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The use of Mediterranean native shrubs for improving the sustainability of urban environments

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The Mediterranean Basin is home to one of the highest levels of biodiversity on Earth, with approximately 25,000 plant species. The typical vegetation in this region is predominantly consists of shrubs. Due to their anatomical, morphological, physiological, and biochemical characteristics, these plants can tolerate abiotic stress, particularly drought. Consequently, incorporating them could enhance the sustainability of urban green spaces. However, species native to the Mediterranean Basin are not yet widely represented in green spaces, despite their attractive ornamental traits. To quantify the contribution of Mediterranean native shrubs, a survey was conducted on Italian flora. Using a selection grid, species of potential interest were identified; these species belong to the Mediterranean chorotype and exhibit appealing ornamental characteristics. The overall attributes of these plant species support their ornamental use, owing to their form and the features of their leaves, flowers, or fruits. The investigation identified 369 species that are not currently available in commercial nurseries. The most represented families included *Rosaceae*, *Asteraceae*, *Fabaceae*, *Lamiaceae*, and *Cistaceae*. Although the flowering period of each species is relatively short, the blooms of different species are distributed throughout the year. Therefore, by simultaneously utilizing various species, it is possible to ensure a continuous ornamental display.

KEYWORDS

biodiversity, ornamentals, native plants, sustainable landscape, new crops, conservation gardening

1 Introduction

The Mediterranean Basin is one of the richest regions in the world in terms of plant diversity, boasting approximately 25,000 plant species (Myers et al., 2000). Due to their high biological diversity, Mediterranean ecosystems have been recognized as biodiversity hotspots and prime targets for conservation efforts (Myers et al., 2000; Tavşanoğlu and

Pausas, 2018). However, the climate makes the Mediterranean Basin one of the most vulnerable areas to both abiotic and biotic stress. Drought, combined with extreme temperatures, constitutes abiotic stress that negatively affects the survival, growth, development, and productivity of Mediterranean woody species (Ogaya and Peñuelas, 2003). These environmental constraints are expected to intensify in the near future due to global climate change (Pinheiro et al., 2014).

Mediterranean plants can tolerate stressful abiotic conditions and, therefore, are somewhat resilient to the warming and increased drought associated with climate change (Toscano et al., 2019). However, only species with significant phenotypic plasticity—particularly those capable of rapid evolutionary changes in both their functional traits and plasticity—will persist under rapidly changing environmental conditions induced by global change (Matesanz and Valladares, 2014). These characteristics are especially common in shrubs, which are characterized by having "more active meristems, and more potential points for stem regeneration" (Givnish, 1984). These traits enable shrubs to tolerate abiotic stress better than trees. Shrubs are often associated with disturbed and stressful environments; for these reasons, they are more suitable for green infrastructures in Mediterranean environments, especially where maintenance is limited. The high biodiversity and aesthetic value of these plants suggest that their use is the key component of sustainable landscape (Romano and Scariot, 2021).

Among Mediterranean ecosystems, shrublands represent a characteristic vegetation type that is widespread across various habitats. Due to several factors—including physiological, morphological, reproductive, phenological, and regenerative traits, as well as inter- and intraspecific interactions—each shrub species constitutes a significant component of the plant community. Shrubs play a vital ecological role (Pasalodos-Tato et al., 2015) in multiple ways, such as soil protection (Bochet et al., 2006; Francini et al., 2021), enhancing biodiversity (Mangas et al., 2008), nutrient production, carbon storage (Chapin, 1983), and ecosystem restoration (Rey et al., 2009).

The spread of shrubs in the Mediterranean region is attributed to their adaptability to harsh climatic conditions, characterized by hot summers and low rainfall, resulting in a long, dry season (Paz et al., 2016). The use of native Mediterranean shrub species offers a potential solution to drought (Munné-Bosch and Peñuelas, 2004), salt stress (Cassaniti et al., 2013), and heat stress. These native shrubs can withstand severe drought, a critical factor influencing plant survival and species distribution (Filella et al., 1998). Due to their unique morphophysiological traits, woody plants are well-suited for ornamental purposes. It is no coincidence that shrubs are commonly found in degraded environments where abiotic stresses are frequent. From an ornamental perspective, shrubs exhibit various features—such as a high number of twigs influencing their growth patterns; pulvinate (cushion-like) shapes that reduce transpiration and enhance the aesthetic appeal of green infrastructures; distinctive leaf characteristics; varied flowering periods; diverse flower colors—that contribute interest and variety to the landscape (Leotta et al., 2023a).

Despite widespread appreciation, the vast plant diversity of the Mediterranean region largely consists of neglected and underutilized species (Padulosi et al., 2013). Only a small fraction of these resources is currently employed in the agricultural and ornamental horticulture sectors due to poor documentation of their potential and the lack of coordinated efforts (Rivera et al., 2006; Scariot et al., 2012). Globally, the ornamental horticulture industry seeks new crops—often of exotic origin—that exhibit appealing ornamental traits, adaptability to diverse conditions, and low maintenance costs (Fascetti et al., 2014; Maloupa et al., 2008; Junqueira and Peetz, 2017). Unfortunately, native plants receive insufficient attention, partly because of limited information regarding their performance and propagation.

