ISSN 1644-0692
www.acta.media.pl

ACTA SCIENTIARUM POLONORUM *Acta Sci. Pol. Hortorum Cultus, 14(3) 2015, 63-80*

FUNGI OCCURRED ON TURFGRASSES IN LAWN MAINTENANCE

Irena Kiecana, Małgorzata Cegiełko, Elżbieta Mielniczuk
University of Life Sciences in Lublin

Abstract. In recent years there has been an increasing interest in lawns and their appearance. Diseases affecting lawns, of which the causative agents can be various pathogens, reduce their quality. The study was conducted in two urban centers in the region of south-eastern Poland – in the years 2006 and 2007 in Lublin and in 2007 in Zamość, both in sunny and in partly shaded places. The species composition of the grass sward and the severity of leaf infection were determined as well as mycological analysis of infected plants was carried out. In the case of the lawns in Lublin, the mean values of the disease indices for the leaves of the investigated turfgrasses were from 53.75 to 83.00 in the spring of 2006, while in spring of 2007 from 6.75 to 29.00. The mean values of the leaf disease indices determined in autumn of 2006 were from 16.00 to 86.25, whereas in autumn of 2007 from 4.50 to 21.25. The mean values of the disease indices for leaves of the turfgrasses studied in Zamość were from 24.50 to 48.25 in the spring of 2007, while in the autumn of that year they ranged from 28.00 to 54.75. *Microdochium nivale* was a great threat to turfgrasses in lawn culture in spring, whereas the cause of leaf spot of turfgrasses in the autumn were species *B. sorokiniana* and *D. siccans*. As far as the lawns in both cities are concerned, species of the genus *Fusarium*, in particular *Fusarium culmorum*, had a high percentage in root infection both in the spring and in the autumn.

Key words: turfgrass, root and leaf pathogens, Fusarium spp., Microdochium nivale, Bipolaris sorokiniana, Drechslera siccans

INTRODUCTION

Turfgrasses have varying soil and moisture requirements and differently respond to treading, mowing, and weather conditions. Due to this diversity of plants, lawns can be established in sunny or partly shaded places, on lightly sandy or cohesive clayey soils [Rutkowska and Pawluśkiewicz 1996].

Corresponding author: Irena Kiecana, Department of Phytopathology and Mycology, University of Life Sciences in Lublin, Leszczyńskiego 7, 20-069 Lublin, Poland, e-mail: irena.kiecana@up.lublin.pl

Diseases affecting lawns, which causative agents can be various pathogens, reduce their quality to a great extent [Prończuk 2000].

Species of the genus *Pyrenophora*, anamorph *Drechslera*, are one of the causes of the incidence of leaf spot diseases in grasses in lawn culture [Vargas 1994, Paul 1995, Prończuk 2000, Czembor 2002].

Drechslera siccans (Drechsler) Shoem., teleomorph *Pyrenophora lolii* Dovaston, is the species that causes brown blight on the leaves of turfgrasses sown in urban lawns or in sports facilities [Paul 1995]. This fungus causes round brown spots or streaks with a yellow halo occurring on the leaf. Initially, these spots are small and brown, with a white center, but with time they quickly enlarge inducing leaf blade necrosis or death of whole plants in a case of severe infection [Vargas 1994].

Bipolaris sorokiniana (Sacc.) Shoem., teleomorph *Cochliobolus sativus* Ito et Kurib., is a serious threat to turfgrasses [Prończuk 2000, Wiewióra and Prończuk 2000, Kiecana et al. 2012]. This pathogen can colonize grass leaves, stems, roots, stolons, and seeds [Vargas 1994, Prończuk 2000, Kiecana et al. 2012]. This fungus is the cause of seedling damping-off, leaf spot disease, and root necrosis [Kutrzeba 1994, Kiecana et al. 2012].

Fungi of the genus *Fusarium* are the cause of turf damage and leaf drying in hot summers with occasional showers. These fungi can damage grasses at various growth stages and at different seasons of the year. Fungi of the genus *Fusarium* form characteristic ring-shaped patches with healthy plants in their centre. Spots on the leaves can also have a form of streaks [Prończuk 1996, 1998, 2000].

Fusarium culmorum, *F. crookwellense*, *F. equiseti*, *F. graminearum*, and *F. acuminatum* play a significant role in damaging the leaves of turfgrasses [Prończuk 2000]. *Fusarium culmorum* occurs on leaves, roots, and stolons of infected grasses, including *Lolium perenne* [Prończuk 1996, 1998, 2000]. *Fusarium crookwellense* has been determined to be the cause of *Fusarium* blight of turfgrasses [Prończuk 1998].

The widespread use of turfgrasses for setting up different kinds of lawns and disturbing informations in phytopathological literature about the healthiness of turfgrasses led to the research on fungi worsening the aesthetic values of different kinds of lawns both in partly shaded and sunny places in the years 2006 and 2007 in Lublin and in 2007 in Zamość.

MATERIAL AND METHODS

The present study was conducted on four lawns in the city of Lublin in the years 2006 and 2007 as well as in five lawns in the city of Zamość in 2007, both in sunny places and in partly shaded places under tree crowns (tab. 1, 2).

The study analyzed selected lawn spaces, including park, ornamental, and recreational lawn types. The species composition of the grass sward and the severity of leaf infection were determined as well as mycological analysis of infected plants was carried out to determine the pathogens that caused the damage to leaves and roots of grasses under natural infection conditions.

Table 1. Type and characteristic of selected lawns in Lublin in the years 2006–2007

No	Lawn type	Localization of the lawn	Turfgrass species on the lawn
I	ornamental	partly shaded places	*L. perenne, F. rubra*, *P. pratensis*
II	ornamental	partly shaded places	*L. perenne, P. pratensis*
III	recreational lawn	sunny place	*L. perenne, F. rubra*, *P. pratensis*
IV	Lawn on a slope	partly shaded places	*L. perenne, F. rubra*, *P. pratensis*

In each year of observation, a 25 m^2 study area was delineated in selected lawns in Lublin and in Zamość, and plants were collected from these study areas along the diagonal and parallel to it. The individual patches from which plant material was sampled had a surface area of 25 cm^2 (5 × 5 cm) and sampling was done in five replicates in each designated area. Each sample included only plants from the family *Poaceae*. Turfgrass species were identified using the key of Jargiełło et al. [1998].

The first observation of the lawns in Lublin was carried out in the spring, on April 20, 2006, and on May 11, 2007, while the second one was conducted on October 24, 2006, and on October 18, 2007. The first observation in Zamość was made on April 10, 2007, whereas the second one on November 13, 2007.

Table 2. Type and characteristic of selected lawns in Zamość in 2007

No	Lawn type	Localization of the lawn	Turfgrass species on the lawn
I	ornamental	partly shaded places	*Festuca rubra* L., *Poa pratensis* L., *Lolium perenne* L.
II	park	partly shaded places	*P. pratensis*, *P. trivialis*, *Bromus mollis* L.
III	ornamental	partly shaded places	*P. pratensis*, *B. mollis*, *L. perenne*
IV	ornamental	sunny place	*L. perenne*, *P. pratensis*, *B. mollis*
V	ornamental	sunny place	*L. perenne*, *Dactylis glomerata* L.

The material for laboratory analysis consisted of infected plants collected from the spaces investigated. In the laboratory, the percentage of infected leaves and the severity of infection of 100 randomly selected leaves for each sample (25 × 4) were determined following the scale of Zimowska and Machowicz-Stefaniak [2004].

