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Instructions to Authors

SOME SHADE TOLERANT PLANTS USED IN LANDSCAPE DESIGN IN MACEDONIABRNDEVSKA V., ¹RIZOVSKA ATANASOVSKA J.¹Ss. Cyril and Methodius University in Skopje, Faculty of Forestry in Skopje, Skopje, Macedonia

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ABSTRACT: The choice of plant species in landscape design is a complex work that depends on many factors. One of them is the plants' need for light. According to this, there are: heliophytes (sun-loving), shade tolerant and semi-shade tolerant plants. The number of shade tolerant plant species is the smallest. However, there are enough in order to shape a complex, functional and aesthetic landscape, and the need for them is a challenge for creating many varieties and cultivars on a daily basis. Some of the shade tolerant plants are present in our green environments for a very long time, but there are some that are relatively new or have existed in Macedonia, but their usage was small. They are characterized by specific morphological characteristics, which give them a specific role and a special place in the design of green areas.

Keywords: landscape design, shade tolerant plants, varieties, cultivars, specific morphological characteristics

1 INTRODUCTION

One of the factors that should be taken into account when designing green areas is the use of plants according to their need of light. According to this, they are divided in: heliophytes (sun-loving), shade tolerant and semi-shade tolerant plants. The number of shade tolerant plants in relation to the other is smaller and thus the choice of plants when designing green areas that are in shade throughout the whole day or much of the day is limited. However, there are enough to form a complex, functional and aesthetic landscape.

There are shade tolerant plants present in green areas with us for a very long time, but there are some that are relatively new or have existed here, but their usage was small. Among the shade tolerant species encountered in designing green areas in Macedonia are a growing number of perennials, some annual and biannual plants, shrubs and trees. Here we can list the taxons from the genus *Taxus* L., *Hosta* Tratt., *Hydrangea* L., *Skimmia* Thunb., *Aucuba* Thunb., *Erica* L., *Calluna* Salisb., *Hedera* L. etc. These plants develop best in shady conditions and then their decoration is the most extensive. Each taxon is characterized by its specific morphological characteristics, which give them a specific role and a special place in the design of green areas.

2 MATERIAL AND METHODS

The material of work are the shade tolerant plant species that are characterized with specific morphological characteristics, have decorative value and which recently can be used in the design of green areas in Macedonia. Most of them has not been present in our region before, some were but with small usage. The emphasis is on species that are best developed in shade, where their decoration is most extensive.

The method of work means finding and determining the shade tolerant plant species that are recently used in the design of green areas in Macedonia. The research was conducted in the city of Skopje, mostly on green areas available for public use and in the larger garden centers in the city ('Eco Growth', 'Foya-Co', 'Horti Expert' and 'Green Planet') which perform procurement of plant material from both domestic and foreign origin and have a large variety of plants. Garden centers, as part of the research locations are chosen because of the specificity of the work and determination of plant species which means

closer contact with plants, that's not possible to be done in private gardens.

Still, during the research, individual specific green areas were visited and explored, that required special permission for entrance by the owners (residential complex 'St. John', some private properties and balcony gardens).

The researches were performed in fall and spring, moreover, in the period from October to November and April to June 2010 and 2011. This period was chosen for research because the selection of seedlings in garden centers in the active planting season is largest. First the plants were determined after locating certain green areas. The basic information regarding taxons located in garden centers were obtained from the declarations attached with the plant material, but in order to obtain detailed and quality data, the plant material was determined by cabinet processing. Afterwards, their basic morphological characteristics, low temperature resistance and durability and the conditions necessary for successful development were processed. All this is presented in tables with results of concrete conclusions.

The research helped determine the effects of their usage in the landscape design of green areas in our country. Relevant data are presented with appropriate photos.

3 DISCUSSION AND RESULTS

The research regarding the shade tolerant plants used in landscape design in our country showed that the most used species are representatives of genus *Taxus* L., *Hosta* Tratt., *Hydrangea* L., *Skimmia* Thunb., *Aucuba* Thunb., *Erica* L., *Calluna* Salisb. and *Hedera* L..

3.1 Genus: *Taxus* L. – Yew (fam. Taxaceae)

The plants from the genus *Taxus* are coniferous evergreen shrubs or small trees. They have soft and flat pins. They are characterized with semi-smooth texture. Yew is a bicameral type and female specimens produce berries with red meaty covering. They ripe in fall and fall off in December and greatly increase the decorative value of the plant. They can withstand temperatures up to -30°C. Best developed in sandy, weakly acidic and well-drained soils. They have relatively slow growth.