Studies on the ornamental value of new crops generally focus on the plants' habit and characteristics, such as morphological and phenological traits, development and growth, ecological characteristics including tolerance to various factors, aesthetic features like flower and leaf attributes, and cultivation methods encompassing agricultural practices such as ease of propagation and adaptability to different cultivation conditions (Krigas et al., 2021). For plants intended for landscaping and gardening, resistance to biotic and abiotic stresses is of particular importance (Krigas et al., 2021).

Another factor supporting the use of native plants in green spaces is the potential to aid populations of declining native species, thereby helping to prevent their extinction. Gardens, which are common in both urban and rural environments, are increasingly recognized for their role in conserving biodiversity (Gratzfeld, 2017). Recently, the concept of conservation gardening has emerged as a novel approach to biodiversity restoration. This approach focuses on cultivating declining native species in private gardens, integrating commercial horticulture with conservation efforts, and promoting public engagement (Segar et al., 2022; Staude, 2024; Munschek et al., 2023). Awareness of the importance of biodiversity and the benefits of incorporating local flora into urban landscape design is growing (Lovell and Johnston, 2009; Ahern, 2013). By doing so, we can safeguard pollinators that have co-evolved with many genera or species of native plants (Hall et al., 2017; Senapathi et al., 2017).

An increasingly informed public is demanding the inclusion of native plants in green spaces, driven by the awareness that this can reduce dependence on resources—primarily water—in urban and suburban environments. Although native flora encompasses a variety of species with diverse water requirements, some species, particularly shrubs, demonstrate greater water-use efficiency (Chaves et al., 2003; Evans et al., 2013; Martinson, 2020).

Recently, the checklist of vascular flora native to Italy has been updated (Bartolucci et al., 2018). The checklist now includes 8,241 species and subspecies, belonging to 1,111 genera and 153 families (Bartolucci et al., 2024). According to Bartolucci et al. (2024), the taxa currently confirmed to occur in Italy number 7,591, as the remaining taxa have not been recently verified, are doubtful, or are affected by errors or incomplete information. In any case, the Italian flora is particularly rich in plant species, which can serve as a valuable resource for revitalizing the biological diversity of

ornamental nurseries and for individuating new species better suited for urban greenery.

In this context, the objective of this study was to review the shrub species present in the Italian flora and examine some of their morphological and functional characteristics to conduct a preliminary assessment of their adaptability to various landscape use modalities.

2 Materials and methods

2.1 Literature sources

The survey began with a review of relevant literature sources (Pignatti, 1982; Raimondo et al., 2010; Conti et al., 2005; Bartolucci et al., 2018, 2024), which facilitated the identification of the initial group of species. All data collection and literature searches were performed within the period November 2024 until February 2025. All identified plants belonged to the category commonly referred to as bushes. These plants correspond to chamaephytes, caespitose phanerophytes, and nanophanerophytes, according to Raunkiaer (1934). Although some individual accessions could be classified under other biological forms (e.g., rhizomatous geophytes, caespitose hemicryptophytes, hemicryptophytes with rosettes, scapose hemicryptophytes), all listed taxa fall within these biological categories. The taxa considered were limited to species spread in Italy and classified as indigenous, naturalized archaeophytes, or cryptogenic. From the preliminary list, certain accessions were selected for further study based on specific morpho-biological characteristics, flowering season, and distribution within the national territory. For each accession, synonym names were verified to eliminate duplicates using Plants of the World Online (2025) (https://powo.science.kew.org/). However, a double taxonomic check (accepted name *versus* heterotypic synonym) has not been performed. Families were listed according to Plants of the World Online (2025). Information on origin and flowering period was referenced from Pignatti (1982) and Acta Plantarum (https://www.actaplantarum.org/). Based on literature data (Pignatti, 1982; Pignatti et al., 2017–2019; Acta Plantarum, 2025), plant height was categorized into classes (< 20 cm; 20–60 cm; 60–100 cm; 100–140 cm; > 140 cm), along with flower color and the organ of greatest showiness (flowers, fruits, or leaves). For the latter information, we relied on iconography available online from reliable websites (Acta Plantarum, 2025; iNaturalist, 2025).

2.2 Morphological traits

Considering morphological traits (height, prominence of flowers, fruits, and leaves) and functional characteristics (origin environments, flowering season), the potential use of these species for ornamental purposes in green areas—such as green roofs, naturalistic gardens, pot cultivation, slopes, xeriscaping, wildflowers, —was proposed. The list of selected plants was then compared with a previous list of species found in twenty-seven nurseries nationwide that marketed ornamental plants used for the arrangement of green spaces (Romano, 2021), in order to identify which of these accessions were available on the market.

3 Results

The review identified 1,137 taxa belonging to 271 genera and 74 different botanical families (Table 1). Based on specific morpho-biological characteristics, flowering season, and distribution within the national territory, a selection process identified 544 taxa belonging to 199 genera and 68 botanical families (Table 2). Among these, 159 taxa were subspecies, accounting for 29.2% of the total (Table 1S). The most represented botanical families are *Rosaceae* (44 genera and 56 species), *Asteraceae* (16 genera and 55 species), *Fabaceae* (17 genera and 50 species), *Lamiaceae* (16 genera and 45 species), *Cistaceae* (3 genera and 38 species), and *Caryophyllaceae* (12 genera and 30 species).

