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CHANGES IN THE SITUATION OF SEGETAL ASSOCIATIONS FROM THE AGROCOENOSIS OF A PREVIOUSLY WELL STUDIED REGION OF ROMANIA

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ABSTRACT

The paper treats the subject of weed spreading phenomenon, based on the fact that in some regions of Romania there is a high degree of land fragmentation and the financial situation sometimes leads to poor crop management. The study presents the nowadays situation, after 50 years since the first studies in the chosen area. The results show an increase in weed infested areas and three new segetal associations. The newly identified associations are formed by *Consolida regalis* ssp. *regalis* S. F. Gray and *Polygonum convolvulus* L.; *Centaurea cyanus* L. and *Lathyrus tuberosus* L.; and *Spergula arvensis* L. and *Apera spica-venti* ssp. *spica-venti* (L.) Beauv. The three segetal associations have been also cited from Hungary and the Republic of Moldova, but little information on their composition is available. Economically speaking, weed development is a costing phenomenon, but from the ecological point of view the increase in weed flora is seen as a winning situation for diversity. The analysis made upon the newly identified associations show that all the species are native to the area, 3 species are considered as threatened in different regions of Romania, 12 species have invasive potential and in each association the invasive species percent vary from 22.7% to 36.8%. Many of the species not threatened in Romania are considered vulnerable or endangered in surrounding countries like Croatia, due to the higher agricultural hygiene.

Key words: weeds, invasive species, threatened species, biodiversity, phytocoenology.

INTRODUCTION

The current study presents the evolution of segetal associations under the incidence of a degraded agricultural system. The paper presents the results obtained studying the segetal flora and vegetation from the Bistriţa River inferior basin (eastern Romania). The segetal associations were first mentioned in the area in 1956 (Burduja et al., 1956) and were mentioned during the 60s, 70s, 80s and the 90s in monographic works, Ph.D. dissertations or analyzed in specific papers by numerous authors like Mititelu et al. (1968; 1971; 1972; 1973; 1976; 1980), Barabaş and Mititelu (1978), Tofan and Tofan (1980), Horeanu et al. (1987), Chifu et al. (1987), Ştefan et al. (1987) and Costică (1998). Even if analyzed during many years (60s-90s) the weed studies got richer and richer in terms of inventory. In order to assess the possible changes that occurred during the years in the flora and vegetation of the area, a 3 years phytocoenological study was performed and the obtained data were compared. The results showed an increase in weed diversity represented by spreading of the segetal associations in new locations and by the occurence of new associations. This result is seen as positive for biodiversity, but negative for crop development and management.

MATERIAL AND METHODS

Study area. Romania is situated in Central – Southeastern Europe, in the north of the Balkan Peninsula, on the lower Danube, bordering the Black Sea. The studied area (Figure 1) is located in the eastern part of Romania, on the lower course of Bistriţa River, between Piatra Neamţ and Bacău towns. The segetal associations were identified in 16 locations in cultivated fields (12 surveys in wheat, 2 surveys in barley and 2 surveys in oat) from the following villages:

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Dăneşti, Dochia, Prăjeşti, Siliştea, Ţuţcanii din Vale, Frunzeni, Costişa (Neamţ County) Marginea and Racova (Bacău County). The climate is temperate – continental with different nuances, depending on altitude and the geographical relief, its shape and the certain particularities of atmospheric dynamics, which add some weak oceanic influence (Geographical Encyclopaedia of Romania, 1982).

