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Clematis: A Comprehensive Strategy Study from Resource Screening to Garden Landscape Design

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Abstract *Clematis*, a genus of perennial ornamental vines, holds significant potential for both decorative and ecological applications in garden landscape design. This research explores the comprehensive strategies from resource screening to garden landscape design, focusing on the cultivation, ornamental properties, disease management, and environmental adaptability of *Clematis* species. *Clematis* species are renowned for their diverse flower shapes and colors, making them ideal for vertical landscaping and garden aesthetics. Research conducted in the Stavropol Botanical Garden identified 29 varieties with high ornamental value, emphasizing the importance of flower shape, size, and color in selection for vertical gardening. Additionally, *Clematis tientaiensis*, an endangered species, demonstrates specific light requirements for optimal growth, highlighting the need for appropriate light management in garden design. Disease management is crucial for maintaining the health and aesthetic value of *Clematis*. Common diseases such as wilt, rust, and powdery mildew, along with pests like nematodes and aphids, pose significant threats. Effective agrotechnical measures and pest control strategies are essential for sustainable cultivation. Environmental adaptability studies reveal that *Clematis* species exhibit varied responses to abiotic stresses such as heat and light. For instance, *Clematis crassifolia* and *Clematis cadmia* show different physiological and molecular responses to heat stress, which can inform breeding and cultivation practices. Similarly, the adaptability of *Clematis tientaiensis* to different irradiance levels underscores the importance of environmental considerations in landscape design. In conclusion, the integration of *Clematis* species into garden landscapes requires a multifaceted approach, encompassing careful selection of varieties, disease management, and environmental adaptability. This research provides a foundation for future research and practical applications in ornamental gardening and landscape architecture.

Keywords *Clematis*; Ornamental plants; Vertical landscaping; Disease management; Environmental adaptability; Garden design; Perennial vines

Clematis, a genus within the Ranunculaceae family, is renowned for its diverse and widespread species, which are highly valued in horticulture for their climbing habit and vibrant flowers (Figure 1). The genus includes over 300 species, many of which are cultivated as ornamental plants in gardens worldwide (Špetík et al., 2022). *Clematis* species are not only appreciated for their aesthetic appeal but also for their ecological roles and medicinal properties. For instance, several species have been traditionally used in ethnopharmacology to treat various ailments, including nervous disorders, syphilis, and gout (Chawla et al., 2012). The genus is also of significant taxonomic and phylogenetic interest due to its complex infrageneric relationships and diverse morphological characteristics (Lehtonen et al., 2016; Ghimire et al., 2020).

Integrating resource screening with landscape design is crucial for optimizing the use of *Clematis* species in horticulture. Resource screening involves identifying and selecting species with desirable traits such as disease resistance, growth habit, and flower characteristics. This process is essential for developing sustainable and resilient garden landscapes. For example, understanding the phylogenetic relationships and taxonomic classifications within *Clematis* can aid in selecting species that are best suited for specific environmental conditions and aesthetic requirements (Lehtonen et al., 2016; Phukhamsakda et al., 2020). Additionally,

knowledge of the chemical and pharmacological properties of *Clematis* species can inform their use in medicinal gardens and therapeutic landscapes (Chawla et al., 2012).

The primary objective of this research is to provide a comprehensive analysis of *Clematis* species from resource screening to garden landscape design. to provide valuable insights for horticulturists, landscape designers, and researchers, facilitating the selection and cultivation of *Clematis* species that enhance garden landscapes while promoting biodiversity and sustainability.

Figure 1 Examples of three famous *Clematis* varieties

Image caption: A: Purple Flower *Clematis* (*Clematis* 'Jackmanii'): This variety has deep purple flowers that bloom from mid-summer to fall. It is renowned for its large, velvety flowers and long blooming period; B: White and Pink Flower *Clematis* (*Clematis* 'Nelly Moser'): This variety features light pink flowers with darker pink stripes. Its bloom time is from late spring to early summer, with a second bloom in late summer. It is known for its bicolored flowers and striking star pattern; C: White Small Flower *Clematis* (*Clematis* 'Huldine'): This variety has pure white, small flowers that bloom from summer to fall. It is celebrated for its abundant small white flowers and prolonged blooming period

1 Resource Screening for *Clematis*

1.1 Selection criteria

1.1.1 Environmental requirements (soil type, pH, light conditions)

Clematis species exhibit a range of environmental requirements, which are crucial for their successful cultivation. The soil type, pH, and light conditions significantly influence their growth and blooming patterns. For instance, *Clematis canescens* showed optimal rooting in a medium of peat and perlite in a 1:1 ratio, indicating a preference for well-draining soil (Guo et al., 2006). Additionally, the pH and light conditions were not explicitly detailed in the provided studies, but it is generally known that *Clematis* prefers slightly acidic to neutral pH and requires full to partial sunlight for optimal growth.