This assessment of leaf health was used to calculate the disease index according to McKinney's formula [Łacicowa 1969]. Having determined the disease index for four individual replicates, the mean value of the disease index was calculated for each lawn. The obtained data were statistically analyzed [Żuk 1989]. The leaves with leaf spot symptoms and the roots of the sampled plants were subjected to mycological analysis.

To isolate pathogens colonizing the plant material studied, the Petri dish method was applied using mineral culture medium with the composition given by Mielniczuk et al. [2010], prepared on a decoction of grass leaves (a decoction of 500 g of leaves was used per 1000 ml of medium). For each sample taken from the lawns, 100 root pieces and

100 leaf pieces were placed on the medium. The monographs and keys for identification of fungal species from diseased rye plants were used to identify fungi isolated from the plant material [Kiecana et al. 2009].

Information on the weather conditions in the area of the study were obtained from the Department of Agrometeorology and Environmental Protection and Management, the University of Life Sciences in Lublin.

RESULTS

The observations of the four urban lawns situated in the central part of Lublin both in partly shaded places and in sunny places, conducted in the spring and autumn of 2006 and 2007 showed visible disease symptoms to occur on the leaves and roots of turfgrasses. These changes related to the appearance of both single leaves and the entire turf.

In spring, disease symptoms appeared in the form of gray spots in the turf. These spots merged to form large patches of dead plants. The leaves of infected plants were chlorotic, yellow, or completely dead. During sunny weather, in particular in the spring of 2006, infected leaves were covered with a salmon-pink coating of *Microdochium nivale* mycelium and sporodochia.

In autumn, on the other hand, black-brown spots of different shapes and sizes with a yellow-orange rim occurred on the leaf blades and sheaths; these spots started from the tip of the leaf blade and extended towards the leaf sheath. Necrosis of the leaf tips and also complete death of leaves were observed.

During the spring observation of the urban lawns in Lublin, the percentage of infected leaves ranged from 95 to 100% in 2006, whereas in 2007 from 13 to 44% (fig. 1). At the time of the autumn observation conducted in the above-mentioned city over the period 2006–2007, the percentage of infected leaves in the lawns analyzed ranged respectively from 27 to 83% and from 11 to 32% (fig. 2).

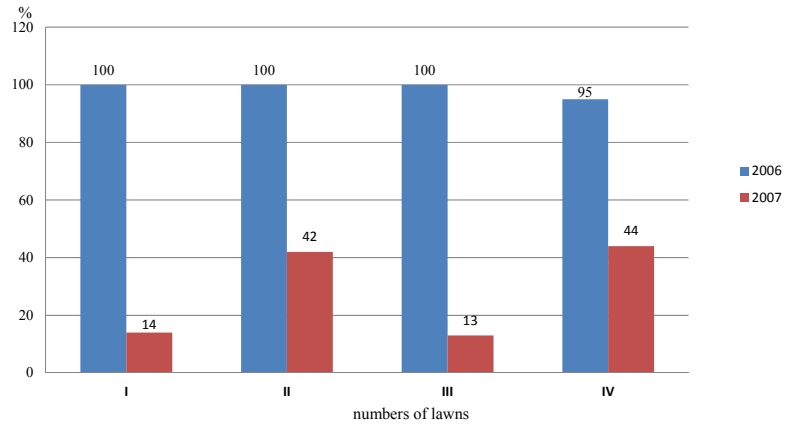

Fig. 1. The percentage of leaves with disease symptoms on selected urban lawns in Lublin during the spring observation in the years 2006–2007

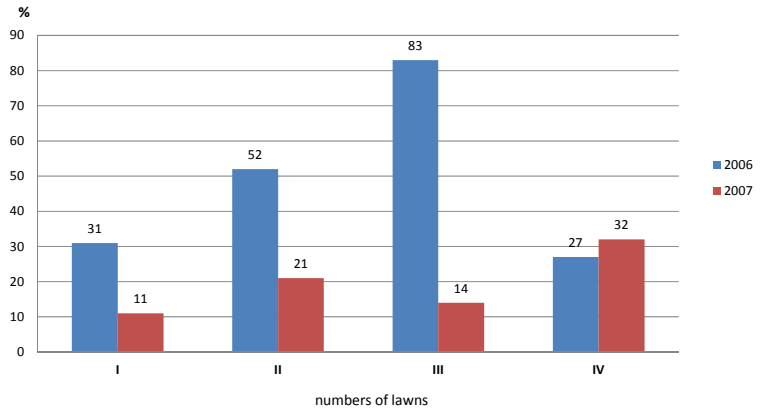

Fig. 2. The percentage of leaves with disease symptoms on selected urban lawns in Lublin during the autumn observation in the years 2006–2007

In the case of the lawns in Lublin, the mean values of the disease indices for leaves of investigated turfgrasses ranged from 53.75 to 83.00 in the spring of 2006, while in the spring of 2007 from 6.75 to 29.00, and they differed significantly. The mean values of the leaf disease indices determined in the autumn of 2006 were from 16.00 to 86.25, whereas in the autumn of 2007 from 4.50 to 21.25, and they differed significantly (tab. 3).

Table 3. Mean values of disease indices for the leaves of the investigated turfgrasses on the lawns in Lublin in years 2006–2007 and in Zamość in 2007

Number of lawn	Growing season					
	Lublin				Zamość	
	2006		2007		2007	
	1	2	1	2	1	2
I	83.00c	86.25d	14.00b	13.50b	48.25b	54.75b
II	59.50ab	27.50b	29.00c	21.25c	32.25a	48.00a
III	80.75b	53.00c	6.75a	4.50a	37.75a	48.25a
IV	53.75a	16.00a	27.25c	18.25c	24.50a	28.00a
V	–	–	–	–	30.25a	53.25a

1 – spring, 2 – autumn
Mean values in columns followed by the same letter do not differ significantly at $p \leq 0.05$

The percentage of leaves with disease symptoms determined for the five urban lawns investigated in Zamość, during the observations conducted in the spring and autumn of 2007, was respectively from 62 to 80% and from 51 to 92% (fig. 3). The mean values of the disease indices for leaves of the turfgrasses studied in Zamość were from 24.50 to 48.25 in the spring of 2007, while in the autumn of that year they ranged from 28.00 to 54.75 and differed significantly (tab. 3).

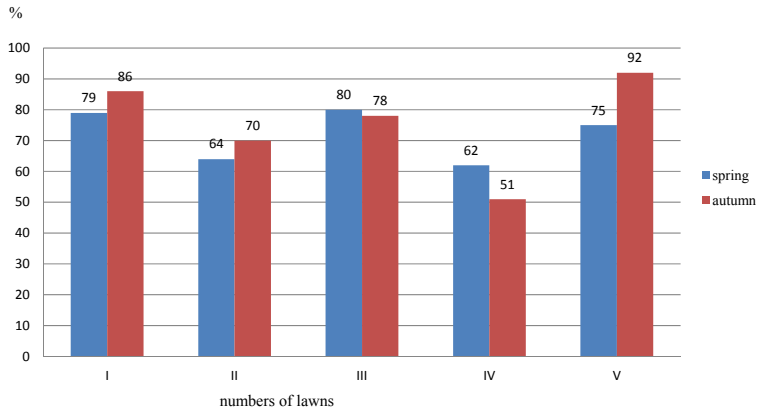

Fig. 3. The percentage of leaves with disease symptoms on selected urban lawns in Zamość during spring and autumn observations in 2007

The mycological analysis of plants sampled from the lawns in Lublin in the spring of 2006 and in Zamość in 2007 showed in particular the presence of *Microdochium nivale* on the leaves. Colonies of this fungus accounted respectively for 43.19 and 10.56% of all isolations in spring in the above-mentioned years of the study (tab. 4, 6). In the spring of 2006, 514 fungal isolates (186 from the roots and 328 from the leaves), represented by 20 species and some non-sporulating forms, were isolated from the infected turfgrasses collected from the urban lawns in Lublin (tab. 4). 327 fungal isolates (97 from the roots and 230 from the leaves), belonging to 11 species and some non-sporulating mycelia, were obtained from the plants sampled from the a.m. lawns in the spring of 2007 (tab. 5).

