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ALTERNATIVES TO CONVENTIONAL PROPAGATION: *IN VITRO* GERMINATION OF *Pleroma* spp. SEEDS AS A STRATEGY FOR CONSERVATION AND SEEDLING PRODUCTION

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ABSTRACT

Objective: This study aimed to evaluate the efficiency of *in vitro* seed germination of *Pleroma granulosum*, *Pleroma heteromallum*, and *Pleroma mutabile*, with the goal of optimizing their germination rates.

Theoretical Framework: Species of the *Pleroma* genus, known for their ornamental and ecological value, face challenges in seed propagation and are commonly multiplied through vegetative methods such as cutting and air layering. These techniques are limited by low production scale and difficulties in maintaining the phytosanitary quality of seedlings. *In vitro* germination thus emerges as a promising alternative to overcome these limitations.
Method: The seeds were subjected to four treatments: T1 – Multiplant® substrate; T2 – germitest® paper; T3 – vermiculite; and T4 – MS medium, under controlled temperature (25 ± 1°C) and a 16-hour photoperiod, except for T1, which was conducted in a greenhouse, for a period of 21 days.

Results and Discussion: Results indicated low efficiency of the Multiplant® substrate, possibly due to unfavorable environmental conditions. In contrast, *in vitro* germination in MS medium showed the highest germination rates for all species, followed by vermiculite, which performed well especially for *P. granulosum* and *P. heteromallum*.

Research Implications: The results indicate the potential of *in vitro* germination as a strategy for the conservation and cultivation of *Pleroma* species, highlighting new possibilities for propagation through biotechnological methods.

Originality/Value: This research is pioneering in comparing the in vitro germination performance of seeds from these three species, providing a foundation for optimizing cultivation conditions and expanding knowledge on their propagation.

Keywords: Melastomataceae, *Pleroma granulosum*, *Pleroma heteromallum*, *Pleroma mutabile*, Native species, Micropropagation.

ALTERNATIVAS À PROPAGAÇÃO CONVENCIONAL: GERMINAÇÃO *IN VITRO* DE SEMENTES DE *Pleroma* spp. COMO ESTRATÉGIA PARA CONSERVAÇÃO E PRODUÇÃO DE MUDAS

RESUMO

Objetivo: Este estudo teve como objetivo avaliar a eficiência da germinação *in vitro* de sementes de *Pleroma granulosum*, *Pleroma heteromallum* e *Pleroma mutabile*, visando otimizar suas taxas germinativas.

Referencial Teórico: Espécies do gênero *Pleroma*, de reconhecida relevância ornamental e ecológica, enfrentam dificuldades na propagação por sementes e são comumente multiplicadas por métodos vegetativos, como estaquia e alporquia, técnicas limitadas pela baixa escala de produção e pela manutenção da qualidade fitossanitária das mudas. A germinação *in vitro* surge, assim, como alternativa promissora para superar esses desafios.

Método: As sementes foram submetidas a quatro tratamentos: T1 – substrato Multiplant®, T2 – papel germitest®; T3 – vermiculita; e T4 – meio MS, sob temperatura controlada (25 ± 1°C) e fotoperíodo de 16 horas, exceto T1, que foi conduzido em casa de vegetação, durante 21 dias.

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Resultados e Discussão: Os resultados indicaram baixa eficiência do Multiplant®, possivelmente devido a condições ambientais desfavoráveis. Em contrapartida, a germinação *in vitro* no meio MS apresentou as maiores taxas de germinação para todas as espécies, seguido da vermiculita, que teve bom desempenho especialmente para *P. granulosum* e *P. heteromallum*.

Implicações da Pesquisa: Os resultados indicam o potencial da germinação *in vitro* como uma estratégia para a conservação e o cultivo de espécies do gênero *Pleroma*, destacando novas possibilidades de propagação por meio de métodos biotecnológicos.

Originalidade/Valor: A pesquisa é pioneira na comparação do desempenho germinativo *in vitro* de sementes dessas três espécies, fornecendo subsídios para otimizar as condições de cultivo e ampliar o conhecimento sobre sua propagação.

