INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGIES
www.journalsresearchparks.org/index.php/IJOT e- ISSN: 2615-8140|p-ISSN: 2615-7071
Volume: 03 Issue: 05 | May 2021

Diseases of Roots and Root in Winter Wheat in Uzbekistan

Turdiyeva Dilfuza Tirkashboyevna,
PhD, senior lecturer of the department of Plant Protection,
Andijan Agricultural and Agrotechnological Institute in Andijan city.
Senior Researcher of the Andijan Regional Branch of the Plant Quarantine Research Centre.
Aznabakieva Dilrabo Tursunboevna,
Senior lecturer of the Department of Plant Protection,
Andijan Agricultural and Agrotechnological Institute in Andijan city.
aznabakieva.dilrabo@mail.ru
Xusanov Baxriddin Baxtiyrjon ugli,
4rd year student, Andijan Agricultural and Agrotechnological Institute in Andijan city.
Xayitalieva Gulxayo Abdusamad qizi,
2rd year student, Andijan Agricultural and Agrotechnological Institute in Andijan city.

----------***----------

ABSTRACT

The occurrence of root and foot rot diseases on winter wheat fields has been surveyed in 16 districts of six regions of Uzbekistan. Reports about wide occurrence of Fusarium root and foot rots on wheat fields have been confirmed, and causal agents have mostly been identified. For the first time in Uzbekistan severe infection of winter wheat seedlings with common root rot (caused by *B. sorokiniana*) has been determined on irrigated fields in two districts of Bukhara region. For the first time in the country infection of winter wheat seedlings with a root rot caused by the new for a country incitant of the disease, a fungus *Microdochium bolleyi*, has been determined in the Andijan region. For the first time an infection of winter wheat seedlings with both the cereal cyst nematode belonging to the *Heterodera avenae* group and *Fusarium* sp. has been registered in one field of the Tashkent region.

***Key words*:** winter wheat, root and foot rot, whitehead, *Fusarium* spp., *Bipolaris sorokiniana*, *Microdochium bolleyi*, *Heterodera avenae*.

INTRODUCTION

Winter bread wheat *Triticum aestivum* L. grown on irrigated areas may be considered as a relatively new crop for Uzbekistan because at Soviet times it has been considered as unimportant and had been cultivated exclusively on unirrigated (boghara) drylands, mostly foothills, on limited areas (100 to 250 thousand ha annually). Currently wheat occupies more than 1.4 million ha of irrigated arable lands annually. Unfortunately, crop growing system on these areas envisages dominance of wheat, and this creates favorable conditions for development not only of common diseases of this crop but leads or to appearance of new ones either to increasing frequency and severity of diseases that before were of little significance[1].

One group of such diseases are seedling blight, root, crown and foot rots of wheat and other cereal crops. Their symptoms include at first appearing of light brown, later becoming dark brown to black spots (necroses) on nodal and seminal roots, crowns, subcrown internodes, lower stem and lower leaf sheets. Infected plants have yellowing leaves and are stunted. At tillering stage one or more shoots can be killed. At heading stage some shoots can be stunted and fail to form ears, or

may develop small heads with few or no seeds. Severe infection with aggressive pathogens (e.g., some *Fusarium* spp.) at booting-heading-early ripening stages can cause premature death of plants with spikes, producing symptoms called "white shoot" and "whitehead"[2].

Symptoms of root, crown and foot rots may vary depending on causal fungi. Aetiology of the disease is complicated and it can be incited by dozens of pathogenic fungi (Table 1), or unfavorable weather and soil conditions. Different species of fungi may be involved and dominate in development of infectious root, crown and foot rots of wheat in various countries. The most devastating diseases are take-all, Fusarium diseases, common root rot, in some countries or regions – eyespot, Pythium root rots, Rhizoctonia root rots, snow molds and rots, and brown root rot[3]. Much less important are root diseases caused by weak pathogens such as chytrids, *Microdochium bolleyi*, *Curvularia* spp., *Hendersonia* sp. a.o. (Hill et al., 1983; Bockus et al., 2010; Nicol et al., 2010) **[1-3]**.

