



LICHENS OF ŁOMŻA TOWN (PODLASIE, NORTH-EASTERN POLAND)

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ABSTRACT. This paper presents new distribution stands for 70 species of lichenized town from Łomża town (Podlasie, NE Poland). The investigations in the area of Łomża were carried out in the years 2014–2015, on 34 research stands. Seven species have been put on the Red list of the lichens in Poland (CIEŚLIŃSKI et al. 2006), including *Rhizocarpon lavatum* in critically endangered – CR, *Ramalina fastigiata*, *R. fraxinea* in the endangered category – EN, in the *Ramalina farinacea* in the vulnerable category – VU and *Evernia prunastri*, *Hypogymnia tubulosa*, *Physcia aipolia* in the category of near threatened – NT and five have been put under legal protection, two of which are strictly (*Ramalina fastigiata*, *R. fraxinea*) and three of which are partially protected (*Cladonia arbuscula*, *Hypogymnia tubulosa*, *Ramalina farinacea*). The lichens occur on following substrate types: soil, decaying wood, bark of all trees and shrubs species, boulders, concrete, foundation, mortar, plaster and bryophytes.

KEY WORDS: Lichens, distribution, urban area, north-eastern Poland

INTRODUCTION

Investigations on lichens in Poland have been carried out in a large number of big and small towns, frequently of a health-resort character, situated in the lowlands as well as the mountains. On the territory of Poland lichen biota has been compiled for big cities, such as Lublin (RYDZAK 1953), Radom (CIEŚLIŃSKI 1974), Warszawa (ZIMNY & KUCIŃSKA 1974), Kielce (TOBOROWICZ 1976), Kraków (KISZKA 1977), Słupsk (ŚPIEWAKOWSKI & IZYDOREK 1981), Gdańsk, Sopot, Gdynia (FAŁTYNOWICZ et al. 1991), Rzeszów (PUSTELNIAK 1991), Przemyśl (KISZKA 1999). However, data concerning small towns populated by up to a few thousand inhabitants are not numerous, e.g. for Muszyna, Wisła (RYDZAK 1956a), Wołczyn (RYDZAK 1956 b), Duszniki Zdrój, Polanica Zdrój (RYDZAK 1959), Limanowa (JAGIEŁŁO 1983), Drezdenko (LIPNICKI 1984). No comprehensive studies on lichens have been carried out in north-eastern Poland except for Białowieża (RYDZAK 1957, MATWIEJUK 2011), Olsztyn (KUBIAK 2005), Białystok (MATWIEJUK 2007), Ciechanowiec (MATWIEJUK & KOLANKO 2007), Mielnik (MATWIEJUK 2008), Boćki (MATWIEJUK 2009a), Drohiczyń (MATWIEJUK 2009b), Narew (MATWIEJUK & KOROBKIEWICZ 2012 a), Ełk (MATWIEJUK & WÓJTOWICZ

2013), Supraśl (MATWIEJUK 2015). This area, which constitutes over 11% of Poland, is in many ways greatly differentiated from other parts of Poland. Its idiosyncratic geological structure, features of climate and the plant cover, as well as the history, ethnographic background and economic relations of the region determine its separate nature (KONDRACKI 1972).

This inspired lichenological investigations in Łomża, the fourth largest urban centre in north-east Poland after Białystok, Olsztyn, Suwałki.

The aim of the study was to present documentation illustrating biodiversity of lichen biota in the area of Łomża, taking into consideration the habitat conditions of species.

STUDY AREA

City towering over Narew – such a picturesque view appears in the eyes of travelers who enter here from the Piątница. Łomża buildings occupied high nadnarwiańska slope and location is, of course, is a great asset. Over 1,000 years ago, when in the area assumed the first settlement from the picturesque position were more important considerations defensive. Castle, which is still acting on the imagination of the

Table 1. The emissions in Łomża in 2014

	Emissions in 2014 ($\mu\text{g}/\text{m}^3$)			
	SO ₂	NO ₂	dust PM 10	dust PM 2.5
Total	6.5	15.9	29.5	28.0

Data source: WIOŚ Białystok.

remains can be found near the present town, guarded the trade route and crossing on Narew. Since 1418 Łomża enjoys the city charter. Her fate was kind to the sixteenth century. Two more centuries experienced her mercilessly, just as World War II, when he destroyed almost 80% of the buildings. Nevertheless, the city has retained interesting sights, which is worth looking at closely. The most important object is a sixteenth-century cathedral. Certainly Łomża would not be what it is, if it were not Narew river, which belongs to the natural pearls of north-eastern Polish. Her spring flood waters can admire, without leaving even outside buildings (ZUBKOWICZ 2009).

Łomża is a city (town rights June 15, 1418 a year) with county rights situated in the north-eastern part of Poland in Podlaskie. The city is located in the middle reaches of the river Narew, which lies on the moraine hills, including a high, left-bank embankment Narew meltwater. The city is surrounded by two geographic regions – Mesopotamia Łomża and Narew Valley. In the north of the city it borders the “Rycerski Kierz” reserve and to the east of Łomża Land-

scape Park Dolina Narwi (www.lomza.polskiemiasta.info/bibliografia).

The city is located in the temperate climate zone transition. The average annual temperature is 7.1°C, average annual rainfall of about 500 mm. Air humidity childbearing in the range of 80–82%. The growing season lasts about 200 days (GÓRNIĄK 2000).

The green areas located in the city occupy an area of 29.91 ha. Squares, lawns and memorials occupy an area of 12.13 ha. In addition, the city’s area are three urban parks – the Jakub Waga Park, People’s Park and Pope John Paul II the Pilgrim Park, which occupy an area of 17.78 ha. These areas take up 0.91% of the city. Forests, which belong to the city area occupy 17 ha are exclusively private property (JASTRZĘBSKI 2004).