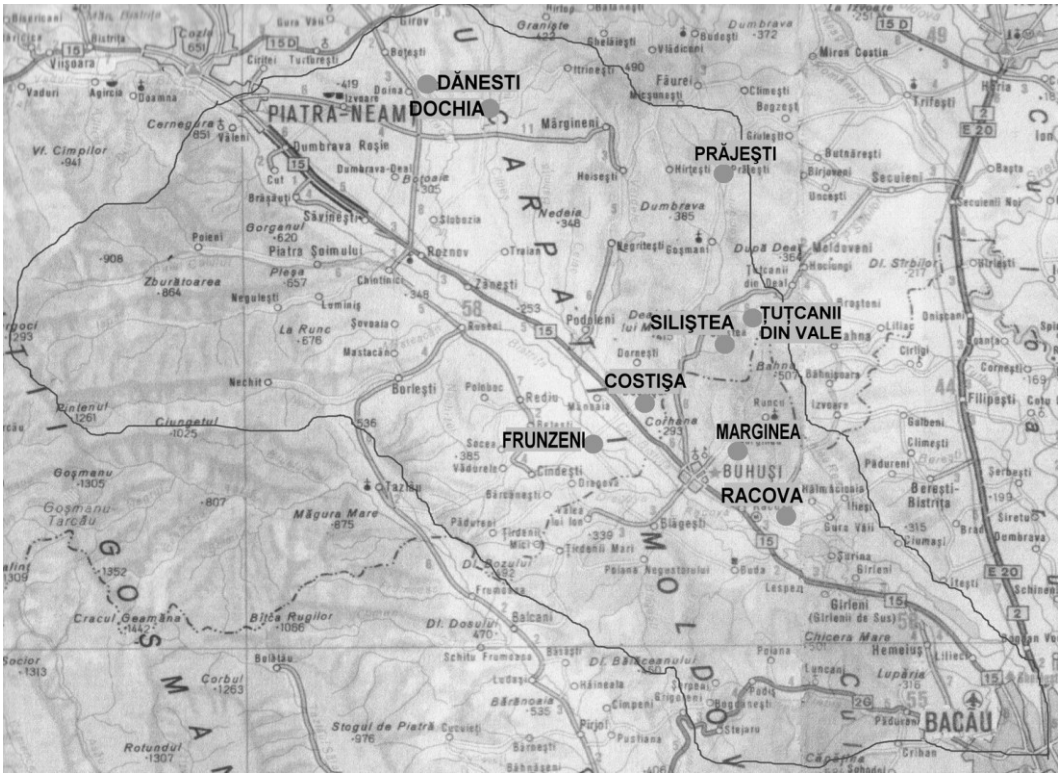

Figure 1. Study area: Bistriţa River inferior basin (eastern Romania)
(Road Atlas, 1981, with modifications; scale 1:350.000)

Field investigations were carried out in 2004-2007 and phytocoenological surveys were performed according to the standard Central European method (Phytocoenological School of Zürich – Montpellier perfected by J. Braun-Blanquet and J. Pavillard (1964, cited Ştefan, 2005). The specifications about the life forms and floral elements are after Sanda et al. (2003) and about the ecological indices (light, temperature, continentality, humidity, pH and nitrogen content) after Ellenberg, 1974. On the right side of the phytocoenological tables, corresponding to the number of each survey, are written the values of *Abundance – Dominance* (AD). These values vary from + to 2 (+ = 0.1-1%; 1 = 1.1-10%; 2 =10.1-25%), as no weed species exceeded this coverage in the crop-weed total coverage. The *Frequency index* (K) is expressed by five categories depending on the percentage of presence in the surveys. The categories are I – 1-20%; II – 21-40%; III – 41-60%; IV – 61-81% and V – 81-100% (Ştefan, 2005).

The phytocoenological tables contain the author of the species, the common names and the following abbreviations: altitude – m, slope's gradient – °, exposition – E, W, S, N; grass stratum coverage – %; surface – m^2; assc. ch. – association characteristic species; sass. – sub-association and sass. diff. – sub-association differential species; and the alliance (-ion); order (-etalia) and class (-etea). The classification of the segetal associations is according to Chifu et al. (2006). The new associations were noted with the symbol: (◙).

