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RESEARCH CONCERNING FLORISTIC COMPOSITION AND DEGREE OF WEED INFESTATION OF CEREAL CROPS IN CONSTANTA COUNTY

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Abstract: Weeds mapping aims to know the segetal floristic spectrum from the point of view of the degree of weed infestation and the frequency of weeds in each crop. Cereals crops are yearly infested by dicotyledonous and monocotyledonous weeds species, annual and perennial, some of them being very harmful, difficult to control and known as dominant weeds or problem weeds. Research carried out in Constanța county, Agigea and Runcu villages, during 2020-2021 years, was concerned with segetal flora assessment. The main purposes considered were: the study of the issues related to the floristic composition, the dynamics of the degree of weed infestation, the identification of the dominant species, the establishment of the most effective herbicide treatments and of the optimal times of application. The analysis of the obtained data reveals that the problem weeds with a density >10 plants/m^2 identified in the wheat and barley crops in Agigea were: *Veronica* species, *Papaver rhoeas*, *Chenopodium album*, *Polygonum convolvulus* and *Fumaria officinalis*. The dominant weed species in wheat and barley crops of Runcu were: *C. album*, *Convolvulus arvensis*, *Stellaria media*, *Equisetum arvense* and *Cannabis ruderalis*. Although the dicotyledonous species prevail in both studied places, the weed control strategy is different because the target species against which control measures must be applied are different and consequently the range of herbicides will also be different. The results obtained fully justify the weed mapping action because it is a tool that offers the farmer the exact perception regarding the degree of weed infestation in the studied areas. Mapping thus becomes a very useful work for weed control practice.

Keywords: *mapping, cereals, weeds, degree of weed infestation*

INTRODUCTION

Weed infestation is one of the major biotic constraints in cereal production. Even if many weed species have adapted itself to environmental conditions, the ever - changing agricultural habitats selectively disturb the weed communities and thus modify the segetal flora (Rademacher et al., 1970; Reuss, 1981; Mahn, 1984; Chancellor, 1985; Légére et al., 1993). As cereals are grown all over the country under contrasting pedoclimatic conditions, the segetal flora that infests these crops is varied both in species and in the degree of weed infestation, but especially as a relationship between species. On the whole, cereal grains can compete with weeds because they cover the soil very well and do not allow their development, but dangerous invasions can occur in early autumn or spring, it means before the soil is covered by plants. Biennial or perennial weed species are just as deleterious because they have a better growth rate than cereals. At the same time, some species, such as cleavers *Galium aparine* (L.), small bindweed *Convolvulus arvensis* (L.), creeping thistle *Cirsium arvense* (L.) Scop. are harmful not so much by competition, but by the fact that they obstruct harvesting and have a prejudicious influence on seed purity.

As a result, the losses caused by weeds range between very wide limits depending on the species and density, the degree of weed infestation, pedoclimatic conditions and cropping technology, ranging in the absence of prevention and control measures, from 10 till 70% of potential production (Cudney & Hill, 1979; Malik & Singh, 1993; Khera et al., 1995; Malik & Singh, 1995; Afentouli & Eleftherohorionos, 1996; Mehra & Gill, 1988; Chhokar & Malik, 2002; Ion, 2010; Petre & Carciu, 2013; Santín-Montanyá et al., 2013). In extreme cases, the losses caused by weeds can be up to complete crop failure (Malik et al., Singh, 1995). Weed control is the main task in cereal crops because weed competition is the biggest source of loss of yield at global level (Liebman et al., 2001). Weed mapping is the one of the important concerns for the elaboration of the complex and specific management of each crop.

Weed mapping has a decisive role in obtaining accurate data on the dynamics and control of the segetal flora at the level of each plot (Berca, 1995 and 2004; Chirilă, 1988; Slonovski & Lăzărescu, 2000; Slonovski et al., 2001). For a better knowledge of the degree of weeding in a farm, the mapping action can be repeated at appropriate times, knowing that in the evolution of weeds there is a certain dynamic of adaptation-readaptation to the agricultural system used. Weed mapping thus becomes a very useful action for weed control practice. By its help it is possible to forecast, in time, the emergence of weeds.