In case of turfgrass plants taken from the lawns in Zamość in spring of 2007, 303 fungal isolates were cultured (84 from the roots and 219 from the leaves), belonging to 13 species and some non-sporulating forms (tab. 6).

As far as lawns in both these cities are concerned, species of the genus *Fusarium* had a high percentage in root infection in the spring. The species *Fusarium culmorum* had the highest proportion in root damage in the spring, both in the lawns in Lublin and in Zamość. *F. avenaceum* and *F. oxysporum* were also found on grass roots in Lublin and in Zamość in the spring each year, while *F. equiseti* was isolated from roots in Lublin in 2006 and in Zamość in 2007. The species *F. sporotrichioides* was recorded on roots of the plants collected from the lawns in Lublin in 2006, whereas *F. poae* was isolated from the grass roots sampled from the lawns in Lublin and in Zamość in 2007. *Cylindrocarpon obtussisporum*, also contributed to fungal colonization of the grass roots in Lublin in the spring of both years of the study and its isolates accounted for 0,78% in 2006 and 5.20% of all isolates in 2007 (tab. 4–5). The roots of the turfgrasses in the spring were colonized by the species *Penicillium verrucosum* var. *cyclopium* in Lublin in both study years and in Zamość in 2007, whereas in Lublin *P. verrucosum* var. *verrucosum* was also found on the grass roots in the spring of 2006 and 2007

Table 4. Fungi isolated from roots and leaves of turfgrasses collected from the selected lawns in Lublin cultivated on mineral medium prepared on a decoction of grass leaves in 2006

Fungi species	Number of isolates										Total	% of isolates
	I		II		III		IV		total			
	r	l	r	l	r	l	r	l	r	l		
Acremonium murorum (Corda) W. Gams	0(0)	0(0)	2(0)	0(0)	0(0)	0(0)	4(0)	0(0)	6(0)	0(0)	6(0)	1.17(0)
Alternaria alternata (Fr.) Keissler	0(13)	10(11)	0(8)	8(0)	0(0)	8(0)	1(1)	14(5)	1(22)	40(16)	41(38)	7.98(7.26)
Aureobasidium pullulans De Barry Arnaud	3(3)	0(0)	0(0)	0(0)	0(0)	0(0)	2(3)	0(0)	5(6)	0(0)	5(6)	0.97(1.15)
Chaetomium globosum Kunze	0(0)	0(0)	0(0)	0(0)	1(0)	0(0)	0(0)	0(0)	1(0)	0(0)	1(0)	0.19(0)
Cylindrocarpon obtusisporum Cooke and Harkness	0(0)	0(0)	4(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4(0)	0(0)	4(0)	0.78(0)
Epicoccum nigrum Link ex Link	0(0)	0(3)	0(1)	5(12)	1(0)	0(4)	0(1)	3(8)	1(2)	8(27)	9(29)	1.75(5.55)
Fusarium avenaceum (Fr.) Sacc.	0(15)	19(39)	0(0)	0(0)	1(0)	0(0)	0(0)	0(0)	1(15)	19(39)	20(54)	3.89(10.33)
Fusarium crookwellense Burgess, Nelson, Toussoun	0(0)	1(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(0)	1(0)	0.19(0)
Fusarium culmorum (W.G.Sm.) Sacc.	1(21)	3(42)	15(30)	0(78)	7(20)	0(25)	5(28)	0(66)	28(99)	3(211)	31(310)	6.03(59.27)
Fusarium equiseti (Corda) Sacc.	1(1)	0(0)	0(0)	0(0)	0(2)	28(0)	6(6)	0(0)	7(9)	28(0)	35(9)	6.81(1.72)
Fusarium graminearum Schwabe	0(0)	0(0)	0(0)	0(0)	0(0)	1(0)	0(0)	0(0)	0(0)	1(0)	1(0)	0.20(0)
Fusarium oxysporum Schlecht.	7(5)	0(0)	3(2)	0(0)	1(1)	0(0)	9(10)	0(0)	20(18)	0(0)	20(18)	3.89(3.44)
Fusarium sporotrichioides Sherb.	1(0)	0(0)	1(0)	0(0)	0(1)	0(3)	0(3)	0(8)	2(4)	0(11)	2(15)	0.39(2.87)
Microdochium nivale (Fr.) Samuels & Hallett	2(0)	58(0)	0(0)	65(0)	0(0)	63(0)	0(0)	34(0)	2(0)	220(0)	222(0)	43.19(0)
Mucor hiemalis Wehmer	0(0)	7(0)	0(0)	0(0)	0(0)	1(1)	1(1)	0(0)	1(1)	8(1)	9(2)	1.75(0.38)
Penicillium nigricans Bainier ex Thom	1(1)	0(0)	0(0)	0(0)	3(2)	0(0)	0(0)	0(0)	4(3)	0(0)	4(3)	0.78(0.57)
Penicillium verrucosum Dierckx var. *cyclopium* (West) Samson, Stolk & Hadlok	18(2)	0(0)	3(3)	0(1)	10(3)	0(0)	8(5)	0(1)	39(13)	0(2)	39(15)	7.59(2.87)
Penicillium verrucosum var. *verrucosum* Westling Samson	0(0)	0(0)	1(0)	0(0)	0(0)	0(0)	20(0)	0(0)	21(0)	0(0)	21(0)	4. 09(0)
Periconia macrospinosa Lefebvre & Aar.G. Johnson	0(0)	0(0)	0(0)	0(0)	2(0)	0(0)	0(0)	0(0)	2(0)	0(0)	2(0)	0.39(0)
Truncatella angustata (Pers.) S. Hughes	14(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	14(0)	0(0)	14(0)	2.72(0)
Non sporulated forms	11(0)	0(0)	10(0)	0(0)	2(5)	0(9)	4(4)	0(6)	27(9)	0(15)	27(24)	5.25(4.59)
Total	59(61)	98(95)	39(44)	78(91)	28(34)	101(42)	60(62)	51(94)	186(201)	328(322)	514(523)	100(100)

I–IV – numbers of lawns, r – roots, I – leaves; values before brackets determine number and percent of isolates obtained in the spring in brackets number and percent of isolates obtained in the autumn

Table 5. Fungi isolated from roots and leaves of turfgrasses collected from the selected lawns in Lublin cultivated on mineral medium prepared on a decoction of grass leaves in 2007

