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New data about the aeroionization characteristics of the territory of National Botanical Garden of Georgia as the factor of the expansion of its sanitation properties for the visitors

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Abstract

Results of the preliminary studies of the content of light ions in air on the territory of the National Botanical Garden of Georgia are represented. Ion concentration was measured at 25 points over area 90 hectare, and also near the main waterfall at 33 points over area 1152 m^2. The maps of the distribution of the content of positive and negative light ions for the territory of waterfall and Botanical Garden as a whole are make. It is obtained that the content of ions in the Botanical Garden, especially in the gorge near the River Tsavkisi and waterfalls, corresponds to hygienic levels "minimally necessary" and "optimum". In the built-on parts of Tbilisi city at this time the content of ions its corresponded to the level "less than minimally necessary". Thus, the conducted investigations revealed the new functions of Tbilisi botanical garden for the visitors: sanitation, reducing and therapeutic. It is recommended in the future in the Botanical Garden make to more detail investigate the content of ions into different seasons of year taking into account weather conditions.

Key words: light ions concentration, tourism, health resorts

1. Introduction

The importance of study of the light ions content in the atmosphere is well known. The content of light ions in the atmosphere plays important role in molding of the physiological state of population. Simultaneously light ions are the indicator of the purity of air [1-4]. Regular observations of the parameters of atmospheric electricity (including air electrical conductivity) in Georgia after the Soviet Union decay were ended. In recent years, the experimental investigations of the content of light ions in air in Georgia were renewed [5-7].

For evaluating the health resort-tourist of the resources of Georgia in the correspondence with the contemporary requirements, the detailed studies of the ionizing state of the air medium of known, little-known and promising recreational-tourist regions are necessary. Special attention should be given to places with the waterfalls, fountains, national parks, preserves, forests, alpine regions, mountain gorges, the coast of rivers and sea, the tectonic breakings (increased concentration of Radon), karstic caves, etc., where the ionization level of air can be suitable for the sessions of ionotherapy [5-8].

Under the conditions of a "good weather" (cloudless or light cloud dry weather with the calm) in urban air the concentration of light ions is approximately 500 cm^{-3} , while in the rural locality -1000 cm^{-3} [1-3, 6,7,9]. Thus, from a biological point of view the condition in the city and a rural locality are completely different. The health of people depends on the concentrations and ratio between a quantity of positive and negative ions per unit of volume of air [4]. Under the "good weather" condition, the minimally necessary level of the sum light ions content for the favorable influence on the health is 1000 cm^{-3} and more (table 1).

Urban smokes cause the decrease of a quantity of negative ions. Ventilation in the compartments causes the decrease of a quantity of positive ions, without decreasing the concentration of negative ions [9].

In Tbilisi for the stationary point of the measurements (territory of cloud chamber laboratory of Mikheil Nodia Institute of Geophysics of Ivane Javakhishvili Tbilisi State University) cases for the favorable influence on the health not more than 30 % (without taking into account weather conditions). The distribution of the light ions content in Tbilisi city has very irregular nature and considerably depends on the level of air pollution, conditions of ventilation, etc. [7]. Therefore great practical value has searches for places in the environments of Tbilisi city with the content in air of light ions with the concentration of useful for the health of people. First of all it is expedient to investigate the existing health resort-tourist resources of Tbilisi city and its environments for the purpose of the development of their new possibilities as the sanitation-reducing functions. Subsequently should be continued the searches for similar places for their integration into the health resort-tourist infrastructure of city.

On the basis of that indicated above we have decided to conduct the preliminary analyses of the content of light ions on the territory of National Botanical Garden of Georgia (or Tbilisi Botanical Garden). Tbilisi botanical garden exists almost 400 years and this is one of the most dear places for the inhabitants of city and the guests of the Georgian Capital [10].

2. Method and date descriptipn

Light ions concentration (cm^{-3}) measurements in Tbilisi were conducted 4 times a day at height 3 floor of the building of the cloud chamber of the Institute of Geophysics (stationary point of measurement, 8 meters above the level of soil, 41.754º N, 44.927º E, the height - 450 m above sea level), into 9, 12, 15 and 18 hour (in the winter season - 17 hours), and in 20 points in different city locations. Stationary monitoring by Gerdien's type instruments was conducted. Mobile studies on the territory of Tbilisi Botanical Garden with the aid of the portable ions counter of the production of firm "AlphaLab, Inc." are conducted.

