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MONITORING INVASIVE WOOLLY CUPGRASS *ERIOCHLOA VILLOSA* IN THE PIR VILLAGE AREA, SATU MARE COUNTY, ROMANIA, AND ITS IMPACT ON SEGETAL FLORA

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Abstract: The focus of this paper is the monitoring a new invasive species in Romania (*Eriochloa villosa*), in particular in the surroundings of Pir village, Satu Mare County, the impact of this species on local segetal flora and new adaptations of this species in a variety of habitats. Monitoring the changes of the plant associations in which this species is encountered suggests that associations and subassociations new for Romania have formed, which are still in primary stages of developement. This paper presents novel data regarding future evolution of these associations.
Key words: *Eriochloa villosa*, invasive species, monitoring, impact, Romania.

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Introduction

Monitoring and updating data regarding the spread of the woolly cupgrass *Eriochloa villosa* (Thunb.) Kunth around the world is increasingly becoming a priority. This invasive species is responsible for decreasing crop production in several areas around the world, in particular North America; raising new issues regarding the chemical warfare against agricultural weeds. It can also become a carrier of pathogenic fungi damaging to grain crops (http://www.inspection.gc.ca).

Eriochloa villosa (Thunb.) Kunth is native to the temperate areas of Asia, from Caucasus, Iran, West Siberia and East Russia, to the Far East (China, Japan, Taiwan, Koreea, and Vietnam) (Tsvelev 1984). It was first reported as an adventive species in North America (in the United States) since 1940 (Clayton et al. 2008), affecting crops in over 13 American states. Since 1987 it was reported in South America in Suriname (Paramaribo region) (***). It was detected in Canada since 2000 (Allison & Darbyshire 2001), and later in Costa Rica and New Zealand (http://www.inspection.gc.ca). In Europe it was mentioned in Ukraine (Clayton 1980) and France (Riviere et al. 1992) without major agricultural impacts. Later its presence was also mentioned in Romania (Ciocârlan & Sike 2006) and Hungary (Partosfalvi et al. 2008). In Hungary *Eriochloa villosa* is spreading in the northern region (Balogh & Novák 2014). Recently it was observed also in the eastern part near Debrecen (Szilágyi et al. 2015) and on the south-western border (Bartha et al. 2015).

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In Romania it was first noticed and mentioned in Satu Mare County at Livada (Ciocârlan & Sike 2006) and Timiș County also in 2006, at several locations (Fărcășescu et al. 2008). Later was also spotted in Arad County, also at several locations (Ardelean et al. 2009), while Carol Karácsonyi mentions its presence at new locations in Satu Mare County around Pir village as well as in Bihor County at Reghea (Karácsonyi 2011). Both locations are part of Tășnadului Hills area, an area where the species spreads rapidly and in 2014 reached Acâș and Supuru de Jos (from Satu Mare County, arriving at the border of Sălaj County).

Figure 1 presents a map with the places in Romania where this invasive species was noted in the Western Romanian Plain and Hills (Ciocârlan & Sike 2006, Fărcăşescu et al. 2008, Ardelean et al. 2009, Negrean 2011, Karácsonyi 2011, Dărăban et al. 2012, Negrean 2012). It is clear that this species is spreading rapidly in the western counties of Romania: Timiș, Caraș-Severin, Arad, Satu Mare, Bihor and even Maramureș at Săbișa (Negrean 2012) and Sălaj in the last years at Someș-Odorhei (2015), Crasna, Muncel and Bocșa (2016). The presence of this species is probably much more extensive throughout these counties (the data presented here include monitoring up to 2016). In the future we anticipate that it will be noted in Serbia, as it was already found in at least five locations on the border of Romania with Serbia. In the fall of 2015 it was discovered in Sălaj County, the region thus becoming the entry gate towards Transylvania, following Someș river valley to the North and the hills Dealurile Tășnadului – Dealurile Silvaniei to the east and south of the County.

Eriochloa villosa (Thunb.) Kunth belongs to grasses family (Poaceae), tribe Paniceae (Ciocârlan 2009). It is an annual species but in midler climates it can become perennial, ranging in height from 0.3 to 1 (2) m (http://www.inspection.gc.ca), in Romania reaching 60 – 100 cm (Ciocârlan & Sike 2006). Due to its great seed production it can easily spread to new areas. Amongsts the countries were it was encountered it was mentioned mainly in maize, sunflower, soy and rice fields as well as in fallow arable fields. In september 2016 the species was observed infesting a sorghum [*Sorghum bicolor* (L.) Moench] field near Acâș village (Satu Mare County).