Taxus baccata L. is a species found in the past on our green areas, and the following taxons are being used in recent times: *Taxus baccata* 'Fastigiata', *Taxus baccata* 'Fastigiata Aurea', *Taxus baccata* 'Repandens', *Taxus*

baccata 'Repandens Aurea' and *Taxus x media* 'Hicksii' which is a hybrid between *Taxus baccata* L. and *Taxus cuspidata* Siebold & Zucc.

Depending on the basic characteristics, each type is differently used in the design of green areas. Some are used as solitary trees, as part of a group of trees, can form hedges or be planted in alpinum or in pots.

They often represent the focal point due to the shape or color, and the spreading plants are usually used as living ground covers. *Taxus baccata* L. is found as topiary tree, and is also used to form hedges due to its bigger growth and the ability to shape it. It is the only representative that can be found in public green areas, while the remaining taxons are found only in private gardens. Cultivars in yellow, unlike the rest of the plants are not so present in our country.

Figure 1 shows group of trees and Figure 2 topiary tree of *Taxus baccata* L. with pyramidal shape.



Figure 1: Group of trees from *Taxus baccata* L. – complex 'St. John', settlement Zlokukani, Skopje



Figure 2: Topiary tree of *Taxus baccata* L. – 'Horti expert', settlement Karposh 2, Skopje

Table I shows the representatives of the genus *Taxus*, their shape and color as basic morphological characteristics and the maximum size they can reach.

Table II shows the most commonly encountered representatives of the genus *Taxus* and their usage in landscape design. These plants, though extremely decorative, due to the expensive cost can only be found in more exclusive yards. This is the reason that there are rare cases of formation of hedges and topiary trees of *Taxus baccata* L..

3.2 Genus: *Hosta* Tratt. – Funkiy, Plantain Lily (fam. Liliaceae)

Hosta spp. is a leafy decorative perenial originating from East Asia. There are about 50-70 species and more than 4,000 hybrids, cultivars and varieties, whose number is constantly growing. They differ in shape, color and size of the leaf. These plants are grown mostly for its decorative leafs.

Their size can be from a few cm to 6m. Dwarf representatives can grow to 10cm, the miniature to 10-15cm, the low high to 15-25cm, the medium high to 25-45cm, the high 45-70cm, and the highest over 70cm. The form of the leaf can be long, circular, elliptical-circular, heart-shaped etc, and the color can be green (all shades), yellow, gray, blue, brown, or colorful leaves combined with the aforementioned colors. They bloom in summer, and the flower is striking and short lasting.

They can withstand shadow and semi-shadow, although some varieties can live on the sun if the soil is sufficiently moist. However, they are best developed in shadow, in quality moist soil, enriched with organic materials whose pH value is between 6.5 and 7.3. They can sustain temperature up to -34°C.

The following representatives of the genus *Hosta* can be found in our country: *Hosta* 'Big Daddy', *Hosta decorata*, *Hosta* 'Gold Standard', *Hosta montana* 'Aureomarginata' and *Hosta* 'Blue Angel' (Fig. 3) and they are usually part of private yards. They are successfully combined with other types of perennial plants. They're used as living ground covers, especially when planted in a group and as a focal point that attracts attention because decorativeness sheet. They can live by water surfaces, and are grown in pots for decoration of small yards, balconies and terraces.



Hosta decorata

Hosta 'Gold Standard'



Hosta montana 'Aureomarginata'

Figure 3: Some representatives of the genus *Hosta* recently used for landscape design in our country

3.3 Genus: *Hydrangea* L. – Hydrangea, Hortensia (fam. Saxifragaceae)

The genus *Hydrangea* L. contains 70-75 species of flower plants that originate from southern and eastern Asia and North and South America. The name Hortensia can be found as a synonym for this plant. There are over 600 named varieties and cultivars. Most of them are flower shrubs that grow to 1-3m, and rarely reach the size of a small tree. Decorativeness is a result of the flower which is large and ball-shaped, 10-20cm in diameter. The color, which varies from the pH value of the soil, can be white, blue, pink, purple and red in various shades.

Acidic soils produce blue flowers, neutral pale brown and alkaline pink or purple.

When designing green areas, they are used as decorative flower shrubs and are often the focal point in the period of flowering. We use them as plants used for decoration of balconies and terraces planted in pots, and they can also be found in yards, planted separately or in groups.