Work gives the results of two day measurements for Tbilisi (stationary point of measurement) and Tbilisi Botanical Garden. 30.07.2011 the measurements of the light ions concentration at 25 points in territory 90 hectare (1125x802 m) of Botanical Garden were carried out. 2.08.2011 the measurements of the light ions concentration at 33 points in territory 1152 m^2 (72x16 m) near main waterfall were carried out.

The following designations will be used below: n (+) - concentration of positive light ions, n (-) - concentration of negative light ions, n (+)/n (-) - coefficient of unipolarity.

3. Results

The results in Fig. 1-4 are given.

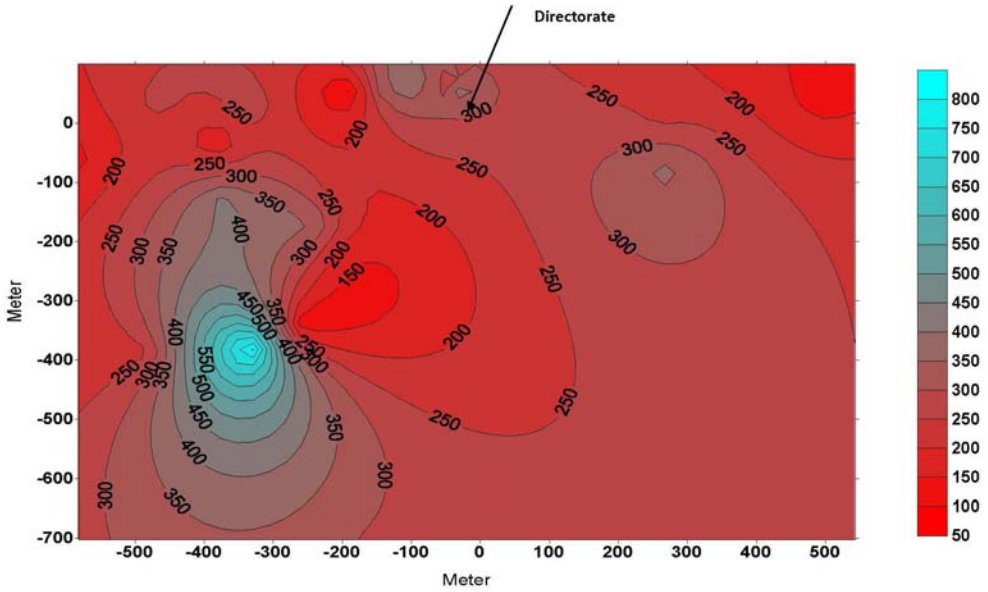

Fig.1 Distribution of positive light ions concentration in air in Tbilisi Botanic Garden

