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EFFECT OF CLIMATIC FACTORS ON THE SUSTAINABILITY OF DIFFERENT VARIETIES OF MULBERRY GROWN IN THE VALLEY OF SOFIA

TSVETELINA NIKOLOVA; IOANNA JEKOVA
University of Forestry, Faculty of Agronomy, Department of Perennials and Gardening, BG-1797 Sofia, Bulgaria

Abstract

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The influence of climatic factors on the sustainability and variability of three mulberry varieties grown in terms of the Sofia valley. The choice of location for planting mulberry directly affects the production of mulberry leaf. Researched signs that determine the economic importance of the mulberry bush, length and thickness of shoots, number of shoots, leaf size and intermediate distance. It was found that the values of climatic factors: air temperature and humidity, affect the growth and development of mulberry.

Key words: mulberry; impact resistance; climatic factors

Introduction

Cocoon is related to the establishment of an effective forage base for the production of mulberry leaves. Of great importance is the variety of mulberry and its good adaptability to climatic conditions meat.

Advancing climate change in recent years influences adversely on mulberry. The stress in plants caused by the adverse conditions of the surface is a major issue in the physiology of plants. Defining the conditions for production of mulberry leaves have a climate and the varieties used.

Studies of Munns (2002) and Ohashi (2009) are mainly focused on disclosure mechanisms for acclimatization and adaptation of plants to various adverse environmental conditions.

According to Kim (2012), climatic factors in the greenhouse do not affect the length of the firing, but affect the number of nodes that are significantly smaller than those of mulberry trees grown in the open. According to the authors, varieties of white mulberry are suitable for cultivation of greenhouse yields.

Stress factors characteristic of our country are high temperature and subsequent droughts. Consequently is violate quality of mulberry leaves. Low temperatures and relative humidity also adversely affect the growth and development of plants (Machii, 1987)

In a research Ramachandra (2004) explores five types of carrots and establishes effective antioxidant properties that could provide better protection against foliar stress in water scarcity.

Spring frosts significant influence on the development and productivity of Mulberry. Frost bites may occur on different parts of the plant, depending on the sensitivity of tissues to them. Spring frosts have caused the destruction of young leaves and flowers in Mulberry. The level of resistance to cold and frost is different in different varieties (Sakai, 1987; Wianiewski, 2003)

The influence of climate, low and high temperatures is reflected differently on different species and varieties of mulberriesby affecting the development and productivity of plants. A number of authors have established species and varietal differences in phenological phases of development and changes in rearing (Ho, 1985; Kumar, 1990; Bari, 1990).

Petkov (2012) in studies found that climatic factors during the years affected the growth and development of the mulberry tree.

**E-mail:* c.alipieva@abv.bg

Many plant species occupy a variety of contrasting habitats and therefore plants must deal with environmental conditions. Mechanisms by which a species may occupy a wide habitat range include reversible modifications to environmental conditions, where plants attain a high degree of phenotypic plasticity (Fukui et al., 2000; Vijayan, 2009).

The increase in temperature may accelerate the faster growth of mulberry. Hence enabling more leaf harvests and a good biomass (Tzenov, 2017).

It is important for each variety to be resistant to cold so as not to damage the plants from low temperatures in winter. The ability of the variety is to produce more biomass under stress. Also, leaf thickness is important (high moisture retention, more photosynthetic efficiency).

Resistance to high cell membranes leads to withstand high temperatures, the high epiculate wax leads to more water-efficiency.

The aim of this study is to trace and analyze the impact of climatic factors on the sustainability of major morphological signs of mulberry varieties grown in Sofia field.

Materials and Methods

The study was conducted in period 2013-2015 in an educational field "Hostile" of Forestry University. Were studied three varieties of mulberries Vratsa 18 and Japanese varieties Kinriu Kokuso and 27 are characterized by very good growth and development, high productivity and nutritional value of the leaves.