This adventive species was monitored for three years (2010 – 2012), in Pir village, enough time to conclude that *Eriochloa villosa* can no longer be ignored where it is found, once established it becomes a difficult to control agricultural weed. Its ability and speed of spreading is similar to that of the annual ragweed *Ambrosia artemisiifolia* L. another species that poses great problems in Romania and throughout Europe. Pir village is located in the south-east of Satu Mare County where the hills Dealurile Tășnadului and the plain Câmpia (Valea) Ierului meet. The habitats in the area are very diverse ranging from marshes, to tree groves, forests and xerophytic pastures.

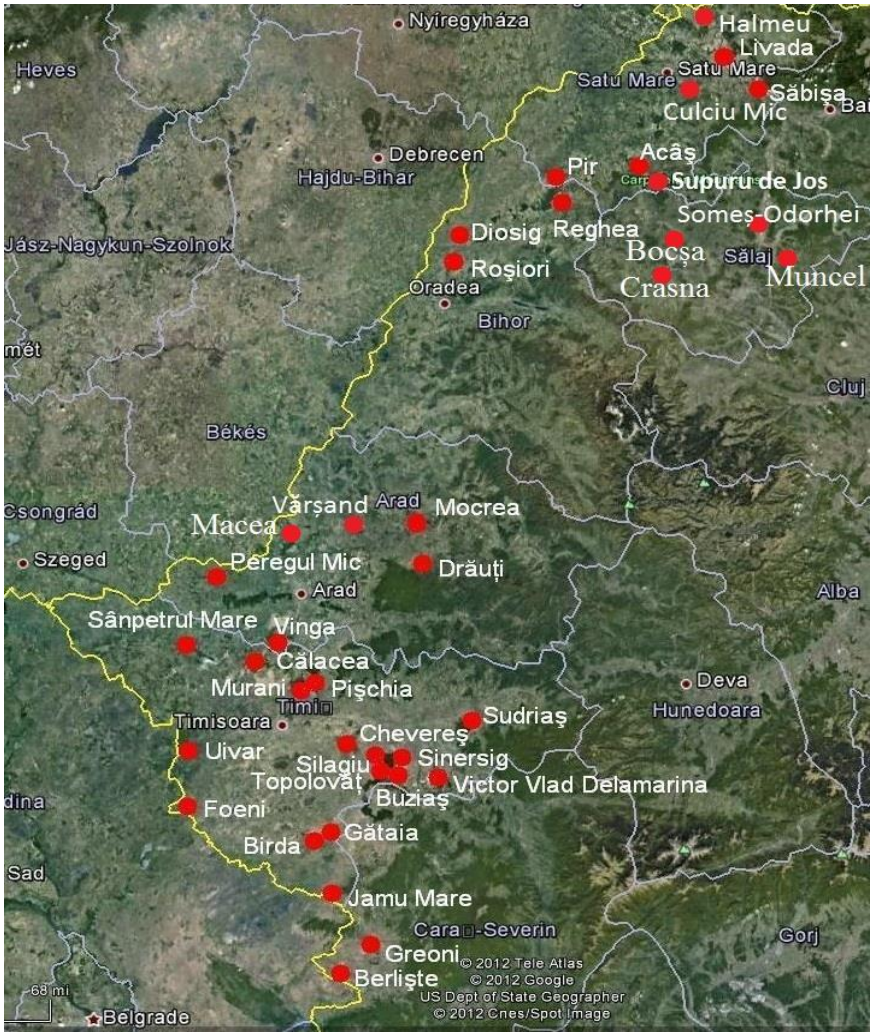

Fig. 1. The spread of *Eriochloa villosa* in western Romania (2016).

Material and methods

Monitoring of this species was done mainly through field observations, mapping the areas where it was encountered. Phytosociological (phytocoenological) sampling plots (relevé) method was also used to determine the abundance of individual plants and the other dominant species present at the same locations. Species identification was performed with the use of taxonomic key *Flora ilustrată a României* (Ciocârlan 2009), and the collected specimens were added to the personal herbarium and the herbarium of the botanical garden in Cluj-Napoca.

Results and discussion

Eriochloa villosa (Thunb.) Kunth (Fig. 2) was first observed in the area of Pir village by Carol Karácsonyi, during floristics research in the hilly region of Dealurile Tășnadului area, in 2009, who together with Gavril Negrean noticed a new association in a maize field that had dominating species *Setaria pumila* (Poir.) Roem. & Schult. and *Eriochloa villosa* (Thunb.) Kunth, accompanied especially by *Digitaria sanguinalis* (L.) Scop., *Setaria verticillata* (L.) P.Beauv. and *Oxalis stricta* L. (Karácsonyi 2011).

Fig. 2. Eriochloa villosa in the field (dominating with *Setaria pumila* on the right).