To highlight the extensive biodiversity observed, it should be noted that 36 botanical families (52.9% of the total) were represented by a single genus, and 23 botanical families (33.8%) were represented by a single species (Table 1). The highest number of genera was found in the *Rosaceae* family, followed by *Asteraceae*, *Fabaceae*, and *Lamiaceae*.

Most of the species were from the Mediterranean area, based on the criteria adopted for inclusion in the list (Figure 1). Endemic or subendemic species account for 29% of the total. Steno-Mediterranean species are also well represented, comprising 21% of the total.

The most common biological form was chamaephytes, which accounted for 58% of the total, followed by cespitose phanerophytes (22%), and nanophanerophytes (20%) (Figure 2).

Over 50% of the plants were under 60 cm in height, while 30% exceeded 100 cm (Figure 3).

The flowering period of different species lasted an average of 3.7 months. In terms of distribution across the months, the highest concentration of flowering occurred between April and June, accounting for over 50% of the blooms. The lowest concentrations were observed in November and December, at 1.9% and 1.2%, respectively (Figure 4).

The conspicuousness supporting the ornamental characteristics was attributed to the flowers in 86.4% of cases, to the fruit in 20.6%, and to the foliage in 23.7% (Table 1S). In fact, some species were valued for multiple ornamental traits.

The color of the flowers, the most conspicuous organ, was white in 134 species (24.6% of the total), yellow in 196 species (30.0%), pink-red in 103 species (18.9%), and violet-lilac in 46 species (8.5%) (Table 1S).

Based on their morphological and phenological traits, the species can be primarily used in naturalistic gardens (39%), xeriscaping (28%), slope stabilization (14%), and green roofs (11%). Their use for pot cultivation and wildflowers is marginal (Figure 5). Each species supports multiple applications, averaging 2.1 uses per species, highlighting their potential value in green spaces.

Despite the small size of the flowers, many species are appreciated for their abundant blooms and, occasionally, for the

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TABLE 1 Number of taxa and genera for botanical families of Italian flora of potential ornamental value.

Botanical family	N. genera	N. taxa	Botanical family	N. genera	N. taxa
Amaranthaceae	12	21	Hypericaceae	1	5
Anacardiaceae	3	6	Lamiaceae	21	89
Apiaceae	3	4	Lauraceae	1	1
Apocynaceae	5	9	Linaceae	1	5
Aquifoliaceae	1	1	Linnaeaceae	1	1
Araliaceae	1	1	Loranthaceae	1	1
Arecaceae	1	1	Malvaceae	2	9
Aristolochiaceae	1	1	Myrtaceae	2	2
Asparagaceae	2	7	Oleaceae	5	6
Asteraceae	22	93	Orobanchaceae	1	2
Berberidaceae	1	2	Phyllanthaceae	1	1
Betulaceae	5	10	Plantaginaceae	8	32
Blechnaceae	1	1	Plumbaginaceae	4	68
Boraginaceae	4	8	Polygalaceae	1	1
Brassicaceae	17	54	Polygonaceae	1	4
Buxaceae	1	2	Ranunculaceae	1	5
Campanulaceae	3	4	Rhamnaceae	5	14
Cannabaceae	2	4	Rosaceae	18	149
Capparaceae	1	2	Rubiaceae	4	6
Caprifoliaceae	3	14	Rubiaceae	2	11
Caryophyllaceae	19	81	Rutaceae	4	8
Celastraceae	1	3	Salicaceae	1	39
Cistaceae	4	44	Santalaceae	1	1
Convolvulaceae	2	3	Sapindaceae	1	3
Coriariaceae	1	1	Saxifragaceae	1	1
Cornaceae	1	4	Scrophulariaceae	1	1
Crassulaceae	5	37	Selaginellaceae	1	1
Cupressaceae	1	5	Smilacaceae	1	1
Elaeagnaceae	1	1	Solanaceae	2	4
Ephedraceae	1	3	Staphyleaceae	1	1
Ericaceae	11	28	Styracaceae	1	1
Euphorbiaceae	2	27	Tamaricaceae	3	7
Fabaceae	22	133	Thymelaeaceae	2	16
Fagaceae	1	3	Ulmaceae	2	3
Frankeniaceae	1	2	Valerianaceae	1	3
Grossulariaceae	1	8	Viburnaceae	2	5
Hydrangeaceae	1	1	Vitaceae	1	1
			TOTAL	271	1137

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TABLE 2 Number of taxa and genera for botanical families of selected plants, according the number of taxa.