Palavras-chave: Melastomataceae, *Pleroma granulosum*, *Pleroma heteromallum*, *Pleroma mutabile*, Espécies nativas, Micropropagação.

ALTERNATIVAS A LA PROPAGACIÓN CONVENCIONAL: GERMINACIÓN *IN VITRO* DE SEMILLAS DE *Pleroma* spp. COMO ESTRATEGIA PARA LA CONSERVACIÓN Y PRODUCCIÓN DE PLÁNTULAS

RESUMEN

Objetivo: Este estudio tuvo como objetivo evaluar la eficiencia de la germinación *in vitro* de semillas de *Pleroma granulosum*, *Pleroma heteromallum* y *Pleroma mutabile*, con el fin de optimizar sus tasas germinativas.

Marco Teórico: Las especies del género *Pleroma*, de reconocida relevancia ornamental y ecológica, enfrentan dificultades en la propagación por semillas y son comúnmente multiplicadas por métodos vegetativos, como esquejes y acodos aéreos, técnicas limitadas por la baja escala de producción y el mantenimiento de la calidad fitosanitaria de las plántulas. La germinación *in vitro* surge así como una alternativa prometedora para superar estos desafíos.

Método: Las semillas fueron sometidas a cuatro tratamientos: T1 – sustrato Multiplant®, T2 – papel germitest®; T3 – vermiculita; y medio T4 – MS, bajo temperatura controlada (25±1°C) y fotoperiodo de 16 horas, excepto T1, que se realizó en invernadero, durante 21 días.

Resultados y Discusión: Los resultados indicaron una baja eficiencia de Multiplant®, posiblemente debido a condiciones ambientales desfavorables. Por el contrario, la germinación *in vitro* en medio MS presentó las tasas de germinación más altas para todas las especies, seguida de la vermiculita, que tuvo un buen desempeño especialmente para *P. granulosum* y *P. heteromallum*.

Implicaciones de la investigación: Los resultados indican el potencial de la germinación *in vitro* como estrategia para la conservación y cultivo de especies del género *Pleroma*, destacando nuevas posibilidades de propagación a través de métodos biotecnológicos.

Originalidad/Valor: La investigación es pionera en comparar el desempeño de la germinación in vitro de semillas de estas tres especies, brindando apoyo para optimizar las condiciones de cultivo y ampliar el conocimiento sobre su propagación.

Palabras clave: Melastomataceae, *Pleroma granulosum*, *Pleroma heteromallum*, *Pleroma mutabile*, Especies nativas, Micropropagación.

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1 INTRODUCTION

Pleroma is a genus of the Melastomataceae family of high ecological and ornamental value, whose species are popularly known as quaresmeiras (Latoh *et al* ., 2022; Santos *et al* ., 2022). Despite the high seed production per plant, these are extremely small, which makes their collection and handling difficult. In addition, they have a high proportion of seeds without embryos, resulting in low germination rates and reduced seedling survival (Bortolini *et al* ., 2008; Cézar *et al* ., 2009; Nienow *et al* ., 2010; Nicknich *et al* ., 2013; Duarte *et al* ., 2019; Fernández-Sánchez *et al* ., 2020). The embryo, usually tiny and with little or no endosperm, becomes highly susceptible and lacking in reserves necessary for the initial development of seedlings (Carreira & Zaidan, 2007).

As an alternative to seminal propagation , techniques vegetative as cuttings , mini-cuttings and air layering they are widely used (Fragoso *et al* ., 2017; Latoh *et al* ., 2018; Latoh *et al* ., 2019; Bastos *et al* ., 2020; Latoh *et al* ., 2022), by provide bigger uniformity genetics and rapid rooting . However , they face limitations regarding production in wide scale , seasonality , maintenance phytosanitary and, in some cases , requirement of phytoregulators (Silva *et al* ., 2019; Latoh *et al* ., 2022).