RESULTS AND DISCUSSION

The investigations made in the study, concerning the *Stellarietea mediae* class, resulted in an inventory of 23 segetal associations of which 3 were new for the region. The Class *Stellarietea mediae* R. Tx.

et al. ex von Rochow 1951 is the typical class of the segetal vegetation composed by weeds that grow in crops, gardens and uncultured fields. It is represented by the segetal and ruderal mesoxerophytic and mesophytic phytocoenosis (Chifu et al., 2006).

The results show that the weed infestation is higher than in the first years of study of the area. While nowadays, in the analyzed fields, the crop management is poor, it seems that, in the past, a better crop management was able to fight against weeds more successfully. The first observation is that the number of locations, where the associations were found, increased during the 50 years of study. Some associations may not have been identified in the previously presented areas, but most of them have probably spread. Economically speaking, it is a costing phenomenon, but ecologically, the increase in weed flora is seen as a winning situation for diversity.

The list below presents the identified associations, the old and the new (◙), and the number of "win" (+) and "lost" (-) locations.

Class *STELLARIETEA MEDIAE* R. Tx. et al. ex von Rochow, 1951
Order *Centauretalia cyani* R. Tx., Lohmeyer et Preising in R. Tx., 1950
Alliance *Caucalidion lappulae* (R. Tx. 1950) von Rochow, 1951
1. *Ranunculetum arvensis* Passarge 1964 **(+ 1)**
2. *Consolido – Polygonetum convolvulus* Morariu, 1967 sass. *polygonetosum convolvuli* Todor, 1971 **(◙)**
3. *Centaureo cyani – Lathyretum tuberosae* Sanda et Popescu, 1999 **(◙)**
4. *Lathyro – Avenetum fatuae* Passarge, 1957 **(- 2, + 4)**

Alliance *Veronico – Euphorbion* Sissingh ex Passarge, 1964
5. *Galinsogo – Euphorbietum peplis* Mititelu, 1972 **(+ 1)**
6. *Galio aparine – Galeopsietum tetrahiti* Horeanu et Ştefan, 1987 **(- 5, + 1)**

Order *Chenopodietalia albi* R. Tx. (1937) 1950
Alliance *Scleranthion annui* Sissingh in Westhoff et al., 1946
7. *Spergulo – Aperetum spica-venti* Soó, 1962 **(◙)**

Alliance *Panico – Setarion* Sissingh in Westhoff et al., 1946
8. *Echinochloo – Setarietum pumilae* Felföldy, 1942 corr. Mucina, 1993 **(- 3, + 9**)
9. *Digitario – Galinsogetum parviflorae* Beck, 1949 **(- 1, + 1)**
10. *Spergulo – Echinochloetum crus-galli* (Kraseman et Vlieger, 1939) R.Tx., 1950 **(+ 1)**
11. *Polygono avicularis – Amaranthetum crispi* Vicol et al., 1971 **(+ 1)**

Order *Eragrostietalia* J. Tx. ex Poli, 1966
Alliance *Amarantho – Chenopodion albi* Morariu, 1943
12. *Amarantho – Chenopodietum albi* Morariu, 1943 **(- 1, + 3)**
13. *Xanthietum spinosi* Felföldy, 1942 **(+ 3)**
14. *Portulacetum oleracei* Felföldy, 1942 **(+ 2)**
15. *Dauco – Matricarietum inodorae* I. Pop, 1966 **(+ 6)**

Alliance *Salsolion ruthenicae* Philippi 1971
16. *Chenopodietum botryos* Sukopp, 1971 **(- 1, + 2)**

Order *Sisymbrietalia* J. Tx. in Lohmeyer et al., 1962
Alliance *Sisymbrion officinalis* R. Tx., Lohmeyer et Preising in R. Tx., 1950
17. *Capsello – Descurainietum sophiae* Mucina in Mucina et al., 1993 **(- 2, + 1)**
18. *Hordeetum murini* Libbert, 1933 **(- 4, + 1)**
19. *Chenopodietum urbici* Soó ,1933 **(+ 2)**