The buildings are evenly spaced on, but clearly marked is the center of the city.

In 2014, it recorded 62 779 residents which puts the city in this regard in 3rd place in Podlaskie (GUS 2015).

Łomża belongs to cities with a small number of large point sources of air pollution and relatively low share of emissions from these sources (Table 1). Much of the city is supplied with thermal energy (heating and hot water) from urban heating MPEC in Łomża. The main sources of air pollution in Łomża are point sources: urban heating plant MPEC, PEPEES Companies Food Industry SA. (WIOŚ 2015).

MATERIALS AND METHODS

Fieldwork research. The investigations in the area of Łomża were carried out in the years 2014–2015, on 34 research localities (Fig. 1). These stands were established within different places. The habitat was considered a stand within which the census of lichens was made from all available substrates. The epiphytic lichens were examined for individual trees with a diameter of trunks > 30 cm. At each stand at least five trees were monitored. At each location all species of lichens on the bark of trees from the base up to 2.5 m were recorded.

Taxonomic identification. For most taxa, taxonomic identification was carried out in laboratory conditions. The collected specimens were determined on the basis of morphological and anatomical characters. Lichens were also determined based on the presence of secondary metabolites – test reactions. Thin-layer chromatography (TLC) was used to identify the types of secondary metabolites, mainly from the genus *Cladonia*, *Lepraria* and *Rhizocarpon*. This method was conducted in accordance with the guidelines from ORANGE et al. (2001). The species have been named according to DIEDERICH et al. (2014) and species *Melanelixia* to HAWKSWORTH et al. (2008, 2011), *Circinaria calcarea* to NORDIN et al. (2010) and *Calogaya decipiens*, *C. pusilla*, *Flavoplaca citrina*, *F. oasis*, *Polycauliona polycarpa*, *Rusavskia elegans* to ARUP et al.

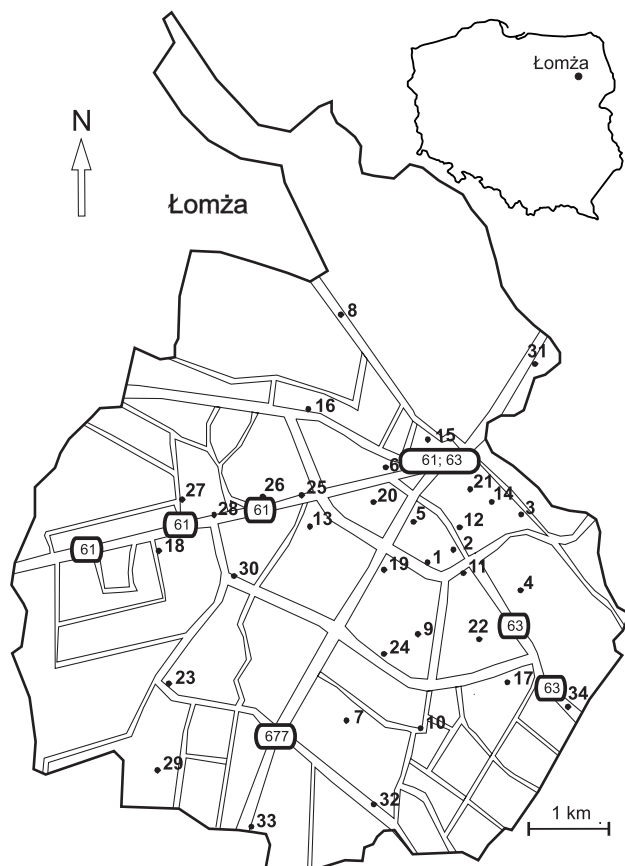


Fig. 1. Distribution of the stands in Łomża

(2013). The lichen material has been deposited at the Herbarium of the Institute of Biology, University of Białystok.

RESULTS

As a result of the study on the territory of Łomża 70 lichen species of 32 genera were recorded. The most abundant numbers of species represented here are those of genera *Lecanora* (17), *Physcia* (6) and *Ramalina* (3).

Lichens occur on following substrata likely to be colonized – on the bark of deciduous and coniferous trees and shrubs, wooden constructions, soil, stones, concrete, mortar, plaster and bryophytes. Lichens are represented by all morphological forms. In the biota of the investigated area, the most dominant lichens are the ones which form different types of crustose thalli. They make up 55% of the overall number of the species. They can be found in shaded and moist places. Amongst the crustose lichens there is a significant number of pioneer species colonizing anthropogenic rock substrata, smooth tree bark and freshly-exposed soil. The second largest group consists of foliose lichens (25%). Lichens with fruticose thalli are the less numerous group comprising 7% of the overall number of biota. The participation of lichens from other morphological groups is insignificant and amounts to around 3–6%.

Corticulous species. The bark of trees (42 species) constitutes a substratum for numerous lichens. Out of 70 lichen species recorded in the area under study, 39 grew on tree bark including 25 obligatorily epiphytes. Roadside trees dominate in Łomża, free-standing trees prevail in agricultural landscape. The richest lichen biota has been recorded on the bark of deciduous trees – *Acer platanoides* (26 species), *Tilia cordata* (28), *Fraxinus excelsior* (24), *Tilia platyphyllos* (11). The epiphytic biota of the maple is of greater interest. Rare taxa have been identified on its bark, such as *Ramalina farinacea*, *R. fastigiata*.

On most roadside trees, high participation in lichen biota is exhibited by nitrophilous macrolichens of genera *Physcia* (*P. adscendens*, *P. dubia*, *P. stellaris*, *P. tenella*), *Physconia* (*P. enteroxantha*, *P. grisea*), *Polycauliona polycarpa* and *Xanthoria parietina*.