Botanical family	N. genera	N. taxa	Botanical family	N. genera	N. taxa
Rosaceae	44	56	Convolvulaceae	2	3
Asteraceae	16	55	Ephedraceae	1	3
Fabaceae	17	50	Grossulariaceae	1	3
Lamiaceae	16	45	Malvaceae	1	3
Cistaceae	3	38	Orobanchaceae	1	3
Caryophyllaceae	12	30	Ranunculaceae	1	3
Brassicaceae	9	29	Solanaceae	3	3
Euphorbiaceae	2	19	Cornaceae	1	2
Plumbaginaceae	4	15	Frankeniaceae	1	2
Crassulaceae	3	14	Rutaceae	1	2
Amaranthaceae	8	11	Viburnaceae	2	2
Caprifoliaceae	4	9	Amaranthaceae	1	1
Ericaceae	3	9	Apocynaceae	1	1
Amaranthaceae	2	7	Aquifoliaceae	1	1
Asparagaceae	2	7	Araliaceae	1	1
Plantaginaceae	4	7	Arecaceae	1	1
Rhamnaceae	3	7	Aristolochiaceae	1	1
Salicaceae	1	7	Asphodelaceae	1	1
Boraginaceae	2	6	Berberidaceae	1	1
Rubiaceae	5	6	Blechnaceae	1	1
Tamaricaceae	2	6	Celastraceae	1	1
Thymelaeaceae	2	6	Lauraceae	1	1
Anacardiaceae	3	5	Loranthaceae	1	1
Apocynaceae	4	5	Myrtaceae	1	1
Campanulaceae	3	5	Phyllanthaceae	1	1
Cupressaceae	1	5	Polygonaceae	1	1
Hypericaceae	1	5	Santalaceae	1	1
Oleaceae	4	5	Sapindaceae	1	1
Apiaceae	3	4	Saxifragaceae	1	1
Betulaceae	4	4	Scrophulariaceae	1	1
Capparaceae	1	4	Selaginellaceae	1	1
Fagaceae	1	4	Smilacaceae	1	1
Ulmaceae	2	4	Vitaceae	1	1
Cannabaceae	2	3	Zygophyllaceae	1	1
Convolvulaceae	2	3	TOTAL	199	544

distinctive characteristics of their fruits and foliage, highlighting the aesthetic appeal of many recorded taxa (Figure 6).

Many of the ornamental species surveyed are not listed in the catalogs of major Italian commercial nurseries. A total of 369 plant species, representing 67.8% of the recorded accessions, were absent from these commercial nursery catalogs. However, it cannot be ruled out that some of these unlisted species are cultivated on a marginal scale.

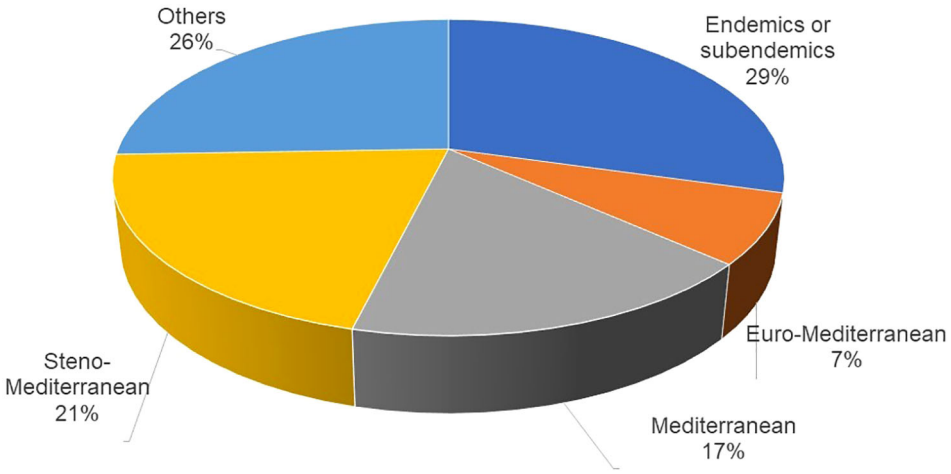

FIGURE 1
Distribution of shrub in the Mediterranean area, in wild, urban, peri-urban areas.

4 Discussion

The survey highlighted the floristic diversity of the Mediterranean region, which is influenced by various factors such as topographical, biogeographical, ecological, and climatic heterogeneity, as well as human interference that has significantly impacted the vegetation. The current levels of endemism—many of the taxa identified in the review are endemic—and biodiversity are the result of these interactions (Rundel and Cowling, 2013; FAO and Plan Bleu, 2019). Italy's geographical position as a peninsula with numerous islands is a key factor explaining its biodiversity (Conti et al., 2005; Tavşanoğlu and Pausas, 2018).

Urban populations rely on various ecosystem services provided by natural areas. However, the expansion of urban environments and the consequent destruction of natural habitats have increased the reliance on ornamental green spaces to deliver ecosystem services for the benefit of city residents (Francini et al., 2022). Among these services, biodiversity conservation plays a crucial role. Introducing native plants can contribute significantly to conservation efforts, especially when these plants are rare or threatened. Many species identified in our study possess these characteristics, which enhances the value of their use. Incorporating native plants into urban landscapes not only boosts biodiversity but also creates environments capable of providing essential ecosystem goods and services within cities.

Public awareness of the importance of biodiversity and the benefits derived from incorporating regional flora into urban landscape design is now well established (Lovell and Johnston, 2009; Ahern, 2013; Phondani et al., 2016).