Table 1. **Fungi that cause seedling blight, root, crown and foot rot diseases of wheat**

**Bipolaris sorokiniana* (Sacc.) Shoem., anamorphic stage of *Cochliobolus sativus* (S. Ito et Kurib.) Drechs. ex Dastur (common root rot)
Fusarium spp. (more than 20 species), mainly **F. pseudograminearum* Aoki et O'Donnell, **F. culmorum* (W.G. Smith) Saccardo, sometimes **F. graminearum* Schwabe and others; (Fusarium root, crown and foot rot)
Gaeumannomyces graminis (Sacc.) Arx et D.L. Oliver var. *tritici* J. Walker, *G. graminis* var. *graminis* J. Walker and *G. graminis* var. *avenae* J. Walker (take-all)
Helgardia herpotrichoides (Fron) Crous & W. Gams, syns. *Pseudocercosporella herpotrichoides* (Fron) Deighton, *Cercosporella herpotrichoides* Fron, anamorphic stage of *Oculimacula yallundae* (Wallwork & Spooner) Crous & W. Gams, syn. *Tapesia yallundae* Wallwork & Spooner (eyespot, or strawbreaker foot rot)
Hendersonia crastophila Sacc., syn. *Wojnowicia graminis* (McAlp.) Sacc. et D. Sacc. (root rot)
**Microdochium bolleyi* (R. Sprague) de Hoog & Hermanides-Nijhof, syns. *Gloeosporium bolleyi* R. Sprague, *Aureobasidium bolleyi* (R. Sprague) v. Arx, *Aureobasidium pullulans* (DB.) Arnaud, *Idriella bolleyi* (R. Sprague) v. Arx (Aureobasidium decay)
Microdochium nivale (Fr.: Fr.) Samuels & I.C. Hallett, syn. *Fusarium nivale* (Fr.) Ces. ex Berl. & Voglino, anamorphic stage of *Monographella nivalis* (Schaffnit) E. Muller, syns. *Calonectria nivalis* Schafnit., *C. graminicola* (Berk. et Br.) Wollenv. (pink snow mold)
Phoma sclerotioides Preuss ex Sacc., syn. *Plendomus melioti* Dearn. & Sanford (brown root rot)
Pythium spp. (more than 20 species) (Pythium root rot or browning, Pythium snow mold and rot); complex species **P. debaryanum* Hesse & Schröet. s.l. is reported to occur in Uzbekistan
Rhizoctonia cerealis van der Hoeven, anamorphic stage of basidiomycete *Ceratobasidium cereale* Mur. et Burp. (sharp eyespot)
**Rhizoctonia solani* Kühn, anamorphic stage of basidiomycete *Thanatephorus cucumeris* (A.B. Frank) Donk; *R. zeae* Voorhees, syn. *R. oryzae* Ryker et Gooch., anamorphic stage of *Waitea circinata* Warcup et P.H.B. Talbot; other *Rhizoctonia* spp. with binucleate cells (Rhizoctonia root rots)

Sclerotinia borealis Bubák et Vluegel, syn. *S. graminearum* Elenev ex Solkina (snow mold, or snow scald)
Typhula idahoensis Remsberg, syn. *T. borealis* H. Ekstr.; *T. incarnata* Lasch, syns. *T. itoana* S. Imai and *T. gramineum* P. Karst.; *T. ishikariensis* S. Imai (speckled snow mold)
An unidentified low-temperature basidiomycete
Chytrids: *Polymyxa graminis* Ledingham, *Lagena radicicola* Vanterpool & Ledingham, *Rhizophidium graminis* Ledingham, *Asterocystis radicis* de Wild., *Olpidium brassicae* (Woronin) P.A. Dang. a. o. (root rot)
***Curvularia geniculata* (Tracy et Earle) Boed., anamorphic stage of *Cochliobolus geniculatus* Nelson; **C. inaequalis* (Shear) Boed.; ***Curvularia lunata* (Wakk.) Boed., anamorphic stage of *Cochliobolus lunatus* Nelson et Haasis; other *Curvularia* spp. (root rot)

Sources: Leslie, Summerell, 2006; Bockus et al., 2010; Nicol et al., 2010 **[2-4]** a. o.
Note. Species registered in Uzbekistan are marked off with asterisks. Common names of diseases are given in brackets.

Root, crown and foot rot diseases of wheat are little studied in Uzbekistan. The purpose of the current work was to determine occurrence of these diseases on wheat fields in central, southern regions and Fergana Valley of our country and to identify their causal agents[4].

MATERIALS AND METHODS

Samples of seedlings and mature plants of wheat infected with root rots have been collected during visits to farms (on a commission from the State Plant Protection Centre); some diseased plant samples had been delivered to us by farmers and scientists of the Uzbek Plant Protection Institute in 2011, 2012, 2015, 2016, and 2019. Route surveys of wheat fields for diseases have been carried out in Andijan and (partly) Fergana regions in 2019. Incidence of root rot disease symptoms including yellowing, stunting, and whitehead, has been determined and samples of infected plants were collected[5].

