The GLOBE Program
Ministry of Education and Science of Ukraine
National Ecology and Nature Center of Ministry of Education and Science of Ukraine
Department of Education and Science of Chernivtsi Regional State Administration
"Chernivtsi Regional Center of Ecological-Naturalistic Creativity of Student Youth"

PHENOLOGICAL OBSERVATION (*Betula pendula* Roth.) IN URBOCOENOSIS OF CHERNIVTSI CITY (Ukraine)

2018

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Abstract

- ***The working hypothesis*** is to check for the presence / absence of influence of processes of crown drying on the course of phenophase of spring and autumn cycles and some morphometric indices of birch leaves.
- Observations were conducted in 2 stages: spring (March-May 2018) and fall (October-November 2018). The study of the spring phenophase and the morphometric indices of the leaves of six birch birches, Betula pendula Roth., Growing on different sites in the administrative boundaries of Chernivtsi, as well as yellowing and falling leaves of the six trees of the species, were studied.
- ***The trial model*** included 3 observation sites, located in different parts of Chernivtsi and selected according to the methodological recommendations of the European phenological campaign and the all-Ukrainian phenological campaign "GLOBE 365", in which the birch trees grew up. 7 trees were investigated, 2 of which had signs of crown depletion of varying intensity. The experimental model included both spatially delimited areas (Nos. 1, 2) and sites located close to each other (separated by a long five-story building) with a different exposition number 3 - south-east, No. 4 - northwest). The distance between trees within one observation plot was 20-25 m. In birch B-1 from the vegetation season in 2017 there were signs of the weight loss of individual branches, in the fall of 2018 the main part of the crown dried up; in the tree B-4/1, the first signs of abrasion appeared in the summer of this year.
- It is established that the length of sheets of healthy birches under the conditions of the city of Chernivtsi depends on the exposure of the place of growth. The largest indicator is registered in birches growing on the area of the northwest exposure. The average length of the leaf on the birch trees, in which the process of drying was observed, is smaller than in healthy trees, regardless of their location and area exposure. The terms of passing the main phenophase to the birch leaves show a clear dependence on the microclimatic conditions and do not depend on the state of the tree. There was no relationship between the microclimatic conditions and the nature and the terms of the passage of autumn phenophase with the leaves of the fallen birch. The partial crown depletion also does not affect the mentioned indicators.

1. Introduction

- At the present stage, one of the main tasks of the development of the environmental monitoring system is the development of approaches to obtain the exact quantitative characteristics of the growth of natural ecosystems. At the same time, the most interesting are approaches that allow to detect even slight deviations of the parameters of the environment from the background state, which do not affect the viability of organisms [1]. The most promising ones consider the characteristics, the change of which is a non-specific response to changing environment. Among them, there is the developmental stability (morphology and ontogenesis), which is the ability to form a similar phenotypic effect with a certain range of environmental conditions.
- Vegetable cover that is not able to actively avoid man-made influences, in comparison with other indicators, is the most representative indicator, which responds quickly to man-made influences. The peculiarities of the morphometry of the woodcutting machine of wood plants as an element of the adaptation strategy of plants in the conditions of technogenic influence and in the localities that differ in terms of soil richness and productivity are studied in detail by many researchers (Shidakov, 2009; Hikmatullina, 2013; Lutshishin, 2015; Savintseva, 2015, cit. for [7]). Scientists note the influence of the taxonomic position and ecological conditions of the plant growth site on the dimensional parameters of the leaves (Shidakov, 2009; Hikmatullina, 2013), the variability of the geometric shape of the leaf plate in urban environments (Hikmatullina, 2013); changes in the magnitude of the fluctuating leaf asymmetry, depending on the age of the trees and the length of the shoots (Amosova, 2010, cited by [9]), as well as the degree of technogenic contamination (Gavrikova, 2014; Savintseva, 2015); An estimation of the adaptive potential of woody plants in the conditions of the urban environment is conducted (Lutshishin, 2015); Correlation between the leaf parameters and the content of man-made elements in the soil and biomass of the leaf plate (Glibovitskaja, 2013; Lutshishin, 2015).