The demand for native plants in landscaping and gardening, driven by ecological concerns, is increasing. Therefore, research is

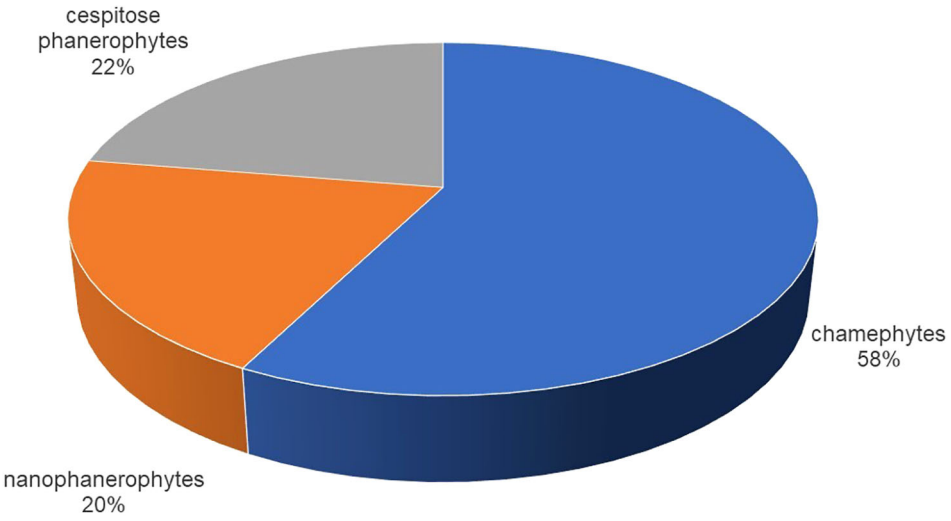

FIGURE 2
Distribution of shrub for biological forms.

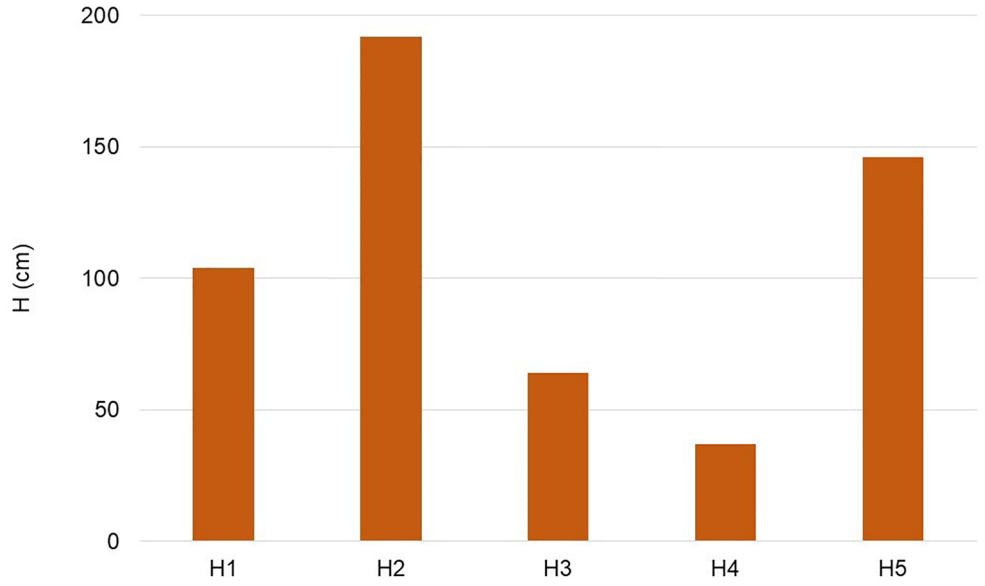

FIGURE 3
Distribution of shrub for height: H1= < 20 cm; H2 = 20–60 cm; H3 = 60–100 cm; H4 = 100–140 cm; H5= > 140 cm.

necessary to identify suitable native plants and to evaluate whether their use can enhance biodiversity resilience and improve the capacity of native plant landscapes to provide ecosystem services for a growing urban population (Martinson, 2020). The most common benefits of green spaces include the reduction of pollution (particulate matter, heavy metals, ozone), mitigation of high temperatures, reduction of surface runoff by preventing erosion, slope stabilization, carbon dioxide sequestration, and oxygen emission (Francini et al., 2021, 2022; Leotta et al., 2023a).

Green infrastructure (GI) plays a crucial role in biodiversity conservation. Conservation gardening has recently been promoted as a strategy to mitigate the decline of native plant species (Affolter, 1997; Gratzfeld, 2017; Ismail et al., 2021; Mounce et al., 2017). This concept has emerged as a participatory approach to restoring biodiversity by cultivating declining native species in private gardens, integrating commercial horticulture with conservation efforts, and encouraging public engagement (Munschek et al., 2023; Segar et al., 2022). Investigating the role of gardens as dispersal corridors for native and endangered plant species could provide valuable insights for collectively addressing the biodiversity crisis (Staude, 2024).

The species identified in our review could therefore contribute to enhancing the native biodiversity of cities; however, the feasibility of their actual inclusion still needs to be evaluated.