Alliance *Atriplicion nitentis* Passarge, 1978
20. *Cynodonto – Atriplicetum tataricae* Morariu, 1943 **(- 1, + 1)**
21. *Chenopodietum stricti* (Oberd., 1957) Passarge, 1964 **(- 1, + 3**)

Alliance *Malvion neglectae* (Gutte, 1966) Hejný, 1978
22. *Malvetum pusillae* Morariu, 1943 **(- 1, + 2)**
23. *Hyoscyamo nigri – Malvetum neglecti* Aichinger, 1933 **(+ 3)**

As it can be seen from the list above, the number of new locations (45) exceeds the number of the locations where currently the associations were not identified again (22). Besides this, three new associations with a total of 16 locations were recorded. The 3 newly identified segetal associations are the following: *Consolido – Polygonetum convolvulus* Morariu, 1967. sass. *polygonetosum convolvulus* Todor, 1971; *Centaureo cyani – Lathyretum tuberosae* Sanda et Popescu, 1999 and *Spergulo – Aperetum spica-venti* Soó, 1962.

Similar studies, regarding the segetal associations, conducted in central Slovenia (Šilk and Čarni, 2005) showed modifications in the composition of associations, the increase (cosmopolites) or decrease (ephemerophytes) of certain species, due to the new agricultural practices. In the same time, while in Slovenia specialized weed species disappeared due to use of commercial seed-mixtures, in the analyzed region of Romania, the low level of sustainability in agriculture, irrational fertilization, discharges from livestock and chaotic field work (Pele, 2009) led to further development of weeds. The reduced level of applying the sanitary methods against weeds is noticeable in their coverage in the field. According to Bogdan et al. (2007) the mechanical method, usually used for controlling weeds, do not ensure a proper hygiene of weeds; the average level of weed control registered in this variant being of only 33%, while using complex herbicides in recommended amounts resulted in an average control degree of 73-75%. Studies performed by Popescu (2007) showed a number of complex herbicides successfully used against *Apera spica – venti* (L.) Beauv. and *Avena fatua* L. in wheat. In the 50 years that passed since the first segetal vegetation studies, the agriculture in the studied area suffered a strong degradation. The fragmented fields and the poor economic situation of the small farms led to poor sanitary actions and crop management.

The floristic composition of the three newly identified segetal associations is made of some species seen as the most harmful weeds of dense crops (wheat, barley): *Cirsium arvense* (L.) Scop., *Galium aparine* L. and *Papaver rhoeas* L., *Convoluvulus arvensis* L. (climbing species that compete with crops for light) and *Chenopodium album* L. (an inhibitor for wheat seedlings growth) (Dujmović and Hulina, 2008). Species like *Avena fatua* L., *Capsella bursa-pastoris* (L.) Medicus, *Papaver rhoeas* L., *Sinapis* sp., *Thlaspi arvense* L., *Veronica hederifolia* L. prefer cereal crops; *Galium aparine* L. and convoluting species like *Convolvulus arvensis* L. and *Polygonum convolvulus* L. suffocate the plants; *Chenopodium album* L. prefers soil rich in nitrate, while *Cirsium arvense* (L.) Scop. and *Elymus repens* (L.) Gould. have a preference for wet, warm and light soils.

Consolido – Polygonetum convolvulus
Morariu, 1967
sass. ***polygonetosum convolvulus*** Todor, 1971 (Table 1)

Chorology. This association is composed of weeds that grow in crops (wheat, barley and oat), abandoned arable lands and stubbles (Sanda et al., 2008; Chifu et al., 2006). The association was identified at Dăneşti in wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.) and oat (*Avena sativa* L.) crops, at Dochia in oat crop and Prăjeşti in wheat crop (Neamţ County). The association was also identified in the west of Romania (Hamar and Sárkány-Kiss, 1995) and in the Republic of Moldova (Mârza, 2010) on fallow ground.