The largest amount of stands and the highest coverage coefficients are attained by species which colonize not only tree bark but other types of substrata as well. These species also comprise the most frequently encountered group in the lichen biota of Łomża: *Phaeophyscia orbicularis*, *Physcia adscendens*, *Xanthoria parietina*.

The rare species worth mentioning here include *Ramalina fastigiata* (localities: 8, 33). This species is strictly protected and is on the red list of lichens in Poland in the endangered category.

The distribution of epiphytic lichens on the territory of Łomża is uneven, which is connected with the fact that many streets and much wasteland are completely deprived of trees.

Epilithic species. The second largest habitat group – 34 species, comprises rock lichens, of which 19 are exclusive epilythes. They colonize both natural and anthropogenic substrata. Stones can be found in the open area, agricultural landscape, as well as within the town and built-up areas (walls, underpinnings and gravestones). Obligatory saxicolous species include, among others *Acarospora fuscata* and *Rhizocarpon lavatum* of which the second species is very rare in lowland Poland). Rich lichen biota occurs also on anthropogenic substrata with properties resembling those of rocks, such as concrete, mortar and bricks. These become colonized by calciphilous species and also by species tolerant towards the presence of calcium carbonate, such as *Calogaya decipiens*, *C. pusilla*, *Caloplaca teicholyta*, *Circinaria calcarea*, *Flavoplaca citrina*, *F. oasis*, *Lecanora albescens*, *L. dispersa* and *Xanthoria parietina*. They are accompanied by numerous nitrophilous species of family *Physciaceae*.

Terricolous species. Soil is colonized by one lichen species of genera *Cladonia* – *C. arbuscula*.

Lignicolous species are represented only by 15 species. On the territory of Łomża lichens of dead and rotting wood favour mainly man-made timber constructions (fences, poles, crosses and farm out-buildings). The exclusive species are *Lecanora varia* and *Micarea denigrata*.

PARTICIPATION OF VULNERABLE AND PROTECTED LICHENS

Of the 70 lichen species identified in Łomża, seven species have been put on the Red list of the lichens in Poland (CIEŚLIŃSKI et al. 2006), including *Rhizocarpon lavatum* in critically endangered – CR, *Ramalina fastigiata*, *R. fraxinea* in the endangered category – EN, *Ramalina farinacea* in the vulnerable category – VU and *Evernia prunastri*, *Hypogymnia tubulosa*, *Physcia aipolia* in the category of near threatened – NT (Table 2).

Table 2. The lichen species of Łomża included in the red list of lichens in Poland

Category of threat	Species	Number (percentages) of species
CR	<i>Rhizocarpon lavatum</i>	1 (1.5)
EN	<i>Ramalina fastigiata</i> , <i>R. fraxinea</i>	2 (3)
VU	<i>Ramalina farinacea</i>	1 (1.5)
NT	<i>Evernia prunastri</i> , <i>Hypogymnia tubulosa</i> , <i>Physcia aipolia</i>	3 (4)

Explanations: CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened.

Table 3. The list of protected species occurring in Łomża

Status of protection	Species	Number (percentages) of species
SP	<i>Ramalina fastigiata</i> , <i>R. fraxinea</i>	2 (3)
PP	<i>Cladonia arbuscula</i> , <i>Hypogymnia tubulosa</i> , <i>Ramalina farinacea</i>	3 (4)

Explanations: SP – strict protection, PP – partial protection.

Of all the 70 lichen species of Łomża, five have been put under legal protection, two of which are strictly and three of which are partially protected (REGULATION... 2014, Table 3).

