

ORIGINAL SCIENTIFIC PAPER

Phytosanitary monitoring of barley crops in Bulgaria

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Abstract

Weed infestation, development of diseases and pests are the main unfavourable factors that limit yield and quality of barley. In all explored regions of Bulgaria were found during April-May of 2008 and 2009 everywhere *Cirsium arvense* (L) Scop, *Convolvulus arvensis* L., *Galium tricorne* With, *Sinapis arvensis* L., *Anthemis* spp., *Polygonum convolvulus* L., *Papaver phoeas* L., *Consolida orientalis* Schrod. In the barley commercial fields in during the spring were found four types of damaging aphids - *Sitobion avenae*, *Schizaphis graminum*, *Rhopalosiphum maidis* and *Rhopalosiphum padi*. The most damaging and wide spread is *Sitobion avenae*. The highest aphids number was reported in barley fields of Southeast, North Central and Northeastern Bulgaria. Species composition of the most frequently occurring diseases in barley was determined. Two groups of diseases were established: leaf-stem and seed borne. It was found that mainly occur were *Erysiphe graminis* f.sp. *hordei*, *Puccinia hordei* and *Rhynchosporium secalis*.

Key words: barley, weeds, disease, pests, phytosanitary monitoring

Introduction

Barley is one of the main cereal crops and occupies a large area in the world. In the group of cereals the barley is after wheat, maize and rice, while in Bulgaria it is the third most important crop after wheat and maize. Weed infestation, development of diseases and pests of the areas sown under barley are ones of the main unfavourable factors that limit yield and quality. The yields losses in some years can vary from 10 to 70 percents. The problem with weeds, pests and diseases in crops is very important. Its constant actuality is supported of the great dynamics of species and communities in crops. Dynamic changes are mainly related to changes in technology of cultivation, with significant variability of weather conditions, changes in economic conditions of grain production. The mapping of weed infestation has an important role and becomes crucial in recent decades due to dynamic compensation processes, especially pronounced in cereals (Lyubenov, 1987, Dimitrova, 1998; Dimitrova-Doneva, 2007; Mitkov, et.al., 2009). Quantity and quality of yield could be reduced significantly by damages of many insects, including aphids are major economic importance (Grigorov, 1980). These insects are vectors of many plant viruses, among of them with most - great economic importance is the Barley yellow dwarf virus (BYDV), which causes serious damages in barley crops and in some years could compromised the entire yield (Gospodinov, Mitov, 1971; Grigorov, 1980; Kovatchevski et.al. 1999; Drees and Jaackman, 1999; Krasteva and Bakardjieva, 2000; Chapin et al., 2001; Jhonson and Townsend, 2004; Thackray et al., 2005). The greatest economic importance diseases for Bulgaria are *Ustilago nuda*, *Drechslera graminea*, *Erysiphe graminis*, *Rhynchosporium secalis*, *Puccinia hordei* and Barley yellow dwarf virus (Navushtanov, 1991). The aim of the study data was to identify the most common weeds, diseases and pests in crops of barley in Bulgaria.

Material and methods

The experiment was carried out in a barley crops in Bulgaria during April-May, 2008-2009 the period. Weeds have been reported in routing method according to our assumed uniform methodology for reporting and mapping of weed infestation in agricultural areas

(Dimitrova et al., 2004). Weeds were determined accordingly Delipavlov et.al (2003), as a record of all species occurring in the area.

The aphid's population size is determined by direct measures on 30 locations on 10 barley stalks in each barley crop (Dewar, Dean, Cannon, 1982). Taxonomic analyses of the aphids are accordingly Emden (1972) и Blackman & Eastop (1984).

To determine the state of the barley crops in terms of diseases was observed during the growing season . Readings were carried out on the route method, via the plants (Stepanov, Chumakov, 1972, Krivchenko, 1984).

Results and discussion

As a result of monitoring carried out in 2008-2009 in crops of winter barley were registered a total of 67 weed species from 20 families. The most common are representatives of the families Asteraceae - 11 species, Poaceae - 10 species and the Brassicaceae - 9 species. By biological groups most commonly found winter-spring weeds - 19 species, early spring - 16 species, perennial - and 10 species ephimers - 9 species. Annual dicotyledonous weeds are characterized as the greatest diversity of species and with the greatest density in surveyed areas (table 1).