In this scenario , germination *in vitro* stands out as alternative viable for difficult species propagation , allowing high germination rates , seedling production in any time of year , with sanity guaranteed and space saving (Afonso *et al* ., 2018; Silva *et al* ., 2021; Soares et *al* ., 2023). In addition of this , it allows multiplication mass and conservation *ex situ* , contributing to the improvement and preservation genetics (Prudente *et al* ., 2016). However , this technique requires care for the asepsis , can to generate anomalies physiological or genetics and involves infrastructure and labor costs qualified (Albino *et al* ., 2019; Silva *et al* ., 2021; Hasnain *et al* ., 2022).

Facing the challenges of propagation conventional , studies about germination *in vitro* of *Pleroma* spp. can increase the efficiency germination and allow the production of seedlings in scale commercial . So this work he had as objective evaluate germination potential *in vitro* of seeds of *Pleroma granulosum* , *Pleroma heteromallum* and *Pleroma mutabile* , in different substrates , aiming increase the seed germination rates of these species .

2 METHODOLOGY

2.1 SELECTION OF PARENT PLANTS, CAPSULES AND SEEDS

In this study, mother plants of *P. granulosum* , *P. heteromallum* and *P. mutabile* located in Mendes/RJ (22°31'36" S; 43°43'58" W), a tropical highland climate region (Cwa), with an average annual temperature of 24 °C, rainfall of 1395 mm and an average altitude of 446 m (Prefeitura Municipal de Mendes, 2024) were used. The capsules were manually collected from five mother plants per species, between April and June 2020 for *P. granulosum* and *P. heteromallum* , and between May and July for *P. mutabile* , based on the natural opening period. After collection, they were placed in paper bags, dried in the shade at room temperature and sent to the Seed Epidemiology and Pathology Laboratory (LabEPS), of the Plant Science Department of UFRRJ (Seropédica campus), to conduct the experiments.

2.2 SEED DISINFESTATION AND SOWING

In the laboratory, the capsules of *P. granulosum* , *P. heteromallum* and *P. mutabile* were manually shaken on sulfite paper to release the seeds. After removing impurities, the seeds were homogenized and distributed in 1.8 mL plastic vials (IMEC ® cryogenic tubes), with 0.01 g of seeds per vial, adapted from Fava and Albuquerque (2009). The seeds were disinfected with a sodium hypochlorite solution (1%) containing Tween ® 20 for 1 minute, followed by three washes in autoclaved distilled water. Seeds that remained in the solution or in the washing water were discarded.

The experiment was organized in a completely randomized design (CRD), with four treatments: (T1) Multiplant ® substrate in 80 mL polypropylene pots (negative control); (T2) double layer of germitest ® paper soaked with autoclaved distilled water 2.5 times its own mass and arranged in Petri dishes (positive control); (T3) vermiculite soaked with autoclaved distilled water 2.5 times its own mass and arranged in 40 mL glass bottles ; and (T4) Murashige and Skoog (1962) culture medium (MS) with 25% of the original salt concentration, arranged in 40 mL glass bottles . 15 g L^{-1} sucrose (Neon PA Laderquímica) and 8 g L^{-1} agar (MicroMED ISOFAR) were added to the culture medium . The pH of the medium was adjusted to 5.8±0.1 before adding the agar and autoclaving was performed for 20 minutes at 121°C and 1.2 atm.

Seed disinfection and sowing procedures were performed in a laminar flow chamber. The flasks and Petri dishes had their edges protected with transparent PVC film and were kept

for 21 days in a BOD type greenhouse (EletroLab Model EL 212) at a temperature of 25±1°C, irradiance of approximately 25 µmol m-2 s-1 provided by tubular fluorescent lamps (Philips TL-D 15W/75-6) and a photoperiod of 16 hours. There was an exception for the negative control (T1), whose seed disinfection and sowing procedures were performed in the laboratory and then the pots were placed in a greenhouse, where they remained for the same period of time.