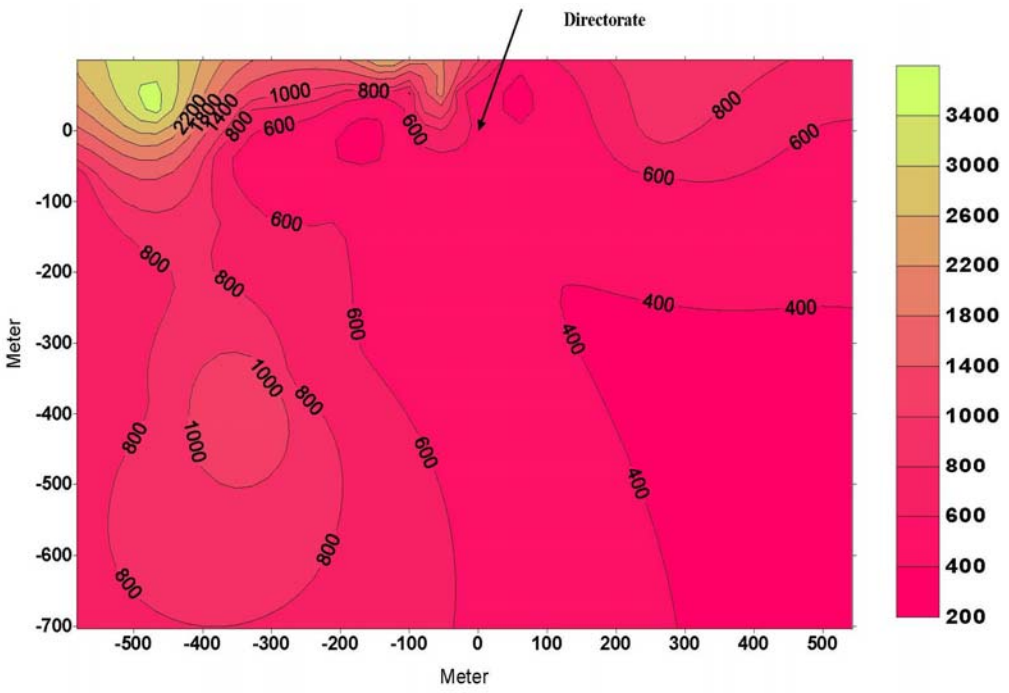

Fig.2 Distribution of negative light ions concentration in air in Tbilisi Botanic Garden 30.07.2011

Distribution of positive and negative light ions concentration in air in Tbilisi Botanical Garden 30.07.2011 in Fig. 1 and 2 are given. As follows from these figures on the territory of Botanical Garden the concentration of positive ions changes from 90 cm^{-3} to 825 cm^{-3} , with average value 281 cm^{-3} and negative - from 420 cm^{-3} to 3700 cm^{-3}, with average value 995 cm^{-3}. It is important to note that for the entire territory of Botanical Garden a quantity of negative ions predominates above the positive (coefficient of unipolarity changes from 0.07 to 0.92 with average value 0.37). This is a known effect the influence of vegetation on the formation of negative ions.

The high concentrations of negative ions near the main waterfall with the height of 24 m (1680-2350 cm^{-3}, coefficient of unipolarity = 0.14), the small waterfall (3700 cm^{-3}, coefficient of unipolarity =0.07) and also under the Tamara bridge (2900 cm^{-3}, coefficient of unipolarity = 0.13) are observed (minimally necessary – optimum, table 1).

Table 1. Content of Light Ions in Air and Their Physiological Action on the Human Organism

Ions concentration cm^{-3}		**Level**	**Physiological action**
n (+)	**n (-)**		
<300	<300	Less than the minimum	Fatigue, weakening attention, retarding of reactions, worsening in the memory, headache, the disturbance of the regime of blood pressure, etc.
400	600	Minimally necessary	Positive action, in particular during exceeding of the concentration of the negative ions above the positive
1500-3000	3000-5000	Optimum	Optimization of blood pressure, positive influence on the course of the diseases of respiratory organs, bronchial asthma, antiseptic action, etc.
≥50000	≥50000	Maximum	Negative reaction of organism

Without taking into account factor by hydro-ionization (21 measuring point) on the territory of Botanical Garden the concentration of positive ions changes from 90 cm^{-3} to 825 cm^{-3}, with average value 278 cm^{-3} and negative - from 420 cm^{-3} to 1350 cm^{-3}, with average value 930 cm^{-3}. Coefficient of unipolarity changes from 0.13 to 0.92 with average value 0.42.

Let us note that in Tbilisi on the stationary point of measurement 30.07.2011 from 12 through 18 hours on the average the ionic air composition was: n (+) = 370 cm^{-3}, n (-) = 460 cm^{-3}, n (+)/n (-) = 0.80 (less than the minimally necessary, table 1).

Distribution of positive and negative light ions concentration in air near the waterfall in Tbilisi Botanic Garden 2.08.2011 in Fig. 3 and 4 are given. As follows from these figures on the territory near of the main waterfall the concentration of positive ions changes from 200 cm^{-3} to 1200 cm^{-3}, with average value 704 cm^{-3} and negative - from 700 cm^{-3} to 4500 cm^{-3}, with average value 1800 cm^{-3}. Value of n (+)/n (-) varied from 0.1 to 0.86 with average value 0.48 (minimally necessary – optimum, table 1).

