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MICROMYCETES ASSOCIATED WITH WHEAT DISEASES IN DIFFERENT REGIONS OF UKRAINE

The study is largely concerned with the micromycetes that represented the causative agents of harmful diseases of wheat and are severe challenges for grain producers in Ukraine. The potential yield of domestic commercial cultivars is 11-12 t/ha, but only 25-40% of their productivity is realized. One of the main factors reducing the yield is ineffective disease control. Eyespot, take-all and sharp eyespot are among the most important diseases of wheat in Ukraine. However they are still underestimated in the country because of difficulties in their detection and causal agent isolation. Results of analysis of 37 Oculimacula strains, causal agents of eyespot, show the prevalence of the O. acuformis in northern regions, O.yallundae – in the south. Both species were detected in the central regions. The wide distribution (up to 100%) of Ceratobasidium cereale, a causal agent of sharp eyespot, has been observed all over the country. Gaeumannomyces graminis var.tritici, a causal agent of take-all, has been detected among darkly pigmented soil-borne fungi. Seed infection has been mainly presented by Alternaria, Fusarium, Penicillium, Helminthosporium and Mucor species. Pathogenicity of Fusarium strains has been confirmed in pathogenicity tests. The information has been obtained during surveys of winter wheat crops under different climatic conditions of Ukraine.

Key words: wheat (Triticum aestivum L.), Oculimacula acuformis, O.yallundae, Ceratobasidium cereale, Gaeumannomyces graminis var.tritici, seed infection.

Wheat (*Triticum aestivum* L.) is associated with many fungi, as causal agents of harmful diseases or secondary invaders. Pathogenic micromycetes cause the destruction of the host tissue. The infection results in tissue death (necrosis) which is very soon contaminated by saprophytic microorganisms. Easy isolation of the last ones from the infected tissue usually leads to ambiguous interpretation of the cause of disease.

Further difficulties are connected with low competitiveness of the pathogenic fungus in comparison with saprophytic ones. They are relatively slow-growing on culture media, and thus it is difficult to isolate them [30]. As a result the pathogenic species are not detected in the soil under the cereal crops [5] though their presence there is doubtless.

Fungal diseases impose very serious constraints on wheat growing in Ukraine. The problem of their effective and economically justified control remains unsolved. The diseases cause the 20-30%

yield loss annually [18]. Winter wheat is grown on about 7 mln ha in three zones: forest (F), forest-steppe (F-S) and steppe (S), which differ both as to soil and climate conditions and as to wheat cultivars and growing technologies. These factors can influence the diseases occurrence and their significance.

Current strategies for the disease control require correct disease diagnosis. Many years of intensive research all over the world resulted in working-out of the molecular method of plant diseases diagnostics [25-27]. However the classic methods of microbiology for isolation and identification of fungal phytopathogens are still relevant.

This work is devoted to research of the harmful fungal diseases of wheat, which importance is underestimated in Ukraine. The data on their distribution in different regions of Ukraine are presented. Described below methods of their diagnostics, pathogen isolation and identification will serve to improve current strategies of their control.

Visual symptoms as an important prerequisite for the agent further isolation and identification. Practitioners of plant pathology need to make visual diagnoses of disease symptoms. There are only a few diseases which can be easily diagnosed based on visual symptoms (powdery mildew, downy mildew, rust, bunt). They are caused by biotrophic fungal pathogens, and strategy of their infection is to save tissue alive as long as possible. However, most of the wheat diseases are caused by hemibiotrophic fungi with biotrophic and necrotrophic phases in the life cycle. Their invasion is more rough, they kill plant cells by toxic metabolites. Their symptoms typically result in tissue death. These are fusarium ear flight and fusarium foot rot, take-all, stem base diseases (eyespot and sharp eyespot), septoria leaf blotch and glume blotch, common root rot, "black point", snow mold, tan spot.

Visual diagnosis of such diseases must then be supported by detailed cultural or molecular laboratory tests [29], the first step of which is the isolation of causal agents in pure culture.