In this context, the research carried out in the villages of Agigea and Runcu from Constanța County during 2020-2021 in autumn wheat and barley crops aimed at mapping the segetal flora. The main objectives considered were: the study of the aspects related to the floristic composition, the dynamics of the degree of weed infestation, the recognition of the dominant species, the establishment of the most effective herbicide treatments and of the optimal times of application.

MATERIALS AND METHODS

Research was conducted in wheat and barley crop in Agigea and Runcu villages, Constanța County, during 2020 – 2021 (Figures 1 and 2).

Figure 1. Location of Agigea farm
N: 44° 5'8.76"; E: 28°17'46.81"

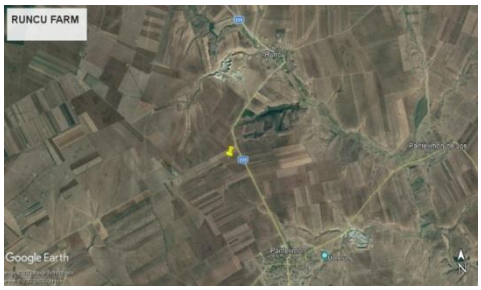

Figure 2. Location of Runcu farm
N: 44°34'22.39"; E: 28°33'43.45"

Weed mapping was conducted in 10 fields sown with winter wheat and 10 with winter barley, included in a suitable crop rotation. The numerical method of weeds assessments was used to which the phenophase and the average height of each plant were added. There were 50 samples taken for each 1 hectare surface. The cereal crops in which the assessments were performed, were cultivated by private farmers according to their own technologies.

For each field, landfills of weed infestation have been done and they present both general data on the location, the soil type, the previous crop and specific data on the density, participation and constancy of each weed species, class (monocotyledonous or dicotyledonous) as well the life period of each weed (ephemeral, annual, biennial, or

perennial). For sampling and weeds inventory, the metric frame ($1m^2$) was used. Each sampling point was established by going through the field in 1-2 diagonals according to the number of specified samples. At the final stage, the data obtained from all the analysed samples were centralised.

The data obtained on weed infestation of cereal crops cultivated in rotation system reveals the ecological characteristics of the weed flora existing at a certain moment in the studied fields. Finally, the weeds were distributed in density categories in descending order to identify the dominant species and the problem weeds, the results obtained by mapping being an important tool in taking the most appropriate weed control measures in a crop.

RESULTS AND DISCUSSIONS

Wheat and barley crops sown in the assessed areas are yearly weed-infested with segetal species belonging to diverse, annual, biennial and perennial botanical families, some of them very difficult to fight against. Thus, at Agigea, 33 weed species with an average density of 172 plants/m^2 were identified (Table 1). Analysing the data in Table 1, we can see that the most important weed species belong to the annual dicotyledonous.