Stationary conditions. Dăneşti village is located at 297 m altitude and the soil is the cambic chernozem type. Dochia village lies at 308 m altitude, and the soil is also the cambic chernozem type. The Prăjeşti village is located at 321 m altitude and the soil is the grey soil type, present only in the eastern part of Romania.

Floristic composition. The two species that form the weed association are *Polygonum convolvulus* L. and *Consolida regalis* ssp. *regalis* S. F. Gray with values of dominance-abundance of 2 (≤ 25%) and 1 (≤ 10), the rest of percentages being covered by the associated weeds and the crop itself. These species develop in such ways that are able to invade the cultures and suffocate the cultivated plants, as *P. convolvulus* L. is

known to convolute around the stems of plants. The floral composition is poor related to other types of vegetation, counting only 22 species with coverage between 30 and 50% (high enough to cause loss of crop).

In our case we identified the subassociation *polygonetosum convolvulus* Todor 1971 that has a floral composition mainly dominated by the characteristic species of the *Stellarietea mediae* class, and *Polygonum convolvulus* L. has a higher impact on the appearance of the association than *Consolida regalis* ssp. *regalis* S. F. Gray.

Table 1. ***Consolido – Polygonetum convolvulus*** Morariu, 1967
sass. *polygonetosum convolvulus* Todor 1971

No. Survey	1	2	3	4	5	
Altitude, m	297	297	297	308	321	
Exposition	E	V	-	-	-	
Slope's gradient, °	5°	10°	-	-	-	K
Grass stratum covering , %	50	35	40	30	30	
Surface, m^2	100	100	100	100	100	
assc. ch.						
Consolida regalis ssp. *regalis* S. F. Gray	1	1	1	1	1	V
sass. diff.						
Polygonum convolvulus L.	2	2	1	2	1	V
Caucalidion lappulae						
Caucalis platycarpos ssp. *platycarpos* L.	1	+	1	+	1	V
Euphorbia plathyphyllos L.	+	-	+	+	+	IV
Lathyrus tuberosus L.	+	+	+	+	+	V
Veronico – Euphorbion						
Erodium cicutarium (L.) L'Herit	+	+	+	-	+	IV
Euphorbia helioscopia L.	+	-	+	+	+	IV
Centauretalia cyani						
Avena fatua L.	+	+	+	+	+	V
Panico – Setarion						
Echinochloa crus-galli (L.) Beauv.	1	+	1	+	1	V
Setaria pumila (Poiret) Schultes	+	1	+	1	+	V
Eragrostietalia						
Consolida orientalis Schrodinger	-	-	+	-	+	II
Stellarietea mediae						
Anagallis arvensis L.	+	+	-	+	+	IV
Cardaria draba (L.) Desv.	+	+	+	-	+	IV
Chenopodium album var. *album* L.	1	+	+	+	1	V
Cirsium arvense (L.) Scop.	+	1	1	1	1	V
Convolvulus arvensis L.	+	1	1	+	+	V
Polygonum aviculare L.	+	+	-	-	+	III
Sinapis arvenis L.	-	+	+	+	+	IV
Sonchus arvensis L.	+	+	+	+	+	V
Stachys annua L.	-	-	+	+	+	III
Bidentea tripartiti						
Polygonum lapathifolium ssp. *lapathifolium* L.	+	+	-	+	+	IV
Galio – Urticetea						
Galeopsis tetrahit L.	+	+	+	+	+	V
Place and date of the surveys: 1-3 – Dăneşti (Neamț County): 1, 2 – wheat, 3 – barley; June, 2007 4 – Dochia (Neamț County): oat; June, 2007 5 – Prăjeşti (Neamț County): wheat; June, 2007						

Centaureo cyani – Lathyretum tuberosae Sanda et Popescu, 1999 (Table 2).

Chorology. *Centaurea cyanus* L. and *Lathyrus tuberosus* L. association is a segetal type of vegetation that develops in cereal crops and prefers moist soils, rich in nutritive substances, the two characteristic species actively participating in the nitrogen fixation in the soil (Sanda et al., 2008). The association was identified at Frunzeni and Costişa (Neamţ County) in wheat fields. The association was presented as developing in Romania (Sanda et al., 2008).