Plants the mulberry are grown under standard agricultural equipment (Penkov, 1971). Of each variety were reported at 20 plants.

In each variety were observed basic morphological signs: the length and thickness of shoots, leaf size and between nodal distances.

Analyzed correlations between signs and climatic indicators: rainfall, amount of effective temperature growing season.

The methodology used for the study of plant resources of mulberry (Petkov, 2000). The necessary weather data were obtained from NIMH Sofia.

The data processing was performed by standard statistical methods with a computer program (ANOVA).

Results and Discussion

The climatic characteristics of in an educational field "Hostile" is located in the Sofia valley, which falls within the European continental climatic region.

As a result of the transformation of passing air masses of different origin, the region is characterized by a greater frequency of western and southwestern winds, thermal inversions, radiation fog and inversion cloudiness during the cold season.

The annual course of precipitation in Sofia has pronounced continental character – with a maximum in May and June and minimum in January and February.

Table 1 shows average monthly rainfall for the period. Precipitation averages 650 mm per year, of which 380 mm fall during the vegetation period and the deficit in the balance of atmospheric moisture for vegetation period is about 55 mm.

From the results table shows that most rainfall in 2013 have fallen in April, May, June and July, while the least in December (5.1-13 mm/m²). May conclude that rainfall during the 2013 of the growing season of Mulberry fully satisfy the needs of plants.

In the second year of the study have high values in March (112.9-297 mm/m²), June 103.7-138 mm/m²) and September (196.7-518 mm/m²), and at least rainfall in July 9.8-16 mm/m²). The highest levels of precipitation in 2015 were in May (106.6-146 mm/m²) and October (124-354 mm/m²), while the least were in December 0.7-2 mm/m²). Rainfall during the period are not evenly distributed more months and are insufficient for the needs of mulberry plants.

Table 2 gives the average temperature. The average annual temperature is around 8.7°C, temperature sums for the vegetation period 28°C, but depending on the altitude in the lower parts of the complex are higher.

Temperature regime of across the autumn the winter period of 2013-2015 years is normal to the area trends. In the coldest month is January is accounted for lowest temperatures. The average monthly minimum temperature during the period and for three years was 0.8-0.9°C.

The highest temperature is July and August. The average monthly minimum air temperature in July is from 20.3 to 22.3°C and in August, from 21.4 to 22.5°C and with maximum 38.3°C.

Table 1
Average monthly values of rainfall Sofia years 2013-2015

	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
2013	25.2-90	9.7-31	65.1-171	150.5-295	148.2-203	114.5-153	118.2-188	76.8-151	21-55	41.1-117	31.4-65	5.1-13
2014	35.2-126	61.7-199	112.9-297	41.6-82	38.7-53	103.7-138	9.8-16	63-124	196.7-518	66.7-191	35.4-74	59.6-149
2015	89.7-320	45.8-148	73.2-193	58.4-115	106.6-146	81.3-108	45.4-72	59-134	79.2-208	124-354	60.4-126	0.7-2

Table 2
Averages monthly temperatures for the town Sofia – 2013-2015

	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
2013	0.9	5.3	8.1	10.7	14.3	18.1	20.3	21.4	16.4	11.8	7.2	0.3
	2.4	4.5	3.3	0.5	-0.22	0.3	0.5	1.9	0.3	1.1	2.1	-2.3
2014	0.8	1.6	4.6	9.9	16.9	18	23.2	22.4	16	10.8	6.5	1.8
	2.3	0.3	-0.2	-0.3	2.2	0.2	3.4	2.9	-0.1	0.1	1.4	1.2
2015	0.9	7.5	7.1	13.9	14.1	20.5	22.3	22.5	18.8	10.5	8.7	2.1
	0.6	6.7	2.3	3.7	-0.6	2.7	2.5	3	2.7	-0.2	3.6	1.5