Since a low competitive power is characteristic of the most of phytopathogenic fungi, as compared with saprophytic micromycetes and bacteria, the specific conditions can favor for their isolation and identification. For example, some of them need low temperature (*Microdohium nivale*), other (*Oculimacula* spp.) – low temperature and UV [15], etc. The creation of such condition must be based on the preliminary conclusion reached by visual symptoms. It is important to know a key diagnostic symptom of every disease and over time examine many plants to identify correctly a key symptom. Diagnostic guides for plant disease identification can assist in the visual diagnostic [14, 21, 29].

Isolation and identification of *Oculimacula* species – causal agents of eyespot.

The disease was first detected in Ukraine in the 1960's [10] and now is widely distributed all over the country. Causal agents of eyespot, ascomycete fungi *Oculimacula yallundae* (Wallwork & Sponer) Crous & W. Gams and *O.acuformis* (Boerema, R.Pieters & Hamers) Crous & W. Gams (anamorphae *Helgardia herpotrichoides* (Fron) Crous & W. Gams and *H.acuformis* (Nirenberg) Crous & W. Gams) [8], previously known as wheat (W) and rye (R) pathotypes of *Pseudocercosporella herpotrychoides* (Fron.) Deighton [23], are different as to their morphological, biological and ecological characteristic. Unfortunately most researches in Ukraine are limited by visual diagnostics of the eyespot, at best they identify the causal agent as *P. herpotrychoides* [1, 4].

Husbandry practices may affect the two eyespot pathogens differently. *O. yallundae* develops more quickly and is often found earlier in crop. The slower development of *O. acuformis* causes its less harmfulness compared to *O. yallundae* [3]. The information relating to dominant species in every concrete case may help in control of this disease.

The identification of *Oculimacula* (*Helgardia*) species, as a rule, is conducted on the basis of cultural characteristics [11]. *O.yallundae* produces colonies with smooth, even margins in culture on potato-dextrose agar (Fig.1). However, *O.acuformis* (former R-type) produce colonies with feathery margins and radial growth rates about half those of *O. yallundae* (Fig.2).

The single spore technique is the preferred method for obtaining pure culture of two fungi. According to Burgess & Liddell [6], a suspension of spores is prepared in 10 ml of sterile water so that it contains 1-10 spores at low power microscope field when a drop is examined on a slide. This spore suspension (1.5 мл) is poured over the solidified water agar so as to cover the entire surface. The dishes such seeded are incubated in an inclined position at room temperature for 18-24 hr. At the end

of this time the dishes are opened and examined under a dissecting microscope. Small squares of the agar containing single geminating spore are cut out with a dissecting needle having a flattened tip and transferred to the desired growth medium (PDA).