1. Introduction

- Among the most studied tree plants are species of the genus Birch (Betula L.). Birches are widespread throughout the Northern Hemisphere, growing in a wide zonal range - from tundra to steppes, characterized by minimal productivity in marginal natural zones, and maximum - in the subzone of the southern taiga and forest-steppe [5]. During the last decade there has been massive crumbling of birches in anthropogenically transformed, and in natural landscapes. The process begins sharply, proceeds quickly and during 1-2 vegetation seasons causes the death of the tree. The phenomenon is also registered in Chernivtsi. In particular, one of these trees grew on the territory of the Chernivtsi Center. This led us to conduct observations within the framework of the European Fenological Campaign and the All-Ukrainian Fenological Campaign "GLOBE 365" within the framework of the international scientific and educational program GLOBE precisely for the birch.
- The working hypothesis is to check for the presence / absence of influence of processes of crown drying on the course of phenophase of spring and autumn cycles and some morphometric indices of birch leaves. The experimental model included 3 observation sites, located in different parts of Chernivtsi and selected according to the guidelines of the program, within which the birch trees grew. 7 trees were investigated, 2 of which had signs of crown depletion of varying intensity. Areas and trees under study are described in the section "Material and methods of research".

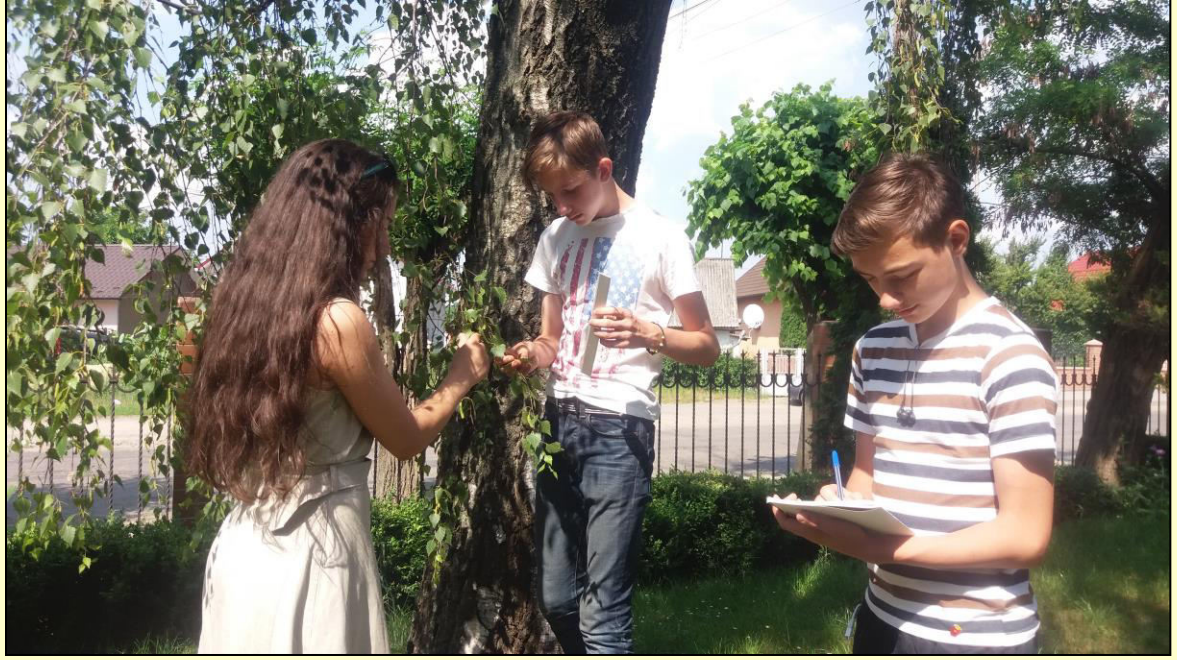
2. Material and methods of research

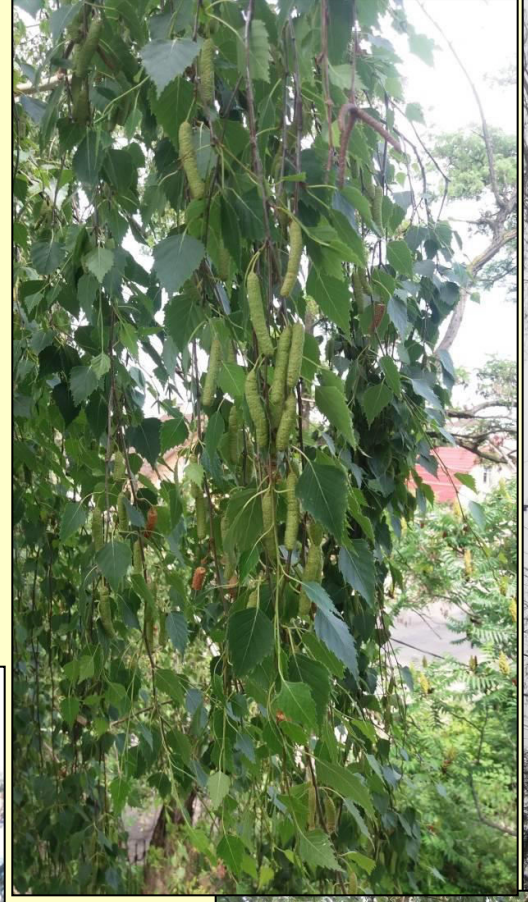
The object of the study is birch hung - Betula pendula Roth. (Betulales: Betulaceae). The species is adapted to low temperatures, does not suffer from spring frosts, is unpretentious to the soil, can grow on the poor sandy and rocky soils, spit marshes, etc. Lightweight, gas-resistant [5]. The widespread distribution of birch birch in the Chernivtsi city and the above-mentioned biological features of the species make it a convenient model for phenological research. Observations were carried out on seven birch trees on the 3rd plot in the administrative boundaries of the city.