Stationary conditions. The soil type is the same in all survey plots and belongs to the cambic – chernozem category. Frunzeni village is located at 338 m altitude and Costişa village is located at 247 m altitude.

Floristic composition. The surveyed phytocoenosis are dominated by *C. cyanus* L. and *L. tuberosus* L. that grow in different co-dominance ratio. The floristic composition is reduced, based on 22 species and has ground coverage between 30 and 40%. Except the two characteristic species specified above, only *Cirsium arvense* (L.) Scop. and *Erigeron annuus* (L.) Pers. are high in abundance.

Table 2. ***Centaureo cyani – Lathyretum tuberosae*** Sanda et Popescu, 1999

No. Survey	1	2	3	4	5	6	K
Altitude, m	338	338	338	338	247	247	
Exposition	E	E	-	-	-	-	
Slope's gradient, °	5°	10°	-	-	-	-	
Grass stratum covering, %	40	35	40	30	35	40	
Surface, m²	100	100	100	100	100	100	
assc. ch.							
Centaurea cyanus L.	2	1	2	2	+	2	V
Caucalidion lappulae							
Euphorbia plathyphyllos L.	+	+	-	+	-	-	III
Lathyrus tuberosus L.	1	1	1	1	1	1	V
Nigella arvense L.	-	+	+	-	+	+	IV
Centauretalia cyani							
Consolida regalis ssp. *regalis* S. F. Gray	+	+	-	+	+	+	V
Papaver rhoeas L.	+	+	-	+	-	+	IV
Thlaspi arvense L.	-	+	-	-	+	-	II
Vicia villosa ssp. *varia* (Host) Corb.	-	-	+	+	+	-	III
Chenopodietalia albi							
Raphanus raphanistrum L.	+	+	-	-	+	-	III
Stellarietea media							
Cirsium arvense (L.) Scop.	+	+	1	+	1	+	V
Tripleurospermum perforatum (Mérat) M. Lainz	+	+	+	+	+	+	V
Mentha arvensis L.	+	-	-	-	+	-	II
Sinapis arvensis L.	-	-	+	-	+	-	II
Sonchus oleraceus L.	+	+	+	-	-	+	IV
Artemisietea vulgaris							
Erigeron annuus (L.) Pers.	1	1	1	+	2	1	V
Hypericum perforatum L.	+	+	-	+	+	-	IV
Rumex patientia L.	+	-	-	+	+	+	IV
Molinio – Arrhenatheretea							
Achillea millefolium L.	+	+	-	+	+	-	IV
Elymus repens (L.) Gould.	+	+	+	+	+	+	V
Leontodon autumnalis L.	-	-	-	+	-	-	I
Trifolium pratense L.	-	+	+	+	+	+	V
Festuco – Brometea							
Dianthus armeria L.	-	-	+	-	+	+	III
Place and date of the surveys: 1-4 – Frunzeni (Neamţ County): wheat; July, 2006 5- 6 – Costişa (Neamţ County): wheat; July, 2006							

Spergulo – Aperetum spica-venti Soó, 1962 (Table 3)

Chorology. This phytocoenosis invades the cereal crops that grow on soils with a high percentage of sand, moderately acid to neutral and poor in humus (Sanda et al., 2008). We encountered this weed association in wheat, barley and oat fields. The association was identified at Racova (Runc region) in wheat and barley crops and at Marginea in wheat fields (Bacău County). In Neamț County, this association was identified at Țucanii din Vale in oat and at Siliştea in wheat crops. The association was also identified in different regions of Romania (Sanda et al., 2008) and in Hungary (Molnár, 1998).