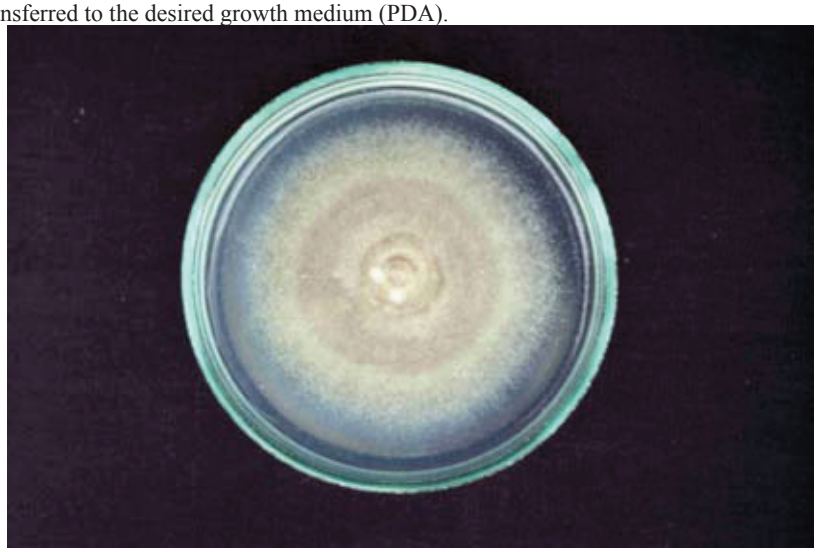

Fig.1. Colony of *Oculimacula yallundae*

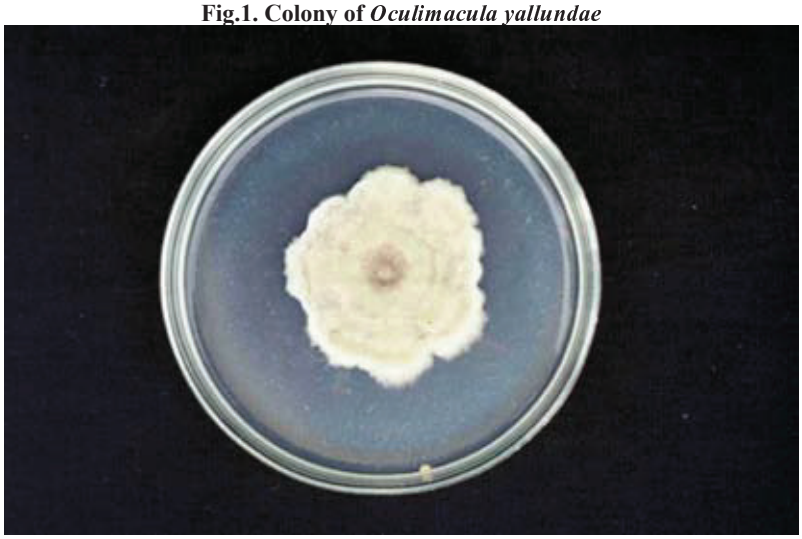

Fig.2. Colony of *Oculimacula acuformis*

The plant samples with eyespot symptoms for the pathogen isolation and species identification have been taken from five locations in different climatic zones of Ukraine. The moist chamber method was used for isolation of the pathogens. Eyespot lesions on stem base were cut, surface sterilized and put on to a moist chamber on top of two damp towels or a plate of agar as described by Bateman & Fitt [2]. After incubation for 3 weeks at 15 ^{0}C under near-ultraviolet light, a suspension of *Helgardia* spores was prepared and pure cultures were obtained as described above.

The list of the obtained monoconidial isolates of *Helgardia* is presented in Table 1. The results show that *O.acuformis* prevailed in the forest zone of Ukraine, *O.yallundae* – in the steppe. The both species were detected in the forest-steppe regions.

Table 1

Distribution of *Oculimacula* species in different Ukrainian region

No strain	Growth rate, mm/day	Colony edge	Species	Isolate source	Zone
1	0.93	feathery	*O.acuformis*	State farm "Baryshivskii"	F
2	1,92	indented	*O.acuformis*		
11	0,95	feathery	*O.acuformis*		
12	0,79	indented	*O.acuformis*		
13/3	1,14	feathery	*O.acuformis*		
13/4	0,99	indented	*O.acuformis*		
14	1,26	feathery	*O.acuformis*		
15	0,82	feathery	*O.acuformis*		
17	0,99	indented	*O.acuformis*		
18	1,10	indented	*O.acuformis*		
19	1,02	indented	*O.acuformis*		
1/04	0,57	feathery	*O.acuformis*	Research enterprise "Glevaha", Institute of plant physiology and genetics of NASU	
3/04	1,11	feathery	*O.acuformis*		
4/04	1,54	feathery	*O.acuformis*		
5/04	0,71	indented	*O.acuformis*		
6/04	0,89	feathery	*O.acuformis*		
7/04	0,61	feathery	*O.acuformis*		
8/04	0,68	feathery	*O.acuformis*		
10/04	0,89	indented	*O.acuformis*		
14/04	1,07	feathery	*O.acuformis*		
23	0,98	indented	*O.acuformis*	Education and research farm "Velykosnytinske", NUBiP	F-S
24	0,91	indented	*O.acuformis*		
5/1	1,64	smooth	*O.yallundae*	"Plotytzkii", State station of plant varieties expertise	
5/3	1,50	smooth	*O.yallundae*		
5/4	1,50	rough	*O.yallundae*		
5/6	2,07	rough	*O.yallundae*		
33/04	1,89	rough	*O.yallundae*		
34/04	1,57	rough	*O.yallundae*		
35/04	1,46	smooth	*O.yallundae*		
36/04	1,71	smooth	*O.yallundae*		
37/04	1,79	smooth	*O.yallundae*		
38/04	1,64	rough	*O.yallundae*		
39/04	1,54	smooth	*O.yallundae*		
4	1,82	smooth	*O.yallundae*	Mykolayiv, Institute of agrarian industry, NAASU	S
5	1,91	smooth	*O.yallundae*		
6	1,74	rough	*O.yallundae*		
22	1,91	smooth	*O.yallundae*		