1.1.2 *Climatic* adaptability (temperature, humidity)

The adaptability of *Clematis* to various climatic conditions is essential for their selection in different regions. Studies have shown that stock plants grown at higher temperatures (27 °C) resulted in greater cutting numbers and better propagation performance compared to those grown at 21 °C (Samarakoon and Faust, 2022). This suggests that *Clematis* can thrive in warmer climates, although specific humidity requirements were not detailed in the provided studies.

1.1.3 Disease and pest resistance

Disease and pest resistance are critical factors in the selection of *Clematis* varieties for both conservation and commercial purposes. While the provided studies did not explicitly address disease and pest resistance, the successful propagation and survival rates in various experiments imply a degree of resilience. For example, *Clematis heynei* exhibited an 88% survival rate with normal morphology and growth characteristics after micropropagation, indicating robust health and potential resistance to common diseases and pests (Chavan et al., 2012).

1.1.4 Varietal characteristics and blooming patterns

Varietal characteristics and blooming patterns are important for both aesthetic and ecological purposes. The study on *Clematis* 'Warszawska Nike' highlighted the importance of cytokinin concentrations in the medium for shoot initiation and flowering, with 8% of explants flowering under optimal conditions (Kulpa and Krupa-Małkiewicz, 2023). This indicates that specific hormonal treatments can influence blooming patterns, which is a valuable consideration for garden landscape design.

1.2 Propagation techniques

1.2.1 Seed propagation

Seed propagation of *Clematis* has been found to be challenging due to low germination rates. For instance, *Clematis* patens showed that generative propagation was not feasible because of the low rate of seed germination (Dai, 2004). This suggests that alternative propagation methods may be more effective for *Clematis*.

1.2.2 Cutting methods (softwood, semi-ripe wood)

Cutting methods have been extensively studied and proven to be effective for *Clematis* propagation. The use of rooting hormones such as IAA and NAA has been shown to significantly enhance rooting success. For example, *Clematis canescens* achieved the best rooting results with a treatment of 200 mg/L NAA + 200 mg/L IBA (Guo et al., 2006). Additionally, stock plants grown at higher temperatures (27 °C) produced more cuttings with greater dry weights, indicating the importance of environmental conditions in cutting propagation (Samarakoon and Faust, 2022).

1.2.3 Grafting and layering techniques

Grafting and layering techniques were not explicitly detailed in the provided studies. However, the success of other propagation methods such as tissue culture and micropropagation suggests that these techniques could also be viable for *Clematis*. For instance, the micropropagation of *Clematis filamentosa* using young stem explants showed successful callus induction and root growth, indicating the potential for similar success with grafting and layering techniques (Shao and Yu, 2005).

In conclusion, the selection and propagation of *Clematis* require careful consideration of environmental requirements, climatic adaptability, disease and pest resistance, and varietal characteristics. Effective propagation techniques such as cutting methods and tissue culture have been demonstrated to be successful, providing valuable strategies for both conservation and commercial cultivation of *Clematis*.

2 Cultivation and Care

2.1 Soil and planting requirements

2.1.1 Soil preparation and amendments (organic matter, drainage improvements)

Proper soil preparation is crucial for the successful cultivation of *Clematis*. *Clematis* plants thrive in well-drained, fertile soils rich in organic matter. Adding compost or well-rotted manure can significantly improve soil structure and fertility, promoting healthy root development and vigorous growth (Kai, 2002; Evgenievna et al., 2020). Ensuring good drainage is essential, as clematis roots are prone to rot in waterlogged conditions. Incorporating sand or perlite into the soil can enhance drainage, particularly in heavy clay soils (Kai, 2002).