Table 3
Basic morphological characteristics

Cultivar	Quantity	A sum	S.D.	Coef. Var.
Between node distance				
Vratsa 18	20	109.19	5.45	0.14
Kinriu	20	91.88	4.59	0.73
Kokuso 27	20	84.2	4.21	0.91
The thickness of the shoots				
Vratsa 18	20	215.04	10.75	0.57
Kinriu	20	169.51	8.47	0.28
Kokuso 27	20	162.42	8.12	0.25
Mass of mulberry a sheet.				
Vratsa 18	20	48.4	2.42	0.04
Kinriu	20	45.82	2.29	0.03
Kokuso 27	20	45.13	2.25	0.003
Length of leaves				
Vratsa 18	20	379.35	18.96	0.82
Kinriu	20	344.91	17.24	1.03
Kokuso 27	20	337.23	16.86	1.08

According microclimatic zoning of Sofia region of RBM «Hostile» falls in the lower peripheral part (with alt. 520-550 m). Fogs and temperature inversions are common. The maximum of mists is in November, December and January and the lowest – during the warm summer months.

The data for the monitored the quantitative characters and productivity of mulberry and impact of climate change are presented in Tables 3-4

From Table 3 it is seen that the mean values ranged from 4.21 at 27 Kokuso and 5.45 at Vratsa18. Signs are influenced by climatic factors and are characterized by a correlation coefficient of 0.14 in Vratsa 18 and 0.73 and 0.91 Japanese varieties. Signs thickness of shoots is influenced by climatic factors and is characterized by a coefficient of correlation. Mass of mulberry a sheet is an important varietal characteristics. From Table 3 shows that the average values ranged from 2.25 in Kokuso 27 and 2.42 in Vratsa 18. The sign responds poorly to climatic factors and is characterized by very low correlation coefficient of 0.04 in Vratsa 18 and 0.003 at Kokuso 27. The data of of table 3 show that the the mass of

Table 4
Climate impact on morphological signs of *Morus alba*

Source of variation	SS	df	MS	F	P-value
Impact of climate change on between nodal distance.					
Between Groups	16.38	2	8.19	13.7	0.0000138036
Within groups	34.07	57	0.59		
Total	50.45	59			
Impact of climate change on the thickness of the shoots.					
Between Groups	81.53	2	40.76	109.86	2.77863E-20
Within groups	21.15	57	0.37		
Total	102.68	59			
Impact of climate change on the table mulberry a sheet.					
Between Groups	0.29	2	0.14	5.44	0.006
Within groups	1.55	57	0.02		
Total	1.85	59			
Effects of climate change on the length of the sheet					
Between Groups	50.31	2	25.15	25.54	0.0000000120158
Within groups	56.14	57	0.98		
Total	106.46	59			

the mulberry leaf is not affected by climatic conditions over the years. From the results of Table 3 it is seen that at Vratsa 18 the variety mean values (18.96 cm.). The leaves are large, entire, dark green, solid, juicy and coarsen slowly. In Kunriu leaves have averages (17.24 cm), large dark green, entire, thick with glossy surfaces and slowly fade. In Kokuso 27 averages of attributes are (16.86 cm), large leaves are dark green, flap, juicy, coarsen slowly. Signs length of the sheet is influenced by climatic factors and is characterized by a high correlation coefficient of 0.82 in Vratsa 18 and from 1.03 to 1.08 in Japanese varieties of mulberries.

Climate conditions affect most of the morphological features, which is confirmed by a talb dispersion analysis. 4. Only the mass of the mulberry leaf of the tested varieties is not significantly affected by the climatic conditions during the years tested.

Conclusions

Climatic factors (temperature and humidity) are favorable for cultivation of mulberry in the Sofia Valley. Our study found that the underlying signs were influenced by climatic factors.

The highest values of the studied characteristics are reflected in the Vratza 18 variety. This indicates that the plants in the garden of the mulberry are stable and adapt to the growing conditions.

They are characterized by very good growth and development and high productivity. The two Japanese varieties of mulberry have high economic characteristics and are well adapted to local climatic conditions.

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