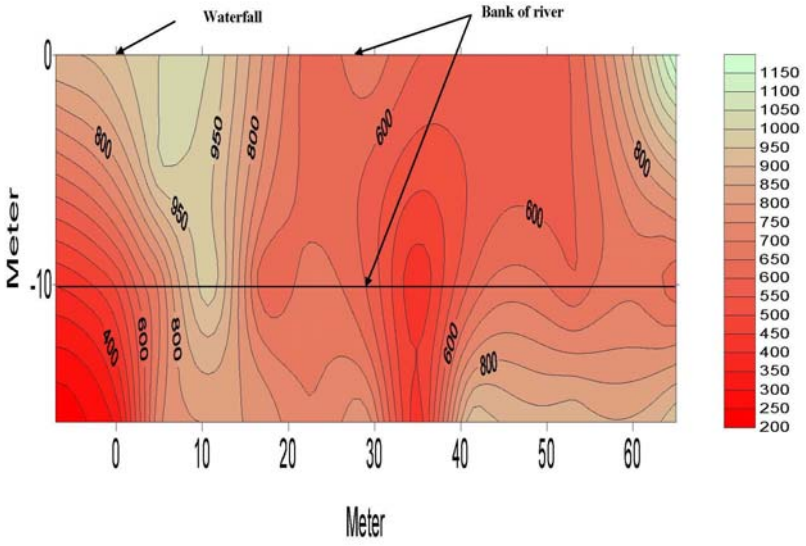

Fig.3 Distribution of positive light ions concentration in air near the waterfall in Tbilisi Botanic Garden 2.08.2011

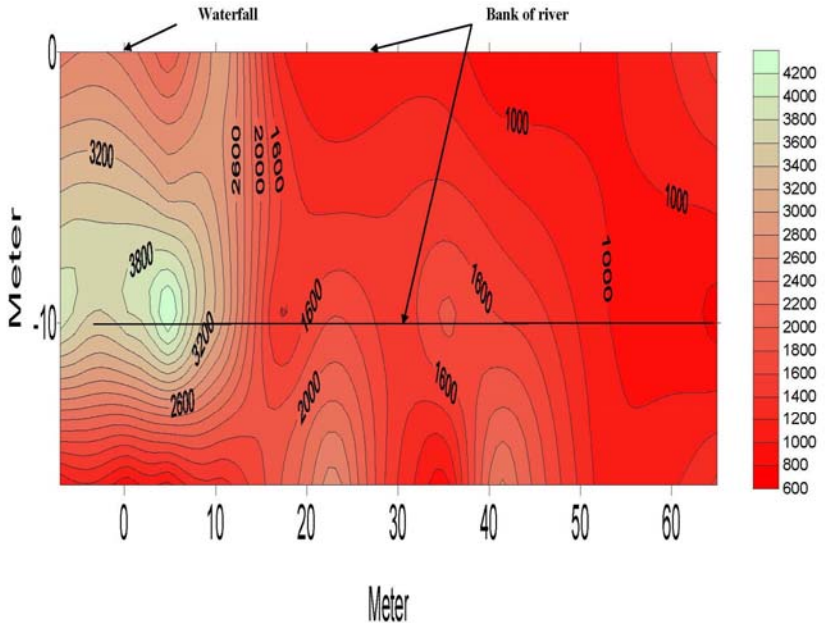

Fig.4 Distribution of negative light ions concentration in air near the waterfall in Tbilisi Botanic Garden 2.08.2011

In Tbilisi on the stationary point of measurement 2.08.2011 from 15 through 18 hours on the average the ionic air composition was: n (+) = 390 cm^{-3}, n (-) = 366 cm^{-3}, n (+)/n (-) = 1.07 (less than the minimally necessary, table 1).

It is interesting to note that the range of the concentrations of light ions on the territory of Botanical Garden is practically commensurate with the values of the content of ions in different health resort- tourist places of Georgia (Fig. 5).

Thus, Tbilisi Botanical Garden besides its previous known functions (science, excursion, leisure, tourism, etc.) can acquire the new: medical and sanitary. The territory of Botanical Garden as a whole completely satisfies the requirements of sanitation-reducing localities. Separate zones of Botanical Garden (near the waterfalls, in the separate places of the gorge of the River Tsavkisi, etc.) can be used also for therapeutic purposes - ionotherapy.

