STUDIES REGARDING THE INFESTATION LEVEL OF MAIZE AGROECOSYSTEMS WITH INVASIVE SPECIES *SORGHUM HALEPENSE* L. IN TIMIS COUNTY

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Abstract: *In Romania, maize crop is the main cereal occupying 4 millions hectares from 10 millions arable lands. From those about 500000 to 700000 ha are infested with Sorghum halepense L., a weed which produce high damages in maize agro ecosystems (85-90%). The herbology papers pointed long time ago the presence of this weed in our country [ANGHEL, IONESCU-ŞIŞEŞTI, ŞARPE etc.] especially in the southern parts of Romania. The infested area extended permanently in the same time with the increasing number of weeds per square meter. This invasive weed is, without doubt, the most damaging species in the south-west part of the country. in order to achieve a better approach of weed infestation level of maize agroecosystems with Sorghum halepense from Timis county, we used the quantitative and numerical determination method. The observations were made in experimental years 2006-2009, in 16 locations. This method relies on counting the number of plants present in 1 square meter, methodology used in mapping works in Romania [CHIRILĂ, 1998]. The assessments allow us to put together in a master table the obtained results and the location along with the maximal constant level. Further than that, the mapping allows us to realize maps wit the locations in where the Sorgum halepense was present and its density in maize crop. For showing down the mean of the infestation level we used the colours code presented in the work "the weeds from agricultural crop mapping" [CHIRILĂ, 1998]. We concluded after four observation years that the Sorgum halepense species develop themselves very good on chernozem and aluvisoils causing a significant yield loses even total loses.*

Key words**:** *Johnson grass, mapping, corn*

INTRODUCTION

Invasive species, have a large economic impact, being placed, in agriculture domain, in a spot among biotic harmful factors. *Sorghum halepense L.*, specie, fall into this category is recognized as a main threat to biodiversity. Johnson grass is a very competitive and invasive weed, is the most damaging weed in Romania weeding crops, causing losses of 20-80% of production and a strong infection may compromise the overall corn crop. Those information were enough for initiation of a study concerning the spread of *Sorghum halepense* L. specie, in Timis county.

SARPE, [1987] states that this species occurred in Rumania before 1693, but only in recent decades has spread with alarming rapidity on all soil types and has become a disaster especially on soils of steppe and sylvo-steppe [IONESCU SISESTI, 1958].

After Flora of Romania [1972], to date, the Johnson grass was widespread on the following areas: Bihor County: Salonta to Ciumeghiu, Hunedoara County, between Deva and Dobra, Arad County: Arad, Timis County: Timisoara and Liebling; Mehedinti County: Orsova on Mount Alion, Vârciorova, Teleorman county: Garagau, Prahova County: Ploiesti, Crivina, Ilfov County: Bucuresti (Herastrau, Marcuta, Cernica, Baneasa, Chitila), Peris, Ciocăneşti, Buftea, Snagov Monastery and Pasarea, the Moara Vlăsia, Padurea Brânzeasca, Comana; Ialomita County: Slobozia, Cocos; Tulcea County between Dealul Consul and Babadag on Valea Taita, Balabancea; Iasi County at Vanatori.

Johnson grass can often be seen in the south, but also in the west of the country and rarely in north-east, center and the north of the country.[ANGHEL et al., 1972; CIOCÂRLAN 1978; POPA 1985; IONESCU et al., 1988; DIACONU 1990; BUDOI GH. et al., 1994; NEGRESCU et al., 1996; VILĂU et al., 1996]. Rarely appears as islands, on the rendzinic soil from north of Ploiesti [CHIRILĂ 1979; PINTILIE et al., 1984]. This specie is more abundant on chernozem soils with phreatic input or irrigated, on rendzinic soils and corn monoculture [ANGHEL et al., 1984].

Sorghum halepense is also present in the western part of Timis and Arad county, being in expansion also on the hilly area especially on alluvial plain [GRIGORE et al., 1975; COSTE et al., 1996; COSTE 1998].

In the mappings performed in Teleorman county was found that in north on the soil preluvosol were found on average five plants per m^2, while in central and south, on the chernozem soils, the values exceeded 10 plants per m^2. In an analysis made in Teleorman County on a route of 100 km from north to south, located between isotherms 10.5◦C 11.5◦C were recorded following such obvious differences: in the Tătărăştii de Jos were found 0,1 plant per m^2 , on Calinesti 6-7 plants per m^2 , in Alexandria 12 plants per m^2, in Izvoarele 14.2 plants per m^2 and in Zimnicea 12.6 plants per m^2 [ANGHEL et al., 1975], analyzed data demonstrate the thermophilic trait of analyzed specie.