2.1.2 Planting depth and spacing

When planting clematis, it is important to set the crown of the plant (where the stems meet the roots) about 2-3 inches below the soil surface. This encourages the development of new shoots from below ground, leading to a bushier plant (Evgenievna et al., 2020; Samarakoon and Faust, 2022). Spacing between plants should be approximately 3-4 feet to allow adequate air circulation and reduce the risk of disease (Kai, 2002; Bilalova, 2021).

2.2 Watering and fertilization

2.2.1 Watering schedules and methods

Clematis plants require consistent moisture, especially during their first year of establishment. Deep watering once a week is generally sufficient, ensuring that the water reaches the root zone. Mulching around the base of the plant can help retain soil moisture and regulate soil temperature (Isnard et al., 2003; Kovalyshyn and St., 2020). During hot, dry periods, more frequent watering may be necessary to prevent stress and wilting (Kovalyshyn and St., 2020).

2.2.2 Nutrient requirements and fertilization schedules

Clematis benefit from regular feeding to support their vigorous growth and abundant flowering. A balanced, slow-release fertilizer applied in early spring and again in mid-summer can provide essential nutrients throughout the growing season (Bosiacki, 2008). Organic fertilizers, such as compost or well-rotted manure, can also be used to enrich the soil and promote healthy growth (Kai, 2002; Bosiacki, 2008). Avoid high-nitrogen fertilizers, as they can encourage excessive foliage growth at the expense of flowers (Bosiacki, 2008).

2.3 Pruning and maintenance

2.3.1 Pruning techniques for different clematis groups

Clematis are categorized into three main pruning groups based on their flowering habits. Group 1 clematis, which flower on old wood, should be pruned lightly after flowering to remove dead or weak stems. Group 2 clematis, which flower on both old and new wood, require moderate pruning in early spring to remove dead or damaged stems and to shape the plant. Group 3 clematis, which flower on new wood, should be pruned back hard in late winter or early spring to about 12-18 inches above the ground (Evgenievna et al., 2020; Samarakoon and Faust, 2020; Bilalova, 2021).

2.3.2 Seasonal care routines

Seasonal care for clematis includes regular monitoring for pests and diseases, such as aphids, slugs, and clematis wilt. Prompt removal of affected plant parts and appropriate treatments can help manage these issues (Liu, 2010; Chebannaya, 2022). Mulching in spring helps conserve moisture and suppress weeds, while a top-dressing of compost or well-rotted manure in fall can improve soil fertility (Kai, 2002; Bosiacki, 2008). Additionally, providing support structures, such as trellises or arbors, is essential for climbing varieties to ensure proper growth and display (Isnard et al., 2003; Bilalova, 2021).

By adhering to these cultivation and care guidelines, gardeners can enjoy healthy, thriving clematis plants that enhance their garden landscapes with stunning floral displays.

3 Landscape Design with *Clematis*

3.1 Design principles

3.1.1 Incorporating focal points and repeating plant groupings for visual cohesion

Incorporating focal points and repeating plant groupings is essential for creating visual cohesion in garden landscapes. *Clematis*, with its diverse range of colors and forms, can serve as an excellent focal point. By strategically placing clematis at key locations and repeating its use throughout the garden, designers can create a harmonious and visually appealing landscape (Zhan, 2007; Chebannaya, 2020).

We planted *Clematis* 'Nelly Moser' near one of the posts of the grape arbor in the backyard as a focal point to achieve visual cohesion (Figure 2). This landscape design strategy leverages the unique aesthetic features of the *Clematis* 'Nelly Moser' flowers—light pink petals with deep pink stripes forming a striking star pattern. By planting this clematis near the post of the grape arbor, we created a visual focal point that guides the eye upward, adding vertical height and visual interest. The climbing nature of the clematis allows it to grow along the post, intertwining with the grape vines to create a layered and dynamic landscape effect. Additionally, the *Clematis* 'Nelly Moser' blooms twice, in late spring to early summer and again in late summer, providing continuous color and beauty, further enhancing the overall attractiveness and harmony of the backyard. Through this strategy, we effectively combined the natural beauty of the plant with the garden structure, creating an outdoor space that is both aesthetically pleasing and harmonious.