This is the first location from which we started the monitoring of this species. The maize field entirely infested with *Eriochloa villosa* is located in between a damp area and Pir Forest. This habitat fits perfectly with the ecological requirements of this species which prefers damp areas (http://www.inspection.gc.ca), and also posesing a very rapid adaptability. It is very interesting to note that this species is not expanding to the natural (uncultivated) habitats around the cultivated fields. The appearance of this species in this area is probably due to the agricultural activities that brought maize seed stocks infested with *Eriochloa villosa* seeds.

According to the field observation around Pir village area, it was noted that *Eriochloa villosa* follows the same seasonal patterns as noted in areas of North America, flowering around middle July, early August, sometimes later (http://www.inspection.gc.ca). The height of plants varies from 50-60 cm tall at the edges of fields or roads to 90-100 cm tall for the specimens towards the center of the fields or in highly damp areas. This species it is not well equiped for periods of long draught as it happened in 2012, an exceptionally dry year for the region when it did not rain in Pir village area for four months. Plants located in areas which dried earlier such as hill tops or asphalted road margins did not make it.

Figures 3, 4 and 5 present the rapid expansion of this species around Pir village. In 2010 this species was only found on a circa 200 m^2 portion of the maize field in front of Pir Forest, the next year 2011 it was noted at 2 km distance from the initial point. In 2012 the species became common almost on the whole southern part of Pir village, areas that are part of Dealurile Tășnadului hills area. In the fall of 2013 the species was already observed in Câmpia Ierului plains located only about 4 km away, where the plain meets the hills. The delay of expansion in the northern marshy area of the Pir village in Câmpia Ierului plain supports the observations in Arad County, where the species was noted in the thermophilous locations (Ardelean et al. 2009), the thermic gradient affecting its expansion, seemingly being more thermophilous. It can be noted that according to the composition of the local vegetation (xerophytic pastures, *Quercus cerris* L. forests) the hills in the southern part of the Pir village have a slightly milder climate and warmer that the northern part. Probably Câmpia Ierului wetlands that are the northern border of the village have a cooler microclimate, with the exceptions of summers.

In the Pir village area *Eriochloa villosa* spread in almost all cultivated fields located on hills. It was found mainly in the maize fields, but also in sunflower fields, in which for now only at the edges, and it is expected that in the following years to be slowly invaded as well. Interestingly it does not grow in the wheat fields, not even on the edges, probably due to its later fruit ripening during August, when wheat fields are already cropped.

Besides cultivated fields *Eriochloa villosa* is rapidly spreading along routes of transportation, what is interesting is that most of those are far from the damper areas usually prefered by *Eriochloa villosa*, but which can survive even amongst gravel of country roads. It can be noted that roads can become a route or a vector of spreading to new locations. Thus the road connecting Pir village to Chereușa to the east has numerous *Eriochloa villosa*, and probably already made it to the nearby village. The same was noted on the road that comes down to the Piru Nou village, from where they can easily spread to Câmpia (Valea) Ierului plain.

Another interesting spreading area of this species is throughout the cemeteries around the village where we found it growing on abandoned resting sites together with species of *Sedum* spp. which are known to prefer less damp areas. These invididuals that survive in harsher conditions, with less water availability, develop numerous lateral branches forming a shorter, compact, and bushier tussock, sometimes even less than 50 cm tall. In areas with optimum conditions *Eriochloa villosa* individuals are less branched, sometimes becoming pendulous. All these observations suggests that this species has great adaptability, easily colonizing disturbed habitats such as cultivated areas and roads, potentially becoming a major problem in the affected areas.

Fig. 3. Eriochloa villosa presence (in red) Pir village area in 2010.

Fig. 4. Eriochloa villosa presence (in red) Pir village area in 2011.

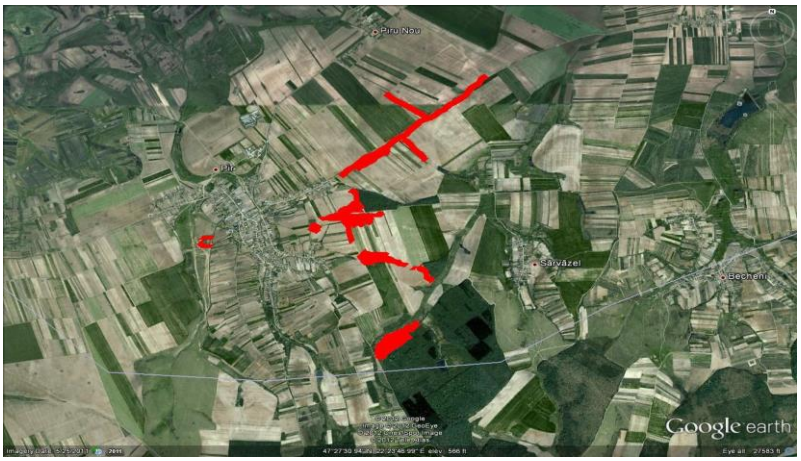

Fig. 5. Eriochloa villosa presence (in red) Pir village area in 2012.

