

Some changes and trends in the weed communities in last years in Sofia region

Senka Milanova^{2*}, *Ganka Baeva*², *Ralitsa Nakova*², *Svetla Maneva*², *Lazar Chavdarov*¹,
*Gergina Stoimenova*¹, *Tatjana Velichkova*¹

¹ National Service for Plant Protection, Sofia, Bulgaria

² Plant Protection Institute, 2230 Kostinbrod, Bulgaria

Abstract:

Milanova, S., Baeva, G., Nakova, R., Maneva, S., Chavdarov, L., Stoimenova, G., Velichkova, T.: *Some changes and trends in the weed communities in last years in Sofia region. Proceeding of the 9th Symposium of flora of Southeastern Serbia and Neighbouring Regions, Nis, 2007.*

During 2004-2007, a national weed survey in winter wheat, barley, maize and sunflower was done in 14 different regions of Bulgaria. The objective was to improve knowledge of the weed communities of cultivated and uncultivated areas in the order to develop effective weed control. The survey in Sofia region was part of the national weed investigation. Observations in these areas show the density of some weed species have increased considerably as: *Cirsium arvense* L., *Cichorium intybus* L., *Artemisia* sp., *Lactuca serriola* L., *Centaurea solstitialis* L., *Conyza canadensis* (L), *Daucus carota* L., *Conium maculatum* L., *Cephalaria transsilvanica* (L.) and others.

Key words: Weed survey, weed communities

Introduction

It is known that different factors influence the composition of weed communities. Manly, soil types are affected because individual species show preferences for particular soils (Kolev, 1963). Rotation and weed management levels have as much influence as tillage in determining the severity of perennial weed infestations (Legere et al., 1993; Pallutt, 1993; Legere, Stevensov, 2002; Lehoczky et al., 2004). A number of authors (e.g. Derksen et al., 1993; Streibig et al., 1993; Nikolova et al., 1995; Malecka, Blecharczyk, 2002; Hyvonen & Salonen, 2002; Vrbnicanin et al., 2002; Gibson et al., 2006) have studied the rate of weed infestation and weed species in various crops. The application of herbicides has also affected the composition of weed communities (Fykse, 1993; Barberi, 2003; Simic et al., 2003). The wide and calamitous spreading of cocklebur (*Xanthium*

strumarium L.) over the farming areas in Bulgaria is attributed to the appearance of compensatory processes (Milanova et al., 2003). Besides well-known negative effect of weeds, they can also bring benefits, such as a positive role in the food chain, supporting biological diversity, their hosting of beneficial organisms, and their role as catch or cover "crops" (Marshall, 2002). The gradual warming up of the climate, as well as human activity, also produced their effect on the weed composition. For the conditions of Hungary, Szoke (2001) established the rapid spread of 11 thermophilous weeds. Obasi (2001) reported that temperature over SE Europe has increased. The anomalies of annual mean air temperatures in Bulgaria during 20th century, relative to the 1961-1990 average, have increased by 0.4° C. There is however noticeable decline of precipitation. In the last years the dry soil conditions were reflected in the distribution of weed species for the conditions of Bulgaria (Milanova, Gusev, 2001). Most of

the species whose population has increased belong to the group of xerophytes (Milanova, Dimitrova, 2003). The objective of weed survey in cultivated and uncultivated areas was done to improve knowledge in order to develop effective weed control.

Materials and methods

During 2004-2007, a national survey of weed communities in winter wheat, barley, maize and sunflower was done in 14 different regions in Bulgaria. The software "Kadis" was created for data base development, analysis and mapping of weed flora in Bulgaria. The survey in Sofia region was part of the national weed investigation. The assessments were done by visually scoring weeds in whole fields and margin (Fetvadjeva, Dechkov, 1981) and adapted to new conditions (Dimitrova et al., 2004). The estimation of weed density was taken according to density cover index (d.c.i.): 0 = none present; 1 = weak degree of infestation (evaluated cover < 5%); 2 = average degree (5 – 25%); 3 = high degree (25-50%); 5 = very high degree (50-100%). The nomenclature of species follows (Assyov et al., 2001; Delipavlov et al., 2003). Life forms of species were taken according to reference sources (Kolev, 1963; Weber, 2005).

