

Epidemiology and Ecological Distribution of Tree Tumors in the Territory of Landscape Reserve “Teply stan”

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Abstract

This study focuses tumors of woody trees in the territory of landscape reserve “Teply stan” in Moscow. Abnormal swellings on the trunk of woody trees are called Tumor. Formation of a swell is an evidence of an infringement of metabolism in a tree's body, is a disease of a tree and is a cause of a tree's premature death. Tumor prevents transportation of water and minerals from roots towards the leaves of a tree and transportation of organic matters from the leaves towards roots. The purpose of this study is to find out some appropriatenesses of spreading of tumors of trees in the landscape reserve “Teply stan”.

In this study, landscape reserve divided into 9 study sections according to ecological conditions. Surveillance of all trees and statistical analysis of tumor trees in studied section of landscape reserve have done. The results showed that 57 of the counted 25 thousands trees have tumors. 50 of the tumors trees are belong to birch (*Betula pendula*). Trees with tumors are distributed non-uniformly, generally in central and east parts of landscape reserve that had ecologic pollution. Mainly birch (*Betula pendula*), oak (*Quercus rubor*) and linden (*Tilia cordata*) are damaged by tumors in the studied territory. The most effected trees with tumors are birch (*Betula pendula*) tree population. The direct proportion between ecological situation and the number of tumors have found.

Keywords: tumors of trees, Moscow, Birch (*Betula pendula*), landscape reserve “Teply stan”, ecological pollution

1. Introduction

The ecological problems of our planet have been very important nowadays. Environmental pollution badly influences not only the health of people, but also the health of trees. The complex ecological program of Moscow was accepted in 1994. One of the directions of program are the restoration of the green planting, replanting areas within the boundaries of city, creation of the separately guarded territories in Moscow. This will make it possible to preserve the natural complexes containing special nature-conservation, scientific, cultural, historical, recreational areas.

Landscape reserve “**Teply Stan**” is one of the the green zone of such natural complexes which situated on the territory of southwestern administrative division. It obtained status of topographical reservation in 1998. Landscape reserve “**Teply Stan**” is the unique combination of the most beautiful landscapes, surrounded by districts. Polyakov et al. (2000) described landscapes are the basic object of protection.

When we walked on landscape reserve we observed some woody plants which have abnormal morphological structure. After literature review we learned that Cancerous growth- tumors are formed on the trees (Guseinov, 1986). Abnormal morphological structures on the bark of tree are called tumor (Figure 1) (Guseinov, 1978). White et al. (1954) investigated tree tumors are usually regular, smooth, woody growths, not fungating or fissured, with continuous bark. When tumor is formed in the body of the tree, tree may die. As we know, trees – one of the main source of oxygen in land ecosystems. A quantity of oxygen decreases with each killed tree. The Landscape Teply Stan is the main recreation zone in the south-west region of Moscow. Guseinov (1988) examined that swell formation is an evidence of an infringement of metabolism in a tree body, a disease of a tree and a cause of the premature death of trees. Formation of a tumor impedes transportation of water and mineral matters from roots towards the leaves of a tree and transportation of organic matters from the leaves towards roots. In this study we want to try to find out connection between the ecological conditions of landscape reserve “Teply Stan” and distributions of tree tumors in this territory. There are many tree populations in landscape. Birch (*Betula pendula*),

Oak (*Quercus rubor.*), Linden (*Tilia cordata*), Aspen (*Populus tremuloides*) and Pine trees (*Pinus sylvestris*) are the major tree populations. The mentioned tree populations selected as examine group.



Figure 1. Examples of tree tumors (*Betula pendula* and *Quercus rubor*)

1.1 Purpose of this Study:

Is to learn the territorial distribution of tree tumors plants and to find relations between environmental conditions and tumor frequency of tree species by statistically in the landscape reserve “Teply Stan”.

1.2 Hypothesis

First hypothesis determines that ecological conditions affect the territorial spread of tumors. More tree tumors can be found in habitats that have worse ecological conditions. Second hypothesis determines that different relative number of tumors can be found on different species of trees.

2. Materials and Methods

2.1 Analysis of Documents

Previous studies about this topic evaluated. Also ecological conditions of territory of landscape Teplystan described by using topographical map and soil map and previous researches. Literature review done about territory.

2.2 Surveillance

Territory of landscape reserve divided into 9 study sections according to ecological conditions that comprising most favorable part, favorable part and unfavorable part (Figure2).

- 1) Most favorable part that means central part of landscape (1 and 7 sections).
- 2) Favorable part that means recreational areas (5 and 9 sections).
- 3) Unfavorable part that means closer to the roads and garages. (2, 3, 4, 6, 8 sections).

