Assessment of Environmental Air Quality in Localities with Different Urbanisation Levels by the Method of Passive Lichenoindication

Rita Nekrošienė*

Klaipėda University. H. Manto str. 84, LT-92294 Klaipėda, Lithuania
Klaipėda State College. Bijūnų str. 10, LT-91223 Klaipėda, Lithuania
E-mail rita_nekrosiene@mail.ru

(Received in December, 2011; Accepted in March, 2012; Available Online from 23th of April, 2012)

Abstract

Research of epiphytic lichen was performed from 2004 to 2005 in localities with different urbanisation levels: in park, forest, and in the city green areas. A total of fifty-one (51) species of epiphytic lichen was found on fifty (50) researched trees. The highest number of lichen species, forty-two (42), was found in Rietavas Park. Fourteen (14) species of lichens dominated in all three (3) habitats. The air pollution level in Rietavas Park was found to be low (AQV value was 43.5), on trees of the streets of Klaipeda city the average air pollution (AQV = 28.8), and in Giruliai Forest, low air pollution (AQV = 36.8).

Key words: *Lichen, lichenoindication, street green areas, environmental air quality.*

Anotacija

Epifitinių kerpių tyrimai buvo atlikti 2004–2005 metais trijose skirtingu oro užterštumu išsiskiriančiose teritorijose: parke, miške ir gatvių želdynuose. Iš viso buvo identifikuotos 52 rūšių epifitinės kerpės. Daugiausia kerpių rūšių rasta Rietavo parke – 42, mažiausiai – Klaipėdos gatvių želdynuose – 21. 14 kerpių rūšių dominavo visose trijose augavietėse. Remiantis vyraujančių kerpių rūšių gausumu nustatyta, kad Rietavo parke ir Girulių miške yra žemas oro užterštumas, AQV atitinkamai 43,5 ir 36,8. Klaipėdos gatvėse fiksuotas vidutinis oro užterštumas, AQV = 28,8.

Reikšminiai žodžiai: *kerpės, lichenoindikacija, gatvių želdynai, aplinkos oro kokybė.*

Introduction

All methods for the evaluation of environmental quality can be conditionally divided into chemical, physical, physicochemical, and biological. Chemical, physical, and physicochemical methods of environmental evaluation are significantly more expensive than biological, and require special preparation and complex equipment (Stravinskienė, 2005).

Lichenoindication – is a method of bio-indication, enabling the evaluation of the quality of an environment, according to lichens and their indicative reactions. *Passive lichenoindication* – is an analysis of lichens in their natural habitats, the condition of communities assessed according to their indicative characteristics, representing the quality of several prior years (Motiejūnaitė, 2002).

When lichenoindicative methods are used for the assessment of environment quality, often only the composition of the lichens community is assessed. To maintain the result impartiality, extreme precision in identification of types is necessary, and impartiality of data collection must be ensured (Jucevičienė, 2002).

Additional data, enabling impartial assessment of stress caused by environmental pollutants, can be very useful. These are research of morphological and anatomical indicators of lichen thallus, and analysis of their physiological processes. These indicators may be accessed for several species growing in the localities with known air pollution, or by applying the transplantation (i.e., active lichenoindication). Analogous analyses can be performed in laboratories, under the conditions of artificial pollution (Motiejūnaitė, 2002; Motiejūnaitė, 2005). Lichen is an association of symbiotic associations of a fungus (the mycobiont) with a photosynthetic partner, resulting in a continuous thallus (body) of a specific structure (Stravinskienė, 2005).

As maintained by V. Stravinskienė (2005), currently, lichens are most widely used as an indicator of environmental changes in the analysis of environment quality. They are best known as indicators of environmental pollution, but lichens may indicate also other changes of environment

* Kontaktinis asmuo / Corresponding author

(i.e., the effect of global climate warming towards the environment, decline of natural habitats, and the impoverishment of biological variety of forests and outer woods).

When lichenoindicative methods are used for the assessment of environment quality, often only the composition of the lichens community is assessed. To maintain the result impartiality, extreme precision in identification of types is necessary, and impartiality of data collection must be ensured (Nekrošienė, 2008; Venckutė et al, 2008; Venckutė et al, 2008a).

The aim of this research is to assess the air quality in localities with different urbanisation levels by the lichenoindication method.