Table 1. Species of weeds registered in the field of barley in Bulgaria

CEM. ASTERACEAE	<i>Anthemis arvensis</i> L., <i>Centaurea cyanus</i> L., <i>Centaurea solstitialis</i> , <i>Cichorium intybus</i> L., <i>Cirsium arvense</i> (L) Scop, <i>Matricaria inodora</i> L., <i>Matricaria tenuifolia</i> (Simk.) Kit, <i>Senecio vernalis</i> W.K., <i>Sonchus</i> <i>arvensis</i> L., <i>Sonchus oleraceus</i> L., <i>Xanthium strumarium</i> L.
CEM. BRASSICACEAE	<i>Arabidopsis thaliana</i> (L.) Heync., <i>Descurainia sophia</i> (L.) Webb. Et Berth., <i>Capsella bursa-pastoris</i> (L.) Medic, <i>Cardaria draba</i> (L.) Desv., <i>Erysimum repandum</i> L., <i>Myagrum perfoliatum</i> L., <i>Raphanus</i> <i>raphanistrum</i> L., <i>Sinapis arvensis</i> L., <i>Thlaspi arvense</i> L.
CEM. RANUNCULACEAE	<i>Adonis aestivalis</i> L., <i>Consolida regalis</i> S.F.Gray , <i>Consolida orientalis</i> <i>Schroding</i> , <i>Ranunculus arvensis</i> L.
CEM. RUBIACEAE	<i>Galium tricorne</i> With.
CEM. POLYGONACEAE	<i>Fallopia convolvulus</i> L., <i>Polygonum aviculare</i> L., <i>Polygonum</i> <i>lapathifolium</i> L., <i>Rumex acetosella</i> L.
CEM. PAPAVERACEAE	<i>Fumaria officinalis</i> L., <i>Papaver rhoeas</i> L.
CEM. BORRAGINACEAE	<i>Lithospermum arvense</i> L., <i>Myosotis arvensis</i> (L.) Hill
CEM. LAMIACEAE	<i>Lamium amplexicaule</i> L., <i>Lamium purpureum</i> L., <i>Sideritis montana</i>
CEM. SCROPHULARIACEAE	<i>Veronica hederifolia</i> L., <i>Veronica tournefortii</i> Gmel.
CEM. ROSACEAE	<i>Rubus caesius</i> L.
CEM. VIOLACEAE	<i>Viola tricolor</i> L.
CEM. APIACEAE	<i>Bifora radians</i> M.B., <i>Caucalis daucoides</i> L., <i>Scandix pecten-veneris</i> L.
CEM. CARYOPHYLLACEAE	<i>Agrostemma githago</i> L., <i>Holosteum umbellatum</i> L., <i>Stellaria media</i> (L.) Cyr, <i>Vaccaria pyramidata</i> Mod.
CEM. FABACEAE	<i>Melilotus officinalis</i> (L.) Medic, <i>Lathyrus aphaca</i> L., <i>Lathyrus hirsutus</i> L., <i>Lathyrus tuberosus</i> L., <i>Vicia grandiflora</i> Scop., <i>Vicia striata</i> M. B.
CEM. EUPHORBIACEAE	<i>Euphorbia helioscopia</i> L.
CEM. CHENOPODIACEAE	<i>Chenopodium album</i> L.
CEM. CONVULVULACEAE	<i>Convolvulus arvensis</i> L.
CEM. CAPRIFOLIACEAE	<i>Sambucus ebulus</i> L.
CEM. POACEA	<i>Aegilops cylindrica</i> L., <i>Alopecurus myosuroides</i> (L.) P.B., <i>Apera spica</i> <i>venti</i> L., <i>Avena fatua</i> L., <i>Bromus arvensis</i> L., <i>Dactylis glomerata</i> L., <i>Hordeum murinum</i> L., <i>Lolium temulentum</i> L., <i>Poa annua</i> , <i>Sorghum</i> <i>halpense</i> (L.) Pers.

In all explored regions of Bulgaria are found everywhere *Cirsium arvense* (L) Scop., *Convolvulus arvensis* L., *Galium tricornis* With., *Sinapis arvensis* L., *Anthemis* spp., *Polygonum convolvulus* L., *Papaver rhoeas* L., *Consolida orientalis* Schrodinger.

In South-Eastern Bulgaria are often found *Avena fatua* L., *Alopecurus myosuroides* (L.) P. B., *Myagrimum perfoliatum* L., *Lithospermum arvense* L., *Polygonum aviculare* L., *Veronica hederifolia* L., *Viola tricolor* L. In some areas at the end occurs *Aegilops cylindrical* L.

In central southern Bulgaria are found less *Myagrimum perfoliatum* L., *Polygonum convolvulus* L., *Polygonum aviculare* L., *Veronica hederifolia* L., *Viola tricolor* L. but more often - *Agrostemma githago* L., and greater density of *Adonis aestivalis* L.

In central northern Bulgaria are rarely found *Cirsium arvense* (L) Scop., *Papaver rhoeas* L. and *Polygonum convolvulus* L. In higher density and most areas than in southern Bulgaria, are registered *Convolvulus arvensis* L., *Sinapis arvensis* L., *Galium tricornis* With. and *Anthemis* spp.

Was registered an increase of the density of *Adonis aestivalis* L. More often were found *Agrostemma githago* L., *Consolida regalis* S.F.Gray., *Lathyrus* spp. and *Vicia* spp.