Figure 2 *Clematis* 'Nelly Moser' planted near a post of the grape arbor in the backyard as a visual focal point

3.1.2 Balancing simplicity and variety

Balancing simplicity and variety is crucial in garden design. *Clematis* offers a wide range of species and varieties, from small-flowered to large-flowered types, which can be used to introduce variety without overwhelming the design. The use of different clematis species, such as those from the Jackmanii, Viticella, and Integrifolia groups, can add both visual interest and ecological benefits to the garden (Prokhorova and Kling, 2021; Bilalova, 2021; Chebannaya, 2022).

3.2 Integration into garden structures

3.2.1 Using clematis on trellises, arbors, and pergolas

Clematis is particularly well-suited for vertical gardening and can be effectively used on trellises, arbors, and pergolas. These structures not only support the climbing habit of clematis but also enhance the vertical dimension of the garden, making it more dynamic and visually interesting. Varieties such as Ville de Lyon and Madame Baron Veillard are excellent choices for these applications due to their vigorous growth and abundant flowering (Chebannaya, 2020; Bilalova and Putenikhin, 2020; Prokhorova and Kling, 2021).

3.2.2 Vertical gardening and space optimization

Vertical gardening with clematis is an efficient way to optimize space, especially in smaller gardens. *Clematis* can cover walls, fences, and other vertical surfaces, providing a lush, green backdrop that maximizes the use of available space. This approach not only enhances the aesthetic appeal but also contributes to the ecological health of the garden by providing habitats for various pollinators (Zhan, 2007; Beridze and Kovalchuk, 2020).

We planted *Clematis* 'Huldine' along an entire section of the backyard fence, pairing it with hydrangeas and azaleas to cover walls, fences, and other vertical surfaces, providing a lush green background for the space (Figure 3). This landscape design strategy takes full advantage of the climbing nature of the clematis, allowing it to grow along the fence and form a dense green barrier. The small white flowers of *Clematis* 'Huldine' stand

out against the green foliage, adding visual highlights while complementing the green and floral colors of the hydrangeas and azaleas, enhancing the overall beauty and texture of the landscape.

Figure 3 *Clematis* 'Huldine' planted along the backyard fence, paired with hydrangeas and azaleas, enhancing the overall beauty and texture of the landscape

3.3 Complementary plantings

3.3.1 Pairing clematis with other plants for aesthetic and ecological benefits

Pairing clematis with other plants can enhance both the aesthetic and ecological value of the garden. *Clematis* can be combined with shrubs, perennials, and other climbers to create layered plantings that offer continuous interest throughout the seasons. For example, pairing clematis with roses or hydrangeas can create stunning visual contrasts and support a diverse range of pollinators (Жигунов and Насурдинова, 2012; Chebannaya, 2020; Chebannaya, 2022).

We planted *Clematis* 'Jackmanii' in the corner of the backyard fence and paired it with plants such as pine trees and roses to achieve aesthetic and ecological benefits (Figure 4). This landscape design strategy takes advantage of the climbing nature of the clematis, allowing it to grow along the fence, creating a natural green screen and adding rich color and texture to the corner. The deep purple flowers of the Jackman *Clematis* contrast sharply with the surrounding green pine trees, creating visual highlights, while complementing the colors of the roses and other plants, enhancing the overall beauty of the landscape.

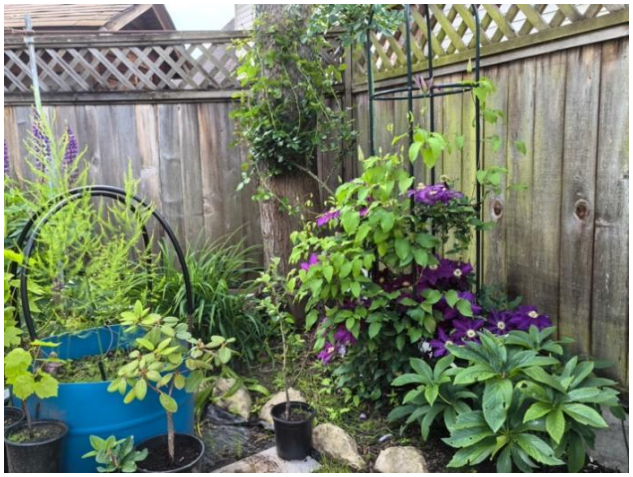

Figure 4 *Clematis* 'Jackmanii' planted in the corner of the backyard fence, paired with pine trees and roses to achieve aesthetic and ecological benefits

This combination is not only visually pleasing but also offers multiple ecological benefits. The dense foliage and flowers of the clematis provide additional shading for the yard, helping to regulate the microclimate and increase the comfort of the environment. Additionally, the diverse planting promotes biodiversity, attracting more insects and birds, which is beneficial to the entire garden ecosystem.