The most often used are *Hydrangea macrophylla* Thunb. and *Hydrangea arborescens* 'Annabelle' (Fig. 4). *Hydrangea macrophylla* Thunb. is the most popular type. It can be found in our regions from a very long time ago, but today are used large number of new cultivars different by color of flower (*Altona*, *Amethyst*, *Ayasha*, *Enless Summer*, *Penny Mac*, *Dooley*, *Forever Pink*, *Harlequin*, *Ravel*, *Nikko Blue* etc). They can withstand temperature of -30°C to -20°C. *Hydrangea arborescens* 'Annabelle' is characterized with higher growth, withstands temperatures up to -40°C and richly blooms even after the coldest winters.



Figure 4: Group of plants from *Hydrangea arborescens* 'Annabelle' – private yard, settlement Center, Skopje

3.4 Genus: *Skimmia* Thunb. – *Skimmia* (fam. Rutaceae)

Skimmia is an evergreen, densely branched shrub that grows up to 1.5 m in height. It's characterized with ball like shape.

The leaves are elliptical egg-shaped, leathery and thick. It is specific by it's with red and white flowers, gathered in grape-like flowers that stand up. *Skimmia japonica* Thunb. has round fruit with red to black color which remains on the branches throughout the winter. In our country, we are familiar with the cultivar *Skimmia japonica* 'Rubella' (Fig. 5). It can be found in rich and moist, well-drained soil, in shadow and semi-shadow. Withstands polluted air temperatures up to -20°C.



Figure 5: *Skimmia japonica* 'Rubella'

Because of the flower that remains in winter, it's highly valued decorative type and is often a focal point,

especially in winter when many plants lose their main decorative features. It's used planted in pots for decoration of small yards, balconies and terraces, as a bush planted separately or in a group in private yards, and is also used to form low symbolic hedges.

3.5 Genus: *Aucuba* Thunb. – *Aucuba*, Gold Dust Plant (fam. Cornaceae)

Aucuba japonica 'Crotonifolia' (Fig. 6) is an evergreen shrub. Grows slowly up to 3m in height, although most specimens reach only 1,8m. As decorative specie, it is valued by the density and color of the leaves. The leaf is leathery, oval-elliptical, long 8-20cm, with rare and rough edge jags. It has bright green color with golden-yellow spots. It form a red ball-like fruit to 1.5cm, which matures in November and falls in March, and during this period increases the decorative value of the plant.

It lives in wet well permeable soil. It withstands temperatures up to -20°C. It can successfully grow in any areas, but its decorative features are most prominent in shade. In designing green areas, it's used as a focal point for the formation of hedgerows, low or medium high, which can but don't have to be formed by cutting. It's also used as a plant for decoration in pots. Here we can rarely find it on public spaces, but often in private yards and green areas around public buildings.



Figure 6: *Aucuba japonica* 'Crotonifolia' as part of landscape design of green area in front of public building – 'Mida Auto', settlement Karpos 2, Skopje

3.6 Genus: *Erica* L. – *Erica* (fam. Ericaceae)

Erica sp. L. is a perennial evergreen flower plant which originates from the mountain areas of central and southern Europe. In designing green areas, we come across the types *Erica carnea* L., *Erica x darleyensis* and *Erica gracilis* L. (Fig. 7) and many cultivars, which differ by the color of the flower. They can reach up to 20cm height. They bloom in various shades of pink, purple and white. They are especially valued because they bloom in winter. They can live in acidic soils, necessary for their flowering. They can withstand temperature up to -30°C, and are best developed in shade.

When designing green areas, they are used as flower plants in flower-beds during winters, but as living ground covers around conifer solitary trees. They can also be found in alpinum and rock gardens as well as decoration of greening slopes and pots. Here, they are mostly planted in private yards, it can be noticed that their use has been reduced due to their rapid extinction or loss of

decorative features as a result of inappropriate soil conditions they grow in.



Figure 7: Some representatives from genus *Erica* L. used in green areas designing in recent time in Macedonia

3.7 Genus: *Calluna* Salisb. – Heather (fam. Ericaceae)

Calluna vulgaris Salisb. is the only specie from the genus *Calluna*. It is a low evergreen shrub that grows 20-50cm or rarely up to 1m in height. Its natural habitat is in Europe and Small Asia, and the numerous cultivars differ in color of the flower, leafy mass and height. They can live in acidic soils, in shadow and semi-shadow. They can withstand temperature up to -30°C.

