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# Nature's Own Miracle: Air Plants an Emerging Ornamental Wonder

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**Abstract**

In the plant kingdom, air plants are indispensable creations of nature and recently gaining popularity. Due to their uniqueness in absorption of water and nutrients through fuzzy trichomes present on leaf surface, sets them far apart from other plants and belongs to epiphytic group. They have a reputation of being well known accumulators of heavy metals present in the air and therefore, act as an excellent biomonitors for purifying the atmosphere. In addition to their medicinal values, their appearance itself makes them aesthetic and a signature ornamental plant as they grow dangling in air without any soil as a substrate. These are low maintenance plants as they require watering once or twice in a week. So they make up a good specimen in a florist's collection of ornamental wonders. This review article highlights interesting facts about air plants, its maintenance and usefulness.

## 1. Introduction

Plants play a vital role in nature and it is impossible to imagine ourselves to live without them. They are nature's precious gift to the ecosystem. Diversity is the mother of enjoyment. So nature has created vivid diversity in the plant kingdom. From the tiniest plant to the tallest trees that seem to touch the sky, are all nature's manifestations. One of the boons of nature to mankind is horticultural science with different branches. Major cereal crops such as wheat, rice and sorghum are well-known staple food crops (UNFAO, 2010). The world is looking towards horticultural crops which are going to satisfy the nutritional security and aesthetic values to mankind. Fruits and vegetables, well known as protective foods, dominate this particular field of science as they are encapsulated with lots of minerals and vitamins that are vital for the very sustenance of life (Singh and Malhotra, 2011). Plantation and spices, popularly known as low-volume with high-value products are important to boost the country's economy. Medicinal and aromatic crops play an important role in maintaining the health of mankind as well as adding to the luxury expenses of an individual. Post-harvest technology helps in dealing with processing, minimizing storage losses and extending the shelf-life of horticultural produce. Floriculture, with its wide display of enchanting flowers, have the ability to steal the stress and worries of the mind and thus a real feast to the eyes and bring joy to heart and helps the mind to bloom with beautiful thoughts (Chadda, 2015). With regard to this, a miracle plant known as air plants, belonging to epiphytic group of *Tillandsia* genus, coming in various forms and sizes, really do act as an ornamental wonder and thus make them a good fit for nature's miracle plants.

## 2. What Do We Know about Air Plants?

Air plants belong to the largest member of *Tillandsia* genus and contain around 650 species of evergreen, perennial flowering plants, belonging to the pineapple family Bromeliaceae (Brighigna *et al.*, 1997; Pryke, 2017). The genus *Tillandsia* is the most xerophytic and primitive of the Bromeliaceae family (Pittendrigh, 1948). Tillandsia species are distributed across Mexico, South America, Central America, Sothern United States and Caribbean (Lesseig, 2016). It can be quoted that "All air plants are Bromeliads but not all Bromeliads are air plants". It is found to grow on holding on to the bark of trees as a as means of support (Brighigna *et al.,* 1997).

## 3. How Do These Differ from Other Plants?

Normally plants grow on soil and also using hydroponics while *Tillandsias* grow on soilless media, most preferably, air itself as a media. Unlike other plants that use their roots for absorption of water and nutrients, *Tillandsias* use specilized trichomes on the surface of leaves for absorption of water and nutrients from the air which is the most striking feature of

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this miracle plant (Figure 1). Previously reported that the fully developed *Tillandsia* Trichomes on the epidermis of the leaf using scanning electron microscopy (Papini *et al.,* 2010). The capillary action between the epidermal surface and trichome wings is responsible for water spread over the epidermal surface which makes these trichomes highly specialized (Brighigna *et al.*, 1997; Herppich *et al.*, 2019).

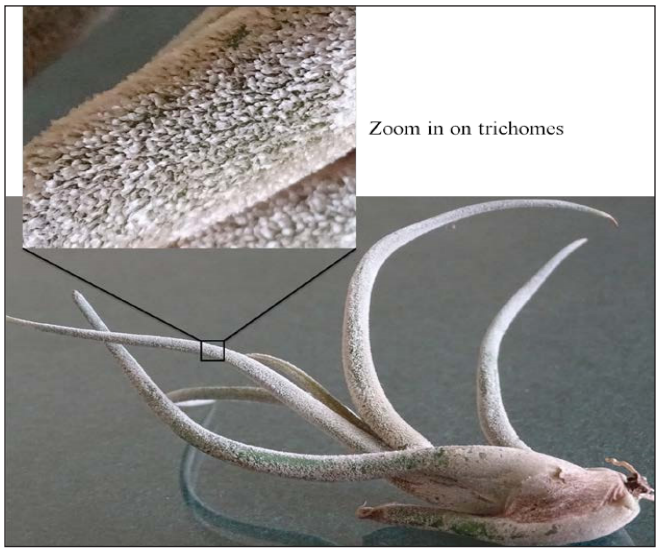


Figure 1: Foliar trichomes of *Tillandsia caput-medusae* (Zoomed in view) (captured using Sony DSC-H400V HD Camera);

*Tillandsias* lack functional roots that are transformed into crampons without any power of absorption, which they use to cling over to surfaces (Brighigna *et al.,* 1997). Moreover, they are monocarpic in nature (Sáyago *et al.,* 2018) and they produce new offsets called pups (Figure 2) which can be separated and used as propagules. Their flowers exhibit striking colors ranging from deep purple (Figure 3) to red to white and soon after.