Results and discussion

A total of 14 representative fields of winter wheat (682 ha), 11 of sunflower (542 ha) and 4 of maize (240 ha) were assessed. In this study 168 weed species from 28 families were identified in the observed crop fields and uncultivated areas (List of weed flora of Sofia region):

The most abundant weed species in the cultivated fields (Table 1) were: *Alopecurus myosuroides* with d.c.i up to 4, *Avena fatua* with d.c.i. up to 2, *Elymus repens* with d.c.i. up to 2.1, *Setaria viridis* with d.c.i up to 2.7, *Persicaria lapathifolia* with d.c.i. up to 2.6, *Chenopodium album* with d.c.i. up to 3.0, *Amaranthus retroflexus* with d.c.i. up to 2.0, *Myagrum perfoliatum* with d.c.i. up to 2.0, *Cardaria draba* with d.c.i. up to 2.1, *Sinapis arvensis* with d.c.i. up to 3.2, *Polygonum aviculare* with d.c.i up to 2.3, *Fallopia convolvulus* with d.c.i up to 2.0, *Lathyrus aphaca* with d.c.i. up to 2.0, *Hibiscus trionum* with d.c.i up to 2.8, *Viola arvensis* and *V. tricolor* with d.c.i up to 3, *Bifora radians* with d.c.i up to 3, *Convolvulus arvensis* with d.c.i.up to 2.7, *Lamium purpureum* with d.c.i. up to 2.2, *Veronica hederifolia* with d.c.i. up to 3.1, *Galium aparine* and *G. tricornutum* with

d.c.i up to 3, *Xanthium strumarium* with d.c.i. up to 2.2, *Anthemis arvensis* with d.c.i. up to 2.0, *Matricaria perforata* with d.c.i.up to 1.8, *Cirsium arvense* with d.c.i. up to 3.3. The dominant weed species in the winter wheat crop were: *Alopecurus myosuroides*, *Avena fatua*, *Polygonum aviculare*, *Fallopia convolvulus*, *Myagrum perfoliatum*, *Sinapis arvensis*, *Viola tricolor*, *V. arvensis*, *Lathyrus aphaca*, *Bifora radians*, *Lamium purpureum*, *Veronica hederifolia*, *Galium aparine*, *G. tricornutum*, *Anthemis arvensis*, *Cirsium arvensis* and *Cardaria draba*. The most frequent weeds in sunflower were: *Chenopodium album*, *Hibiscus trionum*, *Xanthium strumarium*, *Cirsium arvensis*, *Convolvulus arvensis*. The most distributed weed species in maize were: *Setaria viridis*, *S. pumila*, *Persicaria lapathifolia*, *Chenopodium album*, *Amaranthus retroflexus*, *A. hybridus*, *Xanthium strumarium*, *Cirsium arvense*, *Convolvulus arvensis*. The increasing expansion of *Cirsium arvense*, *Alopecurus myosuroides*, *Avena fatua*, *Myagrum perfoliatum*, *Sinapis arvensis*, *Hibiscus trionum*, *Veronica hederifolia*, *Galium aparine*, *G. tricornutum* was evident in the last decade.

Weed flora in cultivated and uncultivated areas in Sofia region

POACEAE:

Poa annua L.
Digitaria sanguinalis (L.) Scop.
Echinochloa crus-galli (L.) Beauv.
Setaria viridis (L.) Beauv.
Setaria verticillata Beauv.
Setaria pumila (Poir.) Shultes
Alopecurus myosuroides Hudson
Apera spica-venti (L.) Beauv.
Avena fatua L.
Avena sterilis ssp. ludoviciana (Durieu) Gillet & Magne
Cynodon dactylon (L.) Pers.
Bromus arvensis L.
Lolium temulentum L.
Elymus repens (L.) Gould.

POLYGONACEAE

Rumex crispus L.
Rumex tenuifolius (Wallr.) A. Love
Polygonum aviculare L.
Persicaria lapathifolia (L.) S.F. Gray
Fallopia convolvulus (L.) A. Love

CHENOPODIACEAE

Chenopodium album L.
Chenopodium polyspermum L.
Atriplex patula L.
Kochia scoparia (L.) Schrader

AMARANTHACEAE

Amaranthus hybridus L.
Amaranthus retroflexus L.
Amaranthus lividus L.
Amaranthus albus L.

PORTULACACEAE

Portulaca oleracea L.

CARYOPHYLLACEAE

Stellaria media (L.) Vill.
Holosteum umbellatum L.
Agrostemma githago L.
Spergula arvensis L.
Agrostemma githago L.