Material and methods

Research of epiphytic lichen was performed (during September to November of 2004 – 2005) in localities with different urbanisation levels: in Rietavas Estate Park (Plunge region), Giruliai Forest, and the Green Areas along the streets of Klaipeda city.

Rietavas Estate Park can be considered to be a city recreational area that is frequently visited by people, and which is remote from streets with intense traffic. Recently, the park is quite well-maintained: the grass is mown, trees are trimmed, and hedges are cut every year.

Giruliai Forest, located in the southern part of the Seacoast Regional Park, stretches in a narrow band along the Baltic Sea. For many years, this forest was maintained according to the needs of the residents of Klaipeda city. This area is also designated as a Recreation Zone.

The first point of research is the Green Areas along the streets of Klaipeda. These are the streets with the most-intense motor-vehicle traffic, and with the most-urbanised environments of all of the analysed sites. The analysed trees in a section of approximately two (2) km were grown at a distance of one-to-three (1–3) metres from the vehicle traffic.

As many as fifty (50) trees were observed in each site of research (the same in 2004 and 2005). The variety and prevalence of lichen growing on them was assessed. Trees of similar height and age, with the trunk diameter of between 0.50 and 0.80 cm were selected for lichenological research. The most species are *Tilia* genera.

Lichen species were identified according to literature (Motiejūnaitė, 1999a; 2002; 2002a; 2002b). Projection cover of lichens was assessed visually, and evaluated according to the Braun-Blanquet Scale (Prigodina, 1999; Prigodina et al., 2001; Motiekaitytė, 1994):

+ low number of plants, plants of the species cover a very small area (a maximum of one percent (1 %) of all of the area);

1 high number of plants, but they cover a small area; the number of plants is large, however, they cover no more than five percent (5%) of the researched area (up to 5 % of all area);

2 very high number of plants, or they cover a minimum of five percent (5 %) of the researched area (5–25 % of all of the area);

3 various number of plants; they cover from twenty-five (25 %) to fifty (50 %) percent of the researched area (25–50 % of all of the area);

4 various number of plants; they cover from fifty (50 %) to seventy-five (75 %) percent of the researched area (50–75 % of all of the area);

5 various number of plants; they cover more than seventy-five percent (75 %) of the researched area (more than 75 % of all of the area).

Relative prevalence frequency of species is calculated according to the formula:

$$\mathrm{Pr} = \frac{nr}{N}, \qquad (1)$$

where: *Pr* – prevalence frequency; *nr* – number of trees on which the species was detected; *N* – the total number of researched trees.

* Kontaktinis asmuo / Corresponding author

Air quality is calculated according to the formula:

$$AQV = \frac{\sum Fij}{nj}, \quad (2)$$

where: *AQV* – air quality value; *ΣFij* – sum of distributions of certain epiphytic species (projectional coverage) of lichens; *nj* – the number of researched trees.

Five (5) indicative species of lichen were used for calculation of AQV *(Xanthoria parietina, Hypogymnia physodes, Parmeliopsis ambiqua, Lepraria glaucella,* and *Parmelia olivacea).* These species are the most-prevailing in every habitat.

Air Quality Values (Tremp, 2006):
0.0–12.2 – very high pollution
12.2–24.4 – high pollution
24.4–36.6 – average pollution
36.6–48.8 – low pollution

Results and discussion

In 2004, a total of fifty-one (51) species of epiphytic lichen was found on fifty (50) researched trees. The highest number of lichen species, forty-two (42), was found in Rietavas Park; the least number of lichen species, twenty-one (21), was found in the Green Areas along the streets of Klaipeda; and thirty-two (32) lichen species were found in Giruliai Forest (Fig. 1.). In 2005, a total of fifty-two (52) lichen species were found. As in 2004, the greatest variety, thirty-seven (37) of lichenoflora was in Rietavas Park, twenty-one (21) species in the Green Areas of the streets of Klaipeda, and thirty-three (33) lichen species were found in Giruliai Forest. Currently, more than twenty-six thousand (26,000) types of lichen are described in the world; although scientists consider their variety to be much higher, about forty thousand (40,000). In Lithuania, about 260 species are found, but scientists consider that there should be approximately 400–500 species (Stravinskienė, 2005). Some lichen species are very sensitive to air pollution. So, the richness diversity of lichen species in Rietavas Park shows the high quality of environmental air in this locality.

