


Brief Communication

Effect of substrate on ornamental bromeliads seedling production

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Abstract

Experiments were conducted with the species *Aechmea distichantha* and *Vriesea hieroglyphica* aiming to improve the management of native bromeliad production. Seedlings of *V. hieroglyphica* and *A. distichantha* were planted on substrates sphagnum, forest litter, phenolic foam flakes and carbonized rice husk (BRH), *Pinus bark* (PB) and *Eucalyptus bark* (EB) with vermiculite in proportions of 1:1, 1:2 or 1:3). The experimental design was a randomized block consisting of 4 replications with 12 plants per plot, totaling the 12 treatments. Evaluations were performed after 270 for *Vriesea hieroglyphica* and 125 days for *Aechmea distichantha* of experimentation and the variables diameter and height of seedlings, number of leaves and dry matter mass of shoot system were evaluated. Our results showed that *V. hieroglyphica* and *A. distichantha* seedlings respond different in relation to substrate composition. Vermiculite is not recommended for *V. hieroglyphica* and *A. distichantha* seedlings cultivation. Sphagnum and forest litter are the best substrate media for *V. hieroglyphica* and *A. distichantha* seedlings growth after the germination process.

Key-words: *Aechmea*, *Vriesea*, Bromeliaceae, Sphagnum, Forest Litter

Bromeliads are one of the most significant components of Atlantic Forest, with a preeminent contribution to its physiognomy and covering a wide number of species with ornamental potential. Bromeliads exhibit exotic forms with great diversity of colors and forms of leaves and flowers; as a result, a great landscape and floricultural potential (Ferreira et al., 2007). There are 1,342 species of bromeliads (1,177 endemic) comprised in 46 genera in Brazil (REFLORA, 2019). The floricultural industry requests an increase of new natural/exotic products in several sectors of domestic and international markets (Negrelle et al., 2012). The increase of commercial production of bromeliads could bring benefits to producers, mainly by an increase of profits to small producers, and to the environment by reducing the predatory extractivism of endangered plant species (Santos et al., 2005).

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Epiphytic plants require substrates with low density and, high permeability and aeration; thus, the presence of high fraction of the organic matter in the substrate should improve this characteristic and the addition of mineral soil should be used for plants cultivated in containers, increasing the substrate porosity (Kämpf, 1992). Bromeliads use different substrates for fixation such as soil, rocks and other plants (epiphytes) (Cogliatti-Carvalho et al., 2001). The different habitats and especially the nature of the substrate influence the presence of the bromeliads, which can vary widely in leaf size and color, and flower morphology (Benzing, 2000). Bromeliads, due to the adaptations to their natural environment, have special needs when it comes to substrate (Bromeliads.info, 2019). The substrate for bromeliad commercial production should be well drained, aerated, non-compacted and slightly acidic, to allow

the development of root system (Paula and Silva, 2004).

In order to contribute and improve the technology for bromeliads cultivation, experiment was conducted to analyze the growth and development of the ornamental bromeliads *Aechmea distichantha* and *Vriesea hieroglyphica* seedlings cultivated on several substrates.

Seeds of *Vriesea hieroglyphica* were collected at the Alto da Serra Biological Reserve of Paranapiacaba, Santo André, São Paulo State, Brazil, and seeds of *Aechmea distichantha* at the Botanical Garden of São Paulo, São Paulo, São Paulo State, Brazil. The seeds were sown in plastic boxes containing soil as substrate at a 50% shading greenhouse. The *Vriesea hieroglyphica* seedlings (262 days after sowing, 2.1 cm height, 2.2 cm diameter and 7.5 leaves, n=10) and *Aechmea distichantha* seedlings (99 days after sowing, 1.85 cm height, 3.5 cm diameter and 4.7 leaves, n=10) were

planted in 128 cells polystyrene trays with sphagnum, forest litter, phenolic flake foam and mixtures of burnt rice hulls (BRH), *Pinus* bark (PB) or *Eucalyptus* bark (EB) with vermiculite in ratios of 1:1, 1:2 and 1:3 as substrates. The experiments were conducted in a greenhouse covered with translucent plastic with 50% shading. The evaluations were carried out after 270 of cultivation for *Vriesea hieroglyphica* and 125 days for *Aechmea distichantha*. The variables diameter and height of the seedlings, number of leaves and shoot system of dry matter were analyzed.