RANUNCULACEAE

Consolida regalis S.F.Gray
Consolida orientalis Schroding
Ranunculus arvensis L.
Ranunculus acer L.
Ranunculus repens L.
Adonis aestivalis L.
Adonis vernalis L.
Adonis flammeas Jacq.

PAPAVERACEAE

Papaver rhoeas L.
Papaver dubium L.
Papaver hybridum L.
Chelidonium majus L.

FUMARIACEAE

Fumaria officinalis L.

GERANIACEAE

Geranium dissectum L.
Geranium molle L.
Erodium cicutarium (L.)L'Her.

BRASSICACEAE

Sisymbrium loeselii L.
Sisymbrium altissimum L.
Descurainia sophia (L.) Webb ex Prantl
Arabidopsis thaliana (L.) Heynh.
Myagrum perfoliatum L.
Berteroa incana (L.) DC
Cardaria draba (L.) Desv.
Camelina sativa (L.) Grantz
Camelina alyssum (Miller) Thell.
Neslia paniculata (L.) Desv.
Capsella bursa-pastoris (L.) Medicus
Thlaspi arvense L.
Lepidium campestre (L.) R.Br.
Sinapis arvensis L.
Raphanus raphanistrum L.

ROSACEAE

Rubus caesius L.
Saguisorba minor Scop.
Geum urbanum L.

FABACEAE

Vicia angustifolia Grufb.

Vicia hirsuta (L.) S.F.Gray

Vicia cracca L.

Vicia villosa Roth

Vicia lathyroides L.

Lathyrus aphaca L.

Lathyrus tuberosus L.

Lathyrus hirsutus L.

Lathyrus cicera L.

EUPHORBIACEAE

Euphorbia peplus L.

Euphorbia falcata L.

Euphorbia helioscopia L.

MALVACEAE

Abutilon theophrasii Medicus

Malva neglecta Wallr.

Hibiscus trionum L.

VIOLACEAE

Viola arvensis Murray

Viola tricolor L.

APIACEAE

Eryngium campestre L.

Scandix pecten-veneris L.

Torilis arvensis (Hudson) Link

Caucalis platycarpus L.

Bifora radians Bieb.

Conium maculatum L.

Daucus carota L.

Falcaria vulgaris Bernh.

PRIMULACEAE

Anagalis arvensis L.

CONVOLVULACEAE

Calystegia sepium (L.) R.Br.

Convolvulus arvensis L.

Ipomea purpurea L.

BORAGINACEAE

Echium vulgare L.

Anchusa officinalis L.

Lycopsis arvensis L.

Myosotis arvensis (L.) Hill

Cynoglossum officinale L.

Asperugo procumbens L.

Buglossoides arvensis (L.) I.M.Johnston

LAMIACEAE

Ajuga reptans L.

Glechoma hederacea L.

Galeopsis speciosa Miller

Galeopsis tetrahit L.

Galeopsis ladanum L.

Lamium amplexicaule L.

Lamium purpureum L.

Salvia verticillata L.

Mentha longifolia (L.) Hudson

SOLANACEAE

Datura stramonium L.

Solanum nigrum L.

Nicandra physaloides (L.) Gaertner

SCROPHULARIACEAE

Verbascum sp.
Kickxia spuria (L.) Dumort.
Kickxia elatine (L.) Dumort.
Linaria vulgaris Miller
Misopates orontium (L.) Rafin.
Veronica hederifolia L.
Veronica persica Poiret
Melampyrum arvense L.
Rhinanthus minor L.

RUBIACEAE

Galium aparine L.
Galium tricornerutum Dandy
Galium verum L.

DIPSACACEAE

Cephalaria transsilvanica (L.) Roemer &Schultes
Dipsacus laciniatus L.

ASTERACEAE

Eupatorium cannabinum L.
Solidago canadensis L.
Solidago gigantea W.Aiton
Conyza canadensis (L.) Cronq.
Erigeron annuus (L.) Pers.
Bidens tripartita L.
Xanthium spinosum L.
Xanthium strumarium L.
Xanthium italicum Moretti
Galinsoga parviflora Cav.
Anthemis cotula L.
Anthemis arvensis L.
Achillea millefolium L.
Matricaria perforata Merat
Matricaria trichophylla (Boiss.) Boiss.
Tanacetum vulgare L.
Artemisia vulgaris L.
Artemisia annua L.
Senecio vulgaris L.
Senecio vernalis Waldst.&Kit.
Arctium lappa L.
Carduus acanthoides L.
Cirsium ligulare Boiss.
Cirsium arvense (L.) Scop.
Onopordum acanthium L.
Centaurea solstitialis L.
Centaurea diffusa Lam.
Centaurea cyanus L.
Cichorium intybus L.
Picris hieracioides L.
Tragopogon dubius Scop.
Sonchus oleraceus L.
Sonchus asper (L.) Hill
Sonchus arvensis L.
Lactuca serriola L.
Taraxacum officinale Weber
Chondrilla juncea L.
Crepis foetida L.

