

PHYTOACOUSTICS: UNDERSTANDING PLANT RESPONSES TO MUSICAL ENVIRONMENTS

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ABSTRACT

Research exploring the connection between music and plants' response has attracted interest from multiple scientific fields. Investigations suggest that plants can respond to musical stimuli in ways similar to other living organisms, with positive effects observed in different growth parameters. Despite limited research, this area of study has revealed that certain musical genres and frequencies appear to enhance growth and overall plant health while others may inhibit development. However, further research with standardized methodologies is needed to fully understand the mechanisms underlying these effects and to determine the most beneficial types of music for plant development.

Key words: Music, plant, growth, development.

Introduction

Music, an art form that utilizes sound as its medium, conveys beauty, emotion, and expression through elements such as rhythm, melody, harmony and tone. Living organisms, including plants, have the ability to respond to external stimuli. As complex multicellular beings, plants are often viewed as highly sensitive to music that has been found to significantly affect plant metabolism, with plants demonstrating varied reactions to different musical genres and wavelengths. Research has shown that music can influence plant growth, with plants appearing to respond to music in ways similar to humans by perceiving sound waves as stimuli. Despite this potential, limited research has explored how various sound types impact plant behaviour. This study aimed to build on existing literature by evaluating the influence of music on plant growth, development and biochemical characteristics.

Influence of music on plant growth

A study conducted by Sharma et al (2015) showed the effects of soft, melodious music on eight medicinal and ornamental plant species like *Tagetes erecta* L., *Catharanthus roseus* L., *Trachyspermum ammi* L., *Dendranthema grandiflorum* L., *Hibiscus rosa-sinensis* L., *Epipremnum aureum* L., *Duranta repens* L., *Ocimum sanctum* L. The plants in the treated group exhibited greater height compared to those in the control group. Among them, *Tagetes*, *Catharanthus*, *Trachyspermum*, and *Epipremnum* demonstrated the most significant growth. Treated plants such as *Tagetes*, *Trachyspermum*, *Epipremnum*, and *Duranta* exhibited a noticeable increase in the number of leaves indicated enhanced biomass production. Similar findings were reported by Chatterjee et al. (2013) and Singh et al (2013), where exposure to music led to increased plant height and improved overall health.

Research by Chivukula and Ramaswamy (2014) explored the effects of various music genres on *Rosa chinensis* plants. Plants exposed to Vedic chants and Indian classical music showed improved growth, characterized by increased shoot elongation, higher flower count, and larger flower diameter. In contrast, plants subjected to rock music exhibited stunted growth and a higher incidence of thorns.

Roy Chowdhury and Gupta (2015) carried out a pilot study to observe the response of *Tagetes* sp. (marigold) to Light Indian Music and Meditation Music as well as to noise. They found that music promoted the growth and development of the plants.

A study by Akhoundnejad (2019) investigated the effects of classical music on bean plants grown in hydroponic and vermiculite environments. The findings revealed that plants exposed to classical music

exhibited increased growth rates, higher leaf counts, and greater plant height compared to control plants, suggesting that classical music can positively influence plant development .

Yeoh et al (2024) investigated the influence of different types of acoustic stimulus (classical vs. rock music) on the growth of bok choy (*Brassica rapa*) plants. They found that those plants exposed to classical music exhibited significant differences in shoot characteristics with the highest total fresh weight, shoot fresh weight, and mean leaf numbers in comparison to those plants exposed to rock music. They also demonstrated that the plants exposed to classical music showed the shortest root length but the greatest root volume, suggesting that their roots were noticeably thicker and more compact compared to those of plants exposed to rock music or no music at all.

Influence of music on plant metabolites

Investigations demonstrated that music influences not only plant growth but also the levels of various metabolites within the plants. Sharma et al., 2015 indicated that plants exposed to music exhibited increased chlorophyll content (in *Trachyspermum*, *Duranta*), and elevated levels of metabolites such as sugars (in *Catharanthus*, *Dendranthema*, *Trachyspermum* ,*Duranta*), starch (in *Catharanthus*, *Hibiscus*, *Duranta*, *Tagetes*, *Ocimum*), proteins (in *Dendranthema*, *Hibiscus*, *Tagetes*, *Ocimum*) even phenol content compared to control plants.

Influence of music on plant physiology and flowering

Roy Chowdhury and Gupta (2015) showed a positive effect on germination of *Tagetes* sp which is attributed to musical frequencies facilitating better physiological processes like absorption of nutrients, photosynthesis, protein synthesis, etc. for the plant.

The application of music was found to influence flowering in plants with the treated group producing a greater number of flowers (Sharma et al , 2015). They found that Species such as *Tagetes* and *Catharanthus* exhibited increased flower production when exposed to music. Additionally, music affected the timing of flowering, as buds and flowers appeared approximately one week earlier in the music-treated plants compared to the control group.

Plants exposed to Vedic chants exhibited the highest number of flowers and the largest flower diameter as investigated by Chivukula and Ramaswamy (2014) in *Rosa chinensis* in comparison to the same species exposed to Indian Classical music, Western Classical music and Rock music.

The overall discussion highlights the positive effects of music on various aspects of plant development, including growth, metabolite production, and key physiological processes such as germination and flowering. It is suggested that music may stimulate the activation of stress-related genes, thereby enhancing plant immunity and increasing resistance to pests and diseases. Jung et al. (2018) investigated how plants respond to sound waves and emphasized that sound can serve as a physical stimulus, impacting both growth and stress tolerance. These beneficial effects of music may be linked to several internal plant responses, such as gene activation, stomatal opening, hormone regulation, cellular activity, and protoplasmic movement (Patel et al., 2022).

Conclusion

While the researchers continues to explore the effects of music on plants, existing studies suggest that certain types of music, particularly soft and harmonious genres, may promote plant growth and health. Scientific investigations have demonstrated that music can influence plant development, suggesting its potential as a tool for farmers to enhance crop growth. Although still emerging, this review indicates that

music could serve as a non-invasive method to support plant growth, offering potential applications in agriculture and horticulture.

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