Samples were delivered to the lab of the Institute of Genetics and Plant Experimental Biology (IGPEB), and symptoms on roots and lower stems were recorded. Identification of causal agents of the diseases have been done in accordance with methods described earlier (Khasanov, 1990) **[5]**. Fragments 5-7 mm long had been cut off aseptically with sterile scissors from samples, and washed under tap water during c. 2 hours, surface sterilized with 0.5% solution of sodium hypochlorite during 30 s, rinsed twice in sterile distilled water with a droplet of Silwet Gold surfactant, and dried between sterile filter papers. Then fragments were placed on surface of sterile 2% water agar or other medium in plastic Petri dishes (Ø 9 mm), 4-6 fragments per a dish. To suppress bacterial growth after cooling till ~50^{o}C all media were added with streptomycin sulphate and penicillin (0.5 g/L + 0.5 g/L). Media in the second set of Petri dishes were not added with antibiotics for revealing bacterial growth if any. Inoculated Petri dishes were incubated during 7±3 days in growth chamber at alternating day-night conditions (4-5 Klx, 12 hours, 22±2^{o}C day and 12 hours, 15 to 20^{o}C night). Illumination had been provided with four L40 W/77 Fluora NUV lamps with a peak 365 nm and four fluorescent daylight lamps[10]. Fungi that have appeared on fragments had been studied first directly (*in situ*) under microscope at low magnification (80-120X), then mounts with fungal reproductive organs were studied at higher magnification (320-400X). Conidiophores, conidia and other structures found were measured and

registered and their characters were used for identification of pathogenic and accompanying fungi to species or generic level using special identification books (Nelson et al., 1983; Sivanesan, 1987; Leslie, Summerell, 2006; Bockus et al., 2010; Nicol et al., 2010) **[2-4, 6,7]**. Some of these fragments were used for isolation of pure cultures of representative causal fungi. Morphology of fungi were studied on potato dextrose agar medium in Petri dishes. Slope cultures of representative isolates are stored at the collection of the IGPEB.

RESULTS

Samples of infected plants were collected from 33 fields of 16 districts, six regions of the country (Table 2). Symptoms observed were yellowing leaves, stunting, discoloration of roots and crowns, lower stems, death of tillers, and whitehead[12].

Incidence of the disease varied in different fields, regions and by years. On some fields at tillering (TP, 11-1; AI, A-1, A-2, A-3, A-4; BS, B-1) and booting (KH, 12-1,2,3; BJ, B-2) growth stages incidence of the disease was enough high and it has been distributed in fields more or less evenly; adverse effect of the disease in such fields consisted mainly in death of tillers, often the main shoots of the plants[14].

Table 2. **Incidence of root, crown and foot rot diseases in wheat fields of Uzbekistan**

Year, region & district*	Sample No.	Growth stage[λ]	Symptoms observed[†]	Incidence[Ψ]
2011, TP (1)	11-1	22-25	YL, S, DT	~20%, E
2012, KH (3)	12-1,2,3	45-51	YL, S, DT	<50%, E
2012, KY (1)	12-4,5	55-65	YL, S, DT	~2-3%, F
2015, KS (5)	15-1,2,3	55-65	YL, S, DT	~2-3%, F
2016, TY (1)	16-1,2	37-43	YL, S	~5-6%, F
2019, AI (1)	A-1	22-25	YL, S	S
2019, AI (1)	A-2-1; A-2-2; A-3; A-4	22-25	YL, DT	~5-6%, E
2019, AK (1)	2	55-65	WH	>0,1%, Sp
2019, AK (1)	3	55-65	WH	>0,1%, Sp
2019, АД (1)	6	55-65	WH	>0,1%, Sp
2019, AS (1)	7	55-65	WH	2-3%, Sp
2019, AB (1)	10	55-65	WH	>0,1%, Sp
2019, AU (1)	12	55-65	DT, WH	~1-2%, Sp, F
2019, AU (1)	13	55-65	YL, S	~50%, E, Ss
2019, AS (1)	14	55-65	YL, S	~0,5%, Sp, Sa
2019, AU (1)	15	55-65	WH	>1-2%, Sp
2019, AU (1)	17	55-65	YL, S	~10%, E, Sa
2019, FF (1)	18	55-65	WH	>0,1%, Sp
2019, FF (1)	20	43-59	WH	>0,1%, Sp
2019, FF (1)	24	43-59	WH	>0,1%, Sp