CAPRIFOLIACEAE

Sambucus ebulus L.

PORTULACACEA

Portulaca oleracea L.

Observation in uncultivated areas show that the density of some weed species have increased considerably in the last years as: *Rumex crispus*, *Conium maculatum*, *Daucus carota*, *Lycopsis arvensis*, *Conyza canadensis*, *Xanthium strumarium*, *Artemisia vulgaris*, *Cichorium intybus*, *Tragopogon dubius*, *Lactuca serriola*, *Chondrilla juncea*, *Dipsacus laciniatus*, *Cephalaria transsilvanica*, *Sonchus arvensis*, *Cardus acanthoides*, *Cirsium arvense*, *Cirsium ligulare*, *Onopordum acanthium*, *Sambucus ebulus* and others. Most of them belong to the family Asteracea. It was found that *Cephalaria transsilvanica*, *Conium maculatum*, *Daucus carota*, *Cichorium intybus*, *Rumex crispus*, *Lactuca serriola*, *Conyza canadensis*, *Artemisia vulgaris* spread from margin to the fields. The agriculture in Bulgaria underwent serious changes in the last 15 years. The arable earth was separated and returned to the ex-owners. Roadside near the small fields, margins, uncultivated fields created a large opportunity for troublesome weed species to form abundant populations and spread of weed species to the crop fields.

In 2007 at the extreme high air temperatures and soil dry conditions the most frequent annual weeds in the fields were: *Xanthium strumarium*, *Amaranthus retroflexus*, *A. hybridus*, *Hibiscus trionum*, *Conyza canadensis*, *Lactuca serriola*, *Solanum nigrum*, *Portulaca oleracea*, *Sinapis arvensis* and others. These results are in accordance with data of some authors. Wall (1993) reported that *Sinapis arvensis* exhibited reduced plant height at temperatures above 26° C, but produced more biomass and greater leaf areas at temperature between 28° C and 34° C and suggested that this species may be better adapted to high temperatures. For the conditions of Oslo area of Norway *Conyza canadensis* and *Lactuca serriola* have increased in numbers in the recent years (Wesenberg, 1998). Parsons (2007) established trapping seed of *Conyza canadensis* in the planetary boundary layer of the lower atmosphere at heights up to 140 m above ground level. Weeds evolve rapidly to overcome control measures, short lived weeds and those that spread vegetatively at the greatest rate. In the condition of global warming, grassland and arable weeds could become more tolerant to control measures (www.ecifm.rdg.ac.uk/climate-change.htm).

New species which were previously unknown for the region of Sofia have appeared, e.g. *Ambrosia artemisiifolia* L., *Iva xanthiifolia* (Nutt.), *Panicum capillare* L., *Phytolacca americana* L., *Commelina communis* L., *Fallopia japonica* (Houtt.) Ronse Decr.

Conclusions

The most problematic weed species in winter wheat crop are: *Alopecurus myosuroides*, *Avena fatua*, *Polygonum aviculare*, *Fallopia convolvulus*, *Myagrum perfoliatum*, *Sinapis arvensis*, *Lathyrus aphaca*, *Viola arvensis*, *V. tricolor*, *Bifora radians*, *Lamium purpureum*, *Veronica hederifolia*, *Galium aparine*, *G. tricornutum*, *Anthemis arvensis*, *Cirsium arvensis*, *Cardaria draba*.

In sunflower since the last national survey in 1981, an increasing tendency for the dominance of some weeds like *Chenopodium album*, *Hibiscus trionum*, *Xanthium strumarium*, *Cirsium arvensis*, *Convolvulus arvensis* are found.

The most distributed weed species in maize are: *Setaria viridis*, *S. pumila*, *Persicaria lapathifolia*, *Chenopodium album*, *Amaranthus retroflexus*, *A. hybridus*, *Xanthium strumarium*, *Cirsium arvense*, *Convolvulus arvensis*.