***Rhizoctonia cerealis* – a causal agent of sharp eyespot.** The confusion of eyespot lesions with those of sharp eyespot is a common problem of visual diagnosis. Both are stem-base diseases. According to the disease description by Goulds & Polley [14], at adult plants sharp eyespot lesions look for the characteristic "watermark" stain which is a diagnostic feature of sharp eyespot. This "watermark" stain is never seen on the stem over eyespot lesions. The causal agent is *Rhizoctonia cerealis* Van der Hoeven, the teleomorph is *Ceratobasidium cereale* D.Murray & L.L.Burpee. But until the 1990's most researchers identified the cause of sharp eyespot as *R. solani* Kuehn. It is now generally accepted that the sharp eyespot fungus is distinct from *R. solani,* early references linking *R. solani* with sharp eyespot can be taken as referring to *R.cerealis* with confidence.

Determination of *Rhizoctonia* in the infected plant is made by isolation of the fungus from the tissue. The wheat stems with a sharp eyespot symptom (up to 5 cm long) are washed in tap water, surface sterilized, twice rinsed in sterile water and blotted to dry. Small samples of plant tissue (0.5 cm long) are then cut from the lesions and transferred to PDA. *R. cerealis* forms white to buff colonies on PDA, grows slowly on the medium. Hyphae of its isolates are narrow, from 2.5 to 8 μm in diameter, and sclerotia are seldom formed on the agar surface. In contrast, sclerotia of *R. solani* are

frequent, hyphae broad (5.5-12 μm), colonies buff to brown and they last grow on PDA dense [7].

Results from our surveys show (Table 2) that the distribution of the sharp eyespot in Ukraine does not depend on the zone. That means the disease may be common under different climatic conditions.

Table 2

Infection of wheat by sharp eyespot

No of samples	Frequency, %	Diseased stem, %	Collection location	Zone
4	100	41.2	Private farm, Mena	F
2	100	60	State farm "Baryshivskii"	
1	0	0	Research farm "Glevaha", Institute of plant physiology and genetics, NASU	
2	100	20	"Velykosnitynskii", Education and research farm, NUBiP of Ukraine	F-S
6	50	5.9	Kharkiv, Education and research farm of National agricultural university	
2	0	0	Vinnitza, Institute of feed, NAASU	
6	0	0	Peremishl', State station of plant varieties expertise	
3	100	15.1	Private farm, Kotovsk	S
4	80	13.9	Mykolayiv, Institute of agrarian industry, NAASU	
7	57,1	0.4	Kherson, Institute of agriculture of southern regions, NAASU	

In our early surveys, sharp eyespot in the 1990's was common and severe, but penetrating lesions, which can result in the yield loss, were relatively seldom [20]. Nothing more was known about this disease. The relative importance of sharp eyespot as a cause of loss has been underestimated. The breeding was considered to be of no importance for this disease. Therefore, most of cultivars in the country are susceptible to the disease that promotes the infection accumulation and can result in the disease outbreak.