From research conducted by CHIRILA C. et al., [1978] in Prahova county results that the plant can be seen in all the land from south of the county and in several municipalities in the north-west, thus occupying a territory much larger than noted in Flora RSR VOL XII. Highest values are found at south and north-west of Ploiesti, on chernozem soils, gley soil and litomorph soils of rendzinic type, formed on deep deposits of limestone gravel.

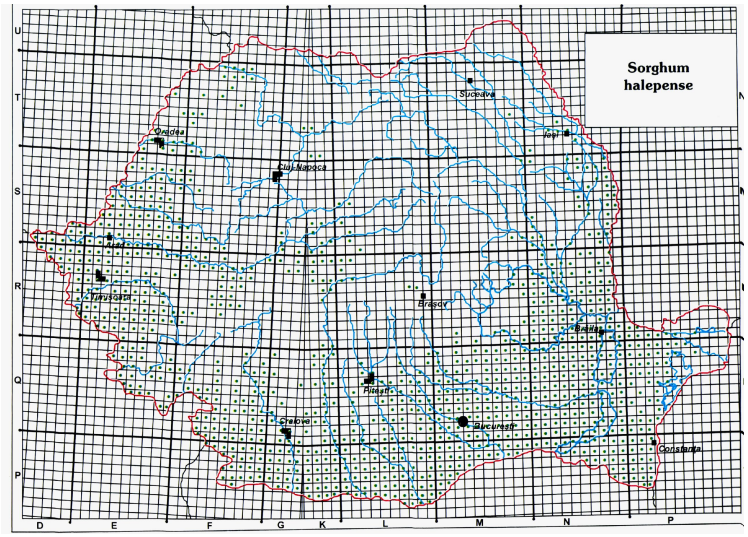

Figure 1 : Johnson grass spread in Romania

In the counties of Constanta and Ialomita *Sorghum halepense* species frequency increases from north to south and the plains [ANGHEL et al., 1975].

In the Insula Mare a Brailei, in 1974, *Sorghum halepense* was absent in the hill area and very poorly represented in other areas but in 1984 reached a density 13 times higher in monoculture and maintain at a high degree in rotations [POPA et al., 1988].

MIRIȚESCU, [1998] examined the degree of weeding in all 41 counties, in five met densities that overcome 100 copies per m^2 (Braila, Calarasi, Ialomita, Mehedinti and Olt), in seven counties met densities between 80 and 100 copies per m^2 (Bihor, Constanta, Dolj, Galati, Giurgiu, Gorj and Ilfov) and the other counties (Alba, Arad, Arges, Bacau, Bihor, Bistrita, Brasov, Braila, Buzau, Caras – Severin, Dambovita, Hunedoara, Iasi, Prahova, Satu Mare, Sibiu, Teleorman, Timis, Tulcea, Vaslui, Valcea, Vrancea)where the specie is present were met densities of 80 plants per m^2.

In the counties: Botosani, Cluj, Covasna, Harghita, Mures, Neamt, Salaj, Suceava Sorghum halepense specie was not not found [MIRIȚESCU, 1998].

Analyzing existing data in the literature concerning the spread of Johnson grass , with those of MIRIȚESCU [1998], was found that the specie has continued, at a rapid rate, the advance to higher regions and inside the country. Thus the species is found in counties like Brasov and Sibiu, counties where before 1980 the species was not reported. Johnson grass spread in Romania is shown in figure 1. [CHIRILA, CIOCARLAN and BERCA, 2002].

MATERIAL AND METHODS

In order to knowledge of the cane spread current situation in crops in Timis County we performed determinations after quantitative, numerical method. This method consisted of counting *Sorghum halepense* specie, from the sample area (0.25 m^2), methodology used in the mapping weeds process in Romania [CHIRILA, 1989]. It is an expedient and sufficiently accurate method. Mapping work involved two phases: a field phase and a data processing phase.

Mapping the *Sorghum halepense* L. specie has been made in agroecosystems between 13 to 30 May, cane plants being phenophase BBCH 12 BBCH 15 (under uniform decimal code for wheat). In the four experimental years the number localities where observations were made was variable (10-19 locations). Observations concerning the spread of *Sorghum halepense* specie were made on different subtypes of chernozem.

Determinations allowed the preparation of a summary table including the localities of Timis where the invasive specie *Sorghum halepense* L. was observed and maximum level found.