Table 1. Weed mapping in wheat and barley crops of Agigea

Wheat and Barley, Agigea, Constanța, Farmer Lamureanu Gheorghe Years 2020-2021; Soil: vermi-calcium chernozem; Previous crop: Maize							
No.	Species	Stage/height (cm)	Average no./m^2	P (%)	K (%)	Family	Life period
Weeds with density: >10plants/m^2							
1.	*Veronica* species	A-B-C; 6-10	20.6	11.9	100	*Plantaginaceae*	AIDW
2.	*Papaver rhoeas*	A; 10-25	14.0	8.1	100	*Papaveraceae*	AD
3.	*Chenopodium album*	A;10-25	13.6	7.9	100	*Amaranthaceae*	AD
4.	*Polygonum convolvulus*	A;10-25-30	12.0	7.0	100	*Polygonaceae*	AD
5.	*Fumaria officinalis*	A; 10-25-30	10.8	6.3	80	*Papaveraceae*	AD
Weeds with density: >5 plants/m^2							
6.	*Galium aparine*	A-B; 20-25	10.0	4.6	76.0	*Rubiaceae*	AD
7.	*Echinochloa crus-galli*	A; 3-15-20	8.0	4.6	80.0	*Poaceae*	AM
8.	*Sinapis arvensis*	A; 15	6.2	3.6	60.0	*Brasicaceae*	ADW
9.	*Daucus carota*	A;12	6.2	3.6	56.0	*Apiaceae*	ABD
10.	*Sonchus oleraceus*	A;10-18	6.0	3.4	50.0	*Asteraceae*	AD
11.	*Capsella bursa-pastoris*	A; 10	5.5	3.2	50.0	*Brasicaceae*	ADW
12.	*Lamium amplexicaule*	A-B; 15-20	5.4	3.1	48.0	*Lamiaceae*	ADW
13.	*Cardaria draba*	A; 20	5.2	3.0	44.0	*Brasicaceae*	PD
14.	*Stellaria media*	A;10-15	5.2	3.0	44.0	*Caryophyllaceae*	ABDW
Weeds with density: >2 plants/m^2							
15.	*Setaria* species	A; 8-20	5.0	2.9	48.0	*Poaceae*	AM
16.	*Descurainia sophia*	A; 15-20	3.8	2.2	32.0	*Brasicaceae*	AD
17.	*Cirsium arvense*	A; 12	3.6	2.0	30.0	*Asteraceae*	PD
18.	*Ranunculus arvensis*	A-C; 20-25	3.2	1.8	24.0	*Ranunculaceae*	AD
19.	*Erigeron annuus*	A; 15-20	3.0	1.7	20.0	*Asteraceae*	AID
20.	*Convolvulus arvensis*	A-B; 10-15-25	3.0	1.7	24.0	*Convolvulaceae*	PD
21.	*Ambrosia artemisiifolia*	A; 10-15	2.2	1.3	12.0	*Asteraceae*	AID
Weeds with density: 1-2 plants/m^2							
22.	*Viola arvensis*	A-B-C; 6-10	2.0	1.1	8.0	*Violaceae*	AD
23.	*Amaranthus* species	A; 10-25	2.0	1.1	8.0	*Amaranthaceae*	AD
24.	*Consolida regalis*	A-C; 20-25	2.0	1.1	8.0	*Ranunculaceae*	AD
25.	*Matricaria inodora*	A-C; 20-25	2.0	1.1	8.0	*Asteraceae*	ABDW
26.	*Bromus secalinus*	A-B; 20-25	2.0	1.1	8.0	*Poaceae*	AIMW

27.	*Lolium multiflorum*	A-B; 20-25	1.8	1.0	6.0	*Poaceae*	ABMW
28.	*Anagallis arvensis*	A; 10	1.6	0.9	6.0	*Primulaceae*	ADW
29.	*Trifolium pratense*	A; 10-15	1.6	0.9	4.0	*Fabaceae*	PD
30.	*Centaurea cyanus*	A-C; 10-15	1.5	0.8	4.0	*Asteraceae*	ADW
31.	*Lithospermum arvense*	A; 10-15	1.0	0.5	2.0	*Boraginaceae*	AID
32.	*Conyza canadensis*	A; 20-40	1.0	0.5	2.0	*Asteraceae*	APID
33.	*Taraxacum officinale*	A-C; 10-15	1.0	0.5	2.0	*Asteraceae*	PD
TOTAL			172	100			

Legend
A = 5 - 7 leaves unfolded/shoot; B = flower buds/Gramineous - bootstage; C = Flowering.
P% = Proportion in which each species was involved to general weed infestation.
K% = Proportion in which each species was found in observation points.
PM = perennial monocotyledonous; AM = annual monocotyledonous.
PD = perennial dicotyledonous; AD = annual dicotyledonous; I = invasive species.
ABD = annual or biannual dicotyledonous.
ADW = annual or winter annual dicotyledonous.
ABDW = annual, biennial, winter or perennial dicotyledonous.
ABMW = annual, biennial, winter or perennial monocotyledonous.