The experimental unit consisted of polypropylene pots, Petri dishes or glass bottles, depending on the treatment, with four replicates each, totaling 16 experimental units. The experiments with *P. granulosum* and *P. heteromallum* were carried out simultaneously, and with *P. mutabile* later.

2.3 SEED GERMINATION TEST

After 21 days of sowing (DAS), the germination test was performed, considering seeds with open primary roots and plumules as germinated. The test followed the Rules for Seed Analysis (Brazil, 2009) and the Instructions for Analysis of Seeds of Forest Species (Brazil, 2013), using the weighted repetition method.

Germination data were subjected to the Shapiro-Wilk normality test at 5% probability, followed by analysis of variance (ANOVA) and comparisons of means by the Tukey test , at 5% probability, using the SISVAR 5.8 software (Ferreira, 2011).

3 RESULTS AND DISCUSSIONS

Pleroma species studied remained within the maximum tolerance allowed by the Rules for Seed Analysis (Brazil, 2009) . However, none of the species tested showed germination of the seeds placed on the commercial substrate Multiplant ® (T1).

The mean values of the number of germinated seeds, considering 0.01 g of *P. granulosum seeds* and the different treatments, are presented in Table 1. Total germination of 11, 66 and 120 seeds was observed in the treatments on germitest paper (T2), vermiculite (T3) and MS culture medium (T4), respectively. The comparison test of means indicated a significant difference between the treatments, with *in vitro* germination on MS medium being superior to the others. Furthermore, germination on vermiculite was significantly superior to that observed on germitest paper .

Table 1

Number of seeds germinated in 0.01g of Pleroma seeds granulosum at 21 days after sowing on substrate commercial Multiplant ® (T1); about paper germitest willing in Petri dish (T2); in vitro on vermiculite (T3) and in vitro on MS culture medium (T4).

Treatment	R1	R2	R3	R4	Total	Difference between repetitions	Table Tolerance	Average *
	Unit							
Multiplant ® (T1)	0	0	0	0	0	0	-	0.0 c
Paper (T2)	1	0	5	5	11	4	8	2.75c
Vermiculite (T3)	16	16	20	14	66	6	18	16.50 b
Half MS (T4)	34	27	29	30	120	7	23	R$ 30.00 to

*means followed by the same letter in the column do not differ from each other by the Tukey test at 5% probability. Coefficient of variation (%) = 19.01.

Research has shown that germination of the species *T. pulchra* (synonymy *Pleroma raddianum*) and *T. granulosa* (synonym *P. granulosum*), soaked in water and placed on filter paper, occurred from the 8th and 15th day, respectively (Zaia & Takaki , 1998). These authors observed maximum germination of around 30% for *T. pulchra* and 15% for *T. granulosa* , with the non-germinated seeds lacking an embryo, as visually verified using an optical microscope.

For the species *P.* heteromallum , the average values for the number of germinated seeds in 0.01 *g* of seeds for the different treatments are shown in Table 2. Total germination of 101, 72 and 413 seeds was observed for treatments T2, T3 and T4, respectively. The comparison test of averages showed that there was a significant difference between the treatments, with T4 (on MS medium) being superior to the others, followed by T2 (on germitest paper) and T3 (on vermiculite).

P. heteromallum seeds *in vitro* , on MS culture medium, can increase the average seed germination percentage by up to four times, when compared with germination on germitest paper arranged in a Petri dish.

Table 2

Number of seeds germinated in 0.01g of Pleroma seeds heteromallum at 21 days after sowing on substrate commercial Multiplant ® (T1); about paper germitest willing in Petri dish (T2), in vitro on vermiculite (T3) and in vitro on MS culture medium (T4).

Treatment	R1	R2	R3	R4	Total	Difference between repetitions	Table Tolerance	Average *
	Items.							
Multiplant ® (T1)	0	0	0	0	0	0	-	0.00 d
Paper (T2)	26	20	27	28	101	8	21	25.25 b
Vermiculite (T3)	19	18	15	20	72	5	19	18.00 c

Half MS (T4)	105	109	96	103	413	13	42	103.25 a

*means followed by the same letter in the column do not differ from each other by Tukey 's test at 5% probability. Coefficient of variation (%) = 9.38.