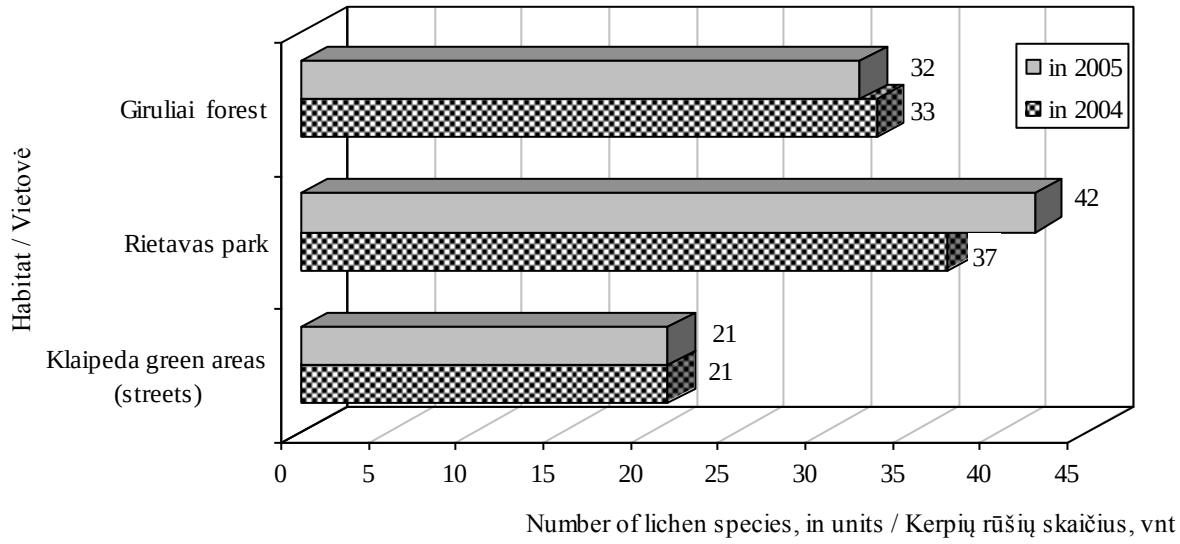

Fig. 1. The number of lichen species in various habitats, 2004–2005
1 pav. *Kerpių rūšių skaičius skirtingose vietovėse, 2004–2005*

* Kontaktinis asmuo / Corresponding author

As indicated by the research data, fourteen (14) species of lichens dominated in all three (3) habitats (Table 1). Density of dominated lichen species is the second indicator of environmental air quality. In 2004, in Rietavas Park the most common species were: *Xypogymnia physodes*, found on 15 trees (Pr=0.30); and *Xanthoria parietina* and *Lepraria glaucella*, found on 14 trees (Pr=0.28). The least-found quantities were those of: *Lepraria aeuriginosa* (Pr=0.02), *Cetraria sepincola* (Pr=0.04), and *Graphis scripta* (Pr=0.06). Plantings along the streets of Klaipeda feature *Xantoria parietina*, found on 22 trees (Pr=0.44). The least common was *Cetraria sepincola*, *Parmeliopsis ambiqua*, and *Parmelia caperata* (Pr=0.02). In Giruliai Forest, the largest quantity of *Parmeliopsis ambiqua* was found on observed 15 trees (Pr=0.30), and *Lepraria glaucella* (Pr=0.26); less-common lichen species were: *Lepraria aeruginosa*, *Physcia aipolia*, and *Parmelia olivacea* (Pr=0.02).

Table 1. Density of dominated Lichen species in various habitats in the period of 2004–2005
***1 lentelė**. Vyraujančių kerpių rūšių paplitimas skirtingose augavietėse 2004–2005 metais*

