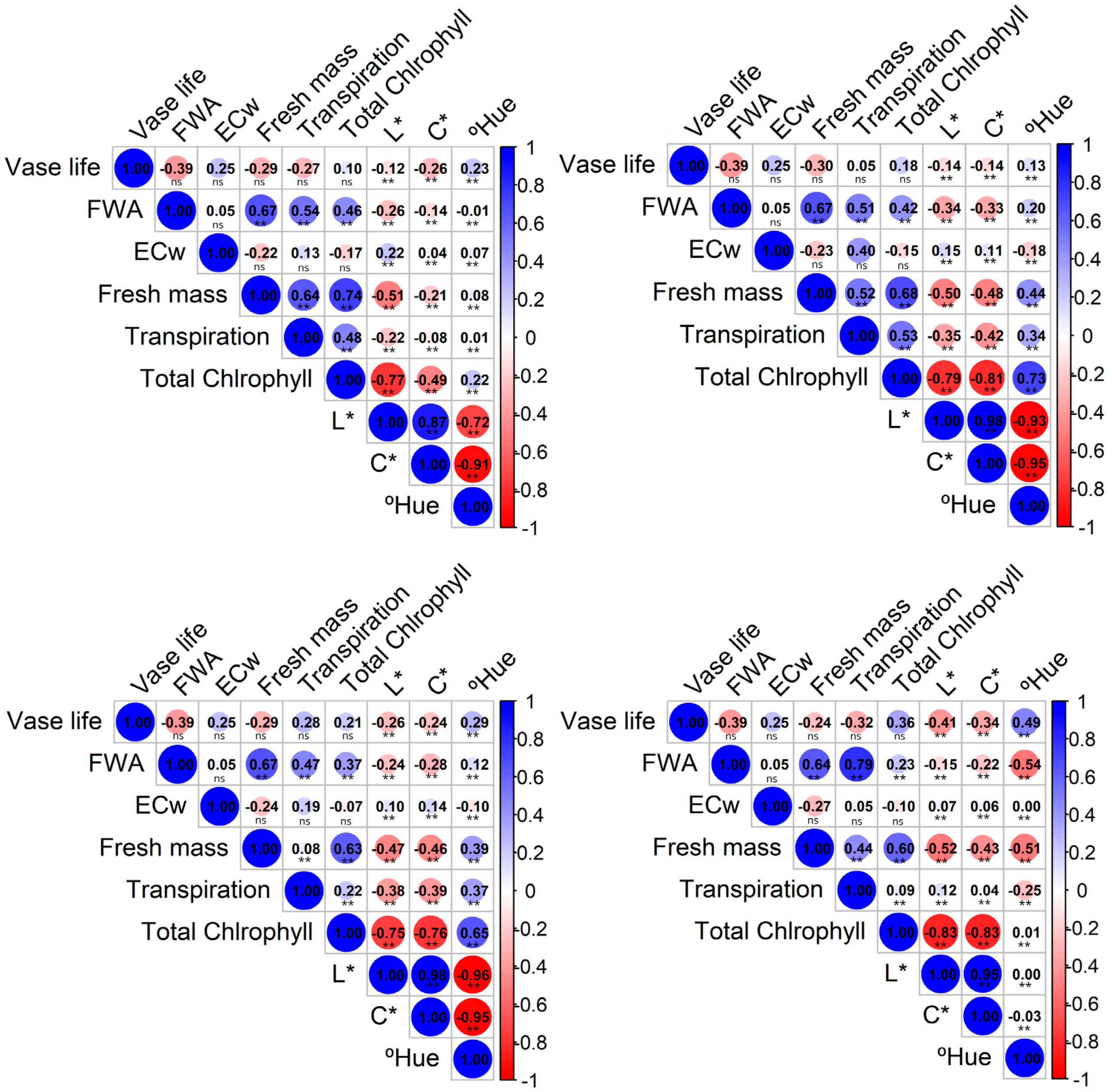

Fig. 6. Pearson correlation matrix among postharvest quality variables of *T. bipinnatifidum* leaves, evaluated at 0 (A), 7 (B), 14 (C), and 21 (D) days of storage. Circle color and size indicate the direction and strength of the correlations, while the numbers represent Pearson's correlation coefficients (r). Significant correlations are indicated by asterisks ($p < 0.05$; $p < 0.01$).