Fungi species	Number of isolates										Total of isolates	(%)
	I		II		III		IV		total			
	r	l	r	l	r	l	r	l	r	l		
Alternaria alternata (Fr.) Keissler	4(4)	42(2)	0(0)	1(18)	0(6)	20(0)	0(0)	0(0)	4(10)	63(20)	67(30)	20.49(6.88)
Botrytis cinerea Pers.	1(0)	0(0)	0(2)	0(0)	0(0)	0(0)	0(0)	0(0)	1(2)	0(0)	1(2)	0.31(0.46)
Bipolaris sorokiniana Sacc. Shoem.	0(0)	0(0)	0(0)	0(12)	0(0)	0(0)	0(14)	0(0)	0(14)	0(12)	0(26)	0(5.96)
Chaetomium globosum Kunze	0(0)	0(0)	0(0)	0(0)	0(0)	3(0)	0(0)	0(0)	0(0)	3(0)	3(0)	0.92(0)
Cylindrocarpon obtusisporum Cooke and Harkness	6(0)	0(0)	3(0)	0(0)	8(0)	0(0)	0(0)	0(0)	17(0)	0(0)	17(0)	5.20(0)
Epicoccum nigrum Link ex Link	0(6)	0(2)	4(0)	5(0)	0(0)	2(0)	0(0)	0(0)	4(6)	7(8)	11(14)	3.36(3.21)
Fusarium avenaceum (Fr.) Sacc.	5(10)	0(10)	0(14)	0(0)	0(0)	2(0)	0(0)	6(8)	5(24)	8(18)	13(42)	3.97(9.63)
Fusarium crookwellense Burgess, Nelson, Toussoun	0(0)	0(0)	0(0)	0(0)	0(6)	0(20)	0(0)	0(0)	0(6)	0(20)	0(26)	0(5.96)
Fusarium culmorum (W.G.Sm.) Sacc.	10(2)	38(2)	22(18)	9(16)	0(44)	0(48)	4(0)	27(34)	36(64)	74(100)	110(164)	33.64(37.61)
Fusarium equiseti (Corda) Sacc.	0(0)	0(0)	0(0)	0(0)	0(6)	0(0)	0(0)	0(0)	0(6)	0(0)	0(6)	0(1.38)
Fusarium oxysporum Schlecht.	3(0)	0(0)	0(0)	0(0)	8(0)	0(0)	0(4)	3(0)	11(4)	3(0)	14(4)	4.28(0.92)
Fusarium poae (Peck) Wollenw.	3(2)	4(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	3(2)	4(0)	7(2)	2.14(0.46)
Penicillium verrucosum Dierckx var. *cyclopium* (West) Samson, Stolk & Hadlok	0(22)	3(8)	4(0)	3(10)	0(0)	0(0)	0(6)	0(0)	4(28)	6(18)	10(46)	3.06(10.55)
Penicillium verrucosum var. *verrucosum* Westling Samson	0(0)	0(0)	0(0)	0(0)	2(0)	29(0)	0(0)	0(0)	2(0)	29(0)	31(0)	9.48(0)
Pythium spp.	0(0)	0(0)	0(0)	0(0)			0(8)	0(0)	0(8)	0(0)	0(8)	0(1.84)
Trichoderma viride Rifai	0(0)	0(0)	0(0)	0(0)	0(30)	0(0)	0(0)	0(0)	0(30)	0(0)	0(30)	0(6.88)
Non sporulated forms	0(0)	0(6)	4(16)	0(0)	4(0)	9(10)	2(4)	24(0)	10(20)	33(28)	43(36)	13.15(8.26)
Total	32(46)	87(30)	37(50)	18(56)	22(92)	65(78)	6(36)	60(48)	97(224)	230(212)	327(436)	100(100)

I–IV – numbers of lawns, r – roots, I – leaves; values before brackets determine number and percent of isolates obtained in the spring in brackets number and percent of isolates obtained in the autumn

Table 6. Fungi isolated from roots and leaves of turfgrasses collected from the selected lawns in Zamość cultivated on mineral medium prepared on a decoction of grass leaves in 2007

Fungi species	Number of isolates												Total of isolates	% of isolates
	I		II		III		IV		V		total			
	r	l	r	l	r	l	r	l	r	l	r	l		
Alternaria alternata (Fr.) Keissler	3(10)	47(4)	11(6)	13(19)	1(1)	12(35)	0(14)	50(14)	0(5)	0(11)	15(38)	122(83)	137(121)	45.21(22.41)
Aspergillus niger Tiegh.	0(0)	0(0)	0(0)	0(0)	0(4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(4)	0(0)	0(4)	0(0.74)
Chaetomium globosum Kunze	0(0)	0(0)	0(0)	3(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1(0)	0(0)	4(0)	4(0)	1.32(0)
Cladosporium cladosporioides (Fresen.) G.A. de Vries	0(11)	0(7)	0(0)	0(0)	0(0)	0(0)	0(1)	0(0)	0(0)	0(0)	0(12)	0(7)	0(19)	0(3.52)
Drechslera siccans (Drechsler) Shoemaker	0(0)	4(0)	0(0)	0(5)	0(0)	0(0)	0(0)	4(10)	0(0)	0(0)	0(0)	8(15)	8(15)	2.64(2.78)
Epicoccum nigrum Link ex Link	0(6)	0(19)	1(6)	1(0)	0(0)	10(15)	1(0)	0(0)	0(3)	0(7)	2(15)	11(41)	13(56)	4.29(10.37)
Fusarium avenaceum (Fr.) Sacc.	2(0)	2(0)	0(0)	0(0)	1(0)	0(4)	4(0)	1(1)	0(0)	0(0)	7(0)	3(5)	10(5)	3.30(0.93)
Fusarium culmorum (W.G.Sm.) Sacc.	2(1)	0(0)	11(12)	0(11)	0(37)	0(16)	5(19)	10(0)	2(0)	6(1)	20(69)	16(28)	36(97)	11.88(17.96)
Fusarium equiseti (Corda) Sacc.	2(0)	0(0)	0(0)	0(0)	1(6)	2(2)	6(0)	0(2)	0(0)	0(0)	9(6)	2(4)	11(10)	3.63(1.85)
Fusarium oxysporum Schlecht.	0(0)	0(0)	0(2)	0(0)	6(0)	0(0)	0(2)	0(0)	0(0)	0(0)	6(4)	0(0)	6(4)	1.98(0.74)
Fusarium poae (Peck) Wollenw.	0(0)	0(0)	0(0)	0(0)	3(0)	0(0)	0(0)	0(0)	0(0)	0(0)	3(0)	0(0)	3(0)	0.99(0)
Fusarium solani (Mart.) Sacc.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(9)	0(0)	0(0)	0(0)	0(9)	0(0)	0(9)	0(1.67)
Fusarium sporotrichioides Sherb.	0(0)	0(0)	0(0)	0(0)	0(32)	0(0)	0(6)	0(1)	0(0)	0(3)	0(38)	0(4)	0(42)	0(7.78)
Microdochium nivale (Fr.) Samuels & Hallett	0(0)	10(0)	0(0)	12(0)	0(0)	5(0)	0(0)	0(0)	1(0)	4(0)	1(0)	31(0)	32(0)	10.56(0)
Penicillium verrucosum Dierckx var. *cyclopium* (West) Samson, Stolk & Hadlok	1(9)	1(16)	0(1)	6(0)	0(0)	1(1)	0(10)	1(9)	1(36)	1(4)	2(56)	10(30)	12(86)	3.96(15.93)
Periconia macrospinosa	0(4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(4)	0(0)	0(4)	0(0.74)
Stemphylium botryosum Sacc.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(2)	0(0)	0(2)	0(0)	0(2)	0(0.37)
Trichoderma aureoviride Rifai	0(0)	0(0)	3(0)	0(0)	0(0)	5(0)	0(0)	0(0)	0(0)	0(0)	3(0)	5(0)	8(0)	2.64(0)
Trichoderma viride Rifai	0(0)	0(6)	0(0)	0(0)	1(2)	0(7)	0(0)	0(16)	4(0)	0(0)	5(2)	0(29)	5(31)	1.65(5.74)
Non sporulated forms	3(2)	2(0)	2(3)	4(0)	0(0)	0(0)	0(0)	1(8)	6(0)	0(0)	11(5)	7(8)	18(13)	5.94(3.16)
Total	13(43)	66(55)	28(33)	39(35)	13(87)	35(80)	16(74)	67(61)	14(46)	12(26)	84(283)	219(257)	303(540)	100(100)