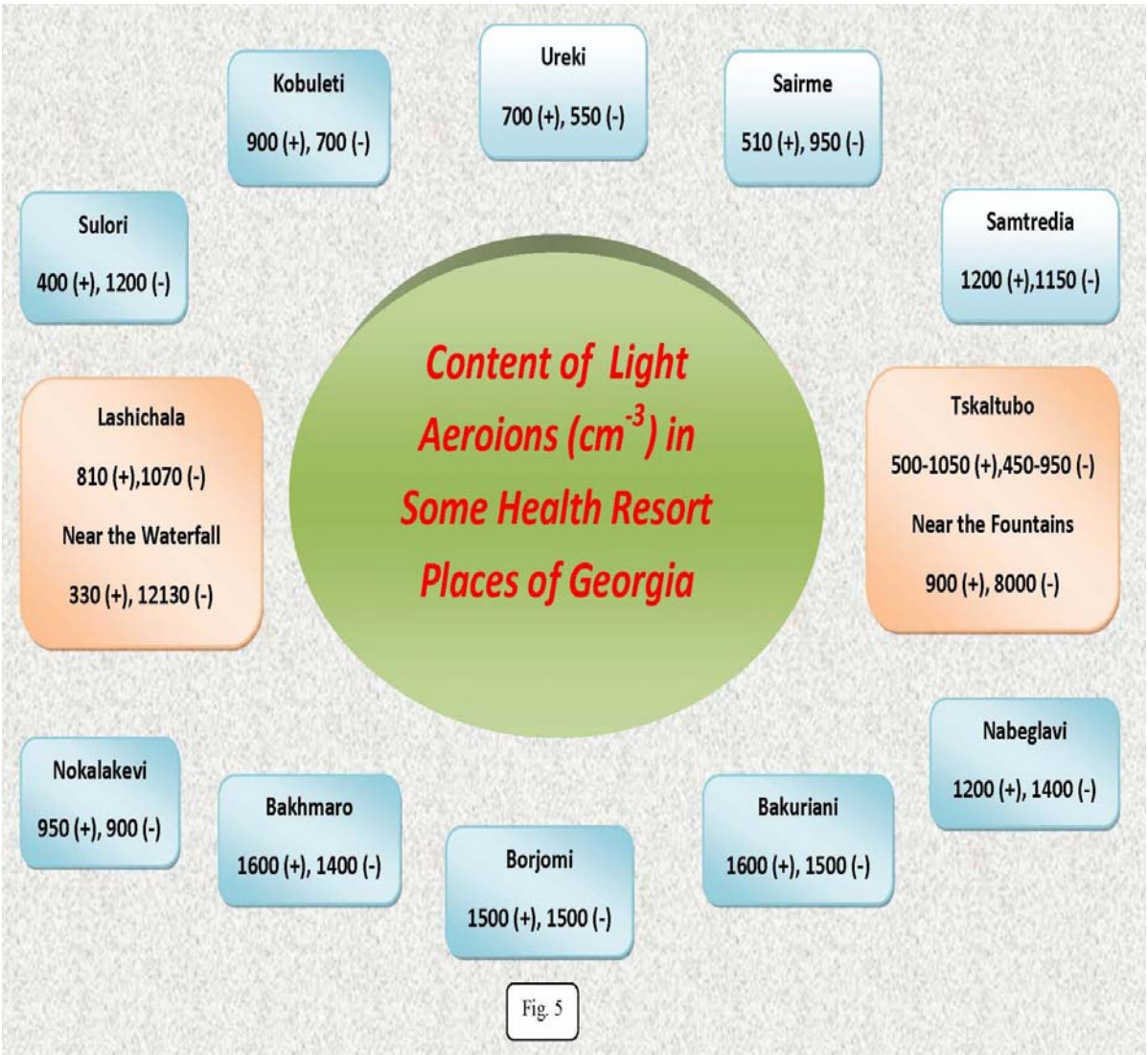

Fig. 5

Therefore, subsequently it is expedient to conduct the detailed analyses of the content of light ions in the entire territory of Tbilisi Botanical Garden into different seasons of year taking into account weather conditions. These studies will make it possible to clearly determine places with the therapeutic properties and to develop the appropriate procedures of sanitation, rehabilitation and treatment of visitors.

However, even without the detailed analyses of ions it is possible to recommend to the inhabitants of Tbilisi city (to especially elderly people and to children) to more frequently visit Botanical Garden. The air here is much cleaner and more useful than in the built-on districts of Tbilisi.

4. Conclusions

Tbilisi Botanical Garden besides its previous known functions (science, excursion, leisure, tourism, etc.) can acquire the new: medical and sanitary. The territory of Botanical Garden as a whole completely satisfies the requirements of sanitation-reducing localities. Separate zones of Botanical Garden (near the waterfalls, in the separate places of the gorge of the river Tsavkisi, etc.) can be used also for therapeutic purposes - ionotherapy.