3.3.2 Seasonal color schemes and continuous blooming cycles

Clematis varieties can be selected to ensure continuous blooming cycles and seasonal color schemes. By choosing early, mid, and late-blooming varieties, gardeners can achieve a succession of blooms that provide color and interest from spring through fall. Varieties from the Lanuginosa and Patens groups, which bloom on both old and new wood, are particularly valuable for extending the flowering season (Zhang, 2010; Chebannaya, 2020; Bilalova, 2021).

By following these design principles and integrating clematis into various garden structures and plantings, gardeners can create beautiful, cohesive, and ecologically beneficial landscapes.

4 Case Studies and Applications

4.1 Successful clematis gardens

4.1.1 Examples of public and private gardens featuring clematis

Clematis has been successfully integrated into various public and private gardens worldwide, showcasing its versatility and ornamental value. For instance, the Kremenets Botanical Garden has introduced several species of *Clematis*, highlighting their decorative qualities and adaptability to local conditions (Beridze and Kovalchuk, 2020). Similarly, the South-Ural Botanical Garden-Institute has conducted extensive studies on 54 varieties of *Clematis*, demonstrating their potential for vertical gardening in the Bashkir Cis-Urals and adjacent territories (Bilalova, 2021). In Italy, *Clematis* × *jackmanii* has been observed in private gardens, where it is appreciated for its climbing habit and rich flower production (Garibaldi et al., 2007).

4.1.2 Analysis of design strategies and plant selections

The design strategies for incorporating *Clematis* into gardens often focus on its climbing ability and prolonged flowering period. In the Kremenets Botanical Garden, *Clematis* species are used to create bright spots of various colors on lawns, enhancing the garden's aesthetic appeal throughout the growing season (Beridze and Kovalchuk, 2020). The South-Ural Botanical Garden-Institute emphasizes the use of root-forming stimulators like "Circon" to improve the rooting success of *Clematis* cuttings, ensuring robust plant growth and sustainability (Bilalova, 2021). In the Stavropol Botanical Garden, *Clematis* varieties are selected based on their ornamental features, such as flower shape, size, and color, as well as their ability to thrive in local soil and climatic conditions (Chebannaya, 2020).

4.2 Ecological impact

4.2.1 Role of clematis in promoting biodiversity

Clematis plays a significant role in promoting biodiversity within garden ecosystems. The diverse range of *Clematis* species supports various microfungi, which in turn contribute to the ecological balance by decomposing organic matter and recycling nutrients (Phukhamsakda et al., 2020). Additionally, *Clematis* plants provide habitat and food sources for various insects and birds, thereby enhancing the overall biodiversity of the garden (Chebannaya, 2022).

4.2.2 Environmental benefits of clematis in garden ecosystems

The environmental benefits of *Clematis* in garden ecosystems are manifold. *Clematis* species are known for their drought resistance and ability to withstand pests and diseases, making them a sustainable choice for garden landscaping (Chebannaya, 2022). Their extensive root systems help in soil stabilization and prevent erosion, while their climbing habit allows them to cover walls and structures, providing natural insulation and reducing the urban heat island effect. Furthermore, *Clematis* plants contribute to air purification by absorbing

pollutants and releasing oxygen, thereby improving the overall air quality in garden environments (Zhang, 2010).

In summary, *Clematis* is a valuable addition to both public and private gardens, offering aesthetic, ecological, and environmental benefits. Its successful integration into various garden designs and its role in promoting biodiversity underscore its importance in sustainable landscaping practices.

5 Challenges and Solutions

5.1 Common issues in clematis cultivation

5.1.1 Troubleshooting non-blooming plants

Non-blooming clematis plants can be a significant challenge for gardeners. Factors such as improper pruning, insufficient sunlight, and inadequate fertilization can contribute to this issue. Ensuring that clematis plants receive the right amount of sunlight and nutrients, and following proper pruning techniques, can help in promoting blooming (Gardener's Path, n.d.).