Discussion

Thaumatophyllum bipinnatifidum has proven to be a crop with a long vase life when produced in semi-arid regions. With an average vase life of 23 days, the species exhibited greater post-harvest longevity compared to other cut foliage crops, such as *Anthurium andraeanum* (10 days) and *Danae racemosa* (21 days) (Bulgari et al., 2015; Rida and Taha, 2025). This longevity even exceeded the 15-day period reported for the control treatment of the same species by Rida and El-Gedawey (2022).

Post-harvest longevity is directly associated with the maintenance of water status and reduced cellular degradation. Water balance is influenced by leaf water loss which occurs due to reduced water absorption and increased transpiration variables that are strongly correlated with each other and with fresh mass (Figure 6) (Franzoni et al., 2024; Trivellini et al., 2025). It was expected that the application of salicylic acid would reduce the transpiration rate, given that its exogenous application promotes stomatal closure, thereby contributing to reduced water and fresh mass loss, as well as the maintenance of leaf water balance (Pereira et al., 2018; Li et al., 2025b). However, in the present study, this effect was not significant; transpiration and fresh mass showed similar behavior across treatments throughout the post-harvest period, and water uptake remained constant.

Regarding the species' structural characteristics, it was observed that management under full sun, regardless of the presence or absence of salicylic acid, promoted greater biomass accumulation, as evidenced by higher fresh mass values compared to *T. bipinnatifidum* plants grown under shade (Fig. 2A). These results are primarily linked to production conditions, since higher solar radiation incidence can boost photosynthetic activity due to the greater energy availability in a full-sun environment and potentially enhance carbon fixation efficiency, although physiological assessments are required to confirm this benefit (Ghassemi-Golezani and Abdoli, 2024).

Exogenous application of salicylic acid may have mitigated cellular degradation, a hypothesis supported by the lower electrical conductivity values observed in treatments with 80 and 160 mg L^{-1} of SA (Table 1). Electrical conductivity is an indicator of cell membrane integrity and is directly related to electrolyte leakage. Lower values for this parameter suggest that salicylic acid contributed to preserving membrane stability, possibly by inducing defense mechanisms that reduce lipid peroxidation and, consequently, electrolyte leakage (Pereira et al., 2018). Although these results indicate that salicylic acid contributed to preserving cellular integrity and the photosynthetic apparatus, this effect did not translate into greater foliage longevity, as these parameters showed no correlation with vase life (Fig. 6) (Sangwan et al., 2022).

The visual appearance of cut leaves is an important parameter for assessing quality during the post-harvest period. Good visual quality was observed in *T. bipinnatifidum* leaves (Fig. 1), they remained green and showed only slight yellowing by the end of the period across all treatments. Although full-sun cultivation resulted in higher total chlorophyll content compared to shaded cultivation (Fig. 4), no significant loss of total chlorophyll was detected during the post-harvest period. Chlorophyll content is a key parameter for assessing damage caused by stress from high solar irradiance, as high radiation levels tend to accelerate chlorophyll degradation and leaf yellowing (Chen et al., 2021). Consistent with the positive correlation with fresh mass, the differences in total chlorophyll content observed in the *T. bipinnatifidum* foliage appear to be primarily associated with the cultivation conditions rather than the post-harvest period.

Reinforcing this behavior, colorimetric analyses demonstrated that, for all treatments, the lightness (L*) and chromaticity (C*) parameters showed a slight linear upward trend throughout the evaluation period, whereas the °Hue parameter remained constant (Fig. 5). The L*, C*, and °Hue values indicate that the leaves became gradually lighter and more saturated, without significant changes in coloration (Esposito et al., 2026). Salicylic acid treatments were expected to delay leaf senescence compared to the control and shading treatments, given that this phytohormone inhibits ethylene biosynthesis, thereby mitigating the hormone's effects on the senescence process (Kumar et al., 2021). However, no differences were observed among the treatments, indicating that the delayed onset of leaf senescence is an inherent characteristic of the *T. bipinnatifidum* species cultivated in semi-arid regions, allowing it to maintain its visual quality during the post-harvest period.

Overall, the results demonstrate that *T. bipinnatifidum* foliage produced in semi-arid regions exhibits high resistance to leaf senescence processes, favoring the maintenance of cellular integrity and water balance throughout the postharvest period. Although cultivation under full sun yielded foliage with greater fresh mass and higher total chlorophyll content, these characteristics neither affected nor correlated with vase life, as there were no significant differences among the treatments. Thus, the advantages gained during cultivation did not translate into postharvest performance.