Impact on local segetal flora. The main studies on *Eriochloa villosa* focused on its impact on cultivated fields and how can it be controled effectively to prevent crop losses. In this paper we will focus on its impact on native flora and the modifications on the plant composition where *Eriochloa villosa* settles. This study presents competitions and possible new associations between segetal species, the so called weeds growing on agricultural fields. The plant species growing on natural habitats are not considered here as *Eriochloa villosa* seems not to settle on areas that did not suffer disturbances. Focusing on observations on the impact of local agricultural weeds could offer important clues on the evolution of plant associations under the pressure of an invasive adventive species. The composition of plant associations with *Eriochloa villosa* is largely affected by the soil water availability, an interesing aspect to analyze. Thus, in the area of Pir village there are two distinct plant associations in which *Eriochloa villosa* is dominant. In the areas where *Eriochloa villosa* is only sporadic there are not major changes, at least in this preliminary data.

We analyzed two different habitats in which this species is found, one with damper soil (Table 1) and another with a deeper aquifer where during summer the lack of water affects the vegetation for several weeks (Table 2). The first habitat, from where the expansion of this species started in this region, is located in a valley surrounded by wetland and forest, the second habitat is located on the crest of the hills located in the southeastern area of the village and the road that connects Pir and Chereușa localities.

Table 1 presents three sampling plots from the above mentioned damper area. The first sampling plot (1) shows data that we collected before *Eriochloa villosa* appeared in the area, in 2008. This data is very important as it offers a comparison and the necessary perspective suggesting the rapid succesion of plant composition. It is easily noticeable that the dominant species are *Echinochloa crus-galli* and *Setaria pumila*, that together form *Echinochloo-Setarietum pumilae* association Felfödy 1942 em. Mucina 1993. The characteristic accompaning species are *Hibiscus trionum* L., *Portulaca oleracea* L., *Polygonum lapathifolium* L., *Galinsoga parviflora* Cav., *Cirsium arvense* (L.) Scop., *Convolvulus arvensis* L. (Sanda et al. 2008). The sampling plots 2 and 3 show data collected four years later suggesting the dominat role that *Eriochloa villosa* has assumed. It is noticeable that *Echinochloa crus-galli* population is drastically reduced, being transformed from a common species to a less present species. On the other side *Setaria pumila* population increased, possibly under the influence of the great number of *Eriochloa*. Looking at the other species several concerning data should be mentioned. Thus more than half of those species dissapeared from the surveyed maize fields, especially in the area with the greatest abbundance (5) of the invasive species (sampling plot 3). Indeed in some areas there were only *Eriochloa villosa* and *Setaria pumila*, with a random individual of *Xanthium strumarium* or *Echinochloa crus-galli*. In some areas *Eriochloa villosa* forms an almost compact carpet, where other species cannot survive. Cultivated plants are also overcrowded, reducing crop production. The species that continue to be abundant are: *Ambrosia artemisiifolia* L., *Xanthium strumarium* L., *Convolvulus arvensis* L., *Hibiscus trionum* L., *Cirsium arvense* (L.) Scop., and some species of *Polygonum*.

Table 1. Plant abundance-dominance at the damper location (Th – annual therophyte, TH – biannual therophyte, H – hemicryptophyte, G – geophyte, Adv – adventive, Cosm – cosmopolitan, Eua – Eurasiatic, Eur – European, Med – Mediteranean, Cp – circumpolar)