Table 3. ***Spergulo – Aperetum spica-venti*** Soó, 1962

No. Survey	1	2	3	4	5	K
Altitude, m	315	315	342	263	338	
Exposition	SV	V	E	-	N	
Slope's gradient,°	5°	15°	15°	-	10°	
Grass stratum covering, %	30	35	25	40	30	
Surface, m^2	100	100	100	100	100	
assc. ch.						
Spergula arvensis L.	+	+	1	1	+	V
Caucalidion lappulae						
Euphorbia plathyphyllos L.	+	+	-	+	+	IV
Veronico – Euphorbion						
Euphorbia helioscopia L.	+	-	+	+	+	IV
Centauretalia cyani						
Centaurea cyanus L.	+	+	+	+	+	V
Thlaspi arvense L.	+	+	+	+	+	V
Panico – Setarion						
Setaria pumila (Poiret) Schultes	1	+	1	1	+	V
Chenopodietalia albi						
Apera spica-venti ssp. *spica-venti* (L.) Beauv.	2	2	1	2	2	V
Stellarietea mediae						
Capsella bursa-pastoris (L.) Medicus	+	+	-	+	1	IV
Cirsium arvense (L.) Scop.	+	1	+	1	+	V
Convolvulus arvensis L.	+	1	1	+	1	V
Tripleurospermum perforatum (Mérat) M. Lainz	+	+	+	1	+	V
Polygonum aviculare L.	-	+	+	-	+	III
Polygonum convolvulus L.	-	+	+	+	+	IV
Sinapis arvenis L.	+	+	+	1	+	V
Artemisietea vulgaris						
Cichorium intybus L.	+	+	+	-	+	IV
Elymus repens (L.) Gould.	+	1	1	1	1	V
Galium aparine L.	1	+	+	+	1	V
Galio – Urticetea						
Galeopsis tetrahit L.	+	+	+	+	1	V
Veronica hederifolia L.	+	+	+	+	-	IV

Place and date of the surveys:
1, 2 – Racova (Runc region, Bacău County): 1 – wheat, 2 – barley; July, 2006
3 – Țuțcanii din Vale (Neamț County): oat; July, 2007
4 – Marginea (Bacău County): wheat; July, 2006
5 – Siliştea (Neamț County): wheat; July, 2007

Stationary conditions. At Racova, the association was not identified near the village as in the other cases, but further into the hills, between two forested areas at 315 m altitude. In this area the soils are the brown eu-meso alkaline type. The same soil category is found at Marginea (263 m altitude). The region from Ţuţcanii din Vale (342 m alt.) village is wetter and enters the podzolic illuvial-clay soil type. Siliştea village is located at an altitude of 338 m. The soils are in the grey soil category.

Floristic composition. The two characteristic and dominant species, *Spergula arvensis* L. and *Apera spica-venti* (L.) Beauv., are co-dominant and accompa-nied by 8 species with AD values reaching 1.

The floristic composition counts 19 species and has ground coverage between 25% and 40%. 8 species, beside the 2 basic species, are participating with a higher coverage to the association structure.

Ecological specifications

The characteristic floral elements of the three associations are the Cosmopolite and the Eurasian species, the first category dominating associations 1 and 3 and the second category dominating the association 2.

The life form spectrum is represented mainly by the annual and the annual – biannual therophytes, which represent in each case over 70%. The light preferences are mainly for the light -reduced shadow category; the temperature preferences, excluding the indifferent species, are for temperate areas to warm areas. The continentality spectrum is co-dominated by the indifferent and the oceanic – sub-oceanic species with main habitat in Central Europe. The humidity preferences showed that, as a rule, excluding the indifferent species, there is a preference for moderately wet soils and dry to moderately wet.

The species indifferent to soil pH are the dominant (>35% for each association) as the responding species prefer soils with pH between 7 and 8 (weakly acid to weakly alkaline and moderately alkaline). The nitrogen preference spectrum is mainly dominated by the indifferent species (≈ 30%), but for association 3 the species with preference for nitrogen rich soils have a higher percentage (35.3%).