I–IV – numbers of lawns, r – roots, I – leaves; values before brackets determine number and percent of isolates obtained in the spring in brackets number and percent of isolates obtained in the autumn

(tab. 4–6). In the spring of 2006 and 2007 in Lublin and in 2007 in Zamość the roots and leaves were colonized by the species *Alternaria alternata*, whose isolates constituted respectively 7.98 and 20.49% of all isolates in Lublin, while in Zamość 45.21% of all colonies obtained (tab. 4–6). The leaves of the grasses in the urban lawns in Lublin were colonized by the species *F. avenaceum* and *F. culmorum* in the spring of both years of the study and in Zamość in 2007, whereas *F. equiseti* was found on the leaves in Lublin in 2006 and in Zamość in 2007, with 28 isolates and 2 isolates, respectively. In Lublin in 2006, the species *F. crookwellense* and *F. graminearum* colonized the grass leaves, whereas *F. poae* in 2007 (tab. 4–5). The mycological analysis of the leaves sampled from the lawns in Zamość in the spring showed the presence of *Drechslera siccans,* whose isolates accounted for 2.64% of all isolates (tab. 6).

As a result of the mycological analysis of grass plants taken from urban lawns in Lublin in autumn 2006, 523 fungal isolates were isolated (201 from the roots and 322 from the leaves) (tab. 4). The cultured colonies belonged to 11 species (tab. 4). On the other hand, 436 isolates (224 from the roots and 212 from the leaves) were obtained from the plants collected from the lawns in Lublin in the autumn of 2007. The obtained colonies belonged to 12 species, *Pythium* spp., and non-sporulating forms (tab. 5). 540 isolates (283 from the roots and 257 from the leaves), which belonged to 15 species and non-sporulating forms, were cultured from the plants collected from the lawns located in Zamość in the autumn of 2007 (tab. 6). In autumn, similarly as in the case of the observation carried out in the spring, fungi of the genus *Fusarium* were also represented in large numbers. In 2006 and 2007, they made up respectively 77.63 and 55.96% of all isolates from the plants taken from the lawns in Lublin and 30.93% of all colonies obtained from the plants sampled from the lawns in Zamość (tab. 4–6). *F. culmorum* contributed to the damage of the grass leaves and roots in the autumn of both years of the study in Lublin and in 2007 in Zamość; its isolates accounted respectively for 59.27 and 37.61% of all isolates in Lublin and for 17.96% of all isolates in Zamość (tab. 4–6). In 2006 and 2007, on the other hand, the species *F. avenaceum* was isolated in the autumn from the turfgrass leaves and roots sampled from the urban lawns in Lublin, and isolates of this fungus constituted respectively 10.33 and 9.63% of all isolates (tab. 4–5). In Lublin in both years analyzed and in Zamość in 2007, the roots of the turfgrasses were colonized by the species *F. equiseti,* whose isolates accounted respectively for 1.72, 1.38, and 1.85% (tab. 4–6), and by *F. oxysporum* whose isolates constituted respectively 3.44 and 0.92% in Lublin and 0.74% of all isolates from the turfgrasses in Zamość.

The species *F. crookwellense* was isolated from turfgrass roots and leaves in the autumn of 2007 in Lublin and its isolates made up 5.96% of all isolates (tab. 5). In Lublin in the autumn of 2006 and in Zamość in 2007, the species *F. sporotrichioides* was isolated from the turfgrass roots and leaves and its isolates accounted respectively for 2.87 and 7.78% of all isolates obtained from the grass roots and leaves (tab. 4, 6).

Bipolaris sorokiniana was isolated from leaves and roots of turfgrasses in Lublin in 2007 and its isolates made up 5.96% of all isolates. 2 isolates of each of *F. poae* and *Botrytis cinerea* were cultured only from the grass roots in Lublin in 2007 (tab. 5), whereas 6 isolates of *Aureobasidium pullulans* were obtained only from these organs in 2006 (tab. 4).

In Lublin in autumn of 2006 and 2007 as well as in Zamość in 2007, turfgrass roots and leaves were colonized by the species *Alternaria alternata* whose isolates constituted respectively 7.26, 6.88, and 22.41% of all isolates (tab. 4–6). In Lublin in both years analyzed and in Zamość in 2007, *Epicoccum nigrum* was obtained from the above-mentioned organs of the turfgrasses and its isolates accounted respectively for 5.55, 3.21, and 10.37% of all fungal isolates (tab. 4–6). In Zamość the leaves of the plants sampled in the autumn were infected by the species *D. siccans* whose isolates made up 2.78% of all isolates (tab. 6).

In Lublin in autumn of 2006 and 2007 as well as in Zamość in 2007, the turfgrass roots and leaves were colonized by the species *Penicillium verrucosum* var. *cyclopium* whose isolates constituted respectively 2.87, 10.55, and 15.93% of all isolates (tab. 4–6).

Trichoderma viride in 2007 colonized the roots and leaves of the turfgrasses in Zamość (3.16% of all isolates) as well as the roots of the turfgrasses in Lublin (6.88% of all isolates) (tab. 5–6). *Trichoderma aureoviride* occurred only in Zamość during spring (2.64% of allisolates) (tab. 6).

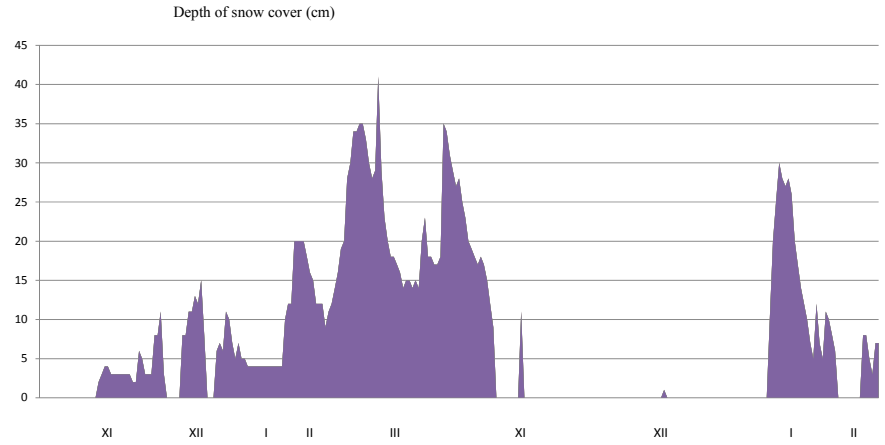

Fig. 4. Seasonal courses of depth of snow cover in 2005–2007 in Lublin

In Lublin the month of December 2005 was characterized by a temperature lower by 2.2°C than the long-term mean and the total precipitation higher by 70% than the long-term mean. The 2006 year was characterized by a temperature higher than the long-term mean in the period between April and December, from +0.1°C in August to +4.3°C in December, whereas it was lower than the long-term average in January, February, and March of that year by 4.0°C, 1.5°C, and 2.0°C, respectively. Compared to the long-term mean, the total precipitation in February, March, May, August, and November was higher by 7.7, 82.2, 2.1, 84.5 and 5.0%, respectively (tab. 7). In Lublin the air temperature was lower than the long-term mean by 0.3 and 1.5°C in October and November 2007, whereas in the other months of that year it was higher than the long-term average from 0.1 to 6.2°C (tab. 7). In the months of January, March, May, June, July, and Sep-

tember, the precipitation was higher than the long-term mean by 137, 17, 39.8, 33.4, 11.5, and 149.1%, respectively, while in February, April, August, October, November, and December the total precipitation was lower than the long-term average (tab. 7). In Lublin in 2005 snow fell on 20th of November and continually covered the grass to the 27th of March, 2006. In the period from 20th of November 2005 to 21st of January, 2006 the snow cover depths ranged from 2 to 12 cm, and from 22nd of January to March 2006 from 9 to 41 cm. In November and December 2006 there was snow only in one day. In 2007, several days of snow cover were recorded in the periods from 24th to 30th of January, and from 1st to14th and from 23rd to 28th of February (fig. 4).