Bioforms	Geoelements	**Sampling plot number***	**1**	**2**	**3**
		Plant cover (%)	70	90	100
		Test area surface (m^2)	50	30	20
Th	Adv	*Eriochloa villosa*	-	4	5
Th	Cosm	*Echinochloa crus-galli*	2	+	+
Th	Cosm	*Setaria pumila*	3	3	4
H	Cosm	*Convolvulus arvensis*	+	+	-
Th	Eua	*Xanthium strumarium*	+	+	+
TH	Eua	*Hibiscus trionum*	+	+	-
Th	Adv	*Ambrosia artemisiifolia*	+	+	+
G	Eua	*Cirsium arvense*	+	+	-
Th	Cosm	*Polygonum aviculare*	+	-	+
Th	Cosm	*Polygonum lapathifolium*	+	+	+
Th	Eua	*Polygonum persicaria*	+	+	+
Th	Eua	*Gypsophila muralis*	+	+	-
G	Cosm	*Cynodon dactylon*	+	+	-
Th	Adv	*Amaranthus powelii*	+	+	-
Th	Adv	*Amaranthus retroflexus*	+	-	-
Th	Adv	*Oxalis fontana*	+	+	-
Th	Med	*Setaria verticillata*	+	+	-
Th	Eua	*Matricaria perforata*	+	-	-
Th	Adv	*Helianthus annuus*	-	+	-
H	Eur	*Rorippa sylvestris*	+	+	-
Th	Cosm	*Digitaria sanguinalis*	+	+	-
Th	Eua	*Fallopia convolvulus*	+	-	-
H	Eua	*Plantago major*	+	-	-
H	Eua	*Lolium perenne*	+	-	-
TH	Eua	*Daucus carota* subsp. *carota*	+	-	-
H	Cp	*Artemisia vulgaris*	+	-	-
Th	Eua	*Bidens tripartita*	+	-	-
Th	Cosm	*Portulaca oleracea*	+	-	-
Th	Cosm	*Capsella bursa-pastoris*	+	-	-
Th	Eua	*Thlaspi arvense*	+	-	-
Th	Adv	*Galinsoga parviflora*	+	-	-
H	Eua	*Sonchus arvensis*	+	-	-
Th	Eur	*Bromus commutatus*	+	-	-
Th	Adv	*Erigeron annuus* subsp. *strigosus*	+	-	-
Th	Eua	*Setaria viridis*	+	-	-
Th	Med	*Euphorbia helioscopia*	+	-	-
Th	Cosm	*Stellaria media*	+	-	-

***Sampling plot 1** – 2008 before *Eriochloa villosa;* **Sampling plot 2** – 2012 *Eriochloa villosa* in one maize field; **Sampling plot 3** – 2012 maximum abundance of dominant species in a second maize field with a damper soil

Following, we are presenting the analysis of the bioforms and geoelements (Sanda et al. 1983) from sampling plots 2 and 3 taken together, plots that together had only 19 species, in order to observe the percentage of the species associated with *Eriochloa villosa*. The bioforms indicate dominance of the annual therophytes (Th) (29 species – 73.68 %). Hemicryptophytes (H – 2 species – 10.52 %), biannual therophytes (TH) – 1 species (5.26 %) and geophytes (G) – 2 species (10.52 %), indicates a reduced presence. This is due especially to the intensive agricultural use of this field, but also due to the loss of competitive edge when faced with more resistant and better adapted species. Geophytes' percentage value indicate the supremacy of cosmopolitan species (Cosm) – 7 species (36.84 %), followed by the adventive (Adv) and Eurasiatic species (Eua) with the same coverage (26.31 % – 5 species each). The European are represented by only one species (10.52 %). The dominance of the cosmopolitan and adventive species together with *Eriochloa villosa* suggests worrisome future problems, as well as for other locations in the world. This is suggested by the fact that *Eriochloa villosa* does not need new adaptations to arrive in other countries, as it is usually found on agricultural monocultures now present worldwide.

In the dry habitat (Table 2) a different floristic composition is noticeable. The dominant species is millet (*Panicum miliaceum* L.), which in this area of Pir village also has only a recent history. This species is considered to be part of the association *Echinochloo-Setarietum pumilae* Felfödy 1942 em. Mucina 1993 (Sanda et al. 2008), but in the tested sampling plots it becomes the dominant species, having a higher abundance compared to *Echinochloa crus-galli* and *Setaria pumila*. It is possible that in this area it is a facies with *Panicum miliaceum.* Another possible phytosociological grouping might be the association *Erigeron canadensis – Panicetum miliacei* Ștefan 1993 (Sanda et al. 2008). The constant number of the species characteristic to the association (*Chenopodium album* L., *Cirsium arvense, Convolvulus arvensis, Setaria pumila, Echinochloa crus-galli*) are supporting this hypothesis. On a different note *Erigeron canadensis* L. (syn. *Conyza canadensis* /L./ Cronquist) is much less represented in this association. Almost all sampling plots analyzed in the area of Pir, *Eriochloa villosa* and *Panicum miliaceum* are found together, alternating in the percentage of abundance-dominance. These two species forming almost compact weedy areas, that suffocate other species and probably lead to reduced crop production of maize and sunflower. It seems like in the drier areas, on the hills and roadsides, *Eriochloa villosa* prefers the association with *Panicum miliaceum*, while in the damper areas with *Setaria pumila*, as it is noticeable in sampling plot 10, located in an area between a gravel road and the water drainage channel from the road.