The vegetation developing in agrocoenosis is considered as living in extreme conditions as the activities performed in the agricultural fields can be considered an extreme situation (Balcerkiewicz and Pawlak, 2008). The response in this situation is the formation of short-living segetal associations, in which most of the species are therophytes (Balcerkiewicz and Pawlak, 2008; Dujmović and Hulina, 2008).

As a general rule, for this geographical area, the weed associations are mainly composed of Cosmopolite (Šilk and Čarni, 2005; Dujmović and Hulina, 2008) and Eurasian species (Dujmović and Hulina, 2008). One of the consequences of irrational use of fertilizations is pH reduction and so, sites of all types of vegetation have become less basophilic and richer in nutrients (Šilk and Čarni, 2005).

The agrocoenosis where high quantities of fertilizers were used are easy to spot due to the number of weeds preferring acidic soils (3. – 31.6%; 2. – 18.1% and 1. – 9.1%; for species with preference of pH from 2 to 6).

Weed species status

The fist analysis is related to the nativity of the species composing the associations. According to the data presented by Chifu et al. (2006) and Sanda et al. (2003), all the species, including the invasive species, are considered to be native to the area.

The analysis of the species presented as threatened in Romania showed 3 species in our associations: *Apera spica-venti* (L.) Beauv.*, Avena fatua* L. and *Tripleurospermum perforatum* (Mérat) M. Lainz (Ciocârlan et al., 2004). *Apera spica-venti* (L.) Beauv. is well represented, as it is the dominant species in the association, *Avena fatua* L. and *Tripleurospermum perforatum* (Mérat) M. Lainz are present in all surveys but in reduced numbers (+). An analysis of threatened species in surrounding countries shows that in Croatia, *Centaurea cyanus* L., *Consolida regalis* S. F. Gray, *Lathyrus tuberosus* L., *Papaver rhoeas* L. and *Stachys annua* L. are seen as vulnerable and *Spergula arvensis* L. is considered endangered (Hulina, 2005).

As it can be seen from the scientific literature (Ciocârlan et al., 2004; Chifu et al., 2006), there is a contradiction between different authors about the situation of *Tripleurospermum perforatum* (Mérat) M. Lainz. Our studies, until this moment tend to incline in the direction of a not-threatened species with invasive potential, but we must not exclude that the situation of species changes with the geographical regions, so what may be considered invasive in the eastern part of Romania may be threatened in south. Further studies across all regions of Romania are necessary, in order to be able to specify the degree of invasiveness or threat of a plant.

The invasive species analysis showed a number of 12 species with invasive potential, known to have developed in high numbers. These species are part of all three segetal associations and are: *Cardaria draba* (L.) Desv., *Chenopodium album* L., *Cichorium intybus* L., *Cirsium arvense* (L.) Scop., *Elymus repens* (L.) Gould., *Erigeron annuus* (L.) Pers., *Galium aparine* L., *Polygonum aviculare* L., *Rumex patientia* L., *Tripleurospermum perforatum* (Mérat) M. Lainz; *Veronica hederifolia* L. (Dihoru, 2004) and *Sonchus arvensis* L. (Fritea, 2008).

An interesting analysis is the *share of invasive/non-invasive* species. Association 1 presents 5 invasive species (22.7%) and 17 non-invasive species (77.3%), association 2 presents 5 invasive species (29.4%) and 17 non-invasive species (70.6%). Association 3 has the highest number of invasive species – 7 (36.8%) and only 12 non-invasive species (63.2%).

CONCLUSIONS

In the analyzed area of Romania, due to a high degree of field fragmentation and poor financial situation that led to poor crop management, an increase in weed infested areas was noticed, in relation to the data presented in previous studies. The number of segetal associations and of their locations grew; as 45 new locations were identified during the 2004-2007 study in comparison with 22 locations where the segetal associations were not identified again. Also, three new associations were identified in a total of 16 locations. 12 species of weeds that have invasive potential were recorded, but the positive aspect is that these species are all native to the region and there is no threat from non-native invasive species yet to be recorded.

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