Conclusions

It is concluded that *Thaumatophyllum bipinnatifidum* foliage produced under semi-arid conditions exhibits high postharvest potential, evidenced by a long vase life and the maintenance of visual quality. The different cultivation practices like full sun with or without salicylic acid application, as well as shade cultivation did not result in significant differences regarding the longevity or visual quality of the foliage. Although cultivation in full sun yielded higher fresh mass and total chlorophyll content compared to shade cultivation, these differences did not translate into variations in postharvest performance; rather, they were associated with field growing conditions. Thus, it is concluded that the application of salicylic acid during production did not influence the postharvest attributes of *T. bipinnatifidum* grown under semi-arid conditions.

Acknowledgments

The authors gratefully thank to Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, Brazil (DS-88887.969421/2024-00); Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (AMD-0065-5.01/25).

Author Contribution

JVMB: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing - Original Draft. **LRA:** Investigation, Methodology. **DMS:** Investigation, Methodology. **HFF:** Investigation, Methodology. **LGL:** Investigation, Methodology. **BHM:** Writing - Review & Editing. **CMM:** Conceptualization, Supervision, Writing - Review & Editing. **MZBC:** Conceptualization, Supervision, Project Administration, Funding Acquisition, Writing - Review & Editing.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

All the research data is contained in the manuscript.

Declaration of generative AI and AI-assisted technologies in the writing process

Statement: During the preparation of this work the author(s) used ChatGPT (OpenAI) to assist with English language revision, grammar correction, and improvement of text clarity and readability. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

References

ABD, S. T.; HATAMNIA, A.A.; MOHAMMADI, M.; SAADATIAN, M.; AGHAEI, M. Melatonin enhances nitric oxide, salicylic acid, and lignin accumulation to reduce neck bending and extend vase life of gerbera cut flowers. **BMC Plant Biology**, v.26, n.1, p.558, 2026. https://doi.org/10.1186/s12870-026-08371-7

AKIF-AÇIKGÖZ, M. Salicylic acid and chitosan elicitors: pre-harvest foliar applications improve antioxidant activity by increasing phenolic compounds in *Achillea gypsicola* Hub-Mor**. Chemistry & Biodiversity**, v.22, n.7, p.e202402716, 2025. https://doi.org/10.1002/cbdv.202402716

BALFAGÓN, D.; PASCUAL, L. S.; SENGUPTA, S.; HALLIDAY, K. J.; GÓMEZ-CADENAS, A.; PELÁEZ-VICO, M. A.; SINHA, R.; MITTLER, R.; ZANDALINAS, S. I. WRKY48 negatively regulates plant acclimation to a combination of high light and heat stress. **Plant Journal**, v.117, n.6, p.1642-1655, 2024. https://doi.org/10.1111/tpj.16658

BANAEE, S.; HADAVI, E.; MORADI, P. Interaction effect of sucrose, salicylic acid and 8-hydroxyquinoline sulfate on vase-life of cut gerbera flowers. **Current Agriculture Research Journal**. v.1, p.39–43, 2013. https://doi.org/10.12944/CARJ.1.1.05.

BULGARI, R.; NEGRI, M.; FERRANTE, A. Evaluation of postharvest storage and treatments in cut ruscus foliage. **Advances in Horticultural Science**, v.29, n.2/3, p.103-108, 2015. https://www.jstor.org/stable/26525313

CHEN, Y.; YAMORI, W.; TANAKA, A.; TANAKA, R.; ITO, H. Degradation of the photosystem II core complex is independent of chlorophyll degradation mediated by Stay-Green Mg^{2+} dechelatase in *Arabidopsis*. **Plant science**, v.307, p.110902, 2021. https://doi.org/10.1016/j.plantsci.2021.110902

DEGIF, A. B.; WOLTERING, E. J. Efficacy of physiologically active anti-transpirants on excised leaves of potted plants. **Malaysian Journal of Medical Biological Research**, v.2, n.2, p.167-174, 2015. https://doi.org/10.18034/MJMBR.V3I2.415