It is interesing to note that the sampling plots where *Eriochloa villosa* is missing or it is in smaller numbers (sampling plots 6 and 9), *Echinochloa crus-galli* populations are more numerous. The data is preliminary, but the observation suggests that *Eriochloa villosa* and *Echinochloa crus-galli* occupy the same ecological niche, and the competition between these two species is one that *Echinochloa crus-galli*, is losing. Also in these sampling plots it can be noted the increased drop of the number of individuals and abundance of segetal species the so called agricultural weeds, to almost a half, comparative to sampling plots 6 and 9 where *Eriochloa* is absent, but this is also noticeable where millet (*Panicum miliaceum*) is expanding (sampling plots 7, 8, 9) comparative to sampling plot 5 for example. Possible causes could be the unusually

long drought (4 months) in 2012 when the sampling plots where designed, but it can be observed that *Eriochloa villosa* is drasticaly eliminating its competitors. Remarkably *Eriochloa villosa* shows affinity to related species in Paniceae (*Panicum, Setaria, Echinochloa, Digitaria*), which was observed in other parts of the world, where cultures of *Panicum* spp., *Echinochloa esculenta* (A.Braun) H.Scholz etc. (http://www. inspection.gc.ca) are prefered. I also have to mention that populations of Paniceae tribe and other resistent weeds has risen in conjunction with *Eriochloa villosa* arrival, which was also noticed in Hungary (Partosfalvi et al. 2008). Amongts these species notable are *Setaria pumila* and *Panicum miliaceum* whose populations doubled, slighter change in populations of *Digitaria sanguinalis, Chenopodium album* and even less of a change in populations of *Cirsium arvense* and *Echinochloa crus-galli*, the later one which I consider in competition with *Eriochloa*; even though in Hungary numbers of this species has risen as well (Partosfalvi et al. 2008).

Table 2. Plant abundance-dominance at the drier locations (abbreviations the same as in Table 1 + Atl-Med – Atlantic-mediteranean)

Biof orm s	**Geoel ement s**	**Sampling plot number***	**4**	**5**	**6**	**7**	**8**	**9**	**10**
		Plant cover (%)	85	75	60	95	70	60	90
		Testing area surface (m^2)	20	20	10	30	10	10	10
Th	Adv	*Eriochloa villosa*	3	3	-	2	+	-	4
Th	Adv	*Panicum miliaceum*	3	+	3	4	3	4	+
Th	Cosm	*Setaria pumila*	+	+	+	-	-	+	1
Th	Cosm	*Echinochloa crus-galli*	+	-	1	-	-	+	+
Th	Eua	*Xanthium strumarium*	1	+	+	+	1	+	-
Th	Adv	*Ambrosia artemisiifolia*	+	+	+	+	+	+	-
TH	Eua	*Hibiscus trionum*	+	+	-	+	-	+	-
H	Cosm	*Convolvulus arvensis*	+	+	+	+	+	-	-
Th	Cosm	*Polygonum aviculare*	+	+	+	-	1	1	+
G	Eua	*Cirsium arvense*	-	-	+	+	-	+	-
H	Eua	*Lolium perenne*	+	-	1	-	+	-	-
Th	Eua	*Polygonum persicaria*	-	-	-	-	-	+	-
G	Eua	*Elymus repens*	-	-	+	-	-	+	-
Th	Cosm	*Digitaria sanguinalis*	-	+	-	+	+	-	+
Th	Cosm	*Chenopodium album*	+	-	+	-	+	+	-
Th	Adv	*Xanthium italicum*	+	-	-	-	-	-	-
Th	Adv	*Amaranthus powelii*	-	+	-	-	-	-	-
Th	Adv	*Amaranthus retroflexus*	-	+	-	-	-	-	-
Th	Cosm	*Capsella bursa-pastoris*	-	-	+	-	+	-	-
H	Cp	*Artemisia vulgaris*	-	+	-	-	-	-	+
Th	Eua	*Gypsophila muralis*	-	+	-	-	-	-	-
Th	Atl-Med	*Crepis setosa*	+	-	-	-	-	+	-
Th	Eua	*Crepis foetida* subsp. *rhoeadifolia*	-	-	-	-	+	-	+
TH	Eua	*Picris hieracioides*	-	-	+	-	-	-	+
Th	Eua	*Lactuca serriola*	+	-	+	-	-	-	-

Th	Med	*Conium maculatum*	-	-	-	-	+	-	-
Th	Eua	*Consolida regalis*	+	-	+	-	-	-	-
Th	Adv	*Erigeron canadensis*	-	+	+	-	-	-	-
Th	Eua	*Oxalis corniculata*	-	+	-	-	-	-	-
Th	Cosm	*Centaurea cyanus*	+	-	-	-	-	-	-
Th	Eua	*Thlaspi arvense*	-	+	-	-	-	-	-
Th	Eua	*Viola arvensis*	+	+	-	-	-	-	-
H	Eua	*Plantago major*	-	+	-	-	-	-	-
Th	Cp	*Atriplex patula*	-	-	+	-	-	-	-
Th	Med	*Raphanus raphanistrum*	+	-	-	-	-	-	-
Th	Adv	*Brassica rapa* subsp. *oleifera*	+	-	-	-	-	-	-
Th	Med	*Brassica rapa* subsp. *sylvestris*	+	-	-	-	-	-	-