A map was also drawn, including locations in the county where *Sorghum halepense* L. was found and also existing densities in corn crop.

To highlight the average number of weeds color code presented in paper work "Mapping weed in field crops" was used [CHIRILA, 1989].

- colorless - under 20 pl/m2;
- Yellow - between 21 -40 pl/m2;
- Blue - between 41-60 pl/m2;
- Green - between 61-80 pl/m2;
- Dark Blue - between 81-100 pl/m2;
- Red - 100 pl/m2.

RESULTS AND DISCUSSIONS

In 2006 the experimental year observations were made in ten localities from Timis County, concerning the infestation of cane, in corn agroecosystems. These observations were aimed to obtain a synthetic image of weeding in maize crops from Timis County. Quantitative numerical mappings were made in May (29/05/2006) cane plants were in stage BBCH 12. The recorded data are presented in table 1.

Following the study was noted that the largest number of cane plants per m^2 was in locality Foeni (34 plants/m^2), precipitations recorded in this locality have reached flood level.

The average degree of weeding in corn crop from the 10 localities in the study was 7.2 plants/m^2.

Table 1.

Spreading of Johnson grass in Timiş county, in experimental year 2006

Localities	Species	Growth stage	Measurements			s	m	Cl. period	Group
			1	2	3				
ŞANDRA	*Sorghum halepense*	A	3	3	3	9	3	M.p	XXVII
SĂCĂLAZ	*Sorghum halepense*	A	6	6	6	18	6	M.p	XXVII
CÂRPINIŞ	*Sorghum halepense*	A	4	4	4	12	4	M.p	XXVII
FOENI	*Sorghum halepense*	A	34	34	34	102	34	M.p	XXVII
BILED	*Sorghum halepense*	A	12	12	12	36	12	M.p	XXVII
ŞANDRA	*Sorghum halepense*	A	3	3	3	9	3	M.p	XXVII
CARANI	*Sorghum halepense*	A	3	3	3	9	3	M.p	XXVII
BĂRĂTEAZ	*Sorghum halepense*	A	3	3	3	9	3	M.p	XXVII
GĂTAIA	*Sorghum halepense*	A	2	2	2	6	2	M.p	XXVII
TIMIŞOARA	*Sorghum halepense*	A	2	2	2	6	2	M.p	XXVII
AVERAGE								7,20	

Observations concerning the degree of *Sorghum halepense* L. infestation in corn agroecosystems continued in 2007, performing the quantitative numerical mappings in 12 cities in Timis County (table 2).

Table 2.

Spreading of Johnson grass in Timiş county, in experimental year 2007

Localities	Species	Growth stage	Measurements			s	m	Cl. period	Group
			1	2	3				
LUGOJ	*Sorghum halepense*	A	1	6	2	9	3	M.p	XXVII
GRABAŢI	*Sorghum halepense*	A	24	20	16	60	30	M.p	XXVII
CÂRPINIŞ	*Sorghum halepense*	A	15	66	45	126	42	M.p	XXVII
DUDEŞTII VECHI	*Sorghum halepense*	A	4	2	1	7	2,33	M.p	XXVII
BILED	*Sorghum halepense*	A	5	0	1	6	2	M.p	XXVII
ŞANDRA	*Sorghum halepense*	A	42	17	47	106	35,33	M.p	XXVII
LOVRIN	*Sorghum halepense*	A	7	0	44	51	17	M.p	XXVII
BECICHERECU MIC	*Sorghum halepense*	A	2	9	0	11	3,66	M.p	XXVII
GOTLOB	*Sorghum halepense*	A	1	7	0	8	2,66	M.p	XXVII
JIMBOLIA	*Sorghum halepense*	A	7	6	1	14	4,66	M.p	XXVII
SÂNNICOLAU MARE	*Sorghum halepense*	A	12	1	0	13	4,33	M.p	XXVII
TIMIŞOARA	*Sorghum halepense*	A	16	26	0	42	14	M.p	XXVII
AVERAGE								13,41	

Largest number of cane plants per m^2 was recorded in localities Carpinis (42 plants/m^2), Sandra (35.33 plants/m^2), Grabati (30 plants/m^2). Average number of cane plants per m^2 obtained in 2007 experimental year was 13.41 plants/m^2.

The results obtained concerning the degree of cane infestation in corn crop in 2008, are presented in table 3.

Largest number of cane plants per m^2 was recorded in localities Sandra (181.2 plants/m^2) Dudeştii Vechii (151.6 plants/m^2) Becicherecu Mic (151.6 plants/m^2). Lowest number of cane plants per m^2 was obtained in the area of Jimbolia (24 plants/m^2).