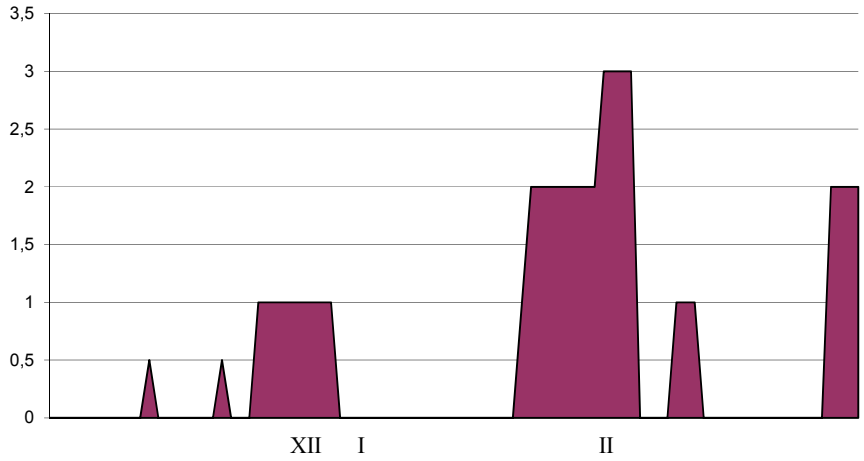

Fig. 5. Seasonal courses of depth of snow cover in 2006–2007 in Zamość

Table 7. Weather conditions in Lublin in the years 2005–2007

Month	Long term mean for 1951–2000		Air temperature difference compared with the mean for 1951–2000			Percentage of precipitations compared with the mean for 1951–2000		
			growing season					
	air temperature (°C)	precipitation (mm)	2005	2006	2007	2005	2006	2007
I	-3.6	21.7	–	-4.0	+6.2	–	72.4	237.0
II	-2.8	24.8	–	-1.5	+1.2	–	107.7	89.9
III	1.0	25.8	–	-2.0	+5.2	–	182.2	117.0
IV	7.5	40.6	–	+1.2	+1.2	–	74.6	43.9
V	13.0	58.3	–	+0.6	+2.0	–	102.1	139.8
VI	16.5	65.8	–	+0.4	+1.6	–	57.6	133.4
VII	17.9	78.0	–	+4.0	+1.3	–	8.7	111.5
VIII	17.3	69.7	–	+0.1	+1.1	–	284.5	53.9
IX	12.9	52.1	–	+2.8	+0.1	–	21.1	249.1
X	7.9	40.3	–	+2.2	-0.3	–	35.2	43.9
XI	2.5	39.1	–	+2.8	-1.5	–	105.0	79.5
XII	-1.4	31.5	-2.2	+4.3	+0.2	170.0	59.0	47.3

Table 8. Weather conditions in Zamość in the years 2006–2007

Month	Long term mean for 1971–2005		Air temperature difference compared with the mean for 1951-2000		Percentage of precipitations compared with the mean for 1951–2000	
			growing season			
	air temperature (°C)	precipitation (mm)	2006	2007	2006	2007
I	3.5	23.4	–	0	–	237.2
II	2.5	20.0	–	-1.7	–	158.5
III	1.6	26.1	–	+5.8	–	159.4
IV	7.9	44.1	–	+2.1	–	49.2
V	14.1	65.5	–	+3.5	–	62.7
VI	16.8	78.9	–	+3.0	–	68.4
VII	18.5	98.4	–	+2.6	–	120.8
VIII	17.8	54.3	–	+0.8	–	58.2
IX	12.9	52.2	–	-0.1	–	228.0
X	7.4	40.3	–	+1.5	–	83.1
XI	2.4	25.6	–	-1.1	–	127.7
XII	1.7	24.6	+1.46	-0.6	89.8	40.6

In Zamość the month of December 2006 was characterized by a temperature higher by 1.46°C than the long-term mean and the total precipitation lower by 10.2% than the long-term mean. In 2007, the air temperature was higher compared to the long-term average by +0.8 to +5.8°C, except for the months of February, September, November, and December which were colder by -1.7, -0.1, -1.1, and -0.6°C, respectively, and the month of January in which the air temperature was equal to the long-term average (tab. 8). In the months of January, February, March, July, September, and November, the amount of rainfall exceeded the long-term average by 137.2, 58.5, 59.4, 20.8, 128, and 27.7%, respectively, whereas in the months of April, May, June, August, October, and December, the amount of rainfall was respectively 49.2, 62.7, 68.4, 58.2, 83.1 and 40.6% of normal rainfall (tab. 8). In Zamość winter 2006/2007 was characterized by light snowfall. In December 2006 it was noticed a short period with snow cover – in 12nd and 15th of December (0.5 cm) and from 24th to 31st of December (1 cm). In the 1st of January 2007 there was a little snow. The retention of snow cover was recorded also from 22nd of January to 3rd of February 2007 (1–3 cm), from 8th to 10th of February and from 15th to 28th of February (2 cm) (fig. 5).

DISCUSSION

The incidence of pathogens on the analyzed lawns in Lublin and in Zamość was associated with the season of the year. The fungus *Microdochium nivale* proved to be a species that damaged the leaves of the grasses in Lublin in the spring of 2006 and in Zamość in 2007. According to Kutrzeba [1994], a long winter and a spring with a too

low temperature and too wet soil create favorable conditions for the occurrence of *M. nivale*. In the case of the present study, such conditions predominated from December 2005 to April 2006, particularly in Lublin, where 114 days with snow cover was noticed. These conditions led to the large contribution of *M. nivale* in the infection of leaves of the turfgrasses in the spring of 2006 in Lublin. The winter 2006/2007 in Zamość was characterized by poor snowfall. The cause of the occurrence of *Microdochium nivale* could be high rainfall from January to March. *Microdochium nivale* can deteriorate the aesthetic value of lawns during cold and wet weather in the autumn as well as during the mild winter [Prończuk 1996, 2002]. The presence of this fungus on the lawns in both sunny and shaded sites confirms its high tolerance to a negative temperature of -5°C and the capacity of this fungus to still grow at a temperature of 21°C. Vargas [1994] as well as Prończuk and Prończuk [2005] also report that *M. nivale* is highly harmful to turfgrasses. The research of Prończuk and Zagdańska [1993] showed that pink snow mold may also occur during a mild and almost snowless winter. *Microdochium nivale* can damage unhardened plants, especially perennial ryegrass [Prończuk 2000]. According to Prończuk [2000], this pathogen caused the greatest damage on perennial ryegrass, sheep's fescue, red fescue, and tall fescue. Species of the genus *Fusarium* proved to be the greatest threat to the ryegrasses growing in the lawns under the conditions analyzed. *Fusarium* spp. can occur on various grass species, in particular *Festuca rubra*. Fungi of the genus *Fusarium* can be the cause of Fusarium blight [Prończuk 1996, 2000, 2002, Kiecana et al. 2012].