Since the last national survey in 1981, an aggressive spread of some weed species in both uncultivated and cultivated fields is evident. It can be concluded that, due to climate and economic changes occurred in the past years, weed species abundance is increasing becoming a serious problem. Modifications in the choice of crops, in rotations, chemical and mechanical weed control, fertilization, soil management, sowing time and technique, purification of seeds and agricultural land separation are the main reasons for these negative processes.

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Table 1. Predominant annual and perennial weed species in winter wheat, sunflower and maize fields in Sofia region (2004 -2007) (valuation - cover index: 0=non observed; 1=weak; 2=average; 3=high; 4=very high)

Weed species	Density cover index (d.c.i) – average		
	Wheat	Sunflower	Maize
ANNUAL WEEDS			
<i>Setaria viridis</i> (L.) Beauv.	0.2	1.0 - 2.2	1.1 – 2.7
<i>Setaria pumila</i> (Poiret) Shules	0.1	2.0	2.0
<i>Alopecurus myosuroides</i> Hudson	1.0 – 4.0	0.5	0.5
<i>Avena fatua</i> L.	1.0 – 2.0	0.3	0.4
<i>Bromus arvensis</i> L.	1.0	0.1	0.0
<i>Polygonum aviculare</i> L.	2.0 – 2.3	0.1	0.2
<i>Persicaria lapathifolia</i> (L.) S.F.Gray	0.2	1.3 – 2.3	1.0 – 2.6
<i>Fallopia convolvulus</i> (L.) A. Love	1.0 – 2.0	1.0	1.2
<i>Chenopodium album</i> L.	0.8	0.9 – 3.0	1.2 – 3.1
<i>Amaranthus retroflexus</i> L.	0.4	1.0 – 2.0	2.0
<i>Amaranthus hybridus</i> L.	0.4	1.4 - 2.0	1.3 – 2.0
<i>Myagrum perfoliatum</i> L.	0.9 – 2.0	0.1	0.1
<i>Capsella bursa-pastoris</i> (L.)Medicus	1.9	0.4 - 1.0	0.5
<i>Sinapis arvensis</i> L.	1.3 – 3.2	0.1 – 2.0	0.2 - 1.3
<i>Lathyrus aphaca</i> L.	2.0	0.0	0.0
<i>Hibiscus trionum</i> L.	0.0	2.2 – 2.8	2.0
<i>Viola arvensis</i> Murray	2.0 – 3.0	0.0	0.0
<i>Viola tricolor</i> L.	1.1 – 3.0	0.0	0.0
<i>Bifora radians</i> Bieb.	0.5 – 3.0	0.3	0.2
<i>Conium maculatum</i> L.	0.1 – 1.0	0.1 – 0.5	0.2
<i>Buglossoides arvensis</i> (L.)	0.6 – 1.1	0.0	0.0
<i>Lamium purpureum</i> L.	1.8 – 2.2	0.1	0.1
<i>Conyza canadensis</i> (L.) Cronq.	0.2 – 0.3	0.2	0.2
<i>Veronica hederifolia</i> L.	1.6 – 3.1	0.1	0.2
<i>Galium aparine</i> L.	1.9 – 3.0	0.2	0.3
<i>Galium tricorutum</i> Dandy	1.5 – 3.0	0.0	0.0
<i>Xanthium strumarium</i> L.	0.8	1.6 – 2.2	1.2 – 2.0
<i>Anthemis arvensis</i> L.	1.8 – 2.0	0.2	1.0
<i>Matricaria perforata</i> Merat	1.0 – 1.8	0.3	0.2
<i>Centaurea cyanus</i> L.	1.0	0.0	0.0
<i>Lactuca serriola</i> L.	0.1	0.6	0.3
PERENNIAL WEEDS			
<i>Elymus repens</i> (L.) Gould.	0.9	1.7	2.6
<i>Sonchus arvensis</i> L.	0.9	0.9 – 1.0	0.9 – 1.0
<i>Cirsium arvense</i> (L.) Scop	2.7 – 3.2	2.0 – 3.3	1.1 – 3.2
<i>Convolvulus arvensis</i> L.	1.0 – 1.2	1.0 – 2.7	1.2 – 2.0
<i>Cardaria draba</i> L. Desv.	1.0 – 2.1	0.0	0.0
<i>Cichorium intybus</i> L.	0.4	0.2	0.1