Following mappings performed in 2008 experimental year, an average of 71.96 cane plants /m2, resulted.

In Table 4. are given numerical results achieved in terms of degree of weeding in maize crops from 19 villages in Timis County, studied in 2009 experimental year.

In corn agroecosystems from Jimbolia area an average number of 121 plants/m^2 was recorded. From the data results that *Sorghum halepense* specie was reported as present only in maize crops from Carani and Calacea localities.

Figure 2 represents the average degree of cane weeding in maize agroecosystems of Timis county, in the four years of observations (27.23 plants/m^2).

Table 3.

Spreading of Johnson grass (weeds/m^2) in Timiş county, in year 2008

Localities	Species	Growth stage	Measurements					s	m	K %	Cl. period	Group
			1	2	3	4	5					
VOITEG	*Sorghum halepense*	A	140	8	44	64	67	323	64,6	100	M.p	XXVII
GĂTAIA	*Sorghum halepense*	A	36	76	80	32	96	320	64,0	100	M.p	XXVII
BIRDA	*Sorghum halepense*	A	60	68	28	60	44	260	52,0	100	M.p	XXVII
JEBEL	*Sorghum halepense*	A	52	28	44	39	43	206	41,2	100	M.p	XXVII
LUGOJ	*Sorghum halepense*	A	16	16	76	20	52	180	36	100	M.p	XXVII
GRABAŢI	*Sorghum halepense*	A	28	84	36	40	58	246	49,2	100	M.p	XXVII
CĂRPINIŞ	*Sorghum halepense*	A	28	68	28	32	50	206	41,2	100	M.p	XXVII
DUDEŞTII VECHI	*Sorghum halepense*	A	88	236	132	98	204	758	151,6	100	M.p	XXVII
BILED	*Sorghum halepense*	A	156	4	80	16	64	320	64	100	M.p	XXVII
ŞANDRA	*Sorghum halepense*	A	108	328	340	96	34	906	181,2	100	M.p	XXVII
LOVRIN	*Sorghum halepense*	A	136	36	20	34	94	320	64,0	100	M.p	XXVII
BECICHERECU MIC	*Sorghum halepense*	A	380	64	28	93	221	758	151,6	100	M.p	XXVII
GOTLOB	*Sorghum halepense*	A	128	28	36	60	65	317	63,4	100	M.p	XXVII
JIMBOLIA	*Sorghum halepense*	A	58	16	20	8	18	120	24	100	M.p	XXVII
BUZIAŞ	*Sorghum halepense*	A	60	13	24	41	57	195	39	100	M.p	XXVII
CHEVEREŞ	*Sorghum halepense*	A	89	72	30	37	22	250	50	100	M.p	XXVII
TIMIŞOARA	*Sorghum halepense*	A	47	120	104	41	121	433	86,6	100	M.p	XXVII
AVERAGE									71,96			

Table 4.

Spreading of Johnson grass in Timiş county, in experimental year 2009

Localities	Species	Growth stage	Measurements			s	m	Cl. period	Group
			1	2	3				
LOVRIN	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
SÂNNICOLAU MARE	*Sorghum halepense*	A	21	21	21	63	21	M.p	XXVII
ŞANDRA	*Sorghum halepense*	A	41	41	41	123	41	M.p	XXVII
GIARMATA	*Sorghum halepense*	A	2	2	2	6	2	M.p	XXVII
REMETEA MARE	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
DUDEŞTII VECHI	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
JAMU MARE	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
BECICHERECU MIC	*Sorghum halepense*	A	14	14	14	42	14	M.p	XXVII
PERIAM	*Sorghum halepense*	A	23	23	23	69	23	M.p	XXVII
VARIAŞ	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
CARANI	*Sorghum halepense*	A	x	x	x	x	x	M.p	XXVII
CALACEA	*Sorghum halepense*	A	x	x	x	x	x	M.p	XXVII
JIMBOLIA	*Sorghum halepense*	A	121	121	121	363	121	M.p	XXVII
CENAD	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
GIULVĂZ	*Sorghum halepense*	A	4	4	4	12	4	M.p	XXVII
JEBEL	*Sorghum halepense*	A	4	4	4	12	4	M.p	XXVII
GRABAŢI	*Sorghum halepense*	A	21	21	21	63	21	M.p	XXVII
TOPOLOVĂŢ	*Sorghum halepense*	A	1	1	1	3	1	M.p	XXVII
TIMIŞOARA	*Sorghum halepense*	A	20	20	20	60	20	M.p	XXVII
AVERAGE								16,35	

Figures 3, 4, 5, 6 represents analytic maps (presents spread in a given territory of a single species or a single group of weeds) of *Sorghum halepense* specie in Timis County.