The contribution of *F. culmorum* to the damage to the turfgrasses was significant regardless of the year, location, time of observation, and access of light. This confirms its capacity to grow and sporulate at various temperatures and under low water potential conditions [Sung and Cook 1981 according to Łacicowa et al. 1990]. In the study by Prończuk [2000], *F. culmorum* isolates were characterized by high pathogenicity to grass seedlings. The species *F. culmorum* is capable of saprotrophic life and has the ability to colonize the roots of plants of the family *Poaceae* as well as to sporulate abundantly and produce chlamydospores in mycelial hyphae [Sitton and Cook 1981 according to Los et al. 1994, Desjardins 2006]. Farr et al. [1989], according to Shaner [2003], mention 10 various hosts of this fungus from the above-mentioned family, among others *Agropyron*, *Festuca*, *Poa*, *Lolium*, *Bromus*, and *Dactylis*. The pathogenicity of *F. culmorum* to plants of the family *Poaceae* is greater at a high temperature [Kiecana et al. 2003]. In the case of the present study, in Lublin in 2006 the temperature from May to October, especially in the month of August with abundant rainfall, promoted the occurrence of *F. culmorum* on the leaves in autumn. *F. avenaceum*, which is considered to be the main causative agent of grass damage in football turfs, also proved to be the cause of damage to the analyzed urban lawns in Lublin in both years of the study [Pląskowska et al. 2006]. Highly pathogenic strains of *F. avenaceum* caused a significant reduction in the emergence of *Lolium perenne* [Gołębniak 2001]. The incidence of *F. avenaceum* on the turfgrasses in these two cities, both in the spring and in the autumn throughout the study period with varying weather conditions, confirms the existing reports about the high tolerance of this fungus to temperature and humidity [Łacicowa and Pięta 1998, Kiecana et al. 2003]. The species *F. equiseti*, known to be pathogenic to turfgrasses, ornamental grasses, and herbal plants, was frequently isolated

from the leaves of the grasses growing in the lawn fully exposed to sunlight in Lublin in the spring of 2006 and from the grass roots in Zamość in 2007 [Prończuk 2000, Machowicz-Stefaniak and Zalewska 2004 a, b, Kiecana et al. 2014].

The species *F. sporotrichioides*, isolated from the roots and leaves of the turfgrasses growing in the lawns with varying sunlight exposure in Lublin in the autumn of 2006 and in Zamość in 2007, was recorded on turfgrasses by Kutrzeba [1994], while on ornamental grasses by Kiecana et al. [2014].

Fusarium crookwellense, which was isolated from the roots and leaves of the grasses collected from the lawn located in a sunny place in the autumn, is included in the list of pathogens of the genus *Fusarium* responsible for Fusarium blight of grasses [Smiley et al. 1992 according to Prończuk 2000, Prończuk 1998]. The species *Bipolaris sorokiniana*, isolated from the grass roots and leaves in Lublin in the autumn of 2007, is considered to be the causative agent of melting out and root rot in grasses [Prończuk 2000, Wiewióra and Prończuk 2000, Pląskowska et al. 2006, Kiecana et al. 2012]. Secretion of host cell wall hydrolytic enzymes at the apex of the penetrating hyphae may facilitate the spread of the fungus. In additions toxins secreted by the fungus might explain the rapid dead of host cells in contact with or distant to fungal cells [Han et al. 2010].

The species *Drechslera siccans*, which infected the leaves of the turfgrasses in Zamość in the spring and autumn of 2007, was recorded on the leaves of red fescue grown for seed in central Poland in 1997 [Prończuk 2000]. This pathogen also damages the leaves of grasses of the genera *Lolium*, *Dactylis*, *Poa*, and *Phleum* in Europe, North America, and Australia [Kwaśna 1995, Prończuk 2000]. The species *D. siccans* exhibits the ability to produce secondary metabolites, which include siccanochromenes A and B as well as siccanin [Kachlicki 1995]. Moreover, this pathogen produces helmintin, methylodiaporthin, and diaporthin, which may cause spots on various plant species [Horodecka 1992, Kachlicki 1995].

The species *Alternaria alternata* was isolated from the turfgrasses under the conditions analyzed, similarly as in the case of permanent ryegrass in the study by Prończuk [2000]. This fungus has been recorded on seed of various species of turfgrasses [Kućmierz and Gorajczyk 1991, Kutrzeba 1994, Kiecana et al. 2012] and ornamental grasses [Kiecana et al. 2014].

CONCLUSIONS

1. *Microdochium nivale* is a great threat to turfgrasses in lawn culture in spring.
2. Fungi of the genus *Fusarium*, in particular *Fusarium culmorum*, are of great importance in the deterioration of the aesthetic appearance of lawns, regardless of their location.
3. Under the analyzed conditions the cause of leaf spot of turfgrasses in the autumn in Lublin was *B. sorokiniana* and in Zamość *D. siccans*.

ACKNOWLEDGEMENTS

Research supported by Poland's Ministry of Science and Higher Education as part of the statutory activities of University of Life Sciences in Lublin

REFERENCES

Czembor, E. (2002). Brunatna plamistość wiechliny łąkowej (*Drechslera poae* (Baudys) Shoemaker). Część I. Taksonomia i znaczenie gospodarcze. Biul. IHAR, 223/224, 213–222.

Desjardins, A.E. (2006). *Fusarium* mycotoxins chemistry, genetics and biology. The American Phytopathological Society St. Paul, Minnesota USA.

Gołębniak, B. (2001). The response of meadow fescue, perennial ryegrass and Italian ryegrass to infection by *Fusarium avenaceum*, *F. culmorum* and *F. graminum*. J. Plant Prot. Res., 41(4), 395–401.

Han, Q., Huang, L., Buchenauer, H., Wang, C., Kang, Z. (2010). Cytological study of wheat spike infection by *Bipolaris sorokiniana*. J. Phytopathol, 158, 22–29.

Horodecka, E. (1992). Mykotoksyny wytwarzane przez patogeny grzybowe występujące na wybranych gatunkach traw, koniczynie i lucernie. Biul. IHAR, 181–182, 285–298.

Jargiełło, J., Kern, H., Mosek, B. (1998). Przewodnik do ćwiczeń z łąkarstwa. Wyd. AR w Lublinie.

Kachlicki, P. (1995). Metabolites of Helminthosporia. In: Helminthosporia metabolites, biology, plant diseases *Bipolaris*, *Drechslera*, *Exserohilum*, Chełkowski, J. (ed.). Poznań, Poland, 1–26.

Kiecana, I., Mielniczuk, E., Cegiełko, M., Pszczółkowski, P. (2003). Badania nad chorobami podsuszkowymi owsa (*Avena sativa* L.) z uwzględnieniem temperatury i opadów. Acta Agrobot., 56 (1–2), 95–107.

Kiecana, I., Cegiełko, M., Mielniczuk, E. (2009). Występowanie *Fusarium* spp. na życie ozimym (*Secale cereale* L.) i podatność różnych genotypów na porażenie przez *F. avenaceum* (Fr.) Sacc. i *F. culmorum* (W. G. Sm.) Sacc. Biul. IHAR, 252, 151 – 161.

Kiecana, I., Cegiełko, M., Mielniczuk, E. (2012). Fungi colonizing the swing material of turfgrasses considering susceptibility of cultivars to selected pathogens. Acta Sci. Pol. Hortorum Cultus, 5, 153–168.

Kiecana, I., Cegiełko, M., Mielniczuk, E., Pastucha, A. (2014). Fungi infecting ornamental grasses and the pathogenicity of *Fusarium culmorum* (W.G.Sm.) Sacc. and *Fusarium equiseti* (Corda) Sacc. to selected species. Acta Sci. Pol. Hortorum Cultus, 13(5), 61–75.

Kućmierz, J., Gorajczyk, S. (1991). Mycoflora of perennial ryegrass (*Lolium perenne* L.) grains. The Polish Phytopath. Soc., Poznań. Phytopathol. Pol., 1(13), 58–61.

