

Woolly cupgrass (*Eriochloa villosa* /Thunb./ Kunth), a recently occurred invasive weed in Trans-Tisza Region and a trial for control in maize

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Summary:

To the effective control of invasive weeds are essential to prevent establish, if has already happened obstacle to massive accumulation, and promoting the efficient and rapid eradication, if it is possible. The Woolly cupgrass (*Eriochloa villosa* /Thunb./ Kunth) belongs to weeds which "hard to control" especially in corn. One of the difficulties of effective control is the prolonged emergence causing avoidance of several individuals the contact with pre-emergent herbicides. Another problem arises due to the intensive use of post-emergence herbicide products with short duration of action. To optimalize of timing of treatment is essential for successful control of later emerging weeds. The recently established Woolly cupgrass in Hungary shows resistance or reduced susceptibility to substantial portion of herbicides used in corn. The data collected from small-plot trials demonstrates that application of sulfonylurea or selective monocotyledonous herbicides can be effective against the Woolly cupgrass.

Keywords: Woolly cupgrass, *Eriochloa villosa*, weed control, selective herbicides, maize, corn

Introduction

The number of weed species affect agricultural production is around 6700. About 200 weed species cause significant problems for crop production worldwide. The accumulation and spread of weeds highly affected by the effectiveness of applied weed control technology in a certain area. Increasing number of new weed species have appeared in Hungary such as Woolly cupgrass (*Eriochloa villosa* /Thunb./ Kunth). Changes in weed flora elements, appearance of new species can be influenced by:

- changes in farming systems and tillage depth. These can highlight those weed species which are less tolerant for disturbances.
- introduction of non native species by seed, feed, and food trade, transport, stuck in vehicles etc).
- climate change contribution to increase frost-free periods resulting extension of growing season especially for the warm-loving weeds (Szöke, 2001).

The Woolly cupgrass (*Eriochloa villosa* /Thunb./ Kunth) is widespread in Eastern Europe. Its proposed Hungarian name is 'ázsiai gyapjúfű'. The plant distribution in the temperate zones of Asia, Caucasus, Russia's Far Eastern region, Iran, Japan, China, Taiwan, Korea and Vietnam is common (Tsvelev, 1984). In several states of the United States and Canada was also released. The species has been found in France, Ukraine, Romania and Hungary (Figure 1). The first report about observations was made by János Madarász and Péter Partosfalvi on the 5th (Hungarian) National Weed Surveys in 2007. Partosfalvi *et al.* (2008) gave an account of occurrence of Woolly cupgrass on 25 July 2007, near Gesztely village (North Hungary). Balogh and Novák (2014) shortly reported about spreading of Woolly cupgrass in the northern region and about a herbicide control trial. It is suggested to control in sunflower culture by cycloxydim, a special monocot herbicide which proved proper effectiveness. The Woolly cupgrass plants were also observed in Debrecen (East Hungary) in 2011 on agricultural fields (Figure 2 and Table 1) by László Szabó and István Dávid (unpublished), too.

The proper identification of *Eriochloa villosa* was confirmed by a grass weed specialist, Prof. Hildemar Scholz (1928-2012).

The Woolly cupgrass belongs to the well adaptable plant species. The Hungarian climate elements provide good conditions for this recently appeared weed. Its favourable conditions are 10-11°C average annual temperature, 550-600 mm average annual rainfall, and an average of 5.5-6.5 soil pH (Fărcășescu *et al.*, 2008). The optimum germination temperature for most of the weeds is between 20-35°C (Bello *et al.*, 2000). The germination of Woolly cupgrass starts in mid-April in Hungary. The mass hatching period is followed by a second minor germination peak. Hence, the emergence fully extended, which makes it difficult to control. The ripening of grain yield starts in August and begin to achieve its distribution by animals and human activities. The Woolly cupgrass is classified as a T4 group plant according to the Ujvárosi' weed plant life system.

Woolly cupgrass gets its name from the hairs covering many parts of the plant. It is a 30-200 cm annual grass with dark green and densely hairy leaves that have a velvety feel. Only one edge of the leaf blade is typically crinkled, and the flowering branches are also one-sided (Figure 3). The Woolly cupgrass impairs corn, sunflower, soybean areas and stubble-fields.