LIST OF SPECIES

- Acarospora fuscata*** (Schrad.) Th. Fr. – stone grave-stones, concrete grave-stones; localities: 3, 4.
- Buellia punctata*** (Hoffm.) A. Massal. – bark of *Aesculus hippocastanum*, *Acer platanoides*, *A. pseudoplatanus*, *A. saccharinum*, *Fraxinus excelsior*, *Quercus robur*, *Q. rubra*, *Robinia pseudoacacia*, *Sorbus aucuparia*, *S. intermedia*, *Tilia cordata*, *T. platyphyllos*, *Ulmus laevis*, wooden bench, concrete grave-stones; localities: 1, 4, 5, 8–11, 17, 18, 24, 26, 27, 32.
- Calogaya decipiens*** (Arnold) Arup, Frödén & Söchting – wooden bench, concrete (cross, wall, pole, curb, sett, board, manhole), stone wall, brick wall, grout, terrazzo; localities: 1, 6, 7, 9, 11–15, 18–22, 24, 25, 28.
- Calogaya pusilla*** (A. Massal.) Arup, Frödén & Söchting – concrete (post, cross, wall, pole, curb, sett), stone grave-stones, terrazzo, tombstone, stone, asbestic tile; localities: 1, 3, 7, 9–13, 15, 17–20, 22–28, 30–32.
- Caloplaca teicholyta*** (Ach.) J. Steiner – concrete; localities: 11, 15.
- Candelaria concolor*** (Dicks.) Arnold – bark of: *Acer platanoides*, *Betula pendula*, dead *Quercus rubra*; localities: 6, 34.
- Candelariella aurella*** (Hoffm.) Zahlbr. – bryophytes, wooden bench, concrete (cross, grave-stones, pole, tombstone, sett, curb, manhole, board, wall), stone, stone wall, terrazzo, grout, bricks; localities: 1, 4, 6–13, 15, 17–20, 22–26, 28, 30–32, 34.
- Candelariella reflexa*** (Nyl.) Lettau – wooden fence; locality: 13.
- Candelariella vitellina*** (Hoffm.) Müll. Arg. – wooden bench, stone grave-stones, concrete (grave-stones, curb); localities: 3, 4, 7, 12.
- Candelariella xanthostigma*** (Pers.) ex Ach. – bark of *Acer platanoides*, *A. saccharinum*, *Betula pendula*, *Cupressus nootketensis*, *Fagus sylvatica*, *Fraxinus excelsior*, *Padus avium*, *Pinus sylvestris*, *Populus tamarahaca*, *P. tremula*, *Quercus robur*, *Q. rubra*, *Robinia pseudoacacia*, *Salix alba*, *Sorbus domestica*, *Tilia cordata*, *T. platyphyllos*, dead tree, wooden bench, metal (grille, screw); localities: 1–3, 5, 6, 8, 9, 11–15, 17–19, 21, 24, 26, 27, 29, 32, 34.
- Circinaria calcarea*** (L.) A. Nordin, Savić & Tibell – concrete grave-stones; locality: 4.
- Cladonia arbuscula*** (Wallr.) Flot. – soil in granite tombstone; locality: 1.
- Cladonia coniocraea*** (Flörke) Spreng., nom. cons. – concrete grave-stones; localities: 4, 29.
- Cladonia fimbriata*** (L.) Fr. – felled tree trunk, concrete grave-stones; locality: 4.
- Evernia prunastri*** (L.) Ach. – bark of *Acer platanoides*, *A. saccharinum*, *Betula pendula*, *Fraxinus excelsior*, *Populus tremula*, *Tilia cordata*, *T. platyphyllos*, *Quercus rubra*; localities: 1, 3, 6, 8, 9, 11, 15, 17, 24, 34.
- Flavoplaca citrina*** (Hoffm.) Arup, Frödén & Söchting – wood (fence, bench), concrete (posts, wall, grave-stones, slab, board, curb, foundation), grout, stone wall, brick wall, metal structures; localities: 1, 3, 4, 7, 11–15, 17–22, 24, 25, 28.
- Flavoplaca oasis*** (A. Massal.) Arup, Frödén & Söchting – concrete (pole, posts, grave-stones), tombstone; localities: 1, 4, 7, 11, 32.
- Hypocenomyce scalaris*** (Ach.) M. Choisy – bark of *Aesculus hippocastanum*, *Acer platanoides*, *Tilia cordata*; localities: 1, 8, 27.
- Hypogymnia physodes*** (L.) Nyl. – bark of *Acer platanoides*, *A. saccharinum*, *Betula pendula*, *Catalpa bignonioides* ‘Aurea’, *Fraxinus excelsior*, *Picea abies*, *Pinus sylvestris*, *Quercus robur*, *Sorbus aucuparia*, *S. intermedia*, *Tilia cordata*, *T. platyphyllos*, *Ulmus laevis*, wooden bench, concrete wall, grave-stones; localities: 3, 6–12, 14–16, 17, 20–22, 24, 26, 27, 29, 34.
- Hypogymnia tubulosa*** (Schaer.) Hav. – bark of *Tilia cordata*; locality: 17.
- Lecanora albescens*** (Hoffm.) Flörke – concrete (post, cross, wall, grave-stones, pole, slab, board, manhole), brick, brick wall, grout; localities: 1, 4, 6, 8, 9, 11–15, 18, 19, 20, 23–28, 30, 31.
- Lecanora allophana*** Nyl. – bark of *Acer platanoides*, *Tilia cordata*; localities: 1, 17, 18.
- Lecanora argentata*** (Ach.) Malme – bark of *Fraxinus excelsior*; locality: 8.
- Lecanora carpinea*** (L.) Vain. – bark of *Aesculus hippocastanum*, *Acer platanoides*, *Catalpa bignonioides* ‘Aurea’, *Fraxinus excelsior*, *Tilia cordata*, *Quercus rubra*; localities: 1, 8, 9, 15, 26, 32.
- Lecanora chlarotera*** Nyl. – bark of *Acer negundo*, *A. saccharinum*, *Sorbus aucuparia*, *Tilia cordata*; localities: 13, 17, 22.
- Lecanora crenulata*** Hook. – concrete (pole); locality: 18.
- Lecanora dispersa*** (Pers.) Sommerf. – wooden bench, concrete (pole, cross, grave-stones, curb, sett, wall, foundation), brick, tombstone, stone; localities: 1, 4, 6–8, 10, 13–15, 17–20, 22–25, 27, 30, 31, 34.
- Lecanora expallens*** Ach. – bark of *Acer saccharinum*, *Fraxinus excelsior*, *Tilia cordata*, bryophytes; localities: 8, 24, 33.