* **Sampling plot 4** – sunflower field on the hills; **Sampling plot 5** – maize field on the hills; **Sampling plot 6** – road side without *Eriochloa villosa*; **Sampling plot 7** – sunflower lot – next to Cionca Forest; **Sampling plot 8** – sunflower lot – roadside; **Sampling plot 9** – maize lot – roadside – without *Eriochloa villosa;* **Sampling plot 10** – area without agricultural crops – roadside

Analyzing the sampling plots it can be noted the constancy of some species in almost all surveyed fields and roadsides. Some were part of previous associations (*Convolvulus arvensis, Polygonum aviculare*, *Hibiscus trionum, Chenopodium album, Cirsium arvense, Digitaria sanguinalis*), others are invasive adventive species (*Xanthium strumarium, Ambrosia artemisiifolia*). In the same time the number of species and individuals within the populations is increasing towards the margins and decreases in the center of the fields. Subspecies of *Brassica* sp., *Plantago major* L., *Cyanus segetum* Hill (syn. *Centaurea cyanus* L.), *Consolida regalis* Gray, *Raphanus raphanistrum* L. or *Picris hieracioides* Sibth. & Sm. appear only at the margins of the cultivated fields. It is important to mention that *Panicum miliaceum* has a similar distribution with deacreasing number of individuals from the field edges to the center, its place being reclaimed by *Setaria pumila.* Similar distribution can be noted by *Eriochloa villosa* in many other places, around the world.

Bioforms and geoelements also indicate interesting percentages. In their calculations I considered data in all sampling plots to observe the impact the two dominant species (*Eriochloa villosa* and *Panicum miliaceum*) have on the surveyed plant communities. In total there are 37 species, this number, larger than in the previous sampling plots, indicates the addition of some species characteristic to roadsides that in most cases did not penetrate to the interior of fields. Thus, throughout the range of the bioforms, the annual therophytes (Th) are predominant (78.37% - 29 species) which is indicative of reduced soil dampness and intense agriculture. They are followed by the hemicryptophytes (H – 10.81 % - with only 4 species), then followed with equal coverage percentage by biannual therophytes (TH) and roadside geophytes (G): each with 2 species – 5,40 %. Amongst the geoelements, predominant are the Eurasiatic (Eua – 40.54 % – 15 species), followed in equal representation by the cosmopolitan (Cosm) and adventives (Adv) geoelements – 21,62 % with 8 species each. Further, with very small representation, are the Mediteranean species (Med – 8.10 % with 3 species), ruderal circumpolar species (Cp – 5.40 % with 2 species) and Atlantic-mediteranean

(Atl-Med – 2.70 % with only one species). If we consider that the majority of the Eurasiatic species are located towards the field margins indicates that the associations are again dominated by the cosmopolitan and adventive species, species that are posing problems throughout the world.

The last table (Table 3 – sampling plot 11) presents the species occupying an area with a high level of disturbance, plowed a number of times and then left fallow. It can be noted that a large portion of the pioneer species are adventive, the other part are native segetal species. The adventive species layer is again dominated by the *Eriochloa villosa* together with *Xanthium strumarium*, while the native segetal species by *Bromus commutatus* Schrad. and less so by *Bromus arvensis* L.. In lower number are the species usually found together with *Eriochloa villosa* such as: *Setaria pumila, Echinochloa crus-galli, Ambrosia artemsiifolia, Convolvulus arvensis, Cirsium arvense, Digitaria sanguinalis, Hibiscus trionum*, these being present on the surveyed fields for many years. It is important to mention that the presence of so many adventive ornamental species is due to the location of the field adjacent to a cemetery. These species have escaped from gardens and are naturalizing in the area for some years (*Eschscholzia californica* Cham., *Portulaca grandiflora* Hook., *Cosmos bipinnatus* Cav., *Tagetes patula* L., *Helianthus tuberosus* L.). According to numerous observations made in the area of the cemetery *Eriochloa villosa* was completely absent in 2009, 2010, 2011, and then it suddently appeared in 2012, with tens of individuals. The speed of colonizing new territories of *Eriochloa villosa* is impressive and worrisome, now reaching the quarantine status together with *Ambrosia artemisiifolia* (Partosfalvi et al. 2008).