No.	Lichen Species	Relative Density (Pr)					
		In Rietavas Park		Plantings Along the Streets of Klaipeda		In Giruliai Forest	
		2004	2005	2004	2005	2004	2005
1.	*Cetraria glauca* (L.) W.L. Culb. & C.F. Culb.	0.18	0.12	0.02	0.04	0.10	0.06
2.	*Cetraria sepincola* (Ehrh.) Ach.	0.04	0.04	0.06	0.04	0.12	0.08
3.	*Graphis scripta* (L.) Ach.	0.06	0.02	0.04	0.02	0.02	0.04
4.	*Lecanora chlarona* (Ach.) Nyl.	0.14	0.20	0.08	0.14	0.12	0.14
5.	*Lepraria aeruginosa* (Weiss) Sm.	0.02	0.04	0.08	0.10	0.02	0.04
6.	*Lepraria glaucella* (Flörke) Ach.	0.28	0.26	0.14	0.12	0.26	0.20
7.	*Hypogymnia physodes* (L.) Nyl.	0.30	0.34	0.04	0.06	0.12	0.18
8.	*Parmelia olivacea* (L.) Ach. em Nyl.	0.22	0.12	0.12	0.18	0.02	0.06
9.	*Parmeliopsis ambiqua* (Wulf) Nyl.	0.24	0.26	0.02	0.04	0.30	0.26
10.	*Parmelia sulcata* Taylor	0.20	0.08	0.10	0.10	0.06	0.12
11.	*Parmelia caperata* (L.) Ach.	0.06	0.02	0.02	0.04	0.08	0.16
12.	*Physcia aipolia* (Ehrh. ex Humb.) Fürnr.	0.08	0.08	0.14	0.18	0.02	0.04
13.	*Ramalina fraxinea* (L.) Ach.	0.16	0.10	0.12	0.08	0.20	0.16
14.	*Xanthoria parietina* (L.) Beltr.	0.28	0.40	0.44	0.34	0.10	0.14

In 2005, in Rietavas Park, the prevailing species was *Xanthoria parietina*, growing on twenty (20) trees (Pr=0.40). Another abundant species was *Hypogymnia physodes* (Pr=0.34). The least-common lichen species were *Graphis scripta* and *Parmelia caperata* (Pr=0.02). Plantings along the streets of Klaipeda are a prevailing habitat for *Xantoria parietina* (Pr=0.34); and *Graphis scripta* (Pr=0.02) was the least-prevailing. In Giruliai Forest, the most-abundant lichen species were *Parmeliopsis ambiqua* (Pr=0.26), and *Lepraria glaucella* (Pr=0.20). The least common were *Lepraria aeruginosa, Graphis scripta,* and *Physcia aipolia* (Pr=0.04). It was determined that *Xanthoria parietina* was very common in all habitats. This indicates that lichens of this species are typical plants of urbanized biotopes, prevailing on all continents. One can state that the species of lichens found in all habitats, and with frequency of high-prevalence, are rather tolerant to various environmental factors, especially to air pollution.

* Kontaktinis asmuo / Corresponding author

During the lichenological research, the distribution of lichen on the trees in different habitats, as it was already mentioned, was estimated according to the Braun-Blanquet Scale determining the abundance of lichen species, and the area of projection cover (Table 2).

Table 2. Projection coverage of dominated Lichen species in various habitats in the period of 2004 – 2005
2 lentelė. *Vyraujančių kepių rūšių projekcinis padengimas skirtingose augavietėse 2004 ir 2005 metais*

No.	Lichen species	Distribution according to the Braun-blanquet Scale					
		In Rietavas Park		Plantings along the streets of Klaipeda city		In Giruliai Forest	
		2004	2005	2004	2005	2004	2005
1.	*Cetraria glauca* (L.) W.L. Culb. & C.F. Culb.	1, 2, 3, 4	2, 3, 4	+	1, 2	2, 3	2, 3
2.	*Cetraria sepincola* (Ehrh.) Ach.	3	2, 3	+	1, 2	2, 3	1, 2
3.	*Graphis scripta* (L.) Ach.	3	1, 2, 3	1, 2	+, 1, 2	+	+, 1
4.	*Lecanora chlarona* (Ach.) Nyl.	3, 4	3	1, 2, 3	2, 3, 4	2, 3	1, 2, 3
5.	*Lepraria aeruginosa* (Weiss) Sm.	4	3, 4	+, 1, 3	2, 3	3	3, 4
6.	*Lepraria glaucella* (Flörke) Ach.	2, 3, 4, 5	1, 2, 3, 4, 5	1, 2, 3, 4	1, 2, 3	2, 3, 4	2, 3, 4
7.	*Hypogymnia physodes* (L.) Nyl.	2, 3, 4, 5	1, 2, 3, 4, 5	3, 4, 5	2, 3, 4	1, 2, 3, 4	1, 2, 3
8.	*Parmelia olivacea* (L.) Ach. em Nyl.	1, 2, 3, 4	2, 3, 4	+, 1	2, 3	3	2, 3
9.	*Parmeliopsis ambiqua* (Wulf) Nyl.	3, 4, 5	1, 2, 3	2, 3	2, 3	1, 2, 3, 4	1, 2, 3, 4
10.	*Parmelia sulcata* (Wulf) Nyl.	2, 3	1, 2, 3	+, 1	1	2, 3	1, 2, 3
11.	*Parmelia caperata* (L.) Ach.	2, 4	1, 2	1	+	1, 2, 3, 4	3, 4, 5
12.	*Physcia aipolia* (Ehrh. ex Humb.) Fürnr.	2, 3	2, 3, 4	2, 3	2, 3	3	2, 3, 4
13.	*Ramalina fraxinea* (L.) Ach.	2, 3	+, 1	1, 2	1, 2	+, 1, 2	2, 3
14.	*Xanthoria parietina* (L.) Beltr.	3, 4, 5	1, 2, 3, 4	+, 1, 2, 3, 4	+, 1, 2, 3, 4	1, 2	1, 2, 3