These species are usually dominant and are important because they cause important losses in crops. From a practical point of view, these species have been called problem-weeds (Turk & Tawaha, 2003; Sarangi & Jhala, 2018; Gibson et al., 2005; Khan et al., 2011).

Among the problem weeds, some are considered target species, according to which specific weed control decisions are taken in a crop (Ionescu et al., 2016).

In order for the farmers to know the problem weeds against effective control measures must be applied, the 33 weed species were divided into 4 categories according to their density. Thus in the first category with a density >10 plants/m^2 included the species: *Veronica* spp., *Papaver rhoeas* (L.), *Chenopodium album* (L.), *Polygonum convolvulus* (L.) and *Fumaria officinalis* (L.). The species with the highest density (>20 plants/m^2) were represented by plants of the genus *Veronica*. In the spontaneous Romanian flora, the genus *Veronica* is represented by 41 species and 3 hybrids grouped in 5 subgenera (Săvulescu et al., 1960). Of the various species of veronica, we have identified 4 species: *Veronica officinalis*, *V. persica*, *V. hederifolia* and *V. arvensis.*

The second category had a density >5plants/m^2 and there were found the following species: *Galium aparine* (L.), *Echinochloa crus-galli* (L.) Pal. Beauv, *Sinapis arvensis* (L.), *Daucus carota* (L.), *Sonchus oleracus* (L.), *Capsella bursa-pastoris* (L.) Medic., *Lamium amplexicaule* (L.), *Cardaria draba* (L.) Desv., and *Stellaria media* (L.) Vill.

The third category including 7 species with a density >2 plants/m^2 (Table 1). Although these species, due to their density, are not a problem for wheat and barley crops from Agigea, some of them are difficult to control, being perennial *Convolvulus arvensis* (L.), others are prolific *Setaria* species and others invasive *Ambrosia artemisiifolia* (L.) and *Bromus secalinus* (L.). The dynamics of these species must be followed on particular consideration because at any time they can become problem weeds and they may cause the reducing of the yields both quantitatively and qualitatively. The last category was the most numerous including 12 species with a low density (1-2 plants/m^2). However, the presence of perennial species is noticeable (*Trifolium pratense* and *Taraxacum officinale).*

The distribution of weed species by botanical groups according to density and the percentage of participation of each species in wheat and barley crops from Agigea is presented in figure 3. Analyzing the database, it is obvious that the problem weeds are represented by the annual dicotyledonous species, which included 24 species with a density of

140.8 plants/m^2 and a participation rate of 81% in the general weed infestation of cereal crops in Agigea.

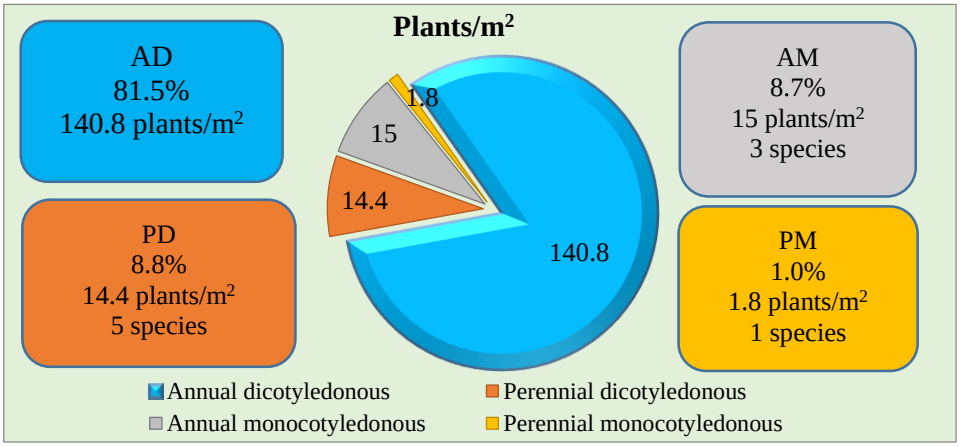

Figure 3. Distribution of weed species by botanical groups - Agigea (Constanța)

In the wheat and barley crops from Runcu there were recorded 20 weed species with a mean density of 125 plants/m^2. The first category with a density higher than 10 plants/m^2 also included dicotyledonous weed species: *C. album, C. arvensis, S. media, Equisetum arvense* (L.) and *Cannabis ruderalis* (Janisch.). The second category had a density >5plants/m^2, being found the following species: *P. convolvulus, Setaria* spp., *Brassica napus* (L.), *Veronica* species and *Papaver rhoeas* (table 2).