The results found for treatment T2 corroborate the work of Fava and Albuquerque (2009), who observed an average number of 32 germinated seeds in 0.01g of *Tibouchina seeds. stenocarpa* . Sowing was carried out in transparent plastic boxes (gerbox type), on blotting paper, using four subsamples, each with 0.01 g of seeds, spread over the substrate. The boxes were kept closed and placed in germination chambers at a temperature of 25°C and a photoperiod of 8 hours.

Campos *et al* . (2009) reported low efficiency in the sexual propagation of *P. heteromallum* , with a total seed germination rate of 56%. However, unlike the results obtained in this study, the authors found 68% of germinated seeds for the control treatment, that is, seeds from natural pollination, placed to germinate on sheets of filter paper arranged in Petri dishes and stored in a BOD type incubator, at a temperature of 25°C ±1.

Prudente *et al* . *(2012) evaluated the germination of Tibouchina* seeds *clavata* under different temperatures (between 15 and 40 °C) and light conditions, using four replicates of 0.01 g of seeds on filter paper. The best germination performance (63%) occurred at 25 °C, with emphasis on the presence of light (46% germination), while in the absence of light there was no germination. The authors considered the rate satisfactory, due to the high seed production per plant.

For *P. mutabile* , total germination of 123 seeds was observed in T4. For the other treatments, there was no seed germination (Table 3).

Table 3

Number of seeds germinated in 0.01g of Pleroma mutabile seeds at 21 days after sowing on substrate commercial Multiplant ® (T1); about paper germitest willing in Petri dish (T2), in vitro on vermiculite (T3) and in vitro on MS culture medium (T4).

Treatment	R1	R2	R3	R4	Total	Difference between repetitions	Table Tolerance	Average *
						Items.		
Multiplant ® (T1)	0	0	0	0	0	0	-	0.0
Paper (T2)	0	0	0	0	0	0	-	0.0
Vermiculite (T3)	0	0	0	0	0	0	-	0.0
Half MS (T4)	25	40	30	28	123	15	24	30.75

*based on the results obtained, no statistical analysis was performed.

Studies such as that of Simão *et al* . (2007) demonstrate the influence of factors such as seed pre-selection and environmental conditions on the germination process. These authors observed that dry *Tibouchina seeds mutabilis* (syn. *Pleroma mutabile*) showed faster and more

concentrated germination between the 7th and 15th day, reaching 87% germination at 21 days. This performance was attributed to the rigorous selection process, which included sieving, soaking in distilled water under light for 24 hours and selection of only seeds with visible embryo. These methodological procedures may justify the differences in relation to the results obtained in the present study.

In addition, Simão and Takaki (2008) found that, in batches used for germination of *T. mutabilis* , only 20 to 40% of the seeds had visible embryos before the test, which may have contributed to the high germination rates recorded. These authors also tested germination over a wide temperature range (15 to 35 °C), observing the best results between 25 and 30 °C (76.7% and 61.4%, respectively), which reinforces the importance of temperature as a determining factor in the germination process. Thus, the similarities in the methodological approaches, especially the prior selection of seeds, help to understand the variations observed between the data of this study and those of previous studies.

The aspect of seed germination for the *species P. granulosum , P. heteromallum* and *P. mutabile* in treatments T2, T3 and T4 are found in Figures 1, 2 and 3, respectively.

Figure 1

Aspect of germination of P. granulosum (A) and P. heteromallum (B) seeds on pair paper layer germitest willing in Petri dishes .