Morphologically normal and abnormal all trees that surviving in mentioned sections observed and marked in summer period with students.

2.3 Measurement and Statistical Analysis

Woody trees with tumors that surviving mentioned section calculated. The number of trees with tumor calculated for each species of studied trees. The number of trees with tumor calculated according to their habitat. The ratio of tumor trees in different species and in different habitats calculated by using basic statistical analysis. Statistical analysis done by using Tyorin methods (Tyorin et al., 2004).

2.4 Drawing of Topographical Map

Distribution of Tumor trees on studied sections of the topographical map of Landscape reserve “Teply stan” generated by using Photoshop program on computer (Figure 2).

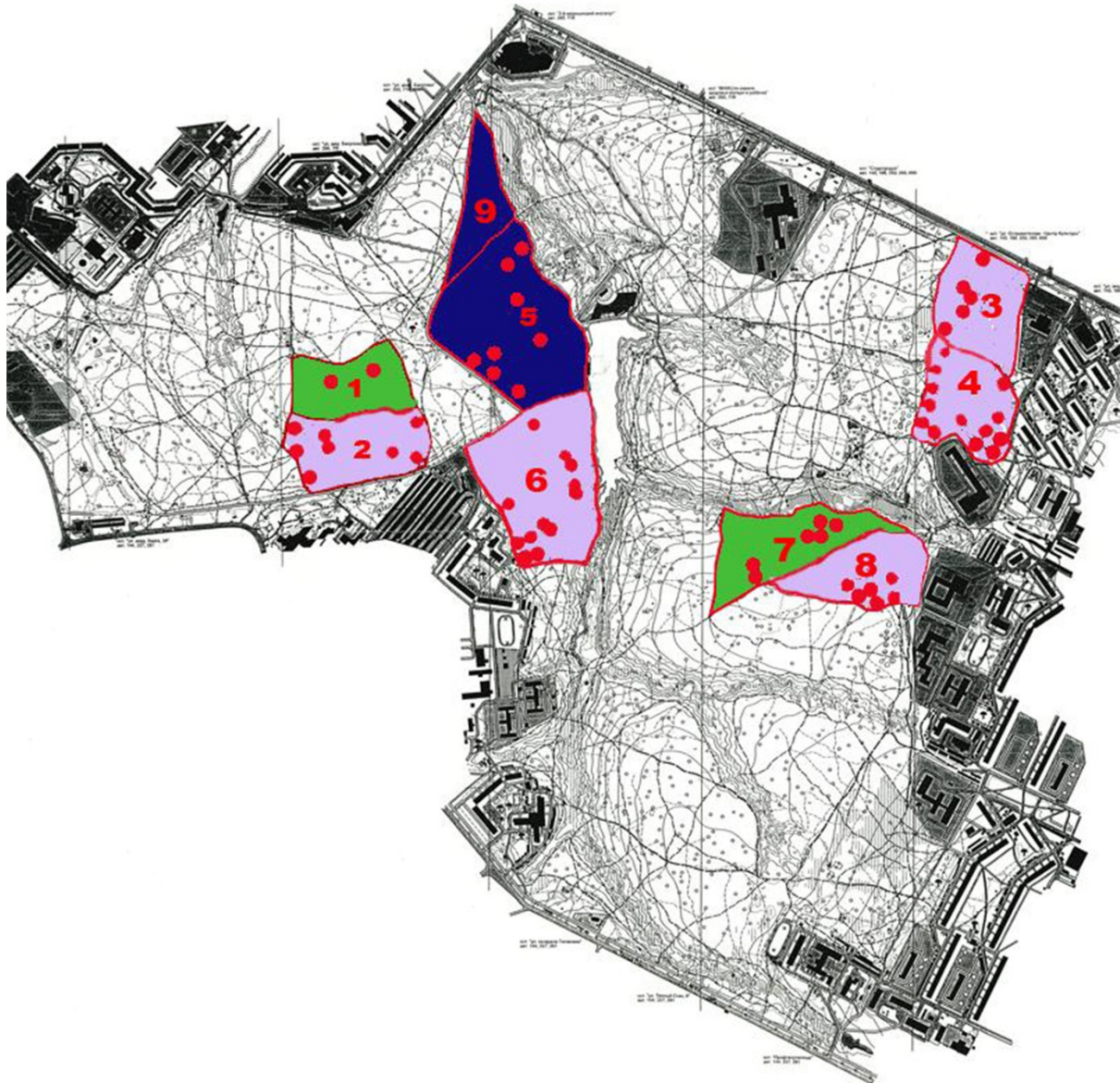


Figure 2. Distribution of Tumor trees on studied sections of the topographical map of Landscape reserve “Teply stan”