Take-all fungus *Gaeumannomyces graminis* (Sacc.) von Arx & Olivier var. *tritici* Walker and its detection on wheat root. Despite periodic reports of outbreaks of take-all in Ukraine, from 1977 [24, 28], the control measures are to be developed. The yield loss is difficult to estimate, especially at the chronic or subclinical level, when the incidence and severity of infection can be seen on the roots, but the classical take-all symptoms in the seedlings or dead-heads or whiteheads at flowering do not occur [32]. Some progress can be achieved with the use of the convectional methods of diagnosis which include isolation of causal agents in pure culture and pathogenicity test [35].

According to Garrett [13] the fungus is an ecologically obligate parasite, it grows slowly on the medium as compared to accompanying micromycetes abundant in soil and on the roots. Furthermore, since *G.graminis* var. *tritici* typically does not sporulate in culture, the correct identification relies on cultural characteristics, such as pigmentation, thick runner hyphae, and hyphal curling at the colony margin [35].

A pure culture may be obtained only after the hard surface sterilization of roots with 1% $AgNO_3$ or 10% sodium hypochlorite and further incubation on medium agar containing antibiotics for 1 week at 20 ^{0}C. Observed under microscope fungal colonies resembling *G.graminis* var. *tritici* (light gray, with hyphal tips starting to curl back) are subcultured on to fresh PDA plates and incubated.

It may be possible to produce pure culture by "hyphal tipping". This means a transfer of a single hyphal tip under the dissecting microscope in much the same manner as a single-sporing [6].

Pathogenicity determination is very time consuming, but it is a necessary step to confirm diagnosis. There are many darkly pigmented fungi in soil which are associated with roots and may be confused with the pathogen [38].

Pathogenicity test is done by placing the inoculum (a ring of agar culture of a *G.graminis* var. *tritici*) on sterile sand in small plant pots and a seed is placed on its top and covered with sand. The pots are placed in a cool growth chamber for 6 weeks, after which the plants are removed, washed and assessed for the disease symptoms. At this stage the main symptom of take-all is a blackening of roots, which is confirmed by a microscopic diagnosis that is based on the detection of runner hyphae of *G.graminis* var.*tritici* on the wheat root (Fig.3).