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საქართველოს ეროვნული ბოტანიკური ბაღის ტერიტორიის აეროიონიზაციური მახასიათებლების შესახებ ახალი მონაცემები როგორც მისი გამაჯანსაღებელი თვისებების გაფართოების ფაქტორი მომსვლელებისათვის

ა.ამირარაშვილი, თ. ბლიაძე, ვ. ჩიხლაძე, ზ. მაჩაიძე, გ. მელიქაძე, ნ.სააკაშვილი, ე. ხატიაშვილი, ი. თარხან-მოურავი, შ. სიხარულიძე, თ. ნაკაიძე, მ.თავართქილაზე

რეზიუმე

წარმოდგენილია ჰაერში მსუბუქი იონების შემცველობის წინასწარი გამოკვლევის შედეგები საქართველოს ნაციონალური ბოტანიკური ბაღის ტერიტორიაზე. იონების კონცენტრაცია იყო გაზომილი 25 წერტილში 90 ჰა ფართობზე, აგრეთვე მთავარი ჩანჩქერის სიახლოვეს 33 წერტილში 1152 მ^2 ფართობზე. აგებულია განაწილების რუკები დადებითი და უარყოფითი მსუბუქი იონების კონცენტრაციებისათვის ჩანჩქერის და მთლიანობაში ბოტანიკური ბაღის ტერიტორიისათვის. დადგენილია, რომ იონების შემცველობა ბოტანიკურ ბაღში, განსაკუთრებით ხეობაში მდინარე წავკისის მახლობლად და ჩანჩქერებთან შესაბამისობაშია ჰიგიენურ დონესთან "მინიმალურად აუცილებელი" და "ოპტიმალური". ამავე დროს ქალაქ თბილისის გაშენებულ უბნებში იონების შემცველობა შესაბამისობაშია დონესთან "მინიმალურად აუცილებელზე ნაკლები". ამგვარად, წინასწარ ჩატარებულმა კვლევებმა გამოავლინა ქალაქ თბილისის ბოტანიკური ბაღის ახალი ფუნქციები მომსვლელებისათვის: გამაჯანსაღებელი, სარეაბილიტაციო და სამკურნალო. რეკომენდირებულია მომავალში ჩატარდეს ბოტანიკურ ბაღში იონების შემცველობის უფრო დეტალური გამოკვლევა წლის სხვადასხვა სეზონის დროს ამინდის პირობების გათვალისწინებით.

НОВЫЕ ДАННЫЕ ОБ АЭРОИОНИЗАЦИОННЫХ ХАРАКТЕРИСТИКАХ ТЕРРИТОРИИ НАЦИОНАЛЬНОГО БОТАНИЧЕСКОГО САДА ГРУЗИИ КАК ФАКТОР РАСШИРЕНИЯ ЕГО ОЗДОРОВИТЕЛЬНЫХ СВОЙСТВ ДЛЯ ПОСЕТИТЕЛЕЙ

А. Амиранашвили, Т. Блиадзе, В. Чихладзе, З. Мачаидзе, Г. Меликадзе, Н. Саакашвили, Э. Хатиашвили, И. Тархан-Моурави, Ш. Сихарулидзе, Т. Накаидзе, М. Таварткиладзе

Резюме

Представлены результаты предварительных исследований содержания легких ионов в воздухе на территории национального ботанического сада Грузии. Концентрация ионов была измерена в 25 точках на площади 90 га, а также вблизи главного водопада в 33 точках на площади 1152 м^2. Построены карты распределения содержания положительных и отрицательных легких ионов для территории водопада и ботанического сада в целом. Получено, что содержание ионов в ботаническом саду, особенно в ущелье вблизи реки Цавкиси и водопадов, соответствует гигиеническим уровням "минимально необходимый" и "оптимальный". В застроенных частях города Тбилиси в это же время содержание ионов соответствовала уровню "меньше минимально необходимого". Таким образом, проведенные исследования выявили новые функции Тбилисского ботанического сада для посетителей: оздоровительные, восстановительные и лечебные. В дальнейшем рекомендуется провести в ботаническом саду более детальные исследования содержания ионов в различные сезоны года с учетом погодных условий.