Preliminary Study on Investigation of Turf Fungi Disease in Hailing District, Taizhou City, Jiangsu Province China

Zhang Cheng-xia[1], Wu Hong[2], Wang Rui[3]

Jiangsu Agri-Animal Husbandry Vocational College, Taizhou, 225300, China

Abstract— *In order to find out the disease of turf fungi and the damage of the disease to the lawn in Hailing District of Taizhou, this paper investigates fungal diseases of lawn and grassland, such as Festuca arundinacea, Cynodon dactylon, Zoysia matrella, Lolium perenne, Trifolium repens, in major parks and urban green spaces in Hailing District of Taizhou City. Then this paper separated and identified pathogenic fungi, mainly there are Alternaria alternate, Bipolaris sorokinianum, Drechslaris poae and Curvularia lunata, etc (8 kinds in all), and then basically defined the species, distributions and damage of turfgrass fungal diseases in Hailing District, Taizhou. In the meantime, this paper put forward specific proposals for the prevention and control of lawn diseases.*

Keywords— Taizhou city, turfgrass, fungal diseases, control.

I. INTRODUCTION

In recent years, As China's economy grows, people's requirements for the ecological environment are constantly improving. The development speed of lawn industry in our country is very fast. Especially in recent years, the evaluation activities of civilized cities and livable cities all over the country have made the lawn green area of large and medium-sized cities increase rapidly. According to incomplete statistics, in nearly 500 cities in the country, the lawn area is nearly 70,000 hectares, and the lawn area in Beijing, Shanghai, Dalian is increasing at the rate of 1.50,2.3 and 2.4 million square meters each year [1]. With the enlargement of lawn planting area, lawn diseases also increase. In less severe cases, this makes the lawn greenish and yellowing, forming exsciccation patches, affecting the appreciation and use of lawns. In severe cases, this will kill the lawn quickly. Diseases not only affect the ornamental value of the lawn, but also affect the commercial operation and environmental beautification of the lawn [2,3]. Therefore, the investigation and control of lawn diseases have become an indispensable part of the healthy development of the lawn industry. Taizhou belongs to the Lixia River region. The climate is north subtropics humid type, and it has four distinct seasons. It is hot and rainy in summer, mild and less rainy in winter. The annual average temperature is about 15℃, and the annual average rainfall is about 1000 mm. The abundant rainfall and warm temperature provide natural conditions for lawn planting. At the same time, the high temperature in summer provides unique natural conditions for lawn planting. Both high humidity and high humidity provide favorable environmental conditions for the occurrence of fungal diseases in turfgrass. In this study, the disease of lawn grass in the main urban area of Taizhou City was investigated for the first time. The purpose was to find out the types and distribution of the disease, and to provide the basis and reference value for scientific management of lawn and formulate disease control measures in this area.

II. MATERIALS & METHODS

2.1 Place of investigation

This study investigated the turf grass diseases in Tiande Lake Park, Taizhou People's Park, Taishan Park, Fenghuang Road Campus of Jiangsu Animal Husbandry & Veterinary College, and Municipal Government Square and other urban green space. The turf grasses collected were mainly *Festuca arundinacea, Cynodon dactylon, Zoysia matrella, Lolium perenne* and *Trifolium repens*.

2.2 Methods of investigation and identification of indoor pathogens

From July to October 2015, we investigated and collected lawn grass disease specimens in the sampling spot designed for the experiment by the method of making an on-the-spot survey. The symptoms of the disease were observed and recorded in detail. After the specimens are taken back to the laboratory, the diseased and health border tissues were isolated and purifying-cultured. The culture medium was potato agar medium (PDA). The isolated pathogens were identified by referring to the "Manual of Fungi Identification", " Illustrated Genera of Imperfect Fungi Barnett "[5] and other materials.

III. RESULTS

3.1 Main diseases

From Table1, it can be inferred that 8 kinds of Pathogenic fungi like *Alternaria alternate, Bipolaris sorokinianum, Drechslaris poae, Rhizoctonia solani, Curvularia lunata, Fusarium equiseti, Fusarium poae* and *Pythium aphanidermatum,* are separated from the turfgrass specimens, which were collected from Taizhou Tiande Lake Park, Taizhou People's Park, Taishan Park, Jiangsu Agri-animal Husbandry Vocational College Fenghuang Road Campus, City Government Square and other urban green space. And these pathogenic bacteria results in turfgrass disease like leaf spot, brown spot, black spot and fusarium wilt of *Festuca arundinacea, Cynodon dactylon, Zoysia matrella* and *Lolium perenne.* (Table1)