It was identified that in 2004 in Rietavas Park, the greatest projection coverage was featured by *Xanthoria parietina, Parmeliopsis ambiqua,* and *Lepraria glaucella* lichen species, covering no less than seventy-five percent (75 %) of the analyzed field on the tree trunk (no less than seventy-five percent (75 %) of all of the area). The largest planted areas in Klaipeda city were occupied by *Hypogymnia physodes*, which coverage scored as much as five (5) points according to Braun-Blanquet Scale. Another species featuring high coverage was *Xanthoria parietina*, on the scale of four (4) points. *Parmelia olivacea, P. sulcata, P. Caperata*, and *Cetraria sepincola* covered the least areas, at a maximum of five percent (5 %) of all of the area. In Giruliai Forest, the most-prevailing species found on the trees were: *Hypogymnia physodes, Parmeliopsis ambiqua,* and *Parmelia caperata*; with coverage area from twenty-five percent (25 %) to seventy-five percent (75 %) of the analyzed field. A very-small area (i.e., from "+" to 1 point) was covered by *Ramalina fraxinea* and *Graphis scripta* species of lichen.

During the research of 2005, it was determined that, in Rietavas Park, lichens are distributed very-unevenly on the trees. The largest areas (i.e., from fifty percent (50 %) to seventy-five percent (75 %) of the centre area) were covered by *Xanthoria parietina, Cetraria sepincola,* and *Parmelia olivacea*. Extra-large coverage (more than seventy-five percent (75 %) of all of the area) was noted for *Lepraria glaucella* and *Hypogymnia physodes* lichen species. Lichen growing on trees of the

* Kontaktinis asmuo / Corresponding author

streets of the city of Klaipeda did not feature high variety. They generally covered from twenty-five percent (25 %) to fifty percent (50 %) of the analyzed area (3 to 4 points according to the Braun-Blanquet Scale). These were *Xanthoria parietina, Hypogymnia physodes,* and *Lecanora chlarona.* In Giruliai Forest, after assessing the projection coverage of epiphytic lichens, the most-prevailing were: *Lepraria glaucella, Parmeliopsis ambiqua,* and *Parmelia caperata*. They occupied as much as seventy-five percent (75 %) of all of the analysed area. A very little area was covered by *Graphis scripta*.

Air quality in different habitats was estimated on the basis of indicative characteristics of lichen. The air pollution level in Rietavas Park was found to be low (AQV value was 43.5), on trees of the streets of the city of Klaipeda (i.e., from Taikos Avenue to H. Manto Street) the average air pollution (AQV = 28.8), and in Giruliai Forest, low air pollution (AQV = 36.8) (Fig. 2).

