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INFLUENCE OF VARIETY AND CLIMATIC FACTORS ON THE HEALTH OF TULIPS

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INTRODUCTION

Tulips encompass an awe-inspiring range of flower forms and colors - from simple, raised calyxes of single varieties, through jagged, curled parrot tulips, to full-bodied forms of peony tulips. Often their decoration is also patterned leaves. Thanks to the variety of colors, shapes and flowering dates, they can be used in large flower beds in urban plantings. All parts of the overground and underground tulips are damaged by abiotic and biotic factors. It could be observed that the temperature and level of precipitation in the study area differed from the long-term averages and affects the health of the tested plants.

MATERIAL AND METHODS

.The three-year studies (2014-2016) was conducted in the conditions of Lublin (south-eastern Poland). They included 9 varieties of tulip from different groups: ‘Jan Reus’, ‘Findel’, ‘Maja’, ‘Winter Gold’, ‘Belica’, ‘Mount Tacoma’, ‘Golden Age’, ‘Mrs Moon’, and ‘Claudia’. The tests were carried out at the beginning of flowering (end of April) from above-ground and underground parts of plants, in the form of leaves and bulbs showing symptoms of disease, and after flowering (beginning of July) in the form of bulbs showing symptoms of disease. Symptoms of infection in the plots concerned from 12 to 42% of plants. Each year, plants with disease symptoms of stem and leaves and root rot were subjected to mycological analysis using artificial cultures. Fungi were observed an optical microscope.

RESULTS

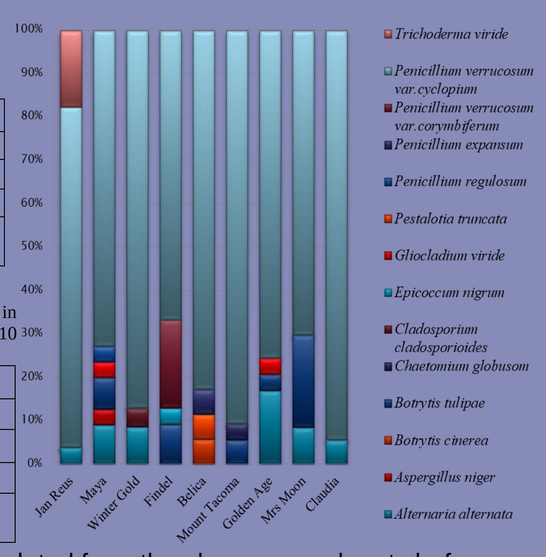
Tulip stems, leaves and bulbs were colonized to a large extent by *Penicillium verrucosum* var. *cyclopium*, *Alternata alternaria*, *Fusarium avenaceum* and *Fusarium oxysporum*. The number of *Botrytis tulipae* colonies from tulip bulbs was much greater than that from above-ground parts of plants. Soil and air temperature as well as the amount of rainfall can significantly affect the health of tulips. This is especially important when the soil is not frozen during the winter months. This was recorded in the 2013/2014 season, when the soil froze at the beginning of the 3rd decade of January and thawed already in mid-February, and the snow cover lasted only 11 days. In this season, very high amounts of rainfall were recorded in November and January, and in May the amount of rainfall was tripled. exceeded the perennial average, which had a large impact on the infestation of shoots and leaves by *Botrytis tulipae*. In the 2013/14 and 2015/16 season, tulips bloomed very early and were low, they also produced the lowest yield of daughter bulbs. In the 2015/16 season air temperatures in the autumn, winter and spring months significantly exceeded the long-term average (in November by 2.9 °C, in February by 6.2 °C in March by 3.0 °C), with a simultaneous high amount of rainfall from November to the end of December on non-frozen soil, as well as in February (the soil thawed at the end of the first decade of this month) and March it limited the access of air to the root system and could have the effect of significant infection of bulbs by fungal pathogens, as well as root rot. The most susceptible to infection by fungi were the 'Maja' and 'Bellica' tulip cultivars, while the least 'Winter Gold' and 'Mrs Moon', which should be included in plantings in urban areas.