Table 1
Species and distribution of main fungal diseases on lawn in Hailing District, Taizhou

Host Plant	Disease Name	Pathogenic Bacteria	Distribution
Festuca arundinacea	Black spot	*Alternaria alternate*	Taizhou people's Park City government square
	Leaf spot	*Bipolaris sorokinianum*	
Zoysia matrella	Black spot	*Alternaria alternate*	Taizhou people's Park
	Leaf spot	*Drechslaris poae*	Jiangsu Agri-animal Husbandry Vocational College
	Cercospora leaf spot	*Rhizoctonia solani*	Taishan Park, Tiande Lake Park
Lolium perenne	Leaf spot	*Bipolaris sorokinianum*	Taishan Park City Government Square
	Black spot	*Alternaria alternate*	
		Curvularia lunata	
Cynodon dactylon	Leaf spot	*Drechslaris poae*	Jiangsu Agri-animal Husbandry Vocational College
		Fusarium equiseti	Tiande Lake Park, Jiangsu Agri-animal Husbandry Vocational College
		Bipolaris sorokinianum	Tiande Lake Park, City Government Square
	Black spot	*Alternaria alternate*	Jiangsu Agri-animal Husbandry Vocational College, Tiande Lake Park
		Curvularia lunata	Jiangsu Agri-animal Husbandry Vocational College Fenghuang Road Campus
	Cercospora leaf spot	*Rhizoctonia solani*	Taizhou people's Park Tiande Lake Park
	Fusarium wilt	*Fusarium poae*	Tiande Lake Park
		Pythium aphanidermatum)	
Trifolium repens	Leaf spot	*Curvularia lunata*	Tiande Lake Park ,Taizhou people's Park,Jiangsu Agri-animal Husbandry Vocational College

3.2 The main symptoms, pathogenesis and preventions of major diseases

3.2.1 Black Spot

The study collected *Festuca arundinacea* and *Zoysia matrella* from Taizhou People's Park, *Cynodon dactylon* from Tiande Lake Park and Jiangsu Agri-animal Husbandry Vocational College Fenghuang Road Campus, *Lolium perenne* from Taishan Park, *Festuca arundinacea, Lolium perenne* and *Cynodon dactylon* from City Government Square, *Alternaria alternate* and *Alternaria alternate* were separated from them, which caused Black spot.

When the disease occurs, the plants in the grass patch are dwarf, grey and dead. Red and brown edges are formed between the healthy tissue and sometimes brown spots on the affected leaves. *Alternaria alternate* and *Alternaria alternate* can both infect common lawn grass species, badly in high temperature, mainly occurs in around 30℃ with high humidity, especially in Spring when the temperature rises, they infect reviving plants and spread with wind and rain, causes reinfection and happens continuously in Summer and Autumn. The disease can occur when the environment is humid and too much nitrogen fertilizer is applied. Therefore, reasonable pruning, timely removal of grass debris and withered layer, and more full-price fertilizer are used to improve the resistance of lawn grass and control the occurrence of black spot.

3.2.2 Cercospora Leaf Spot

Cynodon dactylon collected from Taizhou People's Park and Tiande Lake Park, *Zoysia matrella* collected from Taishan Park and Tiande Lake Park, *Rhizoctonia Solani* was separated from them. At the early stage of the disease, the lesions showed a bluish gray water immersion, reddish brown border, and brown spots at the later stage. In severe cases, the lesion spread around the stem, causing the stem and neck base to become brown, rotten or yellow. If the environmental conditions are suitable for the rapid development of the disease, the diameter of the withered zone from a few centimeters quickly expanded to about 2 meters, because the center of the withered spot after the restoration of the plant color than the edge of the disease, so that the withered spot presents a ring or "frog eye" shape.

Brown spot is a highly prevalent disease, and is one of the most widely distributed diseases in turfgrass diseases. Sclerotium has a strong ability to withstand high and low temperatures, but the optimum temperature for infection and onset is 21-32%. Therefore, in turf maintenance and management should be reasonable fertilization, appropriate increase of phosphorus and potassium fertilizer to improve plant resistance, can effectively control the occurrence of disease; summer cannot be too low pruning, too dense turf should be properly perforated and sparse the lawn. At present, fungicides, such as Chlorothalonil and Methyl Toprazine, are good fungicides for controlling brown spot.