DEHESTANI-ARDAKANI, M.; GHOLAMNEZHAD, J.; ALIZADEH, S.; MEFTAHIZADEH, H.; GHORBANPOUR, M. Salicylic acid and herbal extracts prolong vase life and improve quality of carnation (*Dianthus caryophyllus* L.) flowers. **South African Journal of Botany**, v.150, p.1192-1204, 2022. https://doi.org/10.1016/j.sajb.2022.09.028

ESPOSITO, A.; VETRANO, F.; MONCADA, A.; PALAZZOLO, E.; LUCIA, C.; MICELI, A. Suitability of *Apium graveolens* L. var. *secalinum* Alef. to hydroponic cultivation for baby leaf production. **Scientia Horticulturae**, v.357, p.114619, 2026. https://doi.org/10.1016/j.scienta.2026.114619

FAUST, J. E.; DOLE, J. M. **Cut flowers and foliages**. Oxfordshire, United Kingdom: CAB International, 2021. 408p. https://doi.org/10.1079/9781789247602.0000

FIORUCCI, A. S.; FANKHAUSER, C. Plant strategies for enhancing access to sunlight. **Current Biology**, v.27, n.17, p.R931–R940, 2017. https://doi.org/10.1016/j.cub.2017.05.085

FRANZONI, G.; ROVERA, C.; FARRIS, S.; FERRANTE, A. Packaging materials and their effect on ruscus quality changes during storage and vase life. **Postharvest Biology and Technology**, v.210, p.112789, 2024. https://doi.org/10.1016/j.postharvbio.2024.112789

GHASSEMI-GOLEZANI, K.; ABDOLI, S. Salicylic acid and ironoxide nano-particles improved the growth and productivity of ajowan under salt stress. **Advances in Horticultural Science**, v.38, n.2, p.129-140, 2024. https://www.jstor.org/stable/27323204

GONDOR, O. K.; PÁL, M.; JANDA, T.; SZALAI, G. The role of methyl salicylate in plant growth under stress conditions. **Journal of Plant Physiology**, v.277, p.153809, 2022. https://doi.org/10.1016/j.jplph.2022.153809

KHANDAN-MIRKOHI, A.; PIRGAZI, R.; TAHERI, M. R.; AJDANIAN, L.; BABAEI, M.; JOZAY, M.; HESARI, M. Effects of salicylic acid and humic material preharvest treatments on postharvest physiological properties of statice cut flowers. **Scientia Horticulturae**, v.283, p.110009, 2021. https://doi.org/10.1016/j.scienta.2021.110009

KHENIZY, S.; EL-MONEIM, A. A.; ABDEL-FATTAH, G. Effect of natural extracts on vase life of gypsophila cut flowers. **Scientific Journal Flowers and Ornamental Plants**, v.1, n.1, p.1-16, 2014.

KUMAR, N.; TOKAS, J.; RAGHAVENDRA, M.; SINGAL, H. R. Impact of exogenous salicylic acid treatment on the cell wall metabolism and ripening process in postharvest tomato fruit stored at ambient temperature. **International Journal of Food Science and Technology**, v.56, n.6, p.2961-2972, 2021. https://doi.org/10.1111/ijfs.14936

KWON, H.; LEPORINI, C.; KIM, S.; HEO, S. Prolonged vase life by salicylic acid treatment and prediction of vase life using petal color senescence of cut lisianthus. **Postharvest Biology and Technology**, v.209, p.112726, 2024. https://doi.org/10.1016/j.postharvbio.2023.112726

LI, X.; LIU, Q.; LI, H.; CHEN, Y.; CHEN, Z.; HE, S.; LIU, J.; YAN, S. Pretreatment with nano-silver extends the post-harvest longevity of gladiolus cut flowers by reducing free water mobility. **Horticultural Plant Journal**, v.11, n.1, p.377-388, 2025a. https://doi.org/10.1016/j.hpj.2024.03.010

LI, X.; XIAO, L.; SONG, Y.; WEI, X.; RENGEL, Z.; CHEN, Y.; LI, K.; CHEN, Q. Coordination of phytomelatonin and salicylic acid signalling in stomatal closure. **Plant, Cell & Environment**, v.48, n.10, p.7656-7670, 2025b. https://doi.org/10.1111/pce.70048

MEDEIROS, F. O.; FAVERO, L. A. Aspectos da competitividade brasileira no comércio internacional da floricultura e flores de corte. **Brazilian Journal of Business**, v.6, n.3, e72218, 2024. https://doi.org/10.34140/bjbv6n3-020