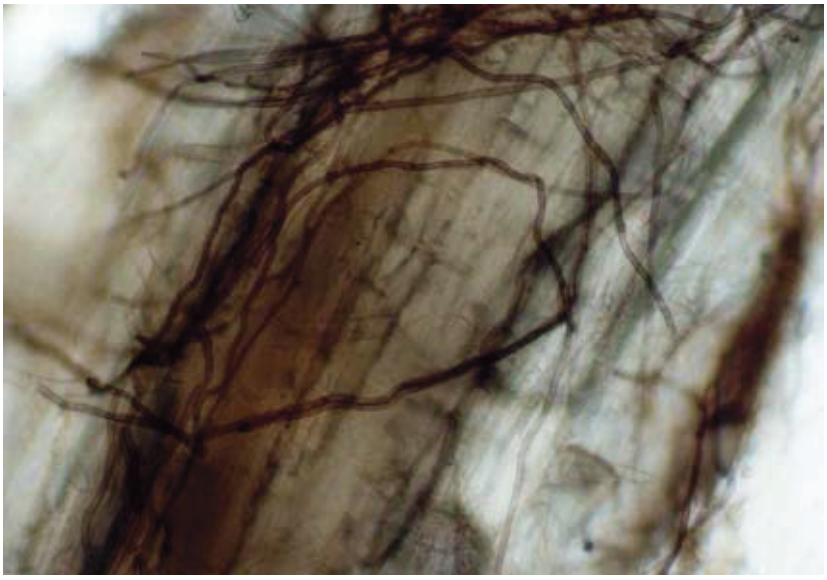

Fig 3. Runner hyphae of *Gaeumannomyces graminis* var. *tritici* on wheat root

Micromycetes on grain. Most studies of the micromycetes on small grain have emphasized fungi that cause the diseases of roots, ears and leaves. Few have been concerned with species of superficial microflora, which can be antagonistic to pathogens. According to Hill & Lacey [16] , the surface microflora of a ripening grain is dominated, in decreasing order of abundance, by bacteria, yeasts, and filaments fungi *Cladosporium* Link:Fr., *Alternaria* Nees:Fr., *Epicoccum* Link, *Fusarium* Link . By the time of harvest, yeast colonize 50 to 85% of grain, *Cladosporium* up to 90% and *Alternaria* up to 100%.

According to Semenov & Fedorova [33], the superficial (or epiphytic) microflora is a special group of microorganisms that colonize the surface of plants and feed products of their life. Under the normal condition they do not invade the tissue and do not cause the damage. Sometimes these organisms play a positive role as the biological control agents. However under certain condition the epiphytic microflora can damage grain especially if it consists of toxin-producing strains.

The epiphytic microflora consists of 80-99% of bacteria *Pseudomonas herbicola* і *P.fluorescens* and fungi of genera *Alternaria, Mucor, Dematium, Cladosporium, Penicillium* Link., *Aspergillus* Micheli.

Endophytic fungi on seed can cause the seedling diseases and thus these are pathogens. These are species of *Fusarium, Helminthosporium* Link:Fr., *Septoria* Sacc., bunt, etc.

Species of *Fusarium, Alternaria, Helminthosporium, Septoria* (field fungi) and *Pseudomonas* colonize the ripening grain in the field [16]. They grow at moisture of kernel more than 20%. Storage mold fungi are presented by species of *Penicillium* Link. and *Aspergillus* Micheli. They grow at moisture 13-20% or moisture in equilibrium with 65-90% of relative humidity [17].

Surveys of fungi on wheat grain grown in different zones of Ukraine have been implemented. Seed samples were collected from 6 locations of the country. The presence of seed-borne fungi was observed from more than 50 samples. The observation was conducted using a moist chamber method. It is the simplest method for assessment of microflora. After surface sterilization 25 wheat grains were placed on the top of two damp towels in a Petry dish and cultivated during 7-10 days. Usually, 100 grains per one sample were analyzed in 4 dishes.

The identified fungi associated with the grains were *Alternaria* spp., *Bipolaris sorokiniana* (Sacc.) Shoemaker, *Fusarium* spp., *Penicillium* spp., *Mucor* spp. (Table 3). Species of *Alternaria* dominated in all analyzed samples. No essential differences of grain mycobiota were established in various zones. Among micromycetes the toxin-producers (*Fusarium, Alternaria, Penicillium*) were abundant, but toxin accumulation still remains to be estimated.

Table 3

Micromycetes in wheat grain

Fungi	Frequency of isolation, %	Infected grain, %	Source*	Zone
Alternaria spp	100	59.6	1-7	F, F-S, S
Fusarium spp	70	1.7	1-7	F, F-S, S
Cochliobolus sativus	15	0.1	1,3,6	F – F-S
Penicillium spp	80	5.4	1,2,3-6	F, F-S, S
Mucor+Rhizopus	85	2.4	1-7	F, F-S, S

*1 – State farm "Fastivskii"; 2 –State Farm "Baryshivskii"; 3 – Research farm "Glevaha", Institute of plant protection and genetics, NASU; 4 – Mycolayiv, Institute of agrarian industry, NAASU; 5 – "Chabany" Institute of farming agriculture, NAASU; 6 - Education and research farm "Velykosnytinske", NUBiP of Ukraine; 7 – Peremishl' State centre of plant varieties expertise