- Lecanora hagenii* (Ach.) Ach. – bark of *Acer platanoides*, *A. saccharinum*, *Populus tremula*, *Sorbus aucuparia*; localities: 2, 8, 17, 24.
- Lecanora muralis* (Schreb.) Rabenh. – concrete (gravestones, pole, board, posts, foundation), stone, stone gravestones, asbestic tile, sett, brick, brick wall, metal grille; localities: 1, 3, 4, 6, 7, 9, 11–15, 17–28, 30–32, 34.
- Lecanora persimilis* (Th. Fr.) Nyl. – concrete (pole); locality: 13.
- Lecanora polytropa* (Hoffm.) Rabenh. – concrete; locality: 20.
- Lecanora pulicaris* (Pers.) Ach. – bark of *Aesculus hippocastanum*, *Acer platanoides*, *A. pseudoplatanus*, *A. saccharinum*, *Fraxinus excelsior*, *Populus tremula*, *Quercus rubra*, *Robinia pseudoacacia*, *Sorbus aucuparia*, *S. intermedia*, *Tilia cordata*, *Ulmus laevis*; localities: 1, 3, 8, 9, 15, 17, 18, 22, 34.
- Lecanora rupicola* (L.) Zahlbr. – gravestones, concrete gravestones; localities: 3, 4.
- Lecanora saligna* (Schrad.) Zahlbr. – bark of *Acer platanoides*; locality: 8.
- Lecanora symmicta* (Ach.) Ach. – bark of *Tilia cordata*; locality: 17.
- Lecanora varia* (Hoffm.) Ach. – wooden cross, wooden bench; localities: 7, 8.
- Lecidella elaeochroma* (Ach.) M. Choisy – bark of *Aesculus hippocastanum*, *Acer platanoides*, *A. pseudoplatanus*, *A. saccharinum*, *Sorbus aucuparia*, *Tilia cordata*; localities: 1, 2, 8, 9, 13, 17, 22, 24.
- Lecidella stigmatea* (Ach.) Hertel & Leuckert – concrete (cross, gravestones, pole, wall, curb, posts), brick, grout; localities: 1, 4, 6, 8–10, 13–15, 17–22, 24–28, 32.
- Lepraria finkii* (B. de Lesd.) R.C. Harris – bark of *Acer platanoides*, *Fraxinus excelsior*, *Pinus sylvestris*, *Tilia cordata*; localities: 1, 6, 27, 29.
- Lepraria incana* (L.) Ach. – bark of *Acer platanoides*; locality: 8.
- Melanelixia fuliginosa* (Duby) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – bark of *Ulmus laevis*; locality: 17.
- Melanelixia glabrata* (Lamy) Sandler & Arup – bark of *Tilia cordata*; locality: 17.
- Melanohalea exasperatula* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – bark of *Aesculus hippocastanum*, *Acer platanoides*, *Fraxinus excelsior*, *Sorbus aucuparia*, *S. intermedia*, *Tilia cordata*, *T. platyphyllos*; localities: 8, 9, 16, 22, 24, 32–34.
- Micarea denigrata* (Fr.) Hedl. – wooden bench; locality: 7.
- Parmelia sulcata* Taylor – bark of *Acer platanoides*, *A. saccharinum*, *Betula pendula*, *Cupressus nootketensis*, *Fagus sylvatica*, *Fraxinus excelsior*, *Padus avium*, *Picea abies*, *Quercus robur*, *Rhus typhina*, *Sorbus intermedia*, *Tilia cordata*, *T. platyphyllos*, *Ulmus laevis*, dead *Quercus rubra*, wooden bench, concrete; localities: 2, 5–12, 14, 15, 17, 20–22, 24, 27, 32–34.
- Phaeophyscia nigricans* (Flörke) Moberg – bryophytes, concrete; locality: 20.
- Phaeophyscia orbicularis* (Neck.) Moberg – bark of *Acer negundo*, *A. platanoides*, *A. pseudoplatanus*, *A. saccharinum*, *Aesculus hippocastanum*, *Betula pendula*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Malus sylvestris*, *Picea abies*, *Populus nigra*, *P. tacamahaca*, *P. tremula*, *Quercus robur*, *Q. rubra*, *Robinia pseudoacacia*, *Salix alba*, *Sorbus domestica*, *S. intermedia*, *Symphoricarpus albus*, *Syringa vulgaris*, *Thuja occidentalis*, *Tilia cordata*, *Ulmus laevis*, wood (bench, fence), stone, stone wall, granite tombstone, concrete (cross, wall, gravestones, board), grout, metal, metal manhole; localities: 1–28, 31–34.
- Phlyctis argena* (Spreng.) Flot. – bark of *Acer platanoides*, *Cupressus nootketensis*, *Fagus sylvatica*, *Fraxinus excelsior*, *Sorbus intermedia*, *Tilia cordata*, *T. platyphyllos*; localities: 1, 2, 6, 8, 15, 18, 33.
- Physcia adscendens* H. Olivier, nom. cons. – bark of *Acer platanoides*, *Acer saccharinum*, *Betula pendula*, *Catalpa bignonioides* 'Aurea', *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Malus sylvestris*, *Populus tremula*, *Quercus robur*, *Q. rubra*, *Sorbus intermedia*, *Symphoricarpus albus*, *Tilia cordata*, concrete (cross, gravestones, wall, foundation), metal; localities: 1, 4–6, 8–12, 14–22, 24, 27, 32–34.
- Physcia aipolia* (Humb.) Fürnr. – bark of *Tilia cordata*; locality: 14.
- Physcia caesia* (Hoffm.) Fürnr. – concrete (pole); locality: 13.
- Physcia dubia* (Hoffm.) Lettau var. *dubia* – bark of *Abies concolor*, *Acer platanoides*, *A. saccharinum*, *Aesculus hippocastanum*, *Betula pendula*, *Crataegus monogyna*, *Cupressus nootketensis*, *Fagus sylvatica*, *Fraxinus excelsior*, *F. pennsylvanica*, *Larix decidua*, *Padus avium*, *Pinus nigra*, *Populus tacamahaca*, *P. tremula*, *Quercus robur*, *Q. rubra*, *Rhus typhina*, *Salix alba*, *Sorbus domestica*, *S. intermedia*, *Tilia cordata*, *T. platyphyllos*, dead *Quercus rubra*, wooden fence, stone; localities: 1–3, 5–7, 9–24, 32–34.
- Physcia stellaris* (L.) Nyl. – bark of *Acer platanoides*, *A. saccharinum*, *Fraxinus excelsior*, *Larix decidua*, *Malus sylvestris*, *Quercus robur*, *Q. rubra*, *Robinia pseudoacacia*, *Salix alba*, *Sorbus aucuparia*, *S. intermedia*, *Tilia cordata*, *Ulmus laevis*, dead *Sorbus intermedia*; localities: 8–12, 17, 19, 22, 24, 34.
- Physcia tenella* (Scop.) DC. – bark of *Acer platanoides*, *Betula pendula*, *Catalpa bignonioides* 'Aurea', *Fraxinus pennsylvanica*, *Rhus typhina*, *Tilia cordata*, *T. platyphyllos*, stone, concrete (foundation, wall, curb); localities: 1, 2, 7, 8, 10, 11, 15, 17, 18, 20–22, 27, 32.
- Physconia enteroxantha* (Nyl.) Poelt – bark of *Tilia cordata*; locality: 8.
- Physconia grisea* (Lam.) Poelt – bark of *Acer negundo*, *A. platanoides*, *Cupressus nootketensis*, *Fraxinus excelsior*, *Populus tremula*, *Rhus typhina*, *Robinia pseudoacacia*, *Salix alba*, *Sorbus domestica*, *S. intermedia*, *Tilia*