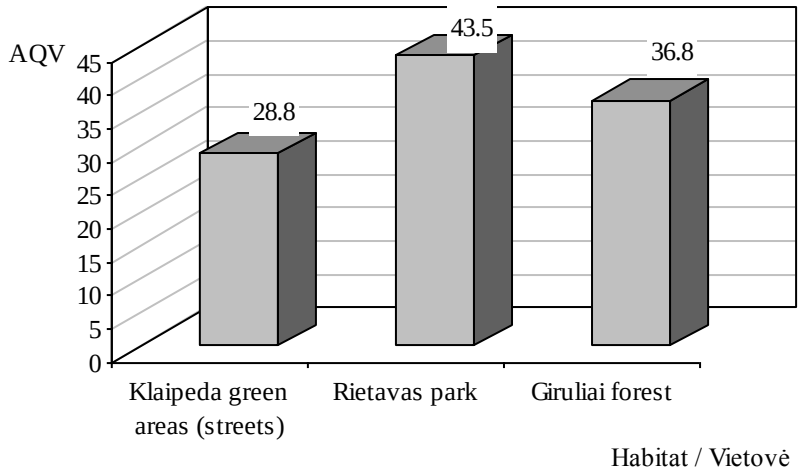

Fig. 2. Air quality values (AQV) in various habitats, average data 2004–2005
2 pav. *Oro kokybės reikšmė (AQV) skirtingose vietovėse, 2004–2005 m. vidutiniai duomenys*

According to the richness of tree bark (media pH>5), Rietavas Park is assigned to the 'clean pollution zone'. This zone features *Ramalina* venera lichen species that prevail in this habitat. Plantings along the streets of Klaipeda can be attributed to the zone of 'weak', having average pollution and resistance, because the prevailing species there are *Xanthoria, Lecanora* and *Lepraria* genera. In Giruliai Forest, the lichen (i.e., *Usnea, Evernia* and *Cetraria* genera species) indicate this habitat to be attributable to the 'clean' and 'relatively-clean' zones.

Conclusions

1. The highest number of lichen species (37–42) during the investigation period was found in Rietavas Park compared with the number of lichen species in other localities.
2. The most common and the greatest projection coverage were these lichen species: in Rietavas Park – *Xypogymnia physodes*, *Lepraria glaucella*, in Giruliai Forest – *Parmeliopsis ambiqua*, *Lepraria glaucella*. These lichen species are the indicators of high air quality Very common in all habitats was *Xanthoria parietina.* The greatest projection coverage was featured by *Hypogymnia physodes* in Klaipėda green areas (but this species was not very common).
3. On the basis of indicative characteristics of lichen the air pollution level in Rietavas Park was found to be low (AQV = 43.5), in the city of Klaipeda – the average air pollution (AQV = 28.8), and in Giruliai Forest, low air pollution (AQV = 36.8).

* Kontaktinis asmuo / Corresponding author

List of literature

1. Jucevičienė N. Pasyviosios ir aktyviosios lichenoindikacijos metodų taikymo miestų aplinkos monitoringo sistemoje tyrimai. *Daktaro disertacijos rankraštis*. Kaunas, 2002.
2. Motiejūnaitė J. Additions to the Lithuanian flora of foliose and fructicose lichens. *Botanica Lithuanica*, 8(4). Vilnius, 2002. P. 69–75.
3. Motiejūnaitė J. Checklist of lichens and allied fungi of Lithuania. *Botanica Lithuanica,* 5(3). Vilnius, 1999a. P. 251–265.
4. Motiejūnaitė J. Effect of land – use on lichen diversity in the transboundary region of Lithuania ant northeastern Poland. *Ekologjia*, Nr. 3. 2005. P. 34–43.
5. Motiejūnaitė J. *Kerpės.* Kaunas, 2002a.
6. Motiejūnaitė J. *Lietuvos grybai XIII. Lapiškosios ir krūmiškosios kerpės (Ascomycetes lichenisati spieces foliosae et fructicosae).* Vilnius, 2002b.
7. Motiekaitytė V. *Augalijos klasifikacija Brauno-Blankės metodu.* Vilnius, 1994.
8. Nekrošienė R. *Ornamental and other plants as indicators of environmental quality*. Kaunas, 2008.
9. Prigodina I. Epifitinių kerpių bendrijos Antalieptės ąžuolyne. *Lietuvos jaunųjų botanikų darbai*. Vilnius, 1999. P. 43–44.
10. Prigodina I., Naujalis J. R. Methods used to study epiphytic lichen communities in oakwoods of Lithuania. *Biologija*, Nr. 2. Vilnius, 2001. P. 102–104.
11. Sharnoff S. D. Lichens more than meets the eye. *Geographic*, 2(197). 1997. P. 60–70.
12. Stravinskienė V. *Bioindikaciniai aplinkos vertinimo metodai*. Kaunas, 2005.
13. Tremp H. Air quality in the city of Stuttgart. *Lichens as bioindicators.* 2006 [interactive]. Internet link: http:/www.uni-hohenheim.de/www320/german/homepages/horst/image/pdfs/air-quality-lichens-stutgart.pdf
14. Venckutė A., Nekrošienė R. Aplinkos oro kokybė – svarbus faktorius žolinių dekoratyvinių augalų asortimento formavimui želdynuose. *Miestų želdynų formavimas'2008: gėlės ir gėlynai. Mokslinių straipsnių rinkinys.* Klaipėda, 2008a. P. 169–172.
15. Venckutė A., Nekrošienė R. Bioindikacinio metodo taikymas oro kokybės vertinimui skirtingo urbanizacijos lygio teritorijose. *Technologijos mokslo darbai Vakarų Lietuvoje,* T. VI. Klaipėda, 2008. P. 166–170.