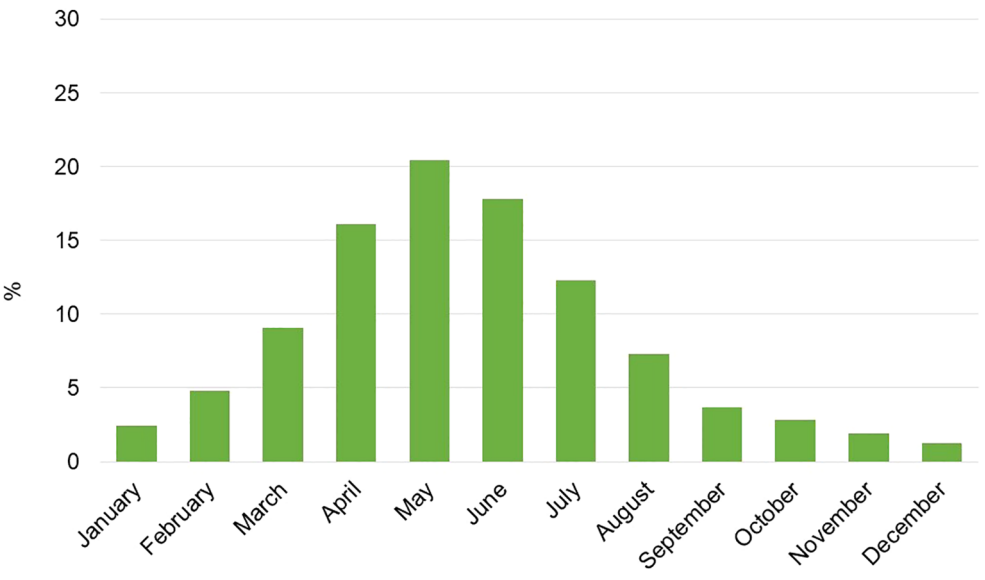

FIGURE 4
Distribution of flowering in the different months of the year.

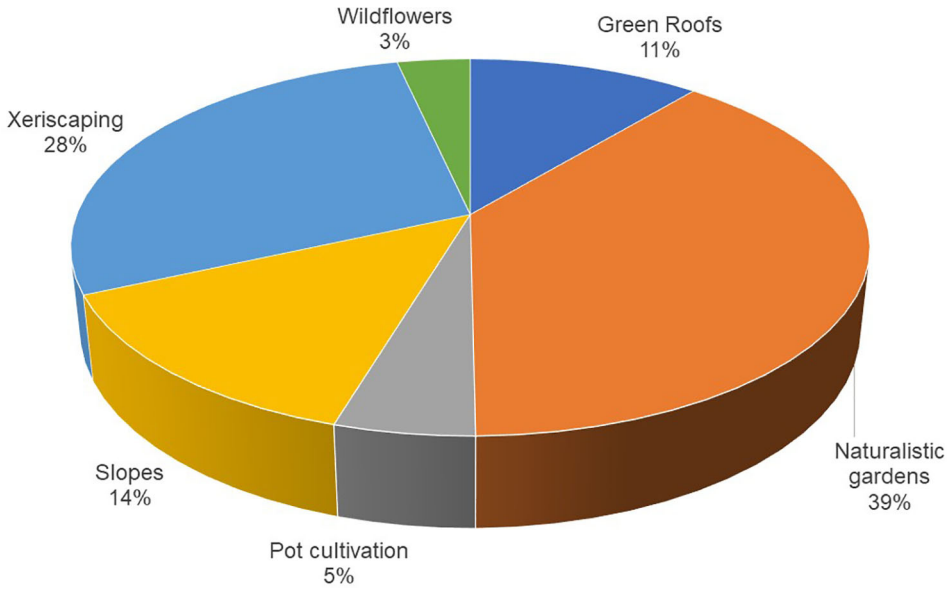

FIGURE 5
Distribution of shrub for the possible uses in green areas.