3.2.3 Leaf Spot

The collected turfgrass *Cynodon dactylon, Festuca arundinacea, Lolium perenne, Zoysia matrella, Trifolium repens* from Tiande Lake Park, Jiangsu Agri-animal Husbandry Vocational College Fenghuang Road Campus, City Government Square, Taishan Park and Taizhou People's Park, *Drechslaris poae, Fusarium equiseti, Bipolaris sorokinianum* and *Curvularia lunata* were separated from them. At the beginning of the disease, a lot of small oval waterlogging spots appeared. The color became dark evenly, showing reddish-brown to purple-black. Many lesions healed to form large necrotic spots. The size of the lesions ranged from a few centimeters to several meters. The severely diseased turf died with the drying of the diseased leaves, and the turf became sparse and premature senescence.

Leaf spot disease is most suitable for infection at about 20 C. The main epidemic period of leaf spot disease is spring with warm temperature and autumn with high temperature and rainy weather. In addition to the most basic lawn maintenance and management measures, cannot be irrigated at night, timely removal of grass debris, withered grass layer after cutting; at the same time, the choice of disease-resistant varieties. The new turf can be mixed with 25% Triadimefon wet-table powder or 50% TMTD wet-table powder by seed weight of 0.2%-0.3%. Spraying fungicides at the initial stage of turf disease can better control the disease development, such as 50% TMTD wet-table powder, 70% manganese zinc wet-table powder and so on.

3.2.4 Fusarium Wilt

Fusarium poae and *Pythium aphanidermatum* were separated from *Cynodon dactylon* collected from Taindehu park, they can infect the stems and leaves of turfgrass, causing rot and collapse of stems and leaves. At the onset of the disease from the tip of the leaf down or from the base of the sheath up a waterlogged wilt, the late edge of the lesion brown red. High temperature and humidity are the most suitable conditions for the occurrence of Fusarium wilt. In general, the highest

temperature in the daytime is above 30℃, the lowest temperature is above 20℃ at night, and the relative humidity is above 90% and lasts more than 12 hours. Fusarium wilt can occur in a large area. Round yellow-brown spot with a diameter of 2-5 cm appears on the lawn.

Establishing good site conditions is the key measure to control Fusarium oxysporum and Fusarium oxysporum wilt, avoiding irrigation in the evening or at night. When the thickness of the grass layer is over 2cm, it should be removed in time. In summer, fungicides should be used to control diseases in high temperature and humidity season in South China, such as protective fungicides TMTD, manganese zinc, inhalant fungicide metalaxyl, metalaxyl and so on.

IV. DISCUSSION

More than 80% of the turf grass diseases are caused by fungi[2]. The pathogen passed through the winter in the roots and dead stems and leaves of the plant.. When the external environment conditions are suitable, it will harm the turf through the spread of soil, air and water, seriously affecting the use and ornamental value of the turf. In this study, eight pathogenic fungi, including *Alternaria alternate*, *Bipolaris sorokinianum* and *Drechslaris poae*, were isolated and purified from turfgrass samples collected from the main parks and urban greenbelts in Hailing District of Taizhou City. They mainly caused Black spot disease, Brown Patch disease, Leaf spot disease and blight of *Cynodon dactylon*, *Zoysia matrella*, *Festuca arundinacea*, *Lolium perenne* and *Trifolium repens*. These diseases are more common in cool-and-warm-season type turfgrass. Black spot disease, Fusarium wilt disease, Brown Patch disease and Pythium disease of turf grass have a strong possibility of transmission in China, and their adaptability is strong, which has a serious impact on urban environmental greening [3].

Black spot is a kind of high temperature disease, which mainly infects cold and warm seasonal type turfgrass, such as *Festuca arundinacea* and *Cynodon dactylon* that are experiencing high temperature stress or high temperature growth cessation. The occurrence of the disease on turfgrass was reported in Gansu, Inner Mongolia and Hainan.[6-8]. Brown Patch disease is a common disease on *Festuca arundinacea*, *Festuca arundinacea* and *Zoysia matrella* and other turfgrass. It also occurs on lawns in Gansu, Nanjing and Chongqing of Jiangsu Province[6,9-10]. Leaf spot disease is one of the most common diseases on *Festuca arundinacea* roots in warm-season type turf. Some scholars reported that the disease was isolated from *Festuca arundinacea* [11]. Turfgrass wilt occurred in Gansu, Inner Mongolia, Chongqing and other places[6-7,10]. High temperature and humidity are the main conditions for turf fungal diseases. Taizhou is located in the south-central part of Jiangsu Province in the middle and lower reaches of Changjiang River. It belongs to the north subtropical humid climate zone. The high temperature and humidity in summer provide a more suitable environment for the occurrence of turf fungal diseases. Therefore, in order to prolong the service life of the turf and improve the ornamental value of the turf, the daily maintenance management for the turf is particularly important.