- cordata*, *Quercus robur*, felled tree trunk, concrete (post); localities: 1, 2, 5, 6, 8–12, 16–19, 24.
- Polycauliona polycarpa*** (Hoffm.) Frödén, Arup & Söchting – bark of *Aesculus hippocastanum*, *Acer saccharinum*, *Betula pendula*, *Catalpa bignonioides* ‘Aurea’, *Fraxinus excelsior*, *Malus sylvestris*, *Picea abies*, *Populus nigra*, *Quercus robur*, *Q. rubra*, *Rhus typhina*, *Robinia pseudoacacia*, *Sorbus aucuparia*, *S. intermedia*, dead *Sorbus intermedia*, wooden bench; localities: 6–11, 14–20, 22, 26, 27, 34.
- Pseudevernia furfuracea*** (L.) Zopf – bark of *Fraxinus excelsior*; locality: 8.
- Ramalina farinacea*** (L.) Ach. – bark of *Fraxinus excelsior*; locality: 8.
- Ramalina fastigiata*** (Pers.) Ach. – bark of *Fraxinus excelsior*; localities: 8, 33.
- Ramalina fraxinea*** (L.) Ach. – bark of *Acer platanoides*, *Fraxinus excelsior*, *Sorbus intermedia*, *Tilia cordata*; localities: 8, 17, 33.
- Rhizocarpon lavatum*** (Fr.) Hazsl. – stone gravestones; localities: 3, 4.
- Rusavskia elegans*** (Link) S.Y. Kondr. & Kärnefelt – concrete (pole, poles, foundation, curb); localities: 9, 13, 18, 20, 22, 24, 26, 30.
- Sarcogyne regularis*** Körb. – concrete (wall); locality: 15.
- Scoliosporum chlorococcum*** (Stenh.) Vězda – bark of *Acer platanoides*, *Betula pendula*; localities: 5, 6.
- Scoliosporum umbrinum*** (Ach.) Arnold – stone, concrete; localities: 1, 3, 20.
- Verrucaria muralis*** Ach. – concrete wall; locality: 15.
- Verrucaria nigrescens*** Pers. – concrete (posts, gravestones, wall, foundation, manhole); localities: 1, 4, 9, 11, 13–15, 18, 19, 21, 24, 26, 28, 32.
- Xanthoria parietina*** (L.) Th. Fr. – bark of *Acer negundo*, *A. platanoides*, *A. pseudoplatanus*, *A. saccharinum*, *Aesculus hippocastanum*, *Betula pubescens*, *Catalpa bignonioides* ‘Aurea’, *Crataegus monogyna*, *Fagus sylvatica*, *Fraxinus excelsior*, *F. pennsylvanica*, *Larix decidua*, *Malus sylvestris*, *Pinus nigra*, *Platanus acerifolia*, *Populus nigra*, *P. tacamahaca*, *P. tremula*, *Quercus robur*, *Q. rubra*, *Rhus typhina*, *Robinia pseudoacacia*, *Salix alba*, *Sambucus nigra*, *Sorbus domestica*, *S. intermedia*, *Symphoricarpos albus*, *Syringa vulgaris*, *Thuja occidentalis*, *Tilia cordata*, *T. platyphyllos*, *Ulmus laevis*, dead *Sorbus intermedia*, wooden bench, concrete (wall, gravestones, poles, foundation) granite tombstone, stone, metal fence; localities: 1–3, 5–34.
- Mikołaj Kopernik Street, square near Cathedral cemetery (53°10'26.2"N, 22°04'39.2"E) – *Acer negundo*, *A. platanoides*, *A. saccharinum*, *Betula* sp., *Fraxinus pennsylvanica*, *Populus tremula*, *Rhus typhina*, *Robinia pseudoacacia*, *Tilia platyphyllos*, concrete wall.
- Rybaki Street, Jewish cemetery, located in the eastern part of the city (53°10'38.2"N, 22°05'17.8"E) – *Populus tremula*, stone, gravestones,
- Boczna Street, Jewish cemetery, located in district detached houses (53°10'17.4"N, 22°05'21.5"E) – concrete steles, stone, gravestones, brick,
- Avenue of Legions, “Park Ludowy”, located near provincial road number 677, founded in 1905 (53°10'30.9"N, 22°04'16.5"E) – *Acer platanoides*, *A. pseudoplatanus*, *Aesculus hippocastanum*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Pinus nigra*, *Quercus robur* (natural monument), *Q. rubra*, *Robinia pseudoacacia*, *Salix alba*.
- Wojska Polskiego Street, Park named of the Jakub Waga, located near national road number 63 – including international transit route, founded in 1842, in the central part is a Jakub Waga monument (53°10'50.1"N, 22°04'11.4"E) – *Abies concolor*, *Acer negundo*, *A. platanoides*, *A. pseudoplatanus*, *Betula pendula*, *Fagus sylvatica* (natural monument), *Fraxinus excelsior*, *Padus avium*, *Populus tremula*, *Quercus rubra*, *Salix alba*, *Syringa vulgaris*, *Thuja* sp., *Tilia cordata*, *Ulmus laevis*, wood.
- Przykoszarowa Street, Catholic municipal cemetery, located in the southern part of the city (53°09'28.8"N, 22°03'47.5"E) – *Betula pendula*, *Picea abies*, wooden constructions (cross 1985, bench), granite tombstones, headstones material terrazzo, sett, concrete structures (curb, wall), grout, brick.
- Grobla Jednaczewska Street, located in northern part of the city, on the border with reserve “Rycerski Kierz”, locality from the bridge on Łomżyczka to allotments (53°11'40.7"N, 22°03'44.0"E) – *Acer platanoides*, *Fraxinus excelsior*, *Salix alba*, *Tilia cordata*, *T. platyphyllos*, concrete, brick, wooden bench, metal poles.
- Pope John Paul II the Pilgrim Park (53°09'56.5"N, 22°04'24.8"E) – *Acer platanoides*, *Aesculus hippocastanum*, *Betula pendula*, *Malus sylvestris*, *Populus tremula*, *Robinia pseudoacacia*, *Tilia cordata*, *Quercus rubra*, concrete structures (wall, lighting pole).
- Julian Ursyn Niemcewicz Street, near apartment building number 5 (53°09'27.6"N, 22°04'25.2"E) – *Betula pendula*, *Larix decidua*, *Rhus typhina*, *Robinia pseudoacacia*, *Tilia cordata*, concrete curb.
- Władysław Sikorski Street, locality from the Lutostawski roundabout to the Zawadzka junction of the street (53°10'17.3"N, 22°04'50.8"E) – *Acer platanoides*, *Sorbus domestica*, *Tilia cordata*, wooden structures (pole, bench), concrete structures (posts, sewer drain, wall), brick wall, grout.
- Niepodległości Square, square opposite “Lalki i Aktora” Theatre (53°10'29.2"N, 22°04'45.6"E) – *Acer*