3. Results

Number of Birch (*Betula pendula*), Oak (*Quercus rubor.*), Linden (*Tilia cordata*), Aspen (*Populus tremuloides*) and Pine tree (*Pinus sylvestris*) populations observed and noticed according to their morphological conditions and living habitats. Approximately 25 thousands of woody plants counted in studied sections and 57 of them have tumors. Table 1 reports the results of direct calculation of different species of trees in 9 sections. Table 2 reports

the number of species of trees with tumors and their habitats. Table 2 shows that the most of the effected plants with tumors are belong to birch population. Table 3 reports relative indices of damage by tumors per 10 000 trees. It also reports average frequency of tumor trees. Table 4 reports absolute and relative indices of tumors trees in most favorable parts, in favorable parts and in unfavorable parts of studied sections.

Table 1. Results of the direct calculation of trees in the sections

Form of the tree	Sections of the forest									Total
	1	2	3	4	5	6	7	8	9	
Birch	1958	1200	3167	3712	1832	1512	1350	451	203	12585
Oak	345	227	378	679	101	301	945	1384	7	4367
Linden	593	1623	177	1206	167	93	315	1212	0	5386
Aspen	152	4	106	58	0	20	0	0	48	388
Pine tree	0	0	0	0	44	68	52	0	0	164
Other	67	76	99	295	208	492	228	95	207	1767
Total	3120	3130	3927	5950	2352	2486	2890	3142	465	24657

Table 2. Damage by the tumors of trees in the sections

Form of the tree	Sections of forest									Total
	1	2	3	4	5	6	7	8	9	
Birch	1	7	5	13	8	12	3	1	0	50
Oak	0	1	0	0	0	0	0	5	0	6
Linden	0	0	0	0	0	0	1	0	0	1
Aspen	0	0	0	0	0	0	0	0	0	0
Pine tree	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Total	1	8	5	13	8	12	4	6	0	57

Table 3. Relative indices of damage by tumors per 10 000 trees

Indices	Sections of forest									Total
	1	2	3	4	5	6	7	8	9	
Number of tumors	1	8	5	13	8	12	4	6	0	57
Number of trees	3120	3130	3927	5950	2352	2486	2890	3142	456	24657
Relative indices	3,2	25,6	12,7	21,8	34,0	48,2	13,8	19,1	0	23,1*

* average frequency of tumors plant.

Table 4. Absolute and relative indices of damage by tumors

Indices	Section of forest								
	Ecologically most favorable		Ecologically average favorable		Ecologically unfavorable				
	1	7	5	9	2	3	4	6	8
absolute indices for all trees	1	4	8	0	8	5	13	12	6
average absolute indices for all trees	2,5		4,0		8,8				
relative indices for all trees	3,2	13,8	34,0	0	25,6	12,7	21,8	48,2	19,1
average relative indices for all trees	8,5		17,0		25,5				
relative indices for the birch	5,1	22,2	43,7	0	58,3	15,8	35,0	79,4	22,2
average relative indices for the birch	13,6		21,8		42,1				

Mentioned data statistically analyzed and showed the following results:

- 1) Tumors trees are distributed non-uniformly and generally in central and east parts of Landscape reserve (Figure 2). In this part ecological pollution is big. Some big roads and garages are located here for many years old.
- 2) Mainly Birch (*Betula pendula*), Oak (*Quercus rubor*) are damaged by tumors in the studied territory . The greatest indices are characteristic for the Birch (*Betula pendula*) (Table 2).
- 3) The tumors of trees are spread irregularly. The direct proportion between ecological situation and the number of tumors were found (Table 4). This result confirmed both of our hypotheses.
- 4) Aspen (*Populus tremuloides*) and Pine tree (*Pinus sylvestris*) species didn't effect by tumors in this territory.

4. Conclusion and Discussion

Tumors can be seen in woody plants. Tumors don't have same effect for all species. There is a directly proportional between ecological conditions of habitat of trees and formation of tumor tendency.

Birch (*Betula pendula*), Oak (*Quercus rubor*) species mostly effected by tumors in unfavorable sections. Birch and Oak trees should not be planted on places close to roads and garages of city parks. This study showed that exhaust gases and other chemicals of land vehicles can be the main reason of the formation of tumor in trees. But which chemical is responsible for the formation of this tumor should be researched in laboratories.

Aspen (*Populus tremuloides*) and Pine tree (*Pinus sylvestris*) species didn't effect by tumors. Linden (*Tilia cordata*) species less effected by tumors. This result offers that Aspen, Linden and Pine trees should be planted on places that are close to roads and garages of city parks.

We think this theme is too new. We could not find more research about our theme on internet. We believe that in the future this topic will attract much attention of ecologists and city designers.

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