5.1.2 Managing pests and diseases

Clematis plants are susceptible to various pests and diseases, which can severely impact their health and ornamental value. Common pests include nematodes, aphids, spider mites, and slugs, while diseases such as wilt, rust, powdery mildew, and gray rot are prevalent. Effective management strategies include regular monitoring, proper sanitation, and the use of appropriate pesticides and fungicides. For instance, wilt, which causes rapid plant withering, can be mitigated through proper watering practices and soil management (Golomidova et al., 2023). Additionally, agrotechnical measures such as crop rotation and the use of resistant varieties can help in disease prevention (Golomidova et al., 2023).

5.2 Innovative solutions

5.2.1 New propagation techniques

Recent advancements in propagation techniques have shown promise in improving the success rate of clematis cultivation. For example, the use of rooting hormones and maintaining stock plants at optimal temperatures (27 °C) have been found to significantly increase the number of cuttings and their rooting success (Samarakoon and Faust, 2022). Additionally, *in vitro* propagation techniques have been developed for varieties with low rooting success, such as Purpurea Plena Elegans and Multi Blue. These techniques involve the use of nutrient-rich media and controlled environmental conditions to enhance rooting and plant development (Evgenievna et al., 2020).

5.2.2 Advances in clematis breeding for improved varieties

Breeding efforts have focused on developing clematis varieties with enhanced ornamental and adaptive traits. Studies have identified varieties with high resistance to local climatic conditions and prolonged flowering periods, making them suitable for various landscaping applications (Chebannaya, 2020; Bilalova, 2021). For instance, varieties from the Lanuginosa and Patens groups exhibit abundant and prolonged flowering on both previous and current year shoots, making them ideal for vertical gardening (Chebannaya, 2020). Furthermore, the selection of small-flowered clematis varieties with high decorative properties and resistance to drought, pests, and diseases has been emphasized for their potential in diverse climatic conditions (Chebannaya, 2022).

By addressing these common issues and leveraging innovative solutions, the cultivation and landscape use of clematis can be significantly improved, ensuring their continued popularity and success in ornamental horticulture.

6 Concluding Remarks

6.1 Summary of key findings from resource screening to landscape design

The comprehensive study of *Clematis* has revealed significant insights into its biological, morphological, and ornamental characteristics. The genus *Clematis*, known for its climbing species, has been extensively studied for its microfungi associations, revealing new families, genera, and species, which are crucial for understanding its

ecological interactions and potential vulnerabilities. In the Stavropol Botanical Garden, 29 varieties of *Clematis* were evaluated for their ornamental qualities, with specific attention to flower shape, size, and color, leading to recommendations for their use in vertical gardening and park construction. Additionally, *Clematis* species have been identified as valuable medicinal plants, with various species traditionally used to treat ailments such as nervous disorders, syphilis, and gout, among others. The landscape potential of *Clematis* in Zhejiang Province and China has been highlighted, emphasizing its ornamental and medicinal value, and suggesting its application in garden landscaping. Studies in the South-Ural Botanical Garden and other regions have further demonstrated the adaptability and decorative properties of *Clematis*, making it a suitable choice for vertical landscaping and ornamental gardening.

6.2 Future directions for clematis research and garden applications

Future research on *Clematis* should focus on several key areas:

(1) Bioactivity-Directed Fractionation: Detailed studies on the bioactive constituents of *Clematis* species are needed to validate their traditional medicinal uses and explore their potential as pharmaceutical agents.

(2) Genetic and Phylogenetic Studies: Continued exploration of the genetic diversity and phylogenetic relationships within the *Clematis* genus will help in the identification and classification of new species and varieties, enhancing our understanding of their evolutionary history and ecological roles.

(3) Breeding and Cultivation Techniques: Developing advanced breeding techniques and optimizing cultivation practices will improve the ornamental qualities and disease resistance of *Clematis* varieties, making them more suitable for diverse climatic conditions.

(4) Pest and Disease Management: Comprehensive studies on the diseases and pests affecting *Clematis*, along with effective control measures, will ensure the healthy growth and longevity of these plants in garden landscapes.

(5) Sustainable Landscaping: Investigating the role of *Clematis* in sustainable gardening practices, including its use in vertical gardens and as part of biodiversity-friendly landscapes, will contribute to environmentally responsible horticulture.