The cultivars have flowers in many shades of white, pink, purple and red. Here, they start to bloom in autumn. The flower is preserved during winter even though it becomes brown. Some have specific texture and leaf color which is found in various shades of green, silver-blue, gold and red. When designing green areas, they are used as living ground covers and flower plants in all types of floral formation. Here, you can come across the following cultivars: *Calluna vulgaris* 'Dark Beauty', *Calluna vulgaris* 'Marleen' (Fig. 8) etc.



Figure 8: Cultivars from *Calluna vulgaris* used in green areas designing in recent time in Macedonia

3.8 Genus: *Hedera* L. – Ivy (fam. Araliaceae)

Genus *Hedera* L. has 15 species and numerous cultivars and hybrids. It can reach a length of up to 30m. It's planted on surface with small roots. There are varieties with different leaves in shape, size and color. Some are characterized by dark blue berries that are ripen in late fall and remain throughout the winter period. Most can live in any area but they perfectly develop in shadow, they can grow in any soil, but best in wet and humus one. Here, you can come across the following: *Hedera helix* L., *Hedera Algeriensis* 'Gloire de Marengo', *Hedera helix* 'Arborescens', *Hedera helix* 'Goldheart', *Hedera hibernica* Bean., *Hedera colchica* 'Dentata Variegata' and *Hedera helix* 'Marginata Elegantissima'. Some of them are present on these regions for a very long time, such as *Hedera helix* L. and *Hedera hibernica* Bean., while others are brand new or rarely used in the past.

When designing green areas, they are used as creepers that cover sodden buildings, as hedges on previously placed foundation, as living ground covers for greening slopes, in pots, separately or in the base of other plants. They successfully grow in combination with other creepers.

Figure 9 shows a hedge formed on a foundation by *Hedera helix* L., and Figure 10 shows *Hedera Algeriensis* 'Gloire de Marengo' as part of balcony foliage in a public facility.



Figure 9: Hedge form *Hedera helix* L. – private yard, settlement Center, Skopje



Figure 10: *Hedera Algeriensis* 'Gloire de Marengo' - balcony foliage in a public facility 'Tetraktis' in the complex of 'Mida Motors', settlement Karpos 2, Skopje

Table III shows resistance to low temperatures of the representatives of genus *Hedera* L.

Table IV shows the taxons that are part of this research, their life forms and main decorative features.

Table I: Basic characteristics of the plants from genus *Taxus* L.

Ordinal number	Plant species	Basic characteristics			
		Shape	Color	Maximal growth	
				Height	Spread
1	<i>Taxus baccata</i>	Irregular pyramidal	Dark green	20m	1m
2	<i>Taxus baccata</i> 'Fastigiata'	Columnar	Dark green	1,5-2,0m	0,5-0,6m
3	<i>Taxus baccata</i> 'Fastigiata Aurea'	Columnar	Yellow	1,5-2,0m	0,5-0,6m
4	<i>Taxus baccata</i> 'Repandens'	Horizontal-spreading	Dark green	0,3-0,5m	0,8-1,5m
5	<i>Taxus baccata</i> 'Repandens Aurea'	Horizontal-spreading	Yellow	0,3-0,5m	0,8-1,5m
6	<i>Taxus x media</i> 'Hicksii'	Columnar	Dark green	1,5m	0,8m

Table II: Use of representatives of the genus *Taxus* L. in landscape design

Ordinal number	Plant species	Use in landscape design					
		Solitary tree	Topiary tree	Group of trees	Hedges	In alpinum	In pots
1	<i>Taxus baccata</i>	√	√	√	√		
2	<i>Taxus baccata</i> 'Fastigiata'	√					√
3	<i>Taxus baccata</i> 'Fastigiata Aurea'	√					√
4	<i>Taxus baccata</i> 'Repandens'					√	√
5	<i>Taxus baccata</i> 'Repandens Aurea'					√	√
6	<i>Taxus x media</i> 'Hicksii'	√					√

Table III: Resistance to low temperatures of the representatives of genus *Hedera* L.