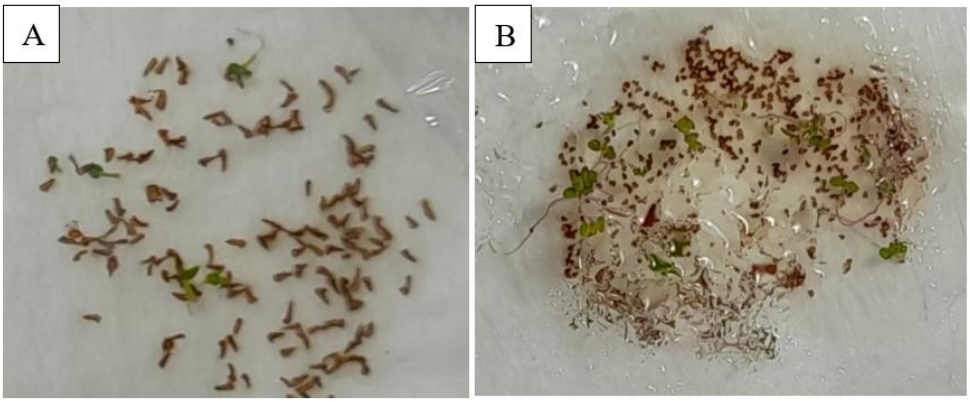


Figure 2

of germination of P. granulosum seeds (A) and P. heteromallum (B) in vitro on vermiculite .

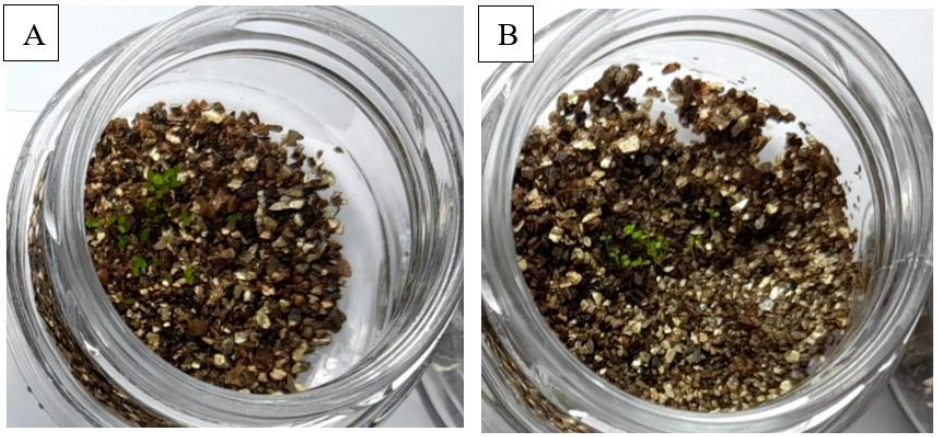
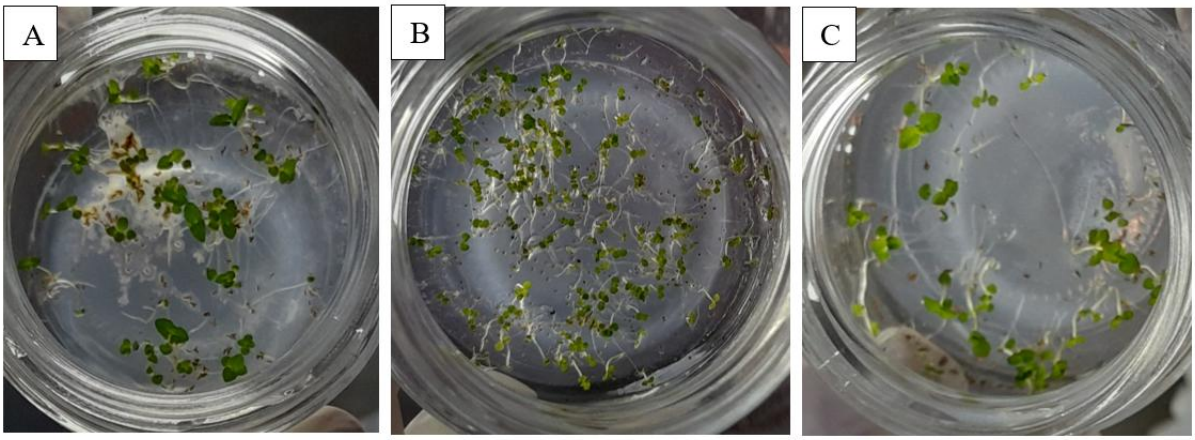


Figure 3

Aspect of germination of P. granulosum seeds (A); P. heteromallum (B); and P. mutabile (C) in vitro on MS medium .



it was possible to notice that seedlings of *P. granulosum and P. heteromallum* germinated on culture medium (T4) and on vermiculite (T3) were more vigorous when compared to those germinated on germitest paper arranged in a Petri dish (T2).