The experimental design consisted of 12 treatments on a randomized block design with 4 replications and 12 seedlings per plot. Data were analyzed by variance analysis (ANOVA) and means compared by Tukey's test ($p \leq 0.05$), using the Sisvar 5.3 Statistical Software.

Table 1. Diameter, height, number of leaves and dry matter of shoot system of *Vriesea hieroglyphica* seedlings.

Treatment	Diameter (cm)		Height (cm)		Number of leaves		Dry matter of shoot system (g)	
Sphagnum	7.64	a	4.21	a	21.33	a	0.64	a
Forest litter	7.63	a	4.06	ab	22.19	a	0.63	a
Phenolic flake	5.22	b	3.32	ab	15.79	a	0.21	b
BRH + vermiculite (1:1)	6.01	b	3.39	ab	16.16	a	0.29	b
BRH + vermiculite (1:2)	5.72	b	3.50	ab	15.80	a	0.25	b
BRH + vermiculite (1:3)	6.13	b	3.48	ab	17.38	a	0.30	b
PB + vermiculite (1:1)	5.71	b	3.59	ab	14.93	a	0.21	b
PB + vermiculite (1:2)	5.57	b	3.32	b	14.62	a	0.20	b
PB + vermiculite (1:3)	5.70	b	3.27	b	15.06	a	0.20	b
EB + vermiculite (1:1)	5.09	b	3.28	ab	13.66	a	0.18	b
EB + vermiculite (1:2)	5.15	b	3.22	ab	13.37	a	0.19	b
EB + vermiculite (1:3)	5.20	b	3.28	ab	14.71	a	0.19	b
F	10.47*		2.35*		1.48 ^{NS}		42.94*	
DMS (5%)	1.34		0.72		8.56		0.13	
CV (%)	9.21		18.64		22.00		17.63	

Means accompanied by the same letter do not differ between leaves at the 5% probability level by the Tukey test. NS – Not Significant at the 5% probability level.

Table 2. Diameter, height, number of leaves, and dry matter of shoot system of *Aechmea distichantha* seedlings.

Treatment	Diameter (cm)		Height (cm)		Number of leaves		Dry matter of shoot system (g)	
Sphagnum	15.20	a	8.38	a	12.53	a	1.65	a
Forest litter	15.55	a	7.88	a	13.18	a	1.42	a
Phenolic flake	7.85	b	4.10	b	9.60	b	0.62	b
BRH + vermiculite (1:1)	6.75	bc	3.53	b	8.78	bc	0.32	b
BRH + vermiculite (1:2)	6.48	bc	3.43	b	8.88	bc	0.35	b
BRH + vermiculite (1:3)	6.98	bc	3.48	b	8.90	b	0.32	b
PB + vermiculite (1:1)	5.33	c	3.28	b	7.65	c	0.23	b
PB + vermiculite (1:2)	5.63	c	3.33	b	8.15	bc	0.28	b
PB + vermiculite (1:3)	5.55	bc	3.15	b	7.95	bc	0.27	b
EB + vermiculite (1:1)	5.28	c	3.33	b	7.68	bc	0.24	b
EB + vermiculite (1:2)	5.50	c	3.40	b	7.93	bc	0.28	b
EB + vermiculite (1:3)	5.33	c	3.20	b	7.78	bc	0.25	b
F	70.53*		35.93*		14.99*		19.56*	
DMS (5%)	2.17		1.53		2.57		0.55	
CV (%)	11.46		14.68		11.68		42.75	

Means accompanied by the same letter do not differ between leaves at the 5% probability level by the Tukey test. NS – Not Significant at the 5% probability level.