2019, AA (1)	37	83-85	WH	>0,1%, Sp
2019, AA (1)	40	83-85	WH	>0,1%, Sp
2019, AI (1)	41-1-2; 41-1; 41-2	83-85	DS	>1%, E
2019, AI (1)	42-2-1	83-85	WH	>0,1%, Sp
2019, BS (1)	B-1	23-25	YL, DT	E on 20 ha of 30 ha in total
2019, BJ (1)	B-2	37-39	YL, S	15 to 20%, E

Districts of regions*: Andijan region: **AA – Altynkul, **AB** – Buz, **AI** – Izboskan, **AJ** – Jalaquduq, **AK** – Khodjaabad, **AS** – Shakhrikhan, **AU** – Ulugnor; Fergana region: **FF** – Fergana; Bukhara region: **BJ** – Jondor; **BS** – Shofirkon; Kashkadarya region: **KS** – Shakhrisabz; **KY** – Yakkabag; Tashkent region: **TK** – Kibray, **TP** – Pskent, **TY** – Yukari-Chirchik; Khoresm region: **KH** – Khazorasp. No. of fields surveyed are shown in brackets.

[λ]*Growth stages* are given after Zadoks et a., 1974 **[8].**

[†]*Symptoms*: **YL** – yellowing of leaves; **S** – stunting; **DT** – death of seedling tillers; **DS** – death of stems of mature plants; **WH** – whitehead (and white shoot).

[Ψ]*Incidence on the field*: **Sp** – sporadic; **F** – focal; **E** – more or less evenly distributed**.** *Soil*: **Sa** – saline; **Ss** – highly saline[18].

Even distribution of stunting plants and yellowing leaves has been observed also on fields with highly saline soils (AU, 13). At later growth stages (heading-flowering and further) diseased plants were registered, as a rule, in small foci, or more often, sparsely. This has been true especialy for whitehead, which has been observed sporadically, with incidence from less than 0.1% to 1-2% (Table 2).

CONCLUSIONS

1. Reports about wide distribution of Fusarium root, crown and foot rots on wheat plants in Uzbekistan were confirmed[14].
2. For the first time in Uzbekistan severe infection of winter wheat seedlings and mature plants with *Bipolaris sorokiniana*, causal agent of the common root rot of wheat was registered in Shofirkon and Jondor districts of Bukhara region.
3. For the first time in the country infection of winter wheat seedlings and mature plants with *Microdochium bolleyi*, causal agent of root rot and seedling blight of wheat was registered in Izboskan district of Andijan region.
4. For the first time in Uzbekistan infection of winter wheat seedlings with a complex *Fusarium* sp. + species of the *Heterodera avenae* group has been recorded in Pskent district of Tashkent region.

REFERENCES:

1. Khasanov, B.A. 1990. Methods of differentiation of wheat leaf spots using disease symptoms and microscopic features of causal agents. Biologicheskie Nauki (Biological Sciences), Moscow, No. 2, pp. 153-159 (in Russian).

2. Турдиева, Д. Т., Азнабакиева, Д., & Хасанова, М. (2019). Биоэкология грибных болезней пшеницы в Андижанской области. Академическая публицистика, (11), 59-65.

3. Турдиева, Д. Т., Азнабакиева, Д. Т., & Алижонова, С. Қ. (2019). ЖЕЛТАЯ РЖАВЧИНА-ОПАСНАЯ БОЛЕЗЕНЬ ДЛЯ ПШЕНИЦЫ. Академическая публицистика, (2), 45-48.

4. Давлатова, Ф. А., Турдиева, Д. Т., & Бердалиев, Х. (2018). ЭКОНОМИЧЕСКИЙ ПОТЕНЦИАЛ СЕЛЬСКОХОЗЯЙСТВЕННОЙ ЭКСПОЗИЦИИ. In ПРОБЛЕМЫ, ПЕРСПЕКТИВЫ И НАПРАВЛЕНИЯ ИННОВАЦИОННОГО РАЗВИТИЯ НАУКИ (pp. 268-270).

5. Азнабакиева, Д. Т., Турдиева, Д. Т., & Лукмонова, М. И. (2019). ФУЗАРИОЗНОЕ УВЯДАНИЕ-ОПАСНАЯ БОЛЕЗЕНЬ ТОМАТОВ. Академическая публицистика, (5), 112-115.

6. Турдиева, Д. Т., Мирхамидова, Г., Абдухалилова, М., Камбарова, Д., & Хатамова, Н. (2017). В ЧЕМ ПОЛЬЗА СМЕШАННЫХ ПОСАДОК. Современные тенденции развития науки и технологий, (3-1), 136-138.