Skirtingai urbanizuotų teritorijų aplinkos oro kokybės vertinimas pasyviosios lichenoindikacijos metodu

(Gauta 2011 m. gruodžio mėn.; atiduota spaudai 2012 m. kovo mėn.; prieiga internete nuo 2012 m. balandžio 23 d.)

Santrauka

Unikaliais bioindikatoriais vertinant aplinkos oro kokybę laikomos kerpės. Didelis kerpių jautrumas oro taršalams susijęs su jų biologija. Tai organizmai, kuriuose grybas, dumblis ar bakterija sudaro simbiozę. Vertinant oro kokybę kerpių pagalba, paprastai naudojami du lichenoindikacijos būdai: aktyvioji ir pasyvioji. Aktyvioji lichenoindikacija – kerpių tyrimas, kai jos kartu su substratu yra perkeliamos iš mažo užterštumo teritorijų į tiriamąją vietovę, kur stebimi jų gniužulų pakitimai ir pagal juos sprendžiama apie oro kokybę ekspozicijos laikotarpiu. Naudojant lichenoindikacinius metodus aplinkos būklei vertinti, dažnai yra vertinama kerpių bendrijų sudėtis. Labai naudingi gali būti ir papildomi duomenys, kurie leidžia objektyviau vertinti stresą, padarytą aplinkos teršalų. Tai kerpių gniužulų morfologinių, anatominių rodiklių bei fiziologinių procesų tyrinėjimai. Šie rodikliai gali būti vertinami atskiroms rūšims, augančioms vietovėse su žinomu oro užterštumu arba naudojant transplantaciją – aktyviąją lichenoindikacija. Analogiški tyrimai gali būti atliekami laboratorijose dirbtinės taršos sąlygomis. Epifitinių kerpių tyrimai buvo atlikti 2004–2005 metais Rietavo dvaro parke (Plungės raj.), Girulių miške (Klaipėdos raj.) ir Klaipėdos miesto gatvių želdynuose. 2004 metais ant 50 tirtų medžių iš viso buvo identifikuota 51 rūšies epifitinės kerpės. Daugiausia kerpių rūšių rasta Rietavo parke – 42, mažiausiai – Klaipėdos gatvių želdynuose – 21, o Girulių miške – 32 kerpių rūšys. 2005 metais rastos 52 kerpių rūšys. Kaip ir 2004 metais, didžiausia lichenofloros įvairove pasižymėjo Rietavo parkas – 37, Klaipėdos gatvių želdynai – 21, Girulių miškas – 33 kerpių rūšys. Kaip rodo tyrimų duomenys, 14 kerpių rūšių dominavo visose trijose augavietėse. Nustatyta, kad *Xanhtoria parietina* pasižymėjo aukštu sutinkamumo

* Kontaktinis asmuo / Corresponding author

dažniu visose augavietėse. Tai rodo, jog šios rūšies kerpės yra tipiški urbanizuotų biotopų augalai, paplitę visuose kontinentuose. Galima teigti, kad tos kerpių rūšys, kurios aptinkamos visose augavietėse, kurių aukštas sutinkamumo dažnis, yra gana tolerantiškos įvairiems aplinkos faktoriams, o ypač oro užterštumui. Remiantis kerpių indikatorinėmis savybėmis nustatyta, kad Rietavo parke ir Girulių miške yra žemas oro užterštumas, AQV atitinkamai 43,5 ir 36,8. Klaipėdos gatvėse (Taikos pr. – H. Manto g.) fiksuotas vidutinis oro užterštumas, AQV = 28,8

* Kontaktinis asmuo / Corresponding author