Figure 2: Mother *Tillandsia ionantha* with baby pups


Figure 3: *Tillandsia ionantha* with purple colour flowers

**4. What are their Types?**

It is classified as mesic and xeric plants. Mesic groups are greener and prefer high humidity. Xeric groups are silver-grey grow in dry conditions (Lesseig, 2016). Tillandsias have striking morphological features that differ from species to species. Different species of *Tillandsias* and their origin are listed in Table 1.

Table1: List of different *Tillandsia species* found across the world

| Sl. No. | Scientific name | Origin |
|---|---|---|
| 1 | *Tillandsia caput medusa* | Central America and Mexico |
| 2 | *Tillandsia ionantha* | Central America and Mexico |
| 3 | *Tillandsia cyanea* | Rainforests of Ecuador |
| 4 | *Tillandsia kolbii* | Oaxaca, Chiapas, and Guatemala |
| 5 | *Tillandsia brachycaulos* | Mexico, Central America, and Venezuela |
| 6 | *Tillandsia bulbosa* | Central America, the West Indies, Southern Mexico |
| 7 | *Tillandsia capitata* | Mexico, Honduras, Cuba and the Dominican Republic |
| 8 | *Tillandsia cacticola* | Peru |
| 9 | *Tillandsia streptophylla* | Central America, Mexico, and the West Indies |
| 10 | *Tillandsia didisticha* | Bolivia and Brazil |

[Source: https://en.wikipedia.org/wiki/Tillandsia]

**5. How Useful Are These Nature's Miracles?**

*5.1 As a Bio-Monitor*

Some of the research work carried out on *Tillandsias* shows its importance towards elimination of heavy metal contaminants from atmosphere. Studies on *T. usneoides* has shown to be an efficient atmospheric accumulator of Mercury, Cadmium,

Copernicium, Lead, Nickel, Copper, Chromium, Carbon and Zinc by the mechanism of phytoremediation. They are commonly used as biomarker and biomonitor of air pollution (Wannaz and Pignata, 2006; Techato *et al.,* 2014). *T. usneoides* constitutes an efficient biomonitor of atmospheric Hg, even under the stress conditions prevailing in heavy metal industries (like high temperatures, elevated Hg concentrations and the oxidizing environment) (Martínez-reséndiz, 2015). *Tillandsia caput-medusae* has proved to be an excellent tester for biomonitoring air pollution and hence, recommended to be used in all Latin American countries (Brighigna *et al.*, 1997). *Tillandsia usneoides* has a high potential for monitoring environments polluted with strontium and proved to endure strontium stress for a long time and was able to resist strontium toxicity (Zheng *et al.,* 2016). Formaldehyde (FA) is one of the major indoor pollutants that have to be removed to reduce its toxicity. The exposure of plants to even a mild concentration of 0.2-0.4 (mM) formaldehyde hindered the root elongation and growth of *Arabidopsis* (Li *et al.*, 2002). A high-concentration of gaseous FA caused necrosis and yellowing of leaves in *Arabidopsis,* tobacco and geranium (Chen *et al.*, 2010). Contrastingly, interesting results were obtained when *Tillandsia velutina* was exposed to FA and the trichomes were found to protect the leaf surface from the harmful effects of FA thus facilitating greater absorption of FA (Li *et al.*, 2015).

*5.2 As a Medicinal Plant*

Cancer has been one of the deadliest diseases. *Tillandsia recurvata* (L.) isolated flavonoid exhibited a potent anticancer activity and result highlighted that it inhibited different kinds of cancer like breast cancer, brain cancer and neuroblastoma (Lowe *et al.,* 2017). The L- asparginase is an enzyme that has a potent anticancer property. It has also been used as an alternative in the food industry for reduction of acrylamide in the foods which is a potential carcinogenic compound. The enzyme could be commercially produced from two fungal sources, *Aspergillus oryzae* and *A. niger.* So the demands of such an enzyme have to be met in order to reduce the activity of carcinogenic compounds. *Tillandisia catimbauensis's* leaves were known to harbor 184 endophytic fungi, of which 52 endophytes belonged to *Penicillium* and *Talaromyces* spp. Out of the twenty endophytic fungi that were tested in a liquid medium, ten of them exhibited the capacity to produce the enzyme L-asparginase (Silva *et al.,* 2018). Leukemia has caused around 2,50,000 deaths globally in 2012 making it a deadly disease. The Jamaican ball moss (*Tillandsia recurvata)* successfully inhibited the proliferating activity of certain leukemic cell lines (Lowe *et al.,* 2014).