7. Турдиева, Д. Т. МЕРЫ БОРЬБЫ ПРОТИВ ЖЕЛТОЙ РЖАВЧИНЫ ПШЕНИЦЫ MEASURES TO FIGHT AGAINST YELLOW RUST WHEAT. ББК 65.2 С56, 345.

8. Мустафакулова, Ф. А., Турдиева, Д. Т., & Алижанова, С. (2017). МИКРОБЫ-АНТАГОНИСТЫ ДЛЯ ЛЕЧЕНИЯ ЗАБОЛЕВАНИЯ РАСТЕНИЙ. In Научно-практические пути повышения экологической устойчивости и социально-экономическое обеспечение сельскохозяйственного производства (pp. 593-594).

9. Турдиева, Д. Т., & Азнабакиева, Д. Т. Алижонова СҚ қизи. НАУЧНЫЙ ЭЛЕКТРОННЫЙ ЖУРНАЛ «АКАДЕМИЧЕСКАЯ ПУБЛИЦИСТИКА», 45.

10. Мирзаева, З., Жалолов, К. Б., Турдиева, Д. Т., & Азнабакиева, Д. Т. (2013). КОРНЕВАЯ ГНИЛЬ ОЗИМОЙ ПШЕНИЦЫ В УСЛОВИЯХ АНДИЖАНСКОЙ ОБЛАСТИ. SCIENCE AND WORLD, 46.

11. Турдиева, Д. Т., Азнабакиева, Д. Т., Луқмонова, М., & Алижонова, С. (2020). COMMON ROOT AND FUZARIUM FOOT ROT OF WINTER WHEAT IN UZBEKISISTAN. Академическая публицистика, (3), 36-39.

12. Turdieva, D. T., Aznabakieva, D. T., Mustafaqulova, F. A., & Karimov, O. K. (2013). COMMON ROOT AND FUSARIUM FOOT ROT OF WINTER WHEAT IN UZBEKISTAN. *SCIENCE AND WORLD*, 37.

13. Турдиева, Ф.Т., Турдиева, Д.Т., & Азнабакиева, Д.Т. (2021). Баҳорги экиш муддатларида экилган баргли салат (lactuca sativa) навларини адаптив қобилиятини ўрганиш. *INTERNATIONAL JOURNAL OF DISCOURSE ON INNOVATION, INTEGRATION AND EDUCATION*, *2*(1), 133-137.

14. Турдиева Д.Т.,& Азнабакиева, Д.Т. Холдаров МХ ўғли. *НАУЧНЫЙ ЭЛЕКТРОННЫЙ ЖУРНАЛ «АКАДЕМИЧЕСКАЯ ПУБЛИЦИСТИКА»*, 48.

15. Бустанов, З. Т., Турдиева, Ф.Т., Салиев, С.А., & Расулова, Ф.И. (2015). АЗИАТСКАЯ МОРКОВЬ. *Современные тенденции развития науки и технологий*, (6-3), 113-115.

16. Туйчиев, Ж. Ш., Убайдуллаев, С. Ш., Турдиева, Ф. Т., & Солиева, М. Б. (2015). ИЗМЕНЕНИЕ ДОЛИ ДЕФЕКТНЫХ КОКОНОВ В ЗАВИСИМОСТИ ОТ СРОКОВ ПОСТУПЛЕНИЯ НА ЗАВОД. *Современные тенденции развития науки и технологий*, (4-2), 78-81.

17. Турдиева, Д.Т., & Азнабакиева, Д.Т. (2021). Таксономия рода fusarrium. *INTERNATIONAL JOURNAL OF DISCOURSE ON INNOVATION, INTEGRATION AND EDUCATION*, *2*(2), 346-349.

18. Khasanov, B. A., Turdieva, D. T., & Sherimbetov, A. G. ROOT AND FOOT ROT DISEASES OF WINTER WHEAT IN UZBEKISTAN.

19. Turdieva, D. T., Khasanov, B. A., & Sherimbetov, A. G. (2019). New root rot disease of wheat. *Agrokimyohimoya va o'simliklar karantini (Agricultural Chemistry, Plant Protection and Quarantine), Tashkent (to be published in 2019)(in Uzbek).*

20. Tirkashboevna, T. D. (2020). ROOT AND FOOT ROT DISEASES OF. *PalArch's Journal of Archaeology of Egypt/Egyptology*, *17*(6), 3309-3318.