Table 1. Average monthly air temperatures that occurred during the tulip growing season in the Experimental Farm Felin UP in Lublin (multiannual average 1951-2010) [°C]

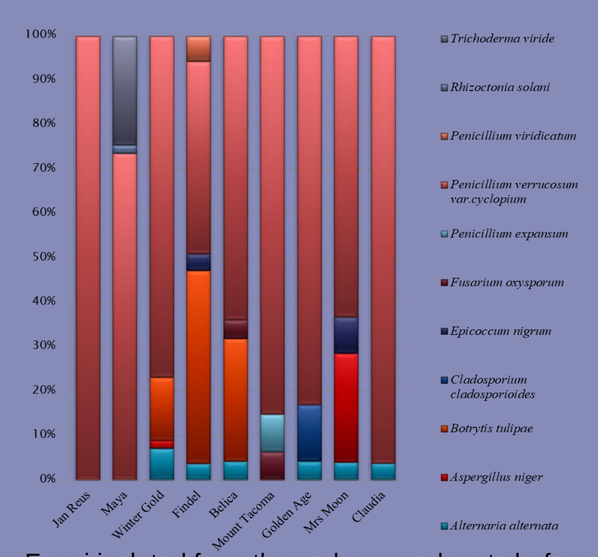
Growing season	X	XI	XII	I	II	III	IV	V	VI
2013/2014	10,1	5,4	1,6	-2,9	1,3	6,2	9,8	13,7	16,3
2014/2015	9,4	4,4	0,1	1,0	0,7	5,2	9,4	14,2	19,2
2015/2016	7,9	5,3	3,8	-3,6	3,5	4,1	9,7	15,1	19,2
Multiannual average 1951-2010	**7,8**	**2,5**	**-1,4**	**-3,5**	**-2,7**	**1,1**	**7,4**	**13,0**	**16,2**

Table 2. Monthly sums of precipitation that occurred during the tulip growing season in Experimental Farm Felin, UP in Lublin in comparisions to multiannual average 1951-2010 [mm]

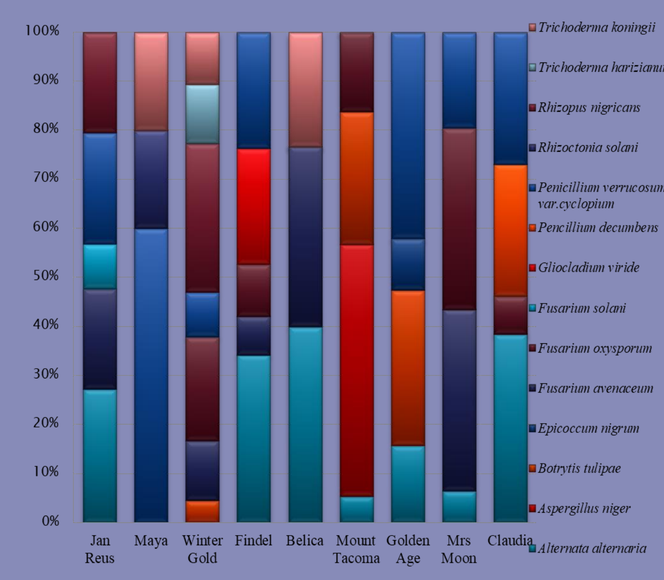
Growing season	X	XI	XII	I	II	III	IV	V	VI
2013/2014	5,4	80,0	16,2	70,8	12,3	48,4	44,7	193,6	78,1
2014/2015	25,6	22,7	56,5	46,8	7,4	57,8	40,8	111,9	12,1
2015/2016	49,6	51,9	30,6	41,2	62,1	63,0	44,0	37,9	43,0
Multiannual average 1985-2010	**40,1**	**38,1**	**31,5**	**22,7**	**25,6**	**26,3**	**40,2**	**57,7**	**65,7**



Fungi isolated from the above-ground parts before flowering



Fungi isolated from the underground parts before flowering



Fungi isolated from the underground parts after flowering

CONCLUSION

1. Among the studied varieties the most common colonies were: *Penicillium* sp., *Alternaria alternata*, *Fusarium* sp. and *Botrytis tulipae*.
2. In the conducted studies, *Botrytis cinerea* and *B. tulipae* could be the cause of lesions on the leaves and shoots of these plants.
3. The severity of disease symptoms may be related to prolonged rainfall and low temperature.
4. Based on the research carried out, the Winter Gold’ and , Mr Moon’ variety should be recommended for urban plantings.