Landscape-functional area of the city	Description of sites Description of sites		Description of the trees Description of the trees	
	№ and name	coordinates	Name of the species	The tree number
Roshinsky (Prietsinsky)	№ 1 – www.chocentum.com	48.278721º noth. lat. 25.920337º east. long	*B. pendula*	Б-1*
Rogatsky (Southern)	№ 2 – « Prospekt»	48.269691º noth. lat. 25.927246º east. long	*B. pendula*	Б-2**

	№ 3 – «Quartz-1»	48.252387° noth. lat. 25.954600° east. long.	*B. pendula*	Б-3/1
			B. pendula	Б-3/2
			B. pendula	Б-3/3
	№ 4 – «Quartz-2»	48.253002° noth. lat. 25.954697° east. long.	*B. pendula*	Б-4/1
			B. pendula	Б-4/2



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Characteristics of the trees under study

- Notes: * - observation was carried out only in the spring season; ** - observation was carried out only in the autumn season
- Observations were conducted in accordance with the guidelines [8]. The GLOBE Plant Color Guide (GLOBE) has been used as the standard for determining the color of the leaves by visual colorimetric method. In the spring monitoring period was started on 02/15/2018, completed - on June 20, 2018 in the autumn - on September 20, 09. 2018 and 30.11.2018, respectively
- The experimental model included both spatially delimited areas (Nos. 1, 2) and sites located close to each other (separated by a long five-story building) with a different exposition number 3 - south-east, No. 4 - northwest). The distance between trees within one observation plot was 20-25 m. In birch B-1 from the vegetation season in 2017 there were signs of the weight loss of individual branches, in the fall of 2018 the main part of the crown dried up; in the tree B-4/1, the first signs of abrasion appeared in the summer of this year.
- The pupils of the circle "GLOBE in my institution" of Chernivtsi ozentym (leader - Cheban T.N.) supervised the trees B-1 and B-2, and the pupils of the circle "Fundamentals of phenology" of the Chernivtsi ATSENTUM (head - Khlus LM) - for trees B-1, B-3/1, B-3/2, B-3/3, B-4/1 and B-4/2. The data on the trees B-1 and B-2 was placed on the GLOBE sit