LIST OF LOCALITIES

Mikołaj Kopernik Street, Cathedral cemetery, located in city center, the oldest cemetery in Łomża city, opened in 1801, monument (53°10'22.8"N, 22°04'29.8"E) – *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata*, constructions of: metal, stone and concrete (headstones, crosses, foundations, fence).

Władysław Sikorski Street, locality from the Lutostawski roundabout to the Zawadzka junction of the street (53°10'17.3"N, 22°04'50.8"E) – *Acer platanoides*, *Sorbus domestica*, *Tilia cordata*, wooden structures (pole, bench), concrete structures (posts, sewer drain, wall), brick wall, grout.

Niepodległości Square, square opposite “Lalki i Aktora” Theatre (53°10'29.2"N, 22°04'45.6"E) – *Acer*

platanoides, *Populus tremula*, *Salix alba*, *Sorbus domestica*, *Tilia platyphyllos*, concrete structures (slab, board, cur), metal structures (lighting poles, manhole).

Fabryczna Street, around the production plant "Bona" (53°10'34.5"N, 22°03'29.2"E) – dead tree, wooden structure (fence, pole), concrete structures (pole, curb, wall, manhole, posts).

Senatorska 13 Street, High School number 13, located near town hall (53°10'39.7"N, 22°05'04.7"E) – *Acer platanoides*, *Betula pendula*, *Quercus rubra*, *Tilia cordata*, wooden constructions (bench), concrete structures.

Piękna Street (53°10'59.1"N, 22°04'27.0"E) – *Acer platanoides*, *Aesculus hippocastanum*, *Betula pendula*, *Larix decidua*, *Sorbus intermedia*, *Symphocarpos albus*, *Tilia cordata*, wooden structure (wall, pole), stone constructions (wall), grout.

Nowogrodzka 60 Street, Forestry Offices of Łomża, located near locality number 6 (53°11'02.3"N, 22°03'46.3"E) – *Sorbus intermedia*.

Marszałek Józef Piłsudski Street, Provincial Hospital area (53°09'39.6"N, 22°05'14.7"E) – *Acer platanoides*, *Sorbus intermedia*, *Tilia cordata*, dead *Sorbus intermedia*, concrete constructions (wall, slab), metal grille.

Wojska Polskiego Street, from Ciepła Street to Studencka Street, located on National road number 61 (53°10'29.2"N, 22°02'08.5"E) – *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata*, dead tree trunk, concrete structures (foundation, the basics of advertising banners).

Adam Mickiewicz Street, located near Primary school number 7 (53°10'15.5"N, 22°04'06.0"E) – *Quercus robur*, concrete constructions (slab, pole, wall).

Kaktusowa Street (53°10'41.4"N, 22°03'53.4"E) – *Quercus robur*, concrete constructions (pole, curb).

Farna Street (53°10'43.0"N, 22°04'48.9"E) – *Tilia cordata*, *T. platyphyllos*, concrete constructions (wall).

Książna Anna Street, located in sports and recreation complex (53°09'57.1"N, 22°04'59.2"E) – *Acer saccharinum*, *Betula pendula*, *Picea abies*, *Sorbus aucuparia*, *S. intermedia*, concrete structures (foundation, pole).

Poznańska 148 Street, located near Browar Łomża (53°09'33.4"N, 22°02'11.6"E) – concrete structures (poles), metal constructions (poles).

Józef Bem Street, from Władysław Broniewski Street to Władysław Reymont Street (53°09'51.9"N, 22°03'53.4"E) – *Acer saccharinum*, *Sorbus intermedia*, *Tilia cordata*, *T. platyphyllos*, wooden structures (decorative fence), concrete structures (lighting poles, curb, posts).

Kręta Street – *Pinus sylvestris*, *Rhus typhina*, concrete structures (curb, pole, wall), sett (53°10'42.7"N, 22°03'22.4"E).