Isolates of seven species of *Fusarium* were obtained from the roots, stem-base and grain of wheat and identified according to Nelson, Toussoun, Marasas [30]. These are *F.graminearum* Schwabe*, F.culmorum* (W.G.Smith) Sacc.*, F.avenaceum* (Fr.) Sacc.*, F.sporotrichiella* Bilai*, F.oxysporum* Schlecht. emend Snyd. et Hans.*, F.solani* (Mart.) Appel et Wollenw. emend Snyd. et Hans. and *F.moniliformis* Sheld. *F.oxysporum* was the predominant species in all samples. Pathogenicity tests show that populations of *F.oxysporum* consist of pathogenic as well as non pathogenic strains (Table 4). About 60% of isolates of *F.oxysporum* caused the disease on wheat seedlings after artificial inoculation. All isolates of *F.culmorum* as well as those of *F.graminearum* were more pathogenic on the average than *F.oxysporum* or *F.solani*. As stressed by many researches [30], in many cases some *Fusarium* species are wrongly assumed to be the cause of the disease because of their frequent isolation from the necrotic tissue.

Table 4

Pathogenicity of *Fusarium* isolates

Isolated from	Species	No of isolates		Severity score (0-4)
		total	pathogenic	
Stem and roots	*F.oxysporum*	14	8	0.80±0.14
	F.culmorum	8	8	1.70±0.42
	F.solani	6	2	0.40±0.05
	F.graminearum	2	2	1.00±0.50
Grain	*F.oxysporum*	15	15	1.73±0.12
	F.culmorum	16	16	3.16±0.10

B.sorokiana (synonym *Helminthosporium sativum* Pammel, King & Bakke) causes one of the most serious foliar diseases of wheat mostly in warm climate areas. The telemorph is *Cochliobolus sativus* (Ito & Kuribayashi) Drechs. ex Dastur). In Ukraine the pathogen can colonize seed ("black point"), root (common root rot) [19]. If seed-borne, the fungus can attack the seedling. The infected seedlings develop dark brown necrotic lesions on their roots, crowns and lower leaf sheath [22].

Alternaria species are mainly saprophytic fungi. However, some of them have acquired pathogenic capacities causing disease over a broad host range, mainly dicotyledon. In general, *Alternaria* species are foliar pathogens that cause a relatively slow destruction of the host tissue. The infection leads to the formation of necrotic lesions. The fungus can survive as a latent infection in seeds. If seed-borne, the fungus can attack the seedling once the seed has germinated [34].

Unfortunately, most researches of *Alternaria* pathogenicity are limited by isolation of *Alternaria* strains from the wheat grain, at best they identify their species [31]. But to complete Koch's postulates, the parasitic capacities of *Alternaria* strains have to be confirmed in pathogenisity tests. According to Gannibal [12], in laboratory assay none of 68 *Alternaria* strains tested were able to induce the symptoms on young leaves of different wheat and barley cultivars in spite of high inoculums concentration.

Storage mold fungi (*Penicillium* spp.*, Mucor mucedo)* are often encountered on various natural and synthetic substances. They destroy plant residue intensively and participate in the destruction of organic matter [37]. In addition, among *Penicillium* fungi there are toxin producers that cause contamination of grain [36].

Discussion. We confirmed that a diverse range of micromycetes species can be isolated from diseased tissue of wheat. However, only a few species were associated with harmful diseases. These are *Oculimaculla* spp. and *R. cerealis* isolated from the stem base and *G. graminis* var. *tritici*, isolated from roots.

Some species of *Fusarium* (*F. oxysporum*) can colonize dead tissue as secondary invader, but can be wrongly assumed to be the cause of diseases [30]. This suggestion agrees with our finding, that *Fusarium* strains isolated from seed are more strongly associated with pathogenicity than the isolates from diseased stem base and root.

Alternaria isolates from cereal seed were not associated with pathogenecity factor as well as *Penicillium* isolates that reveal their cosmopolitan nature and active participation in organic matter destruction. However, the species of *Fusarium, Alternaria* and *Penicillium* as toxin producers are important agents of human and animal diseases.

As is known, fungi on the living plants differ from those on the dead ones. Some microorganisms (saprothrophic) colonize only dead tissue. The living plants, despite of the ability of nutrients, are not available for them because of some defense response. Vice versa, the pathogenic fungi can overcome the defense response of living plant, but die themselves or form the resting bodies after the plant death [9].