3. Results of research and their discussion

- Observations were conducted in 2 stages: spring (March-May 2018) and fall (October-November 2018). The study of the spring phenophase and the morphometric indices of the leaves of six birch birches, Betula pendula Roth., Growing on different sites in the administrative boundaries of Chernivtsi, as well as yellowing and falling leaves of six trees of the mentioned species (Table 2.1). Data of spring observations are summarized in Table. 3.1 (Observers - circle pupils "GLOBE in my institution") and 3.2 (observers - pupils of the circle "Fundamentals of phenology"). The data of autumn observations - in tables 3.3 and 3.4, respectively. An example of the dynamics of changes in leaf length is shown on the histogram

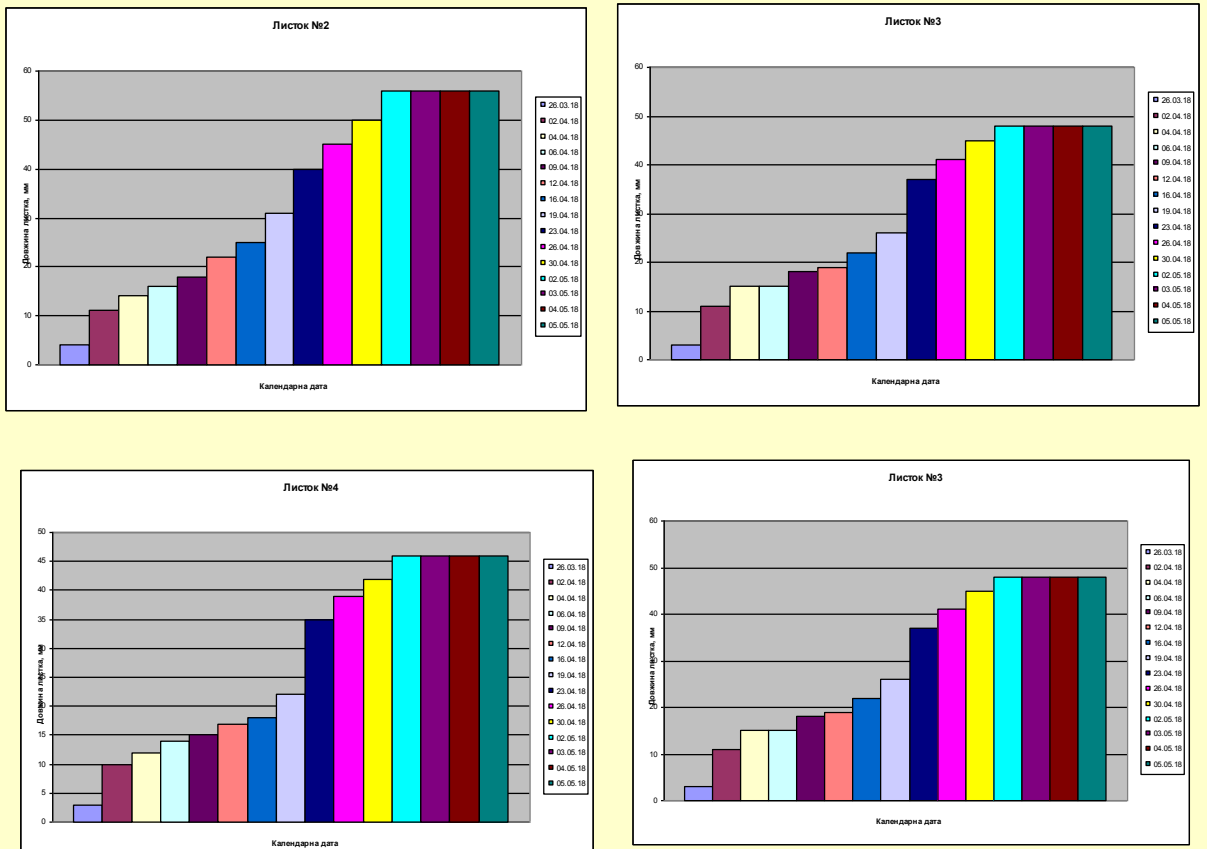

Fig. 3.1. Growth pattern of the length of birch leaves - Betula pendula Roth. (B-1) in the spring of 2018