The sphagnum and forest litter substrates showed the best results ($p \leq 0.05$) for all biometric variables of *A. distichantha* seedlings (Table 1) and for diameter, leaf number and shoot dry mass ($p \leq 0.05$) of *V. hieroglyphica* seedlings (Table 2) in relation to the others treatments. Sphagnum showed better results ($p \leq 0.05$) than PB + vermiculite (1:2) and (1:3) substrates for height of *V. hieroglyphica* seedlings (Table 2); whereas, sphagnum and forest litter substrates were superior ($p \leq 0.05$) to phenolic flake, BRH + vermiculite (1:3), PB + vermiculite (1:1) treatments (Table 2) for *A. distichantha* seedlings.

The plant habit of bromeliads plants such as epiphytic, terrestrial or lithophytes, species with or without tank and, heteroblasty (absence of tank while juvenile plant and presence as the plant turns adult) among others, allowed bromeliads to growth on a wide diversity of substrates, which could explain the different results observed in the literature. The recommended substrate for bromeliad cultivation should have low density, high permeability and

aeration (Kämpf, 1992), not compacted and slightly acidic to allow stimulate the development of root system (Paula, 2001). The literature recommends several types of substrates for bromeliad cultivation such as *Pinus* bark (Muraro et al., 2014; Sanches et al., 2017), soil, sand, vermiculite or sphagnum (Silva et al., 2006), vermiculite (Ferreira, 2007), charred land and rice husk (Rodrigues et al., 2004), vermicompost, tezontle, and pine bark (Trejo-Téllez et al., 2018) and others.

On our study the seedlings were very small and tank was not totally formed (also called atmospheric form); therefore, the root system was also small and probably not fully functional, so substrate as sphagnum and forest litter that holds much water favor the plants cultivated on these substrates. Forest litter had excellent results on our study and organic matter seems to be a very important on substrates formulations; once the development of Pineapple (*Ananas comosus*) roots and shoots were enhanced by organic matter mixed in all substrates analyzed (Moreira et al., 2006), the increase of vermicompost

contents in substrate mixtures improve *Tillandsia flavobracteata* and *T. limbata* performance (Trejo-Téllez et al., 2018) and, organic matter added to substrates improved their chemical characteristics and enhance *Alcantarea imperialis* growth (Rodrigues et al., 2004). Vermiculite is a popular substrate component due to its high water retention, substrate aeration improvement and nutrients contents such as K, Mg and Ca (Owen and Lopez, 2015), however all treatments with vermiculite had a low performance on *V. hieroglyphica* e *A. distichantha* seedlings growth.

The economic potential and environmental benefits of Non-Timber Forest Products, including bromeliads, can avoid predatory extraction preserving forests and stimulate their production in nurseries (Rodrigues et al., 2004). Consequently studies that improve the technology of commercial bromeliad production are very important. Our results showed that vermiculite is not recommended for *V. hieroglyphica* and *A. distichantha* seedlings production. *V. hieroglyphica* and *A. distichantha* seedlings respond different in relation to substrate composition. Sphagnum and forest litter are the best substrate for potting media for *V. hieroglyphica* and *A. distichantha* seedlings after the germination process.

Conflict of interest: All authors declare no conflict of interest.