In North-Eastern part of the country were often found *Cirsium arvense* (L) Scop., *Sinapis arvensis* L., *Consolida orientalis* Schrodinger., *Galium tricornis* With., *Polygonum convolvulus* L., *Papaver rhoeas* L. and *Anthemis* spp. *Sambucus ebulus* L., *Bifora radians* M. B., *Caucalis daucoides* L., and *Agrostemma githago* L. were appeared. In the northeastern end areas was not found *Avena* spp. In various areas where it is not observed agrotechnics for cultivation and crops are thinned out, there was a secondary weed infestation of *Xanthium strumarium* L., *Chenopodium album* L., *Polygonum aviculare* L., and *Persicaria lapatifolia* (L.) S. F. Gray.

As a result of surveys conducted on barley in Bulgaria in the spring were found four species of harmful aphids - *Sitobion avenae*, *Schizaphis graminum*, *Rhopalosiphum maidis* and *Rhopalosiphum padi* (Table 2).

Table 2. Species composition and distribution of aphids on barley in Bulgaria

Species	Areas Southeastern Bulgaria	SouthCentral Bulgaria	Northwest Bulgaria	North Central Bulgaria	Northeastern Bulgaria
<i>Sitobion avenae</i>	×	×	×	×	×
<i>Schizaphis graminum</i>	×	×	×	×	×
<i>Rhopalosiphum maidis</i>	×	×	×	×	×
<i>Rhopalosiphum padi</i>	×	×	-	×	-

The most and wide spread species in both years of monitoring is a *Sitobion avenae*, which corresponds to Thesis of Grigorov (1980), that is - common type of aphids on wheat crops in Bulgaria. *Sitobion avenae* first appeared in crops in spring. Later on are found - *Schizaphis graminum*, because of that species is thermophilic *Rhopalosiphum maidis* - not hibernates in Bulgaria, but it is flying with the air currents from the south, but during the warm winter some specimens may be seen and *Rhopalosiphum padi* - a migratory species, which major host is *Prunus padus* and therefore it migrate later on the cereal crops. In Southeastern and Central Bulgaria has seen all four species of aphids. In the Northwest and Northeast Bulgaria in the period of the study was not detected *Rhopalosiphum padi* (Table 2). The higher numbers of aphids in the two years is reported in barley crops of Southeast North Central and Northeastern Bulgaria, probably due to favorable weather conditions.

As a result of the monitoring conducted during the survey period were recorded following diseases: *Erysiphe graminis* f.sp. hordei, *Puccinia hordei*, *Ustilago nuda*, *Drehslera graminea*, *Rhynchosporium secalis*.

It was determined a high degree of attack by powdery mildew in barley crops in the North Central and Northeastern Bulgaria. The powdery mildew on barley plant was based on 2 - 3 leaves. Were recorded single plants in crops with symptoms of loose smut and net blotch. High degree of attack of leaf blotch was recorded in 2008. Development of the disease was impacted by an appropriate combination of temperature and moisture. Barley crops in Southern Central Bulgaria were heavily infested. The results from the survey are contained in a table 3.

Table 3. Composition and distribution of diseases in barley during the period 2008 -2009

Diseases	Southeastern Bulgaria		SouthCentral Bulgaria		Northwest Bulgaria		North Central Bulgaria		Northeastern Bulgaria	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
<i>Erysiphe graminis</i>	+	+	+	+	+	+	++	+	++	+
<i>Puccinia hordei</i>	-	-	-	-	-	-	+	+	+	+
<i>Ustilago nuda</i>	+	-	+	-	-	-	-	-	+	-
<i>Dreschlera graminea</i>	+	-	+	-	-	-	++	-	+	-
<i>Rhynchosporium secalis</i>	+	+	++	+	+	+	+	+	+	-

+ low disease severity – up to 10 %; ++ medium disease severity – from 10 to 25 %; +++ high disease severity – over 25 %.

In different areas and at certain times the harmful and distribution may be different. Analyzing the survey results two groups of diseases were established: the first group is with leaf-stem symptoms (*Erysiphe graminis* f.sp. *hordei*, *Puccinia hordei*, *Rhynchosporium secalis*) and the second group – seed borne diseases (*Ustilago nuda* and *Dreschlera graminea*). Our observation confirm the finding of Navushtanov (1991) who reported the occurrence of these diseases on barley.

Conclusions

In all explored regions of Bulgaria were found everywhere *Cirsium arvense* (L) Scop, *Convolvulus arvensis* L., *Galium tricorne* With, *Sinapis arvensis* L., *Anthemis* spp., *Polygonum convolvulus* L., *Papaver phoeas*, *Consolida orientalis* Schroding.

In the barley commercial fields in Bulgaria during the spring months were found four types of damaging aphids - *Sitobion avenae*, *Schizaphis graminum*, *Rhopalosiphum maidis* and *Rhopalosiphum padi*. The most damaging and wide spread species in both years of monitoring is *Sitobion avenae*. The highest aphids number in the two years was reported in barley fields of Southeast, North Central and Northeastern Bulgaria.

Species composition of the most frequently occurring diseases in barley was determined. Two groups of diseases were established: leaf, stem and seed borne. It was found that mainly occur were *Erysiphe graminis* f.sp. *hordei*, *Puccinia hordei* and *Rhynchosporium secalis*.

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