NGUYEN, N. X. B.; SAITHONG, T.; BOONYARITTHONGCHAI, P.; BUANONG, M.; KALAPANULAK, S.; WONGS-AREE, C. Methyl salicylate induces endogenous jasmonic acid and salicylic acid in 'Nam Dok Mai' mango to maintain postharvest ripening and quality. **Journal of Plant Physiology**, v.303, p.154356, 2024. https://doi.org/10.1016/j.jplph.2024.154356

PEREIRA, A. M.; GOMES, M. P.; FREIRE, A. I.; COSTA, L. C.; SANTOS, R. M. C.; FINGER, F. L. Salicylic acid reduces chilling injury in post-harvest of Bird-of-Paradise. **Revista Brasileira de Ciências Agrárias**, v.13, n.3, p.1-6, 2018. https://doi.org/10.5039/agraria.v13i3a5558

RIDA, M. E. F.; EL-GEDAWEY, H. Influence of some anti-transpirants on the longevity, quality and cold dry transportation of *Thaumatophyllum bipinnatifidum* (Selloum) cut leaves. **Scientific Journal of Flowers and Ornamental Plants**, v.9, n.2, p.115-132, 2022. https://doi.org/10.21608/sjfop.2022.251807

RIDA, M. F.; TAHA, A. M. Enhance the longevity and aesthetic appeal of *Anthurium andraeanum* cv. Fire cut leaves by using some natural components. **Advances in Horticultural Science**, v.39, n.2, p.83-92, 2025. http://doi.org/10.36253/ahsc-17201

SAKURAGUI, C. M.; CALAZANS, L. S. B.; OLIVEIRA, L. L.; MORAIS, E. B.; BENKO-ISEPPON, A. M.; VASCONCELOS, S.; SCHRAGO, C. E. G.; MAYO, S. J. Recognition of the genus *Thaumatophyllum* Schott - formerly *Philodendron subg. Meconostigma* (Araceae) − based on molecular and morphological evidence. **PhytoKeys**, n.98, p.51-71, 2018. https://doi.org/10.3897/phytokeys.98.25044

SANGWAN, S.; SHAMEEM, N.; YASHVEER, S.; TANWAR, H.; PARRAY, J. A.; JATAV, H. S.; SHARMA, S.; PUNIA, H.; SAYYED, R. Z.; ALMALKI, W. H.; POCZAI, P. Role of salicylic acid in combating heat stress in plants: insights into modulation of vital processes. **Frontiers in Bioscience-Landmark**, v.27, n.11, p.310, 2022. https://doi.org/10.31083/j.fbl2711310

SHI, Y.; KE, X.; YANG, X.; LIU, Y.; HOU, X. Plants response to light stress. **Journal of Genetics and Genomics**, v.49, n.8, p.735-747, 2022. https://doi.org/10.1016/j.jgg.2022.04.017

TEIXEIRA, M. I. O.; ALVES, A. B.; DIAS, P. C; JACOME, T.; MELO, A. K. S.; SOUZA, J. E. A. Efeito do ácido salicílico na germinação de *Pityrocarpa moniliformis* Benth. em meio salino. **Agropecuária Científica no Semiárido**, v.20, n.2, p.172-175, 2024. https://doi.org/10.30969/6fv08y76

TRIVELLINI, A.; FRANZONI, G.; FERRANTE, A.; MENSUALI, A. Melatonin improves the postharvest life of cut ruscus foliage after a long storage condition. **Postharvest Biology and Technology**, v.222, p.113419, 2025. https://doi.org/10.1016/j.postharvbio.2025.113419

WANG, W.; ZHANG, G.; YANG, S.; ZHANG, J.; DENG, Y.; QI, J.; WU, J.; FU, D.; WANG, W.; HAO, Q. Overexpression of isochorismate synthase enhances drought tolerance in barley. **Journal of Plant Physiology**, v.260, p.153404, 2021. https://doi.org/10.1016/j.jplph.2021.153404

ZHU J.; TREMBLAY, N.; LIANG, Y. Comparing SPAD and atLEAF values for chlorophyll assessment in crop species, **Canadian Journal of Soil Science**, v.92, p.645–648, 2012. https://doi.org/10.4141/cjss2011-100