Kutrzeba, M. (1994). Występowanie grzybów patogenicznych na gatunkach traw z rodzaju *Festuca* Huds. Biul. IHAR, 192, 113–121.

Kwaśna, H. (1995). Ecology, taxonomy and nomenclature of *Helminthosporia*. History and actual situation. W: *Helminthosporia* metabolites, biology, plant diseases *Bipolaris*, *Drechslera*, *Exserohilum*, Chełkowski, J. (ed.). Poznań, Poland, 27–61.

Los O., Bard, S.W., Marasas, W.F.O., Burgess, S.A. (1994). The effect of crop rotation with wheat and oats on the incidence of Fusarium crown rot of wheat. S. Afr. J. Plant Soil, 11(4), 170–177.

Łacicowa, B. (1969). Metoda loboratoryjna szybkiej oceny odporności jęczmienia jarego na *Helminthosporium sativum*. P.K. et B. Biul. IHAR, 3–4, 61–62.

Łacicowa, B., Pięta, D. (1998). Wpływ temperatury i opadów na udział grzybów w powodowaniu chorób podsuszkowych jęczmienia jarego (*Hordeum vulgare* L.). Acta Agrobot., 51(1–2), 51–61.

Łacicowa, B., Kiecana, I., Pięta, D. (1990). Choroby podsuszkowe jęczmienia jarego (*Hordeum sativum* L.) uprawianego w Lubelskiem. Rocz. Nauk Rol. eec. E, 20(1/2), 7–15.

Machowicz-Stefaniak, Z., Zalewska, E. (2004a). Grzyby zagrażające uprawie wybranych gatunków ziół z rodziny *Apiaceae* w południowo-wschodniej Polsce. Folia Univ. Stetin., Agricultura, 239(95), 223–228.

Machowicz-Stefaniak, Z., Zalewska, E. (2004b). Patogeniczność grzybów z rodzaju *Fusarium* dla tymianku właściwego (*Thymus vulgaris* L.). Acta Sci. Pol. Hortorum Cultus, 3(1), 115–123.

Mielniczuk, E., Kiecana, I., Cegiełko, M., Werwińska, K. (2010). Grzyby zasiedlające materiał siewny owsa (*Avena sativa* L.). Zesz. Probl. Post. Nauk Roln., 556, 879–890.

Paul, V.H. (1995). Grass diseases caused by *Drechslera* spp. In: Helminthosporia metabolites, biology, plant diseases, *Bipolaris*, *Drechslera*, *Exserohilum*, Chełkowski, J. (ed.). Poznań, Poland, 175–186.

Pląskowska, E., Wolski, K., Moszczyńska, E., Kaczmarek, J. (2006). Study of the healthiness of species and cultivars of turfgrass and their mixtures for football pitches. Zesz. Nauk. UP we Wrocławiu. Rolnictwo, 88(545), 211–219.

Prończuk, M. (1996). Główne choroby traw gazonowych w Polsce. Biul. IHAR, 199, 157–169.

Prończuk, M. (1998). Choroby traw i ich zapobieganie na trawniku. VII Targi Zieleni Miejskiej i Ogrodnictwa Taragra'98. Konf. Nauk. „Problemy ochrony i kształtowania zieleni miejskiej" 18–20. 04. Dolnośląskie Wyd. Nauk., 65–70.

Prończuk, M. (2000). Choroby traw – występowanie i szkodliwość w uprawie na nasiona i użytkowaniu trawnikowym. Monogr. i Rozpr. Nauk. IHAR Radzików.

Prończuk, M. (2002). Występowanie i szkodliwość chorób traw, a intensywność uprawy trawników. Przegl. Nauk. Inż. Kształt. Środ., 11, 1 (24), 218–227.

Prończuk, M., Zagdańska, B. (1993). Effect of *Microdochium nivale* and low temperature on winter survival of perennial ryegrass. J. Phytopathol., 138, 1–8.

Prończuk, M., Prończuk, S. (2005). Występowanie pleśni śniegowej na życicy trwałej (*Lolium perenne* L.) w zależności od warunków świetlnych i intensywności pielęgnacji trawników. Acta Agrobot., 58(2), 381–394.

Rutkowska, B., Pawluśkiewicz, M. (1996). Trawniki. Poradnik zakładania i pielęgnowania. PWRiL., Warszawa, 23–28.

Shaner, G. (2003). Epidemiology of *Fusarium* head blight of small grain cereals in North America. In: *Fusarium* head blight of wheat and barley, Leonard, K.J., Bushnell, W.R. (eds). The American Phytopathological Society St. Paul, Minnesota, 84–119

Vargas, J.M. (1994). Management of turfgrass diseases. CRC Press., Inc.

Wiewióra, B., Prończuk, M.(2000). Mikroorganizmy zasiedlające nasiona traw i ich wpływ na występowanie chorób w uprawie trawnikowej. Biul. IHAR, 214, 269–284.

Zimowska, B., Machowicz-Stefaniak, Z. (2004). Grzyby zagrażające uprawie dziurawca zwyczajnego (*Hypericum perforatum* L.) w województwie lubelskim. Acta Sci. Pol. Hortorum Cultus, 3(1), 61–74.

Żuk, B. (1989). Biometria stosowana. PWN, Warszawa.

GRZYBY WYSTĘPUJĄCE NA TRAWACH GAZONOWYCH W UŻYTKOWANIU TRAWNIKOWYM

Streszczenie. W ostatnich latach obserwuje się coraz większe zainteresowanie trawnikami i ich wyglądem. Jakość trawnika obniżają pojawiające się choroby, których sprawcami mogą być różne patogeny. Badania przeprowadzono w dwóch ośrodkach miejskich w rejonie południowo-wschodniej Polski: w latach 2006–2007 w Lublinie i w 2007 r. w Zamościu, z uwzględnieniem miejsc nasłonecznionych i częściowo zacienionych. Określono skład gatunkowy runa, oznaczano stopień porażenia liści oraz przeprowadzono analizę mykologiczną porażonych roślin. W przypadku trawników w Lublinie średnie wartości wskaźników chorobowych dla liści badanych traw wiosną 2006 r. wynosiły 53,75–83,00, zaś wiosną 2007 r. 6,75–29,00. Średnie wartości wskaźników chorobowych dla liści określone jesienią 2006 r. wynosiły 16,00–86,25, natomiast jesienią 2007 r. 4,50–21,25. Średnie wartości wskaźników chorobowych dla liści badanych traw gazonowych w Zamościu wiosną 2007 r. wynosiły 24,50–48,25, natomiast jesienią tego roku 28,00–54,75. Dużym zagrożeniem dla traw gazonowych w uprawie trawnikowej wiosną okazał się *Microdochium nivale*, natomiast przyczyną brunatnej plamistości liści traw gazonowych jesienią w analizowanych warunkach okazały się *Bipolaris sorokiniana* (Lublin) i *Drechslera siccans* (Zamość). W przypadku obu lokalizacji trawników, w analizowanych latach badań, zarówno wiosną jak i jesienią znaczny udział w porażaniu korzeni miały gatunki z rodzaju *Fusarium*, a szczególnie *F. culmorum*.

Słowa kluczowe: trawy gazonowe, patogeny korzeni i liści, *Fusarium* spp., *Microdochium nivale*, *Bipolaris sorokiniana*, *Drechslera siccans*

Accepted for print: 11.03.2015

For citation: Kiecana, I., Cegiełko, M., Mielniczuk, E. (2015). Fungi occurred on turfgrasses in lawn maintenance. Acta Sci. Pol. Hortorum Cultus, 14(3), 63–80.