Janusz Korczak Street (53°10'40.2"N, 22°03'08.3"E) – *Betula pendula*, *Fraxinus excelsior*, *Rhus typhina*, con-

crete structures (pole, posts, wall), metal structures (fence, screw),

Piaski Street, from Świerkowa street to Podleśna street, locality located on "Maria" residential (53°10'42.5"N, 22°02'12.2"E) – *Tilia cordata*, wooden structure (pole), concrete structures (wall, pole), metal structure (fence).

Piwna Street (53°10'36.5"N, 22°02'37.2"E) – *Salix alba*, concrete structures (poles, manhole), eternity tiles.

Polygonowa Street (53°08'55.8"N, 22°02'13.5"E) – *Pinus sylvestris*, *Sambucus nigra*, felled tree trunk.

Marszałek Józef Piłsudski Street, from Poznańska Street to Spokojna Street (53°10'11.3"N, 22°02'48.2"E) – wooden structures (post), concrete structure (pole).

Zjazd Street, locality on the border with Piątница (53°11'24.4"N, 22°05'24.2"E) – *Tilia cordata*, concrete structures (poles).

Highway to Mężenin (53°09'08.1"N, 22°03'37.6"E) – *Acer pseudoplatanus*, *Tilia cordata*, *Picea abies*, concrete structure (fence).

Avenue of Legions, locality on the border with Konarzyce (53°08'59.0"N, 22°02'53.3"E) – *Fraxinus excelsior*.

Szosa Zambrowska Street (53°09'46.1"N, 22°05'30.9"E) – *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata*, concrete structures (curb, posts).

DISCUSSION

The lichen biota of Łomża consists of 70 species of lichens. This number is relatively small considering the results of research conducted in a similar type of cities in other parts of the country. In Poland, it has been studied more than 50 cities (MATWIEJUK & KOROBKIEWICZ 2012b). A similar number of species recorded in Lublin – 73 (RYDZAK 1953), Międzyzdroje – 68 (IZYDOREK 2005) and Świnoujście – 74 (IZYDOREK 2005). The greatest number of species recorded in Olsztyn – 251 (KUBIAK 2005). In north-eastern Poland, in Narew 97 species of lichens were observed (MATWIEJUK & KOROBKIEWICZ 2012a), in Mielnik – 91 (MATWIEJUK 2008), in Drohiczyń – 86 (MATWIEJUK 2009b) (Table 4).

The small number of lichen species in Łomża can be conditioned by the absence of forest complexes in the city. The lichen biota of Łomża have been not recorded species lichens characteristic for forest areas. For comparison the city of Olsztyn area is characterized, as compared to other Polish cities, by a much higher overall number of lichens taxa, higher number of rare, protected and threatened species as well as a lower number of locally rare taxa. In Olsztyn, more than 21% of the city area is taken by the municipal forest. The indicators of lowland old-growth forests, to a limited extent, is one of the most characteris-

Table 4. The summarizes of the number of species of lichens in cities in the Podlasie voivodeship similar size to Łomża based on literature and own data

City	Literature	Number of species						
		total	corticolous	lignicolous	saxicolous	terricolous	muscicolous	other
Łomża		70	39	15	34	1	3	5
Supraśl	Matwiejuk (2015)	89	57	46	39	–	7	9
Ciechanowiec	Matwiejuk & Kolanko (2007)	114	57	54	41	22	4	10
Mielnik	Matwiejuk (2008)	91	47	26	38	13	2	1
Boćki	Matwiejuk (2009a)	118	57	41	38	31	2	15
Drohiczyn	Matwiejuk (2009b)	86	44	6	32	15	–	–
Narew	Matwiejuk & Korkobkiewicz (2012a)	97	38	50	36	19	–	20

tic elements of the local biota differentiating Olsztyn from among other Polish cities (KUBIAK 2005).

Epiphytes are the most numerous habitat group in cities. The analysed towns differ due to a significant number of species growing on the bark of trees and shrubs (Białowieża – 68 species, Limanowa – 60, Supraśl, Ciechanowiec, Boćki – 57, Drohiczyn – 44, Drezdenko – 39, Narew – 38, Łomża – 39). Their rich species variety and abundant occurrence highlights the maintenance of biocenotic structures deformed to an insignificant extent by anthropopressure.

The number of epiphytes in Polish cities is comparable to the cities such as in Ukraine, and Italy. In Ukrainian and Italian cities where both suburban forests and the built-up area have been investigated and all available tree species have been monitored, only 35–60 epiphytic lichen species have been recorded, e.g. 38 species in Kherson (KHODOSOVTSSEV 1995), 48 in Lviv (KONDRATYUK et al. 1991), 56 in Chernigiv (ZELENKO 1999) 57 in Sienna (LOPPI et al. 2002) and 65 in Kyiv (DYMOTROVA 2009).

Among the lichens colonizing secondary rock substrata the most frequently represented habitat group are calciphilous lichens bound up with concrete. These species are spread especially in city zone. The most common-place species are *Lecanora albescens*, *L. dispersa*, *Calogaya decipiens*, *C. pusilla*, *Candelariella aurella*, *Phaeophyscia orbicularis*, *Xanthoria parietina*. They frequently cover large surfaces, especially the old plaster of houses, walls and poles.

In Łomża, as in other parts of the country, the presence of epixyloous lichens is marked on the wooden buildings, fences around fields, buildings, gardens, pillars (MATWIEJUK 2008, 2009a, b). The list of this group is dominated by common lichen taxa and those exhibiting a wide range of ecological spectrum, developing both on the wood and the bark of trees and on soil.

Terricolous lichens have been found outside urban settlements, primarily in forest fragments, grassland, on sandy wasteland situated in the vicinity of the administrative boundaries of the city and on the outskirts. In all of the towns, a group of species can

be differentiated, the ones which have found here optimal living conditions.

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