Table 2. Weed mapping in wheat and barley crops of Runcu

Wheat and Barley, Agigea, Constanța, Farmer Altan Abduraman Years 2020-2021; Soil: Cambic chernozem; Previous crop: Sunflower							
No.	Species	Stage/ height (cm)	Average no./m^2	P (%)	K (%)	Family	Life period
Weeds with density: >10plants/m^2							
1.	*Chenopodium album*	A; 12-25	15.5	12.4	100	*Amaranthaceae*	AD
2.	*Convolvulus arvensis*	A-B; 15-25	12.4	9.6	100	*Convolvulaceae*	AD
3.	*Stellaria media*	A; 6-12	11.0	8.8	100	*Caryophyllaceae*	ABDW
4.	*Equisetum arvense*	A; 15-20	10.8	8.6	80	*Equisetidae*	PID
5.	*Canabis ruderalis*	A; 12-20	10.6	8.5	80	*Cannabaceae*	PID
Weeds with density: >5 plants/m^2							
6.	*Polygonum convolvulus*	A; 10-20-30	10.0	8.0	100	*Polygonaceae*	AD
7.	*Setaria* species	A; 8-20	8.6	7.0	80.0	*Poaceae*	AM
8.	*Brassica napus*	A; 10-25	7.8	6.2	60.0	*Brasicaceae*	ABD
9.	*Veronica* species	A-B-C; 6-10	5.6	4.5	50.0	*Plantaginaceae*	AIDW
10.	*Papaver rhoeas*	A; 10-25	5.2	4.2	50.0	*Papaveraceae*	AD
Weeds with density: >2 plants/m^2							
11.	*Daucus carota*	A; 12	4.2	3.4	48.0	*Apiaceae*	ABD
12.	*Fumaria officinalis*	A; 10-25-30	4.0	3.2	44.0	*Papaveraceae*	AD
13.	*Erigeron annuus*	A; 15-20	3.8	3.0	32.0	*Asteraceae*	AID
14.	*Galium aparine*	A-B; 20-25	3.4	2.8	20.0	*Rubiaceae*	AD
15.	*Echinochloa crus-galli*	A; 3-1-20	3.0	2.4	20.0	*Poaceae*	AM
Weeds with density: 1 - 2 plants/m^2							

16.	*Hibiscus trionum*	A; 5-10	2.0	1.6	12.0	*Malvaceae*	AD
17.	*Verbena officinalis*	A; 10	2.0	1.6	8.0	*Verbenaceae*	PD
18.	*Sonchus oleraceus*	A; 10-18	1.8	1.5	6.0	*Asteraceae*	AD
19.	*Erigeron canadensis*	A; 15-20	1.8	1.5	4.0	*Asteraceae*	AID
20.	*Myosotis arvense*	A; 15	1.5	1.2	2.0	*Brasicaceae*	ADW
TOTAL			125	100			

Among the weed species of the third category, with a density higher than 2 plants/m^2, it was noticed the presence of *E. annuus* and of the last category with a density of 1-2 plants/ m^2 *E. canadensis* was recorded. The distribution of weed species by botanical groups according to density and the percentage of participation of each species in wheat and barley crops from Runcu is shown in figure 4. Analyzing the presented data, it is evident that the problem weeds are represented by the annual dicotyledonous species, which included 14 species with a density of 77.6 plants/m^2 and a participation percentage >of 62% in the general weed infestation of cereal crops in Runcu. There is also an increase in the share of perennial dicotyledons in the general weeding of wheat and barley crops, respectively 28.3% compared to Agigea, where their share was 8.8% (Figure 4).