Ordinal number	Plant species	Resistance to low temperatures
1	<i>Hedera helix</i>	-30°C
2	<i>Hedera algeriensis</i> 'Gloire de Marengo'	-10°C
3	<i>Hedera helix</i> 'Arborescens'	-30°C
4	<i>Hedera helix</i> 'Goldheart'	-20°C
5	<i>Hedera hibernica</i>	-30°C
6	<i>Hedera colchica</i> 'Dentata Variegata'	-20°C
7	<i>Hedera helix</i> 'Marginata Elegantissima'	-20°C

Table IV: Taxons classification according to life forms and their decorative characteristics

Ordinal number	Plant species	Life form	Decorative characteristics
1	<i>Taxus</i> sp.	Evergreen shrubs or small trees	Shape and color
2	<i>Hosta</i> sp.	Perennials	Leafy decorative
3	<i>Hydrangea</i> sp.	Deciduous flowering shrub	Flowery decorative
4	<i>Skimmia japonica</i> 'Rubella'	Evergreen flowering shrub	Flowery and leafy decorative
5	<i>Aucuba japonica</i> 'Crotonifolia'	Evergreen shrub	Leafy decorative
6	<i>Erica</i> sp.	Evergreen flowering perennial	Flowery decorative
7	<i>Calluna vulgaris</i>	Evergreen flowering perennial	Flowery decorative
8	<i>Hedera</i> sp.	Evergreen climber	Leafy decorative

4 CONCLUSIONS

After the conducted research regarding the shade tolerant types of plants used in recent times in landscape design of green areas in Macedonia, the following conclusions have been reached:

- The following taxons from the genus *Taxus* L. can be found on our green areas: *Taxus baccata* L., *Taxus baccata* 'Fastigiata', *Taxus baccata* 'Fastigiata Aurea',

Taxus baccata 'Repandens', *Taxus baccata* 'Repandens Aurea' and *Taxus x media* 'Hicksii'. Only *Taxus baccata* L. is a type found in the past on our green environments, and the rest can be found in recent times;

- In landscape design in our country, the representatives of the genus *Taxus* L. are often used as solitary trees, as part of group of trees, they can form hedges or be planted in alpinum and in pots. They often represent the focal point due to the shape or color, and

the spreading ones are usually used as living ground covers. *Taxus baccata* L. is found as topiary tree, and is used to form hedges. Cultivars in yellow, unlike the rest of the others, are less present in our country;

- Representatives of the genus *Hosta* Tratt. used for landscape design in our country are: *Hosta 'Big Daddy'*, *Hosta decorata*, *Hosta 'Gold Standard'*, *Hosta montana 'Aureomarginata'* and *Hosta 'Blue Angel'*. They are usually part of private yards. They are successfully combined with other types of perennial plants. They are used as living ground covers, especially when planted in a group when they represent the focal point. They are grown in pots for decoration of small yards, balconies and terraces;

- Representatives of the genus *Hydrangea* L. used in our country are *Hydrangea macrophylla* Thunb. and *Hydrangea arborescens 'Annabelle'*. In designing, they are often a focal point in the period of blooming. Here, we use them as plant used for decoration of balconies and terraces planted in pots, and in the yards they can be found planted separately or in groups;

- *Skimmia japonica 'Rubella'* is often a focal point in the winter. It's used planted in pots to decorate small yards, balconies and terraces. Here we can find it in private gardens planted separately or in a group, used to form low symbolic hedges;

- *Aucuba japonica 'Crotonifolia'* is used in private gardens and green areas in front of public facilities. It's planted separately, in a group, and is used to form low and middle-low hedges that often present a focal point;

- They are used as flower plants in flower-beds during the winter, living ground covers around conifer solitary trees, in alpinum and rock gardens, for decoration of slopes and in pots;

- *Calluna vulgaris 'Dark Beauty'* and *Calluna vulgaris 'Marleen'* are the representatives from the genus *Calluna* that can be found in our country. They are used as living ground covers and flower plants in flower formations;

- The following representatives from the genus *Hedera* L. can be found on our green areas: *Hedera helix* L., *Hedera algeriensis 'Gloire de Marengo'*, *Hedera helix 'Arborescens'*, *Hedera helix 'Goldheart'*, *Hedera hibernica* Bean., *Hedera colchica 'Dentata Variegata'* and *Hedera helix 'Marginata Elegantissima'*. They are mostly used for covering sodden objects, to form hedges previously placed foundation, as living ground covers, for decoration of slopes and decoration with pots.

From all of the above stated, it can be concluded that although the number of shade tolerant plants in relation to others is smaller, there are still enough in order to be able to form a complex, functional and aesthetic landscape. Besides the researched plants, other types encountered in the design of green areas in Macedonia include large number of perennials, some annual and biannual plants, shrubs and trees.

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