The methods described above will assist in isolation and identification of pathogenic micromycetes, associated with eyespot, take-all, sharp eyespot, seed infection of wheat, and in promotion of their further research and control.

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МІКРОМІЦЕТИ З УРАЖЕНОЇ ХВОРОБАМИ ПШЕНИЦІ У РІЗНИХ РЕГІОНАХ УКРАЇНИ

Р е з ю м е

Дослідження присвячені мікроміцетам – збудникам небезпечних хвороб пшениці, які становлять серйозну проблему для виробників зерна в Україні. Потенційний урожай вітчизняних сортів пшениці досягає 11-12 т/га, проте реалізується він всього на 25-40%. Одним із головних чинників зниження урожайності є неефективний захист рослин від хвороб.

Церкоспорельоз, офіобольоз і ризоктоніоз серед найбільш важливих хвороб пшениці в Україні. Проте вони до цих пір недооцінені через труднощі з їх виявленням та ізоляцією збудників.

Результати аналізу 37 штамів *Oculimacula,* збудників церкоспорельозу, свідчать, що вид *O. acuformis* домінує в північних регіонах, *O.yallundae* – в південних. В центральних регіонах було виявлено обидва види. Значне розповсюдження (до 100%) гриба *Ceratobasidium cereale* – збудника ризоктоніозу, відмічали повсюди в країні. *Gaeumannomyces graminis* var. *tritici* – збудник офіобольозу було виявлено серед інших темно-пігментованих ґрунтових грибів. Насіннєва інфекція представлена видами *Alternaria, Fusarium, Penicillium, Helminthosporium* і *Mucor.* У тестах на патогенність підтверджено патогенність штамів *Fusarium.*

Інформація отримана при обстеженні посівів озимої пшениці в різних ґрунтово-кліматичних умовах України.

К л ю ч о в і с л о в а: пшениця, мікроміцети, *Oculimacula acuformis, O.yallundae, Ceratobasidium cereale, Gaeumannomyces graminis var.tritici,* насіннєва інфекція

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МИКРОМИЦЕТЫ НА ПОРАЖЕННОЙ БОЛЕЗНЯМИ ПШЕНИЦЕ В РАЗЛИЧНЫХ РЕГИОНАХ УКРАИНЫ

Р е з ю м е

Исследования посвящены микромицетам – возбудителям чрезвычайно важных болезней пшеницы, вызывающих серьезные проблемы у производителей зерна в Украине. Потенциальный урожай отечественных сортов пшеницы достигает 11-12 т/га, но реализируется он только на 25-40%. Одним из главных факторов снижения урожайности есть неэффективная защита растений от болезней.

Церкоспореллез, офиоболез и ризоктониоз среди наиболее важных болезней пшеницы в Украине. Однако они до сих пор недооценены в связи со сложностями при их обнаружении и изоляции возбудителей.

Результаты анализа 37 штаммов *Oculimacula* свидетельствуют о том, что вид *O. acuformis* преобладает в северном регионе, *O.yallundae* – в южном. Оба вида были обнаружены в центральном регионе. Широкое распространение (до 100%) *Ceratobasidium cereale* – возбудителя ризоктониоза отмечено повсеместно. *Gaeumannomyces graminis* var. *tritici* – возбудитель офиоболеза выявлен среди темнопигментированных почвенных грибов. Семенная инфекция представлена видами *Alternaria, Fusarium, Penicillium, Helminthosporium* и *Mucor.* В тестах на патогенность подтверждена патогенность штаммов *Fusarium.*

Информация получена при обследовании посевов озимой пшеницы в различных почвенно-климатических условиях Украины.

К л ю ч е в ы е с л о в а: пшеница, микромицеты, *Oculimacula acuformis, O.yallundae, Ceratobasidium cereal, Gaeumannomyces graminis* var. *tritici*, инфекция семян.

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