



A Review

Ornamental Plants Used for Improvement of Living, Working and Studying Spaces Microclimate

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Abstract

There are a high number of indoor ornamental plants that can purify the air in living spaces. These plants acts as micro filters and removes some toxic substances emanated by various building materials, heating system, air conditioning system, but also from different indoor accessories. Numerous studies in this area show that employees in offices without plants can suffer various allergies, irritations, hypersensitivity, asthma, drowsiness, and eye problems. Also, it is known that the presence of plants can positively affect mood and health of employees. Based on the literature review, this article presents the most effective ornamental plants with direct action on improving the air from indoors.

Keywords: indoor plants, indoor design, benefits, quality of life.

1. Introduction

The use of ornamental plants in indoor spaces is growing, being studied for their benefits on improving the quality of life. Plants have shown that bring psychological and perceptual benefits such as increased privacy, which act in a restorative manner [9] and affect mood. Research has shown that employees prefer offices with plants than without plants [11]. Incorporating nature in interior design can play an important role in creating an environment that promotes physical and mental health of the occupants.

In the contemporary global business environment one of the key components for competitive advantage is the human capital assets – the employees and the intellectual value they bring to the table, but an essential element of a company's success is employee productivity.

Unfortunately, productivity, health and creativity can be prevented by a high stress level in work environment [13].

The quality of air inside of living spaces has become a matter of growing concern over the last thirty years. A major problem in many cases concerning health problems was related to high concentrations of specific air pollutants in living space air, such as formaldehyde, benzene, xylene, which increased the attention to determinate the climate conditions and chemical compounds in the air of rooms, offices, classrooms, whenever people complained about bad indoor air quality [10]. This leads the employers to continually seek new and creative ways to maximize their employees' productivity and provide the most effective work environment, and a low cost way is to add plants in office design, studies in the fields of interior design and cognitive psychology provides evidence that there are benefits not only physiological but also psychological for employees surrounded by nature at work.

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Incorporating nature or representations of nature, in the design of interior space can play a key role in creating environments that not only support their intended purpose, but promote the mental and physical wellbeing of their occupants [5, 8, 14].

A good workplace design that includes plants can make a big difference in employee's satisfaction, attraction, motivation, and retention. It can also affect the level of knowledge and skills of workers, how innovative and creating they are, and how they respond to business and technological change. Poor workplace design, by contrast, is linked to lower performance and higher level of stress experienced by employees [1].

Interior plants are a solid return on investment and a must for any corporation concerned with sustainable, 'green building' solutions.

Due to a wide range of ornamental plants and well known culture technologies, indoor plants are the most common hobbies. Whether at first only the rich people could afford it, today is accessible to everyone. In any home the family atmosphere is warmer, more enjoyable, and more tranquil with ornamental plants [3]. Houseplants do more than bring brightness and color into the design of a room; they also offer real benefits on the body.

Ornamental plants like *Dracaena*, palms, *Ficus* spp., are not just accessories in various indoor settings as workplaces, public institutions, but also a part of the design, giving liveliness and create a fresh atmosphere.

The benefits of indoor plants used in design are the following: spending longer period of time around flowers can reduce physical and mental fatigue, can improve the mood and can provide a sense of comfort and tranquility. Flower colors have different effects on people for example: yellow flowers give a feeling of warmth, quiet, intimacy, satisfaction, reds causes irritation and incite; green flowers offers relaxation.

In this continuous changing and modernization period man ever took care to combine the utility with the pleasure. Indoor plants are known for their double function performed: is enhancement the aesthetic value of living spaces and purify the air efficiently, absorbing room toxins that are filtered by leaves. They contribute to accumulation of positive energy, as they develop a good mental strength. The effect of relaxation and calming that vegetation has on humans, release every day's accumulated stress.

Plants fit perfectly into any room in the home or in an office, being more effective in those areas where the air stagnates and accumulates toxins (bedroom, kitchen, dining-room), but in the same time they are having an aesthetic effect. Ornamental

plants are recommended not only in living spaces, but also in public spaces and work or study environments.

2. Ornamental plants used in indoor for improve the quality of life

Because the world is an inexorable trend in the direction of urbanization, citizens need nature more than ever [12]. These problems of contemporary society involving urban lifestyle with more hours at work, time constraints and subconscious separation from nature can have negative effects on personal health and happiness, for this reason it's necessary the identification and evaluation of psychological potential of ornamental plants in indoors [2, 4, 13].

Main goals to study the benefic effect of ornamentals on the indoor air quality:

- in an urbanized context, the need for a thorough understanding of the relationship between plants and human well-being becomes more and more important;

- these problems of contemporary society involving urban lifestyle with more hours at work, time constraints and subconscious separation from nature can have negative effects on personal health - mental, behavioral and social health problems;

- the main goal was to determine if ornamental plants have positive effects on a wide range of factors such as productivity, mood states, creativity and stress.