Seed germination results from the interaction of genetic, environmental and technological factors (Wenneck *et al .*, *2021). Pleroma spp.* seeds are tiny, with little or no endosperm, which, in addition to acting as reserve tissue, provides protection to the embryo (Fernández-Sánchez *et al .*, 2020). Among the environmental factors that influence seed germination, we can consider temperature, light, sowing depth, pH, salt concentration, humidity and type of soil/substrate (Rezvani *et al .*, 2018).

Since small environmental variations can interfere with the germination capacity of seeds, it is suggested that the environmental conditions of the greenhouse, as well as the characteristics of the Multiplant ® substrate, can not having been adequate in promoting the seed germination process under the established conditions.

Fernández-Sánchez et al. (2020) observed that *Tibouchina grossa seeds* germinated with 21% success in the laboratory and 44% in the greenhouse, attributing this result to thermal oscillations in the laboratory (20/10 °C) that reduced enzymatic activity. However, *T. grossa seedlings* from laboratory germination died in the first month of monitoring, and those that germinated in the traditional way died in the second month of monitoring.

Melastomataceae seeds , especially *Pleroma* spp., are positive photoblastic , with the seed germination rate influenced by the quantity and quality of available light and the temperature range between 20 and 30°C being the most efficient in seed germination for most species (Lopes *et al* ., 2005; Garcia *et al* ., 2006; Carreira & Zaidan, 2007; Simão *et al* ., 2007; Simão & Takaki , 2008; Fava & Albuquerque, 2009; Prudente *et al* ., 2012; Silva *et al* ., 2022). It is worth noting that and that most experiments with these species are conducted in the laboratory, with seeds arranged on filter paper in gerboxes or Petri dishes, under controlled light and temperature conditions (Zaia & Takaki , 1998; Campos *et al* ., 2009; Prudente *et al* ., 2012).

in vitro germination tends to be more efficient than *ex vitro* , due to greater environmental control and the presence of nutrients in the culture medium (Afonso *et al* ., 2018). Nery *et al* . (2008), when comparing the germination of *Tabebuia serratifolia* (Bignoniaceae) , observed higher percentages and precocity in *in vitro culture* , regardless of the medium used. A similar result was obtained by Coelho *et al* . *(2001) with Pterodon* seeds *pubescens* (Fabaceae) , whose *in vitro* germination rate was 95%, compared to 55% under *ex vitro conditions* .

Santos *et al* . (2011), in a study of the germination of *Caryocar brasiliense* (Caryocaraceae) seeds under *in vitro* and *ex vitro conditions* on filter paper, also observed the highest germination percentage and the highest germination speed index in those cultivated *in vitro* on WPM medium. Abbade *et al* . (2010), studying the germination of *Tabebuia roseo - alba* (Bignoniaceae), also obtained better percentages of germinated seeds in *in vitro cultivation* on MS medium, when compared with *ex vitro* on different substrates (sand, soil, soil + sand and Plantmax ®).

In contrast, Apóstolo *et al* . (2016) did not observe a significant difference between the *ex vitro* seed germination methods (soil: peat: perlite - 1:1:1) and *in vitro* (on WPM medium) in the propagation of *Handroanthus impetiginosus* and *Handroanthus ochraceus.* (

Bignoniaceae), except for *Handroanthus lapacho whose in vitro* germination percentage was significantly higher than that of *ex vitro* .