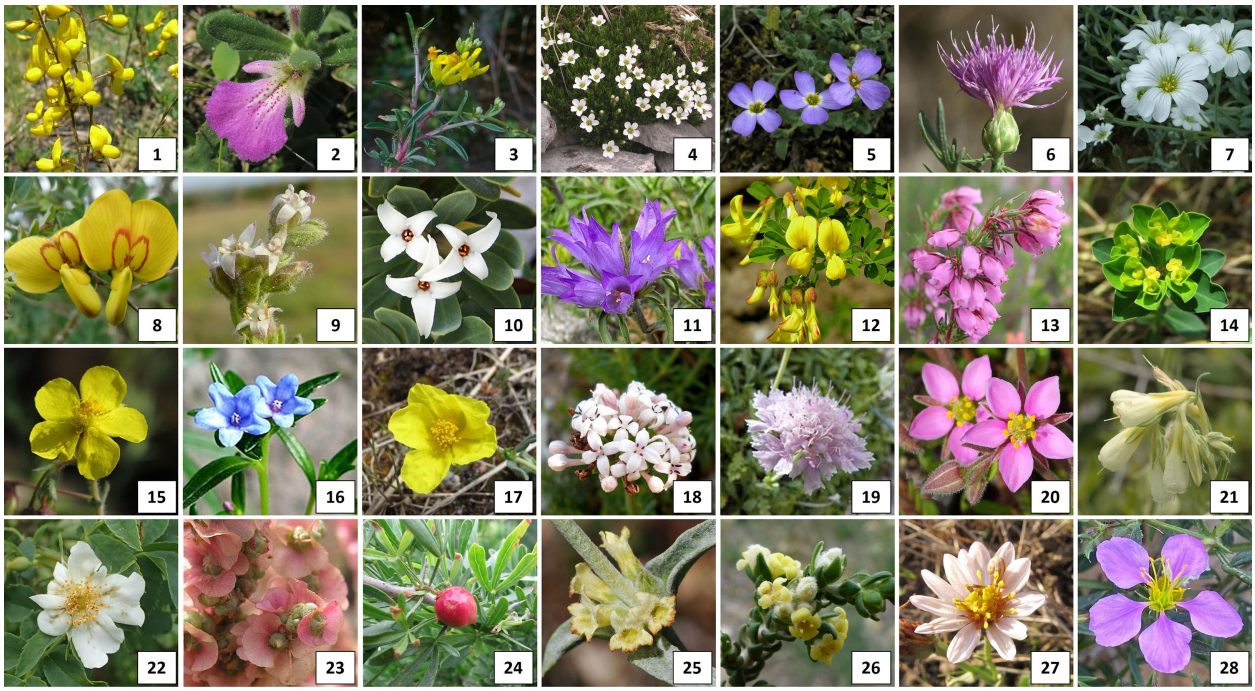

FIGURE 6
Top left to right: 1) *Adenocarpus complicatus* subsp. *bivonae* (C.Presl) Peruzzi; 2) *Ajuga iva* subsp. *iva*; 3) *Anthyllis hermanniae* L.; 4) *Arenaria grandiflora* subsp. *grandiflora*; 5) *Aubrieta columnae* Guss.; 6) *Centaurea aeolica* Guss. Ex Lojac.; 7) *Cerastium tomentosum* L.; 8) *Colutea arborescens* L.; 9) *Cressa cretica* L.; 10) *Daphne oleoides* Schreb.; 11) *Edraianthus graminifolius* A.DC.; 12) *Emerus major* Mill.; 13) *Erica cinerea* L.; 14) *Euphorbia gasparrinii* Boiss.; 15) *Fumana laevipes* Spach; 16) *Glandora rosmarinifolia* (Ten.) D.C.Thomas; 17) *Helianthemum croceum* (Desf.) Pers.; 18) *Hexaphylla rupestris* (Tineo) P.Caputo & Del Guacchio; 19) *Lomelosia crenata* (Cirillo) Greuter & Burdet; 20) *Minuartia geniculate* Thell.; 21) *Onosma echioides* (L.) L.; 22) *Rosa caesia* Sm.; 23) *Salsola vermiculata* L.; 24) *Searsia pentaphylla* (Jacq.) F.A.Barkley ex Moffett, 25) *Sideritis italica* (Miller) Greuter & Burdet; 26) *Thymelaea hirsuta* Endl.; 27) *Tripolium sorrentinoi* (Tod.) Raimondo & Greuter; 28) *Zygophyllum creticum* (L.) Christenh. & Byng.

The long-term sustainability of landscapes utilizing native plant resources requires management to consider not only ornamental purposes but also ecological and environmental values (e.g., soil, water, biodiversity) and socio-economic factors (Muhtaman et al., 2000; Burlando et al., 2025).

The biodiversity of urban green spaces is crucial because it mitigates the risks posed by pests, diseases, and climate change, thereby enhancing the resilience of the ecosystem services provided by green infrastructure (Leotta et al., 2023a).

Depending on their hardiness, shrubs play a fundamental ecological role in green areas (Pasalodos-Tato et al., 2015). In natural environments, the shrub stage represents a secondary succession that can stimulate, facilitate, or positively interact with community dynamics. In fact, shrub species, which act as nurse plants, can promote the germination and growth of woody forest species beneath their canopy by improving the water status of seedlings through reducing radiation, lowering soil temperature, conserving moisture, and protecting them from herbivore damage. These effects are also influenced by the shrubs' functional traits and morphological characteristics (Bruno et al., 2003; Castro et al., 2004; Manaut et al., 2011). Shrubs are pioneer, branched plant species that are highly adaptable and strongly interactive with other species (Götmark et al., 2016).

In Mediterranean ecosystems, shrubs are a characteristic type of vegetation, widespread across various habitats. Due to multiple factors—including physiological, morphological, reproductive, phenological, and regenerative traits, as well as inter- and intraspecific interactions—each shrub species constitutes an important component of the plant community and fulfills a specific ecological role (Lombardo et al., 2020). The most critical morphological traits for abiotic stress tolerance are leaf morphology and functionality, particularly the ability to reduce gas exchange and enhance metabolite accumulation (Toscano et al., 2020; Leotta et al., 2023a).

The high biodiversity potential offered by the identified plant species—over 540 taxa belonging to 68 botanical families—can ensure the goal of enhancing the sustainability of green spaces. Native shrubs, due to their hardiness, are well-suited for new urban green design systems that reduce maintenance costs, partly through more naturalistic planting (Nam and Dempsey, 2019). This approach enables an increase in biodiversity even within urban environments (Capotorti et al., 2020; Bonthoux et al., 2019; Pomatto et al., 2023).