V. CONCLUSION

The occurrence of turf diseases is the result of the interaction of environmental factors (such as temperature and humidity), susceptible plants and pathogenic bacteria. Therefore, in the process of turf planting and maintenance, we should create the environment conditions which are beneficial to the growth of turf plants but not conducive to the storage of pathogens, and it should adapt to local conditions and we should comprehensively and systematically apply various preventive measures to coordinate the ecosystem composed of turf plant, disease and environment, and control the disease damage to the lowest level, so as to achieve the best economic, ecological and social benefits. The prevention and cure of lawn diseases should follow the principle: main prevention and comprehensive cure. Specific control measures are: first, the selection of disease-resistant varieties, balanced and appropriate fertilizer, moderate increase of P, K fertilizer can improve the disease resistance of lawn grass; second, scientific maintenance and management, such as timely pruning and clearance of grass debris and withered layer, and the summer pruning can not be too low, and when the resistance of the plant is low, we should improve the height of pruning, Timely removal of disease plants, no evening or night irrigation, etc. Third, for the newly-planted turf, we adopt mix seeds with pesticide. We can use protective fungicides (Thiram, Capeton, etc.) and inhalant fungicides (metalaxyl, Benomyl, thiophonate-methyl, etc.) in advance to prevent the occurrence of turf diseases to a minimum to extend the service life and use effect of lawn.

In short, through this study, we preliminarily understand the main species distribution, pathogenic pathogens, symptoms of turf grass fungal diseases in Hailing District of Taizhou City, providing some basic information for turf scientific conservation and management.

ACKNOWLEDGMENT

The research work was funded by the key project of Jiangsu Agri-animal Husbandry Vocational College (Grant No: ZD1207). Innovation and Entrepreneurship Training Program for College Students in Jiangsu Province in China, 2018 (Grant No:201812806047H)

REFERENCES

[1] Jin Yue bo, Fu Wentao, Sun Junde. Research on Brown Patch Disease of Kentucky Bluegrass and Biological Control of this Disease. Journal of Liaoning agricultural college, 2009, 11(1):33-35.

[2] Zhang Cheng-Xia Nan Zhi-Biao Li Chun-Jie Wang Yan-Rong, Studies progress of fungicide seed treatments on the control of turfgrass diseases. Acta Prataculturae Sinica, 2005,14(6):14-22.

[3] Wang Yue-dong, Liu Zi-Xue, Su Ai-Lian, Preliminary establishment and application of turfgrass disease risk evaluation system. Pratacultural Science, 2012,29(8):14-22.

[4] Wei Jing-Chao. Manual of Fungi Identification [M].Shang Hai Shanghai Scientific and Technical Publishers, 1979: 463- 476, 549-647.

[5] Barnett H L , Hunter B B . Illustrated genera of imperfect fungi[M]// Illustrated genera of imperfect fungi /. Burgess Pub. Co. 1955.

[6] Liu Jin-Rong, Xie Xiao-Rong. Study on Main Diseases of Cold Season Turfgrasses and Their Control techniques in Hexi Corridor. Pratacultural Science, 2003, 20(4):48-51.

[7] Yuan Xiu-Ying, Han Yan-Jie, Jiang Hai-Yan, Identification of Pathogens of Lawny Diseases and Control in Hohhot. Grassland Of China ,2005,26(6): 70-72.

[8] Liu Xiao-Mei, Pu Jin-Ji. Initial report on turf grass disease occurrence in the Hainan province. Pratacultural Science, 2004,21(6):73-74.

[9] Zhang Qing-Feng Lin Shu-Yan Zhang Qiang. Prevention and control measures of main turfgrass diseases in Nanjing City, Journal Of Jiangsu Forestry Science & Technology, 2005, 32(3):26-28.

[10] Wang Yue-dong, Liu Zi-Xue, Su Ai-Lian, Preliminary studies on turfgrass diseases and identification of the pathogens in Chongqing. Plant Protection, 2009,35(3):141-144.

[11] Yu De-yi, Tang Bao-sha, Weng Qi-yong, Diseases and pathogens reported on 4 warm-season turfgrasses. Pratacultural Science, 2001, 18(4):60-64.