Results of observations of spring growth of birch leaves - Betula pendula Roth

The name of the tree species that was followed by the observation	leaf	The date is awesome	Date of conquest	Date of leaflet deployment	Date of termination	The largest length	Lost	The data is included on the site GLOBE (+/-)
	Leaf 1	15.03	23.03	30.03	15.05	57,0		
	Leaf 2	17.03	27.03	31.03	17.05	56,0		
	Leaf 3	16.03	24.03	30.03	16.05	48,0		
	Leaf 4	14.03	23.03	30.03	14.05	46,0		

- The analysis of the results showed that the average length of the leaf on birch trees, in which the process of drying (B-1 and B-4/1) was observed, is smaller than in healthy trees, regardless of their location and area exposure. In B-1 it was 48.29 mm (51.75 mm on one branch and 44.83 mm on the other).

- The length of leaves of healthy trees, probably, depends on the exposure of the growth site. In the birches growing on the southeast exposure, this index was 54.45 mm, 56.08 mm and 58.73 mm in the trees B-3/1, B-3/2 and B-3/3, respectively. At the same time, the average leaf length in the birch B-4/2, growing on the area of the north-western exposition, was 61.33 mm. Dependence of the morphometric parameters of birch leaves from a number of factors of both natural and anthropogenic origin has been demonstrated by researchers for various sections of its species range [2-4, 9, 11].

- The terms of the passage of the main phenophase with birch leaves show a clear dependence on the microclimatic conditions (which are integrated in the exposition of the site) and do not depend on the state of the tree: in healthy B-4/2 and B-4/1 (with signs of falling), there are close dates of the onset of the main investigations phenophase, and in the birches B-3/1, B-3/2 and B-3/3 all phenophases are observed earlier (Table 3.1, 3.2). Comparison of our data with literature allows us to state that the studied phases of spring development of leaves in birches in our region are observed on average one month earlier than in the Urals and the Middle Volga region [1, 5].

The results of observations on the yellowing of the leaves of the birch pods - Betula pendula Roth. (B-2)

Date (day and month)	Leef 1 (color, fall, covered with snow)	Leef 2 (color, fall, covered with snow)	Leef 3 (color, fall, covered with snow)	Leef 4 (color, fall, covered with snow)	Data entered on the GLOBE site (+/-)
23.10	5GY-6/10	5GY-5/10	5GY-5/10	5GY-7/12	30.11
25.10	5GY-6/10	5GY-5/10	5GY-5/10	5GY-7/12	30.11
26.10	5GY-5/10	5GY-5/10	5GY-5/10	5GY-7/12	30.11
27.10	5GY-5/10	2.5Y-8/6	2.5Y-8/6	5GY-7/12	30.11
28.10	2.5Y-6/6	2.5Y-8/6	2.5Y-8/6	2.5Y-8/12	30.11
28.10	2.5Y-6/6	2.5Y-8/6	2.5Y-8/6	2.5Y-8/12	30.11
29.10	2.5Y-6/6	2.5Y-6/6	2.5Y-6/6	2.5Y-8/12	30.11
30.10	2.5Y-6/6	2.5Y-6/6	2.5Y-6/6	5YR-7/12	30.11
31.10	2.5Y-6/6	7.5YR-6/4	7.5YR-6/4	5YR-7/12	30.11
15.11	fallen	7.5YR-6/4	7.5YR-6/4	7.5YR-6/4	30.11
16.11	fallen	fallen	fallen	7.5YR-6/4	30.11
17.11				fallen	30.11

- The noticeable yellowing of leaves on all healthy birches began on October 27-28, and in the birch B-4/1, in which the spring fell branches in the summer of October 29 (Table 3.3, 3.4). Autumn monitoring of the B1 birch was not carried out, since at this time more than 50% of its crown has dried up.
- The leaves on the trees B-2 and B-3/1 (from the regions of the south-eastern exposition) fell from November 15-17, birch B-3/2 - 17-19 November, and birch B-3/3 - November 21-22. The leaves of the B-4/1 tree (with signs of falling) fell on November 22, and on the shore of B-4/2 all the leaves under study (like many others) remained on a tree covered with snow.

The results of observations on the yellowing of the leaves of the birch pods - Betula pendula Roth.