Table 3. Species abundance-dominance on a fallow field. (abbreviations are the same as those in Table 1 + Atl-Med – Atlantic-mediteranean, Pont-Med – Pontic-mediteranean, Balc-Pont-Cauc – Balcanic-pontic-caucasian)

		Number of sampling plot*	**11**
		Plant coverage (%)	70
Bioforms	**Geoelements**	Test area surface (m^2)	15
Th	Adv	*Eriochloa villosa*	1
Th	Cosm	*Setaria pumila*	+
Th	Cosm	*Echinochloa crus-galli*	+
H	Cosm	*Convolvulus arvensis*	+
Th	Eua	*Xanthium strumarium*	1
TH	Eua	*Hibiscus trionum*	+
Th	Adv	*Ambrosia artemisiifolia*	+
Th	Adv	*Xanthium italicum*	+
Th	Eur	*Bromus commutatus*	1
Th	Cosm	*Polygonum aviculare*	+
Th	Med	*Setaria verticillata*	+
Th	Adv	*Eschscholzia californica*	+
G	Eua	*Elymus repens*	+
Th	Eua	*Bromus arvensis*	+
G	Eua	*Cirsium arvense*	+
Th	Atl-Med	*Crepis setosa*	+
Th	Med	*Stachys annua*	+
TH	Pont-Med	*Cephalaria transylvanica*	+

Th	Eua	*Lactuca serriola*	+
Th	Eua	*Avena fatua*	+
Th	Cosm	*Digitaria sanguinalis*	+
TH	Eua	*Daucus carota* subsp. *carota*	+
H	Cp	*Artemisia vulgaris*	+
Th	Cosm	*Chenopodium album*	+
Th	Eua	*Medicago lupulina*	+
Th	Eua	*Trifolium arvense*	+
Th	Adv	*Tagetes patula*	+
Th	Med	*Lactuca saligna*	+
Th	Eua	*Consolida regalis* subsp. *paniculata*	+
H	Eua	*Rubus caesius* var. *arvalis*	+
Th	Adv	*Cosmos bipinnatus*	+
H	Eua	*Chodrilla juncea*	+
Th	Adv	*Portulaca grandiflora*	+
TH	Eua	*Echium vulgare*	+
Th	Balc-Pont-Cauc	*Vicia grandiflora*	+
H	Eua	*Cichorium intybus*	+
G	Adv	*Helianthus tuberosus*	+

*** Sampling plot 11** – fallow field near a cemetery [the species abundance in all tables is marked from + (a few individuals) to 5 (the species is dominating the sample)]

Conclusions

According to the field observations, *Eriochloa villosa* associates with species of Paniceae Tribe (Poaceae): *Setaria pumila* and *Panicum miliaceum*, with which easily forms a range of abundance-dominance. *Eriochloa villosa* settles within previous plant associations, changing their floristic composition. We would like to point out two tendencies of new plant associations: *Eriochloa villosa* together with *Setaria pumila* in the damper areas and *Eriochloa villosa* together with *Panicum miliaceum* in drier areas. As more data from other counties throughout the country will be added, further comparisons regarding these associations can be made. Due to the fact that *Panicum miliaceum* is a species escaped from cultivation and almost naturalized in a few areas throughout the country, it won't be found together with *Eriochloa* in these areas, even if they are on the drier side. This suggests that *Panicum miliaceum* association with *Eriochloa villosa* is only a facies around Pir village, the main codominant species together with *Eriochloa villosa* being *Setaria pumila*, as I observed in the sample plots with less *Panicum miliaceum*.

The dominant species in the damper areas are *Eriochloa villosa, Setaria pumila, Echinochloa crus-galli*, and in drier areas: *Eriochloa villosa* and *Panicum miliaceum*, with lower percentages of *Erigeron canadensis, Setaria pumila, Echinochloa crus-galli*. The species characteristics to both types of the above mentioned associations in constant percentages are: *Hibiscus trionum, Convolvulus arvensis, Digitaria sanguinalis, Cirsium arvense, Ambrosia artemisiifolia, Xanthium strumarium*, with *Chenopodium album* especially in the drier areas.

The establishment of the adventive invasive species *Eriochloa villosa* in new habitats, even the ruderal weedy areas or segetal flora causes drastic perturbations in the

plant species associations. Thus some species are multiplying uncontrollably, to the detriment of others whose numbers are drastically reduced or even eliminated. A careful monitoring of *Eriochloa villosa* is of utmost importance due as its very quick adaptation which would lead to an unprecedented decrease of native flora, further followed by decrease of the fauna that depends on it. Still, field observations suggests that *Eriochloa villosa* is not able to establish itself in the undisturbed habitats, which are for now safe. Regarding its propagation speed, amongst the invasive plants in the Pir area, *Eriochloa villosa* occupies second place only after *Ambrosia artemisiifolia*, and followed by *Prunus serotina* Ehrh. and *Robinia pseudoacacia* L..

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