*5.3 As an Ornamental*

Since they have attractive shapes, sizes, color and foliage, they have been priced very highly in markets. Presently in India, air plants available in Bangalore, Kolkata and various other nurseries, per plant with the price range from rupees 250 to 3000. They have been exclusively used in creating beautiful riparіums which mimic the wetlands of the Amazon rainforests. Moreover, they also find a place in terrariums which enrich the beauty of any room space. Small table adornments like polished wooden holders, drift wood, ceramic hand holders and polished stones have been extensively used to hold these air plants and thus function as gorgeous home decors (Figure 4).

Figure 4: Different *Tillandsia spp*. adorned with various kinds of decors (First row is polished stones, Second row is ceramic holders, third row is wooden decors and fourth row is terrarium)

**6. How to Maintain Air Plants?**

*Tillandsia utriculata* showed a high capacity for acclimatization even when subjected to highly divergent climatic conditions, thus showing that it is highly plastic in nature (Rosado-Calderon *et al.,* 2018). Low temperature is not a limiting factor for growing *Tillandsia usneoides* (Garth, 1964). *Tillandsia dasyliriifolia* showed moderate tolerance to drought when compared to other succulent plants (Castillo *et al.,* 2016). Hence, air plants are low water requirement plants but water requirement varies from species to species. Generally, a daily spray of water is necessary or one can go for dipping these plants in water for about an hour once in a week (Figure 5).

They love to be dipped in rain water as it contains some nutrients already dissolved in it. A liquid fertilizer spray can also be given but they can be managed even in absence of these fertilizers.

**7. Future Prospectus**

There is a scope for them to be used in therapeutic gardens which take away huge amount of stress from an individual

and bring soothingness to the people. So in the near future, it is possible to view these air plants in many working places where they provide soothing effect over the distressed minds. As biomonitors, they have a widespread use in accumulating heavy metals from the air preventing many health hazards and keeping the environment healthier. As medicinal plants, they have a great potential to fight cancer and other deadly diseases, giving them a top priority in developing cancer drugs. Air plants possess a great potential in landscaping to increase the aesthetic appeal of both indoor and outdoor spaces. They definitely fit for a good focal point, not only in a garden but also in open areas. In the form of riparium, which is a very new concept in the modern era, they can be used extensively in working spaces to enhance the positivity of the surrounding atmosphere.

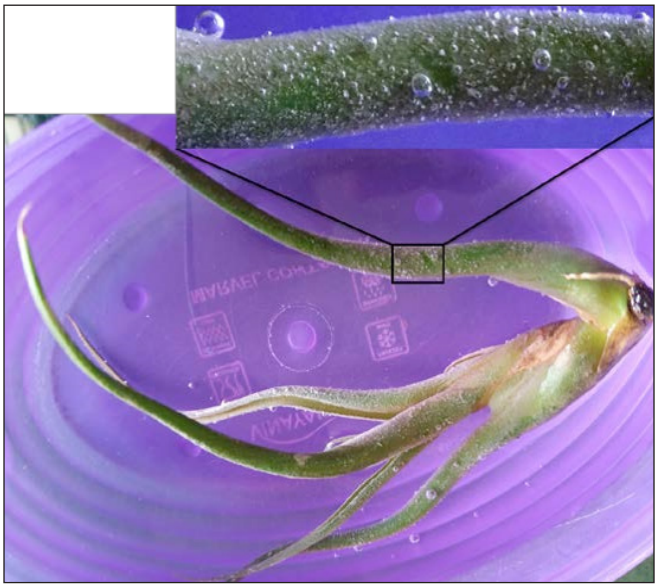

Figure 5: Immersing *Tillandsia caput-medusae* in water and formation of air bubbles over the leaf surface (captured using Sony DSC-H400V HD Camera)

**8. Conclusion**

Air plants are thus, an ideal ornamental wonder having many peculiar morphological characters and also posses' medicinal and environmental benefits, apart from their aesthetic value. In the current era of booming landscape industries, air plants might serve as a very good utilitarian gem in corporate offices as they are endowed with good attractive features through which they can mitigate stress of an individual's as well as bio-monitoring effects through which they can absorb toxic substances present in the atmosphere. Hence, air plants could add to the liveliness of dead concrete jungles of cities with minimum care and attention.

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