Date (day and month)	Sheet 1 (color, fall, covered with snow)	Sheet 2 (color, fall, covered with snow)	Sheet 3 (color, fall, covered with snow)	Sheet 4 (color, fall, covered with snow)	Data entered on the GLOBE site (+/-)
			Б-3/1		
23.10	5GY-6/10	5GY-5/10	5GY-5/10	5GY-7/12	
25.10	5GY-6/10	5GY-5/10	5GY-5/10	5GY-7/12	
26.10	5GY-5/10	5GY-5/10	5GY-5/10	5GY-7/12	

27.10	5GY-5/10	2.5Y-8/6	2.5Y-8/6	5GY-7/12	
28.10	2.5Y-6/6	2.5Y-8/6	2.5Y-8/6	2.5Y-8/12	
28.10	2.5Y-6/6	2.5Y-8/6	2.5Y-8/6	2.5Y-8/12	
29.10	2.5Y-6/6	2.5Y-6/6	2.5Y-6/6	2.5Y-8/12	
30.10	2.5Y-6/6	2.5Y-6/6	2.5Y-6/6	5YR-7/12	
31.10	2.5Y-6/6	7.5YR-6/4	7.5YR-6/4	5YR-7/12	
15.11	fallen	7.5YR-6/4	7.5YR-6/4	7.5YR-6/4	
16.11	fallen	fallen	fallen	7.5YR-6/4	
17.11				fallen	

Б-3/2					
23.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
25.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
26.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
27.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
28.10	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	
28.10	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	
29.10	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	
30.10	5YR-7/12	2.5Y-8/12	2.5Y-8/12	5YR-7/12	
31.10	5YR-7/12	5YR-7/12	5YR-7/12	5YR-7/12	
15.11	7.5YR-6/4	5YR-7/12	5YR-7/12	7.5YR-6/4	
16.11	7.5YR-6/4	7.5YR-6/4	5YR-7/12	7.5YR-6/4	
17.11	fallen	7.5YR-6/4	7.5YR-6/4	fallen	
18.11		fallen	7.5YR-6/4		
19.11			fallen		

Б-3/3					
23.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
25.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
26.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
27.10	5GY-7/12	5GY-7/12	5GY-7/12	5GY-7/12	
28.10	5GY-7/12	5GY-7/12	2.5Y-8/12	5GY-7/12	
28.10	5GY-7/12	5GY-7/12	2.5Y-8/12	5GY-7/12	
29.10	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	
30.10	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	2.5Y-8/12	
31.10	2.5Y-8/12	2.5Y-8/12	5YR-7/12	2.5Y-8/12	
15.11	2.5Y-8/12	2.5Y-8/12	5YR-7/12	2.5Y-8/12	
16.11	5YR-7/12	2.5Y-8/12	5YR-7/12	5YR-7/12	
17.11	5YR-7/12	5YR-7/12	7.5YR-6/4	5YR-7/12	
18.11	5YR-7/12	5YR-7/12	7.5YR-6/4	5YR-7/12	
19.11	5YR-7/12	5YR-7/12	7.5YR-6/4	7.5YR-6/4	

Consequently, no relationship was found between the microclimatic conditions and the nature and the terms of the passage of autumn phenophase with the leaves of the fallen birch. Probably, the partial crown depletion also does not affect the mentioned indicators.

Conclusions

- The length of sheets of healthy birches in the conditions of the city of Chernivtsi depends on the exposure of the place of growth. The largest indicator is registered in birches growing on the area of the northwest exposure. The average length of the leaf on the birch trees, in which the process of drying was observed, is smaller than in healthy trees, regardless of their location and area exposure.
- The terms of the passage of the main phenophase with birch leaves show a clear dependence on the microclimatic conditions and do not depend on the state of the tree.
- There was no relationship between the microclimatic conditions and the nature and terms of the passage of autumn phenophase with the leaves of the fallen birch. The partial crown depletion also does not affect the mentioned indicators

In the development of conducted morphometric studies we plan:

- - to increase the number of trees and leaves under study for them, which will enable to statistically process the results and increase their representativeness;
- - to increase the number of investigated morphometric parameters, adding commonly used measurements;
- - to estimate the level of fluctuating asymmetry of leaves of birch veneer in healthy specimens and trees with signs of crown drying.

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Thank you for your attention!