6.3 Final thoughts on the integration of clematis in sustainable gardening practices

Clematis, with its diverse species and varieties, offers immense potential for enhancing garden landscapes through its ornamental and ecological value. Its ability to thrive in various climatic conditions, coupled with its medicinal properties, makes it a versatile plant for both aesthetic and functional purposes. Integrating *Clematis* into sustainable gardening practices involves selecting varieties that are well-suited to local conditions, promoting biodiversity, and implementing eco-friendly pest and disease management strategies. By leveraging the unique characteristics of *Clematis*, gardeners and landscape designers can create visually appealing and environmentally sustainable spaces that contribute to the overall health and beauty of urban and rural environments.

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Conflict of Interest Disclosure

The author affirms that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Beridze O., and Kovalchuk I., 2020, Класифікація роду *Clematis* L. та інтродукція в Кременецькому ботанічному саду, 80: 8-13.
https://doi.org/10.25128/2078-2357.20.3-4.1

Bilalova R., 2021, Introduction of sorts of *Clematis* L. genus in the South-Ural Botanical Garden-Institute of UFRC RAS., 21: 56-61.
https://doi.org/10.18500/1816-9775-2021-21-1-56-61

Bilalova R., and Putenikhin V., 2020, Representatives of the vitalbae prantl. sub-section of *Clematis* L. genus in the collection of the southural botanical garden–institute of ufrc of the ras.,2: 73-77.
https://doi.org/10.17072/1994-9952-2020-2-73-77

Bosiacki M., 2008, Effect of type of Osmocote fertilizers on the growth and yielding of *Clematis* from J Jackmanii group 'John Paul II' cultivar, Acta Scientiarum Polonorum-hortorum Cultus, 7.

Chavan J., Kshirsagar P., and Gaikwad N., 2012, Rapid in vitro propagation of *Clematis heynei* M. A. Rau: An importantmedicinal plant -. Emirates Journal of Food and Agriculture, 24: 79-84.
https://doi.org/10.9755/EJFA.V24I1.10601

Chawla R., Kumar S., and Sharma A., 2012, The genus Clematis (Ranunculaceae): chemical and pharmacological perspectives.. Journal of ethnopharmacology, 143(1): 116-150.
https://doi.org/10.1016/j.jep.2012.06.014

Chebannaya L., 2020, Introduction and prospects of using Clematis l. in the stavropol territory, Pomiculture and small fruits culture in Russia.
https://doi.org/10.31676/2073-4948-2020-61-77-85

Chebannaya L., 2022, Small-flowered clematis collections of the Stavropol Botanical Garden. Agrarian science, (5): 58-62.
https://doi.org/10.32634/0869-8155-2022-359-5-58-62

Dai T., 2004, Preliminary Study on Propagation of Clematis patens. Journal of Southwest Forestry College.

Do N., 2006, Clematis hagiangensis N. T. Do, a new species of Ranunculaceae from Vietnam, Journal of Systematics and Evolution, 44: 595-597.
https://doi.org/10.1360/APS050138

Evgenievna K., Evgenievna M., Sergeevna K., Vitalevna T., and Ivanovich T., 2020, Technologies of reproduction terry varieties of clematis, The Journal of Agricultural Science, 12: 214.
https://doi.org/10.5539/jas.v12n3p214

Garibaldi A., Bertetti D., and Gullino M., 2007, First Report of Leaf Spot Caused by a Phoma sp. on *Clematis* × *jackmanii* in Italy, Plant disease, 91(10): 1363.

Guo Y.Q., Shi J.N., Wei-Hua N.A., Guo J., and Shao F., 2006, Studies on seeding and cutting propagating of *Clematis canescens*, An Endangered Wild Plant, Forest research.

Ghimire B., Park B., Son D., and Oh S., 2020, Achene Morphology and Anatomy of *Clematis* L. (Ranunculaceae) in Korea and Its Taxonomic Implications, Plants, 9(10):1279.
https://doi.org/10.3390/plants9101279

Golomidova T., Mukhametova S., Kurnenkova I., and Sukhareva L., 2023, Diseases and pests of clematis from the collection of the Botanical Garden-Institute of VSUT (Yoshkar-Ola). Сельское хозяйство, 2: 1-19.
https://doi.org/10.7256/2453-8809.2023.2.43591

Isnard S., Rowe N., and Speck T., 2003, Growth habit and mechanical architecture of the sand dune-adapted climber *Clematis flammula* var. *maritima* L.. Annals of botany, 91(4): 407-417.
https://doi.org/10.1093/AOB/MCG044

Jiang Q., Deng H., Qian W., Yang Z., and Zhang H., 2017, *Clematis wuxiensis* (Ranunculaceae), a new species from Chongqing, China. Phytotaxa, 296: 197-200.
https://doi.org/10.11646/PHYTOTAXA.296.2.10

Kai G., 2002, A preliminary study on the introduction and cultivation of clematis, Acta Botanica Yunnanica.