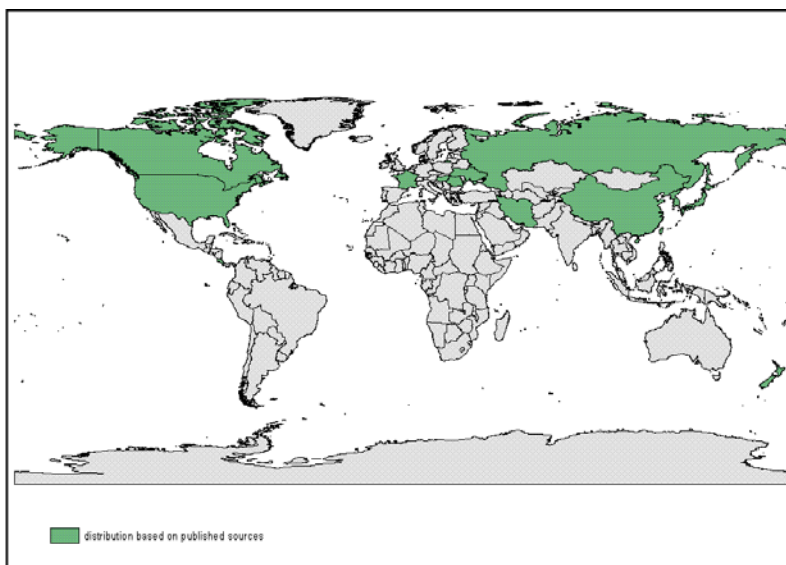


Figure 1: Distribution of Woolly cup grass worldwide (Source: <http://www.q-bank.eu/Plants/BioloMICS.aspx?Table=Plants%20-%20Species& Rec=971&Fields=All>)



Figure 2: The Woolly cupgrass has been sprading around Debrecen (Source: Indicated points on Google-Earth picture by Somogyi *et al.*, 2011)

K1 – Maize 1, K2 – Maize 2, K3 – Maize 3, K4 – Maize 4, K5 – Maize 5, K5 – Maize 6, K7 – Maize 7, K8 – Maize 8, N1 – Sunflower 1, T1 – Stubble-field 1

Table 1

The dense of Woolly cupgrass on surrounding arable areas of Debrecen, 2011								
	Woolly cupgrass observations on maize fields, Debrecen district, and its proportion in weeds (%)							
	K1	K2	K3	K4	K5	K6	K7	K8
Infection of <i>Eriochloa villosa</i> on the maize field	71	0	2.3	0	0.2	0	0.5	0
Infection of <i>Eriochloa villosa</i> on ruderal areas	71	2	3	4	2	0.5	0.5	0.5

(Source: Somogyi *et al.*, 2011)

B/

A/



Figure 3: Woolly cupgrass inflorescence branch (A), infesting the edge of a corn field (B/) (Sources: A: Szilágyi, 2015; B: <http://www.inspection.gc.ca/plants/plant-protection/invasive-plants/fact-sheets/woolly-cupgrass/eng/1331822413731/1331822996178>)

MATERIALS AND METHODS

A small-plot herbicide experiment was performed at Gesztely outskirts in 2015. The measurements of the plots: 2 m wide and 10 m long. The plots of nine post-emergent herbicide treatments and untreated ones were designed in randomized block in 4 repetitions. The maize field was totally infested by Woolly cupgrass. The coordinates of trial the follows in UTM system:

- | | |
|-----------------|-----------------|
| 1. 48°12'80.63" | 2. 48°12'80.92" |
| 20°99'34.63" | 20°99'36.78" |
| 3. 48°12'65.81" | 4. 48°12'65.95" |
| 20°99'38.92" | 20°99'40.86" |
- (Figure 4).

The maize hybrid was the Focus Ultra (cycloxydim) resistant, calls Duo System. The spraying of plots was made on 08 June 2015 by a special plot sprayer.