Biological form helps us understand the characteristics of plants and their ability to adapt to marginal conditions. In our review, the most common type was chamaephytes. The specific morphological traits of chamaephytes can vary greatly depending on the species and environmental factors. Chamaephyte plants are characterized by low growth close to the ground, which allows them to survive in harsh conditions such as cold climates, where the warmth of the soil aids their survival, or drought conditions, due to reduced transpiration resulting from the plant's cushion-like shape. Many chamaephytes possess adaptations that enable them to endure these challenging environments. Additionally, survival in harsh conditions is facilitated by a reduction in leaf size, which minimizes water loss.

The list is well represented by caespitose phanerophytes, which are plants characterized by the formation of dense clumps or groups of stems arising from a common base. Nanophanerophytes, typically low-growing woody plants that usually reach only a few meters in height, are also included in the list compiled by our study.

The potential for domesticating endemic plants for ornamental purposes is underscored by the inadequate *ex situ* conservation of local endemic species in botanical gardens and seed banks (Krigas et al., 2021). Another challenge is the lack of studies on assessment systems for the rapid identification of suitable landscapes and garden plants. Key characteristics to consider include plant habit and height, vegetative and flowering periods, flower traits, modes of reproduction, tolerance to biotic and abiotic stresses, and associated survival rates (Liu et al., 2016). Utilizing these plants in landscapes and gardens can also contribute to the conservation of endemic species at risk of extinction.

An interesting aspect that emerged from this study was the variability in the heights attained. In many cases, the plants did not exceed 20 cm in height; therefore, the species identified can be used as ground cover. Ground cover plants serve as components or connecting elements in other green infrastructure interventions (Woods Ballard et al., 2015), such as rain gardens, green roofs, or rainwater harvesting tanks (Nur Hannah Ismail et al., 2023).

Their small size—over 54% of the species surveyed do not exceed 60 cm—makes them particularly suitable for new types of greenery, such as extensive green roofs (Savi et al., 2016; Leotta et al., 2023b). Their limited height is linked to their biological form: in 58% of cases, they are chamaephytes. The height of the plants surveyed, often less than one meter, allows for a wide variety of uses and plays an important ecological role in plant communities. The cushion shape, which minimizes the exposed surface area of the plant relative to its volume, contributes to their tolerance of abiotic stresses, as observed in the Mediterranean region.

Based on the information available for each of the accessions surveyed, we can only hypothesize about their possible uses, which appear to be quite diverse. The different species had an average of 2.1 uses. However, only experimental trials conducted in representative contexts will be able to accurately assess the actual uses of the accessions surveyed.

Aesthetic aspects play a crucial role in urban landscape design. The beauty of plants is primarily conveyed through their visual appearance, which is inherently linked to color. Ornamental plants contribute vibrant color to urban green spaces (Wang, 2021). Additionally, the landscape created by ornamental plants evolves over time, meaning that the color of plants across different seasons has a significant chromatic impact. The color of plants, particularly their flowers, is therefore a key element in crafting an appealing urban landscape (Wang, 2021). The survey revealed that plants typically flower for several months; notably, it is possible to have varying blooms—and thus different colors—throughout the year. Many of the species identified were also valued for their combined aesthetic qualities related to flowers, foliage, and fruit.

Today, ornamental plants are valued not only for their aesthetic appeal but also for their ability to enhance the environment and improve quality of life (Savé, 2009). A large number of Mediterranean-

origin species, particularly shrubs, are well-suited for sustainable landscaping due to their capacity to thrive in harsh conditions and tolerate drought stress. Unlike agriculture, the success of an ornamental landscape is not measured by yield but by its ability to satisfy user expectations while requiring minimal maintenance. In degraded environments, plant survival may be the primary objective of cultivation (Toscano et al., 2019). Many of these plants, owing to their origin, resilience in marginal settings, distinctive morpho-biometric traits, and attractive ornamental qualities, appear well-equipped to meet the current demands of urban landscaping.

5 Conclusions

The Mediterranean region is a rich source of biodiversity for the ornamental sector, hosting a wide variety of plant species suitable for urban and peri-urban landscapes. Although morphological and physiological traits vary among botanical families, they remain of significant interest. The ornamental value is derived from leaves, flowers, and fruits, each contributing to aesthetic appeal at different times or seasons. Consequently, combining various ornamental species can extend the visual appeal of an area throughout the year. In this study, the most important genera and species were identified for use in successive experimental tests aimed at selecting native plants capable of adapting to urban environments. This approach aims to enhance the sustainability of urban green spaces while revitalizing the biological diversity of ornamental floriculture.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material. Further inquiries can be directed to the corresponding author.

Author contributions

LL: Writing – original draft. ST: Writing – review & editing. AF: Writing – review & editing, Conceptualization, Writing – original draft. DR: Conceptualization, Data curation, Writing – original draft, Writing – review & editing.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fhort.2025.1652517/full#supplementary-material

SUPPLEMENTARY TABLE 1
Mediterranean shrub species selected d for the potential landscape use.

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