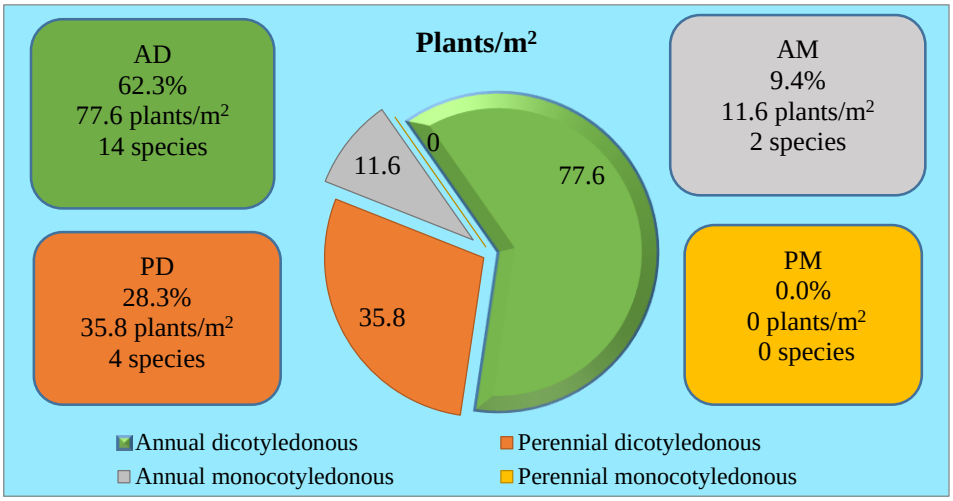

Figure 4. Distribution of weed species by botanical groups - Runcu (Constanța)

Considering the species which demand special control measures, we can see that there are 3 target species at Agigea, as follows: *Veronica* species, *P. rhoeas* and *P. convolvulus*. At Runcu, *C. arvensis*, *E. arvense* and *C. ruderalis* are the ones. Although in these 2 locations the dicotyledonous ones exceeded, weed control strategy should be different, as the target weeds supposed to be controlled are not the same and therefore another range of herbicides would be applied.

The results obtained fully justify the weed mapping task as this is an useful tool that offers the farmer the specific situation regarding the degree of weed infestation in the studied areas. Mapping thus becomes a very useful action for weed control management. In Agigea, even if perennial species grow in the area, the application of herbicides against perennial weeds is not justified (because the density is below the economic damage threshold), while in Runcu the application of such herbicides is mandatory due to the presence of perennial species *C. arvensis*. In Romania this species has a great ecological plasticity and creates special problems, generated especially by its ability to reproduce, through seeds but especially vegetative, as well as resistance to many herbicides. Aspects regarding the research carried out in the 2 experimental fields are presented in figure 5.

Figure 5. Aspect from experimental plots

CONCLUSIONS

Cereal crops are infested every year with dicotyledonous and monocotyledonous weed species, some of them being very deleterious, difficult to control and known as dominant weeds or problem weeds.

In the wheat and barley crops of Agigea, the problem weeds were represented by 24 annual dicotyledonous species. Their density was of 140.8 plants/m^2 and ground cover exceeded 81% within the whole weed infestation.

In wheat and barley crops of Runcu, annual dicotyledonous species were also the problem weeds including 14 species. Their density was of 77.6 plants/m^2 and frequency exceeded 62% in the whole weed infestation.

The target weeds identified at Agigea, for whom special control measures must be applied, are *Veronica* species and *P. convolvulus* and at Runcu *C. arvensis*, *E. arvense* and *C. ruderalis*.

Following this research, the farmer is in posession of all necessary data to establish the optimal weed control strategy according to problematic species and target weeds, thus weed mapping becomes a very useful practice and integrated weed management control action.

Among the invasive species identified, some are of particular importance because they reduce biodiversity, they cause a depreciation of crops both quantitatively and qualitatively, and others are harmful to human health, being allergenic, having the effect of increasing costs: *V. persica*, *E. annuus*, *E. canadensis*, *A. artemisiifolia* etc.

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