References

- Benzing, D.H. 2000. Bromeliaceae: profile of an adaptive radiation. Cambridge: Cambridge University Press, 690p
- Bromeliads.Info. Soil and potting needs for bromeliads, 2019. Available at: <<http://www.bromeliads.info/bromeliad-potting-soil/>>. Accessed may 30th
- Cogliatti-Carvalho, L.; Freitas, A.F.N.; Rocha, C.F.D.; Van Sluys, M. 2001. Variação na estrutura e na composição de Bromeliaceae em cinco zonas de restinga no Parque Nacional da Restinga de Jurubatiba, Macaé, RJ. *Revista Brasileira de Botânica* 24(1): 01-09
<http://dx.doi.org/10.1590/S0100-84042001000100001>
- Ferreira, C.A.; Paiva, P.D.D.O.; Rodrigues, T.M.; Ramos, D.P.; Carvalho, J.G.D.; Paiva, R. 2007. Desenvolvimento de mudas de bromélia (*Neoregelia cruenta* (R. Graham) L.B. Smith) cultivadas em diferentes substratos e adubação foliar. *Ciência e Agrotecnologia* 31(3): 666-671
<http://dx.doi.org/10.1590/S1413-70542007000300010>
- Garrett Owen, W.; Lopez, R. G. 2015. Evaluating Container Substrates and Their Components, Purdue Extension, Purdue University, 10p.
<https://www.extension.purdue.edu/extmedia/HO/HO-255-W.pdf>
- Kämpf, A.N. Bromélias. 2006. In: Castro, C.E.F.; Angelis, B.L.D.; Moura, L.P.P.; Silveira, R.B.A.; Angelis Neto, G.; Sato, N.T. Manual de Floricultura. Maringá: SBFPO, 1992. p.201-211
- Moreira, M.A., Carvalho, J.G.D., Pasqual, M., Fráguas, C.B., Silva, A.B.D. 2006. Efeito de substratos na aclimatização de mudas micropropagadas de abacaxizeiro cv. Pérola. *Ciência e Agrotecnologia* 30(5): 495-498
<http://dx.doi.org/10.1590/S1413-70542006000500008>
- Muraro, D., Negrelle, R. R. B., Anacleto, A. 2014. Germinação e sobrevivência de *Vriesea incurvata* Gaudich. sob dossel florestal em diferentes substratos. *Scientia Agraria Paranaensis* 13(3): 251-258
<http://dx.doi.org/10.1818/sap.v13i3.8448>
- Negrelle, R.R.; Mitchell, D.; Anacleto, A. 2012. Bromeliad ornamental species: conservation issues and challenges related to commercialization. *Acta Scientiarum, Biological Sciences* 34(1): 91-100
<http://dx.doi.org/10.4025/actasciobiolsci.v34i1.7314>
- Paula, C.C. 2001. Cultivo prático de bromélias, UFV, 73p.
- Paula, C.C.; Silva, H.M.P. 2004. Cultivo prático de bromélias. Viçosa: Universidade Federal de Viçosa, 106p.
- Reflora. 2019. Bromeliaceae A.Juss. Available at: <<http://floradobrasil.jbrj.gov.br/reflora/listaBrasil/>>. Accessed may 30th
- Rodrigues, T.M.; Paiva, P.D.O.; Rodrigues, C.R.; Carvalho, J.D.; Ferreira, C.A.; Paiva, R. 2004. Desenvolvimento de mudas de bromélia-imperial (*Alcantarea imperialis*) em diferentes substratos. *Ciência e Agrotecnologia* 28(4): 757-763
<http://dx.doi.org/10.1590/S1413-70542004000400005>
- Sanches, L.V.C., Ludwig, F., Bôas, R.L.V., Mateus, C.D.M.D.A. 2017. Growth of *Aechmea fasciata* plants in function of substrate base saturation and fertirrigation methods. *Ornamental Horticulture* 23(4):444-450.
<http://dx.doi.org/10.14295/oh.v23i4.1028>
- Santos, A.J.; Bittencourt, A.M.; Nogueira, A.S. 2005. Aspectos econômicos da cadeia produtiva das bromélias na região metropolitana de Curitiba e litoral paranaense. *Revista Floresta* 35(3): 409-417.
<http://dx.doi.org/10.5380/rf.v35i3.5193>
- Silva, A.L.P.; Franco, E.T.H.; Walter, J.M.; D Bisognin, D.A.; Calgaroto, N.S. 2006.

Aclimatização de clones de *Dyckia maritima* em diferentes substratos – Bromeliaceae. Revista Brasileira de Agrociência 12(4): 495-498

<https://www.researchgate.net/publication/234777786>

ACCLIMATIZATION OF CLONES OF *Dyckia maritima* IN DIFFERENT SUBSTRATES - BROMELIACEAE

Trejo-Téllez, L.I., García-Albarado, J.C., Méndez-Urbano, D., Pérez-Sato, J.A., Gómez-Merino, F.C. 2018. Plant growth and nitrogen concentration of *Tillandsia* species produced in organic, volcanic, and lignocellulosic substrates. Journal of Plant Nutrition 41(20): 2547-2559

<https://doi.org/10.1080/01904167.2018.1482911>

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