The most effective known and used as purifying plants, are the following species:

- *Spathiphyllum wallisii* (fig. 1) – contribute to the regulation of moisture levels. Can absorb electromagnetic radiation emitted by computer and printer. In research conducted by NASA regarding the air purification capacity the score allowed was 7.5.

- *Dracaena deremensis* (fig. 1) – absorbs harmful emissions from computers, printers and other factors that produce carbon dioxide [6, 15, 16]. Absorb 1.328 micrograms of formaldehyde and 154 micrograms of xylene per hour. The score allowed by NASA in air purification research is 7.8. It is recommended in rooms where furniture or carpets are new.

- *Dracaena marginata* (fig. 1) - Remove xylene from the stuffy atmosphere of living and working places.

- *Hedera helix* (fig. 1) – it is used to remove benzene from air. Removes easily formaldehyde and carbon monoxide [6, 15, 16]. Absorb cigarette smoke. It is recommended for those who have asthma.

- *Ficus elastica* – tolerant with insects, removes toxins that can be harmful for the human body. Absorb odors, reduces the number of microorganisms, and the amount of toxic substances. The score granted by NASA in the rate of air purification was 7.7.

- *Philodendron scandens* – remove formaldehyde (the most common toxin from indoors where used cleaning products or gas stoves are present).

- *Chrysanthemum morifolium* - absorbs benzene from cigarette smoke and toxins emitted from adhesives, paints, and printers.



Figure 1. Several air purifying house plants

(1. *Dracaena deremensis* „Lemon”, 2. *Phoenix roeblinii*, 3. *Chlorophytum comosum*, 4. *Rhapis excelsa*, 5. *Tradescantia* sp., 6. *Aspidistra elatior*, 7. *Hedera helix*, 8. *Spathiphyllum wallisii*, 9. *Gerbera hybrida*, 10. *Dracaena marginata*, 11. *Dracaena deremensis*)

- *Chlorophytum comosum* (fig. 1) – Recommended for absorbing toxic gases accumulated in buildings with poor ventilation. This plant has the ability to absorb in few days 90% of formic aldehyde and carbon monoxide (absorb cigarette smoke). Removes 96% of carbon dioxide in the ambient air [6, 15, 16].

- *Echinocactus grussonii* - Reduce electromagnetic waves emitted by TV and displays.

- *Gerbera hybrida* (fig. 1) - Removes trichlorethylene and benzene from indoor air [6, 7, 15, 16].

- *Sansevieria trifasciata* - Removes a large amount of benzene and formaldehyde; night produces the greatest amount of oxygen (it is recommended for bedrooms)

- *Aspidistra elatior* (fig. 1) – Absorb cigarette smoke.

Ferns are known for removing pollutants from the air and contribute to enhancing interior air

humidity through transpiration (*Asplenium nidus*, *Platycerium bifurcatum*, *Adiantum raddianum*, *Nephrolepis exaltata*) [2, 6, 15, 16].

Palm trees have an important role in regulating the level of air humidity.

They are most important indoor plants because it eliminates the chemical toxins from the air (*Chamaedorea elegans*, *Chamaerops humilis*, *Livistona chinensis*, *Rhapis excelsa*, *Washingtonia robusta*, *Chrysalidocarpus lutescens*, *Phoenix roebelenii*) [3, 6, 7, 15, 16].

Based on the specialized literature, it can be remark that the offices, living or working spaces populated with plants benefit by a better conditions and air quality.

It also shows that plants can directly influence the productivity, comfort and human health. In the other hand ornamental plants can enhance the aesthetic value of working, studying, living spaces and offices.

3. Conclusions

Human-plants relationship is a major concern of the contemporary world, as confirmed by this study. Plants as an integrated environment are a healthy and essential to the prosperity and quality of life. Landscape architects in particular and horticulturists should step into the "environmental decade" being necessary to recognize the inter-relationship between man and the environment and extend research efforts to approach this relationship, thus increasing the value of green.

The results of this study permit not only straightening gaps in current knowledge, but in the same time to obtain new knowledge in this area, to ease decision-making and to promote interdisciplinary approaches and provide a basis for further empirical and theoretical work.

The office plants can have a significant positive effect on humans, regarding comfort, mood states, productivity and reduced levels of stress. Considering that this area is dynamic and constantly changing, Romania requires the identification and evaluation of sanogenic potential of indoor ornamental plants, which will contribute and enrich the conceptual framework for the further development of guidelines. Living with indoor ornamental plants, as ficus, *Spathiphyllum*, bamboo, *Dracaena*, palms, ferns, azaleas, orchids, regardless of location, human can benefit the fresh air provided, that induce pleasant fillings and relaxation.

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