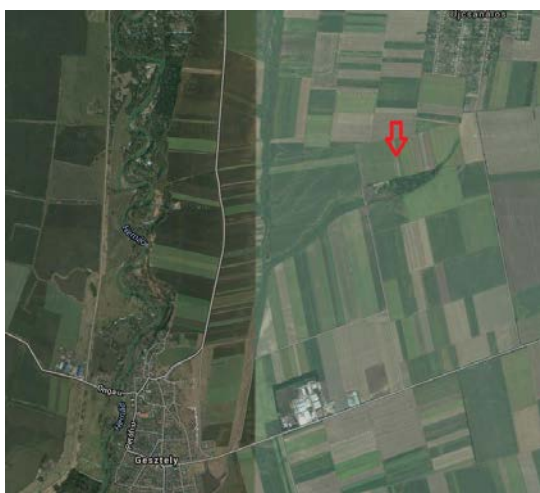


Figure 4: Place of small plot trial next to Gesztely, 2015 (Source: Google Earth)

RESULTS

The effectiveness of post-emergent herbicide treatments is shown in the *Table 2*. The most of herbicides which generally used in maize production reached weak or very poor rating. So those areas, which heavy infested by Woolly cupgrass, there are very important to apply a wide range of weed control. Because of weak effectiveness of post-emergent herbicides, it should be reasonable to find effective pre-emergence herbicides, which could suppress the emergence of the first wave of weeds including Woolly cupgrass. The post-emergent herbicides can push back the late germinating Woolly cupgrass with weak effectiveness only.

Table 2

Effectiveness of herbicide treatment in maize (Gesztely, 2015)

Treatments (Number)	Active substances	Dose	Effectiveness	
		(kg/ha, l/ha, %)	%	Textually
1	<i>nicosulfuron</i> dicamba	1.5	71	weak
		0.6		
2	<i>nicosulfuron</i> dicamba ethoxylated isodecyl alcohol	1.5	83	weak
		0.6		
		0.3		
3	<i>nicosulfuron</i> + rimsulfuron dicamba ethoxylated isodecyl alcohol	0.09	65	very weak
		0.6		
		0.3		
4	mesotrione + nicosulfuron+ prosulfuron dicamba modified trisiloxane + polyester	2	85	weak
		0.017		
		0.6		
		0.2		
5	nicosulfuron dicamba plant oil fatty acid methyl ester (FAME) + etoxylated alcohols + alkyl polyglykoside citrate	0.25	67	very weak
		0.6		
		0.6		
6	foramsulfuron + thiencazone-methyl + ciprosumamid dicamba	2.0	50	very weak
		0.6		
7	topramezon dicamba methyl oleate+ methyl palmitate	0.15	56	very weak
		0.6		
		1.2		
8	tembotrion + thiencazone-methyl + izoxadifen-ethyl dicamba demethylated rape oil	0.44	62	very weak
		0.6		
		2.0		
9	sulcotrione dicamba	2	45	very weak
		0.6		

CONCLUSIONS

The Woolly cupgrass is a new invasive weed species in Hungary, which was detected at the first time in Gesztely (North-Hungary) in 2007, then it occurred the outskirts of Debrecen (East-Hungary) in 2011. The main objective of the herbicide trial was to find an effective herbicide against Woolly cupgrass in maize culture. On the base of foreign literature the use of sulphonylureas, including nicosulfuron proved to be weak but acceptable effectiveness (65-85%). The mesotrione + nicosulfuron + prosulfuron + dicamba + trisiloxane added with modified polyester herbicide mixture achieved the best results with a 85% efficiency. The most effective defense preemergence and postemergence according to a combination only defense, because of the delayed emergence. By avoidance of monocultural maize production practice and keeping a four-five-year crop rotation successfully can be avoid the Woolly cupgrass accumulation in soils. In dicotyledonous cultures the application of cycloxydim active substance can also be effective that inhibits the acetylcoenzyme A carboxylase (ACCase) in chloroplasts of sensitive weeds.

The ruderal areas play role in the maintenance of Woolly cupgrass producing many seeds to survive and spread.

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