Kovalyshyn I., and St. K., 2020, Peculiarities of the genus Clematis L., Plants Water Regime., 52: 449-460.
https://doi.org/10.15407/frg2020.05.449

Kulpa D., and Krupa-Małkiewicz M., 2023, Propagation of Clematis 'Warszawska Nike' in In Vitro Cultures, Agronomy, 13(12): 3056
https://doi.org/10.3390/agronomy13123056

Lehtonen S., Christenhusz M., and Falck D., 2016, Sensitive phylogenetics of Clematis and its position in Ranunculaceae. Botanical Journal of the Linnean Society, 182: 825-867.
https://doi.org/10.1111/BOJ.12477

Liu L.B., Yang H., and Wang J., 2010, Study on the adaptability of *Clematis*, Northern Horticulture.

Phukhamsakda C., Phukhamsakda C., Phukhamsakda C., McKenzie E., Phillips A., Jones E., Bhat D., Stadler M., Bhunjun C., Wanasinghe D., Thongbai B., Camporesi E., Ertz D., Jayawardena R., Perera R., Ekanayake A., Tibpromma S., Tibpromma S., Tibpromma S., Doilom M., Doilom M., Doilom M., Xu J., Xu J., Xu J., and Hyde K., 2020, Microfungi associated with Clematis (Ranunculaceae) with an integrated approach to delimiting species boundaries, Fungal Diversity, 102: 1-203.
https://doi.org/10.1007/s13225-020-00448-4

Prokhorova N., and Kling A., 2021, Assessment of propagation efficiency of Clematis L. green cuttings in Western Siberia, IOP Conference Series: Earth and Environmental Science, 624.
https://doi.org/10.1088/1755-1315/624/1/012090

Samarakoon U., and Faust J., 2022, Influence of stock plant growing environment, origin of cuttings, cultivar, and rooting hormone on clematis cutting production and propagation, HortTechnology, 32(4): 369-376.
https://doi.org/10.21273/horttech05029-22

Samarakoon U., and Faust J., 2020, Shortening the Production Cycle of Clematis, HortScience, 55(12): 1974-1979.
https://doi.org/10.21273/hortsci15384-20

Shao L., and Yu G., 2005, In vitro propagation of Clematis filamentosa].. Zhong yao cai = Zhongyaocai = Journal of Chinese medicinal materials, 28(5) 364-366.

Špetík M., Špetík M., Eichmeier A., Burgova J., Groenewald J., and Crous P., 2022, Calophoma clematidina causing leaf spot and wilt on *Clematis* plants in the Czech Republic, Plant disease.
https://doi.org/10.1094/PDIS-09-22-2142-PDN

Yang T., and Huang T., 1995, Additional Remarks of Ranunculaceae in Taiwan (5)-The Genus *Clematis* L., 40: 209-255.
https://doi.org/10.6165/TAI.1995.40.209

Yan S.X., Wang P.F., Zhu C.S., Yang Q.S., and Kong D.Z., 2005, *Clematis acerifolia* var. elobata, a new variety of the Ranunculaceae from Henan, China, Journal of Systematics and Evolution, 43: 76-78.
https://doi.org/10.1360/APS040068

Zhan G., 2007, Resources of *Clematis* in Zhejiang Province and Its Utilization Prospect, Subtropical Plant Science.

Zhang G.X., 2010, Research Status and Garden Application Patterns of *Clematis* L., Plants in China, Journal of Anhui Agricultural Sciences, 38: 12076-12078.

Жигунов О., and Насурдинова Р., 2012, Опыт оценки декоративности сортов рода *Clematis* L. - перспективной культуры для Южного Урала, 8-11.
https://doi.org/10.30906/1999-5636-2012-3-8-11

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