Flores *et al* . *(2018) demonstrated that in vitro* germination of *Dyckia vicentensis* (Bromeliaceae) was more efficient than the *ex vitro method* , with greater speed and uniformity during germination, in addition to the production of more vigorous seedlings and a higher survival rate of plants in the greenhouse. These results corroborate those observed by Bhattacharya and Khuspe (2001), who found that under *in vitro* cultivation conditions there is an increase in the germination percentage and the germination speed index of seeds of different *Carica cultivars. papaya* , compared to *ex vitro condition.*

Plessis *et al* . (2020) observed that the best performance in terms of germination parameters of *Hibiscus coddii* subsp . *barnardii* (Malvaceae) occurred for seeds germinated on filter paper, solid Gelrite ® medium and in lower concentrations of MS medium (¼, ½ and ¾), however, these treatments proved unsustainable for the establishment of seedlings *in vitro* . Thus, Plessis *et al* . (2020) found that MS medium with 100% of the original salt concentration is the most suitable treatment for the *in vitro production* of *H. coddii seedlings* , due to the better growth performance of the seedlings.

Zambrano-Arteaga *et al* . (2022) evaluated the germination efficiency of *Carludovica seeds palmata* (Cyclanthaceae) *in vitro* in semi-solid MS medium; and *ex vitro* , in three different substrates (soil, peat and 1:1 soil-peat mixture). These authors found that the *in vitro seed germination technique* provided the highest germination percentages, showing that this method is more efficient for the production of palm seedlings compared to conventional protocols. Zambrano-Arteaga *et al* . *(2022) suggested that in ex vitro* conditions it is more difficult to control variables such as light, temperature and even oxygen levels, factors that in one way or another could affect the germination processes of *C. palmata seeds* .

Small and light seeds have little stored energy, so they are generally dependent on light for their germination and biomass production, that is, for photosynthesis and seedling growth (Salomão *et al* ., 2023). Therefore, small seeds such as those of Melastomataceae , which have little nutrient reserve, when grown in a culture medium such as MS, can have the seedling establishment process benefited by the availability of macro and micronutrients, vitamins and amino acids in the medium (Burgos *et al* ., 2023).

in vitro culture media , such as MS, represents an effective alternative for the germination of *Pleroma granulosum* , *P. heteromallum* and *P. mutabile seeds, especially in situations in which natural conditions or conventional substrates do not favor the germination*

process. Furthermore, in vitro cultivation appears to be a promising strategy for both seedling propagation and *ex situ conservation* of these species.

4 CONCLUSION

germination of *P. granulosum* , *P. heteromallum* and *P. mutabile* seeds varied significantly among the treatments tested. Seed germination on the substrate commercial Multiplant ® he was ineffective for all species , which suggests that substrate conditions , possibly associated to the variations environmental aspects of the greenhouse , not they were ideal for the process germinative . On the other hand , the alternative substrates such as paper germitest , vermiculite and MS culture medium , presented results variables , but significantly more effective .

For *P. granulosum* and *P. heteromallum* , the MS culture medium proved to be the most efficient for seed germination , with the highest average of seeds germinated , followed by vermiculite and paper germitest . These results corroborate the idea of what conditions environmental controlled and the use of culture media suitable , such as MS, can optimize seed development by providing one combination balanced nutrients and elements necessary for germination and establishment of seedlings .

The research also revealed that for *P. mutabile* , germination occurred exclusively in the treatment with the MS medium , reinforcing the idea that this species requires conditions more specific to success germinative . The lack of germination in other treatments he can be related to the needs particular characteristics of P. *mutabile for* germination , such as the composition of the substrate and the cultivation environment .

The findings of this study highlight the importance of environmental and technological factors, such as temperature, light, humidity and type of substrate, in the germination process of seeds of species of the genus *Pleroma* (Melastomataceae). Strict control of these variables is essential for the development of efficient propagation strategies, especially under *in vitro culture conditions* . Thus, the data from this study provide support for the improvement of germination protocols aimed at *Pleroma* species , in addition to reinforcing the need for future research aimed at large-scale seedling production and *ex situ* conservation of these plants.

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