In the four years of observations in maize agroecosystems, from Timis county, was concluded that cane grows very well on chernozem and alluvial soils causing an significant reduction and even compromising the crop. Species is in an obvious expansion both in the area and in the weeding of the sole. The phenomenon is favored by increasing areas of land left fallow, the reduction of weed hoeing as a result of applying herbicide with substances based on Atrazin (not affecting the cane rhizomes) and monoculture of hoes. Another reason contributing to the spread of cane on less infested land is that exudates from the leaves,

rhizomes and roots of this species have a strong inhibitory effect on seed germination of many other plants, thereby *Sorghum halepense* specie becoming a dominant [LITTLE, 1972].

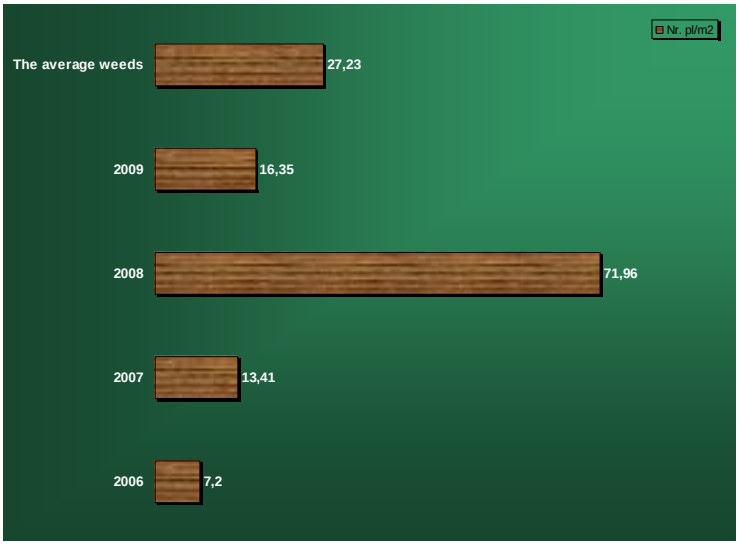

Figure 2. – The average of weed infestation in maize, Timiş county

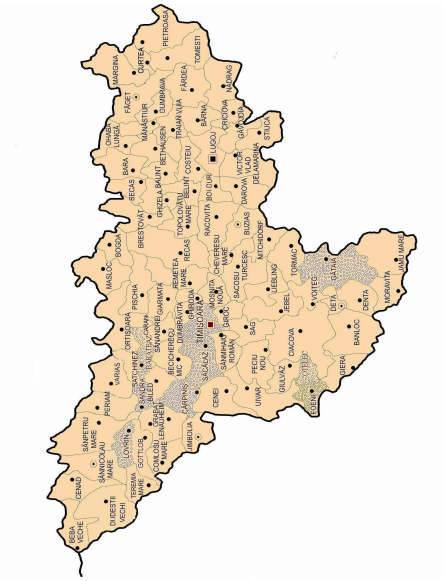

Figure 3. - Synthetic map of *Sorghum halepense* specie, in 2006 experimental year

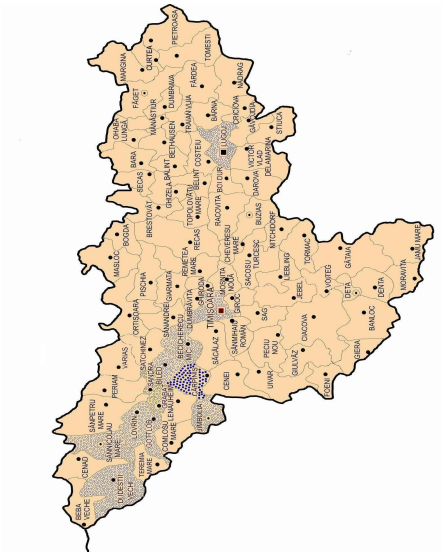

Figure 4. - Synthetic map of *Sorghum halepense* specie, in 2007 experimental year

Legenda < 20 pl/m^2 | 21 – 40 pl./m^2 | 41 – 60 pl/m^2 | 61 – 80pl./m^2 | 81 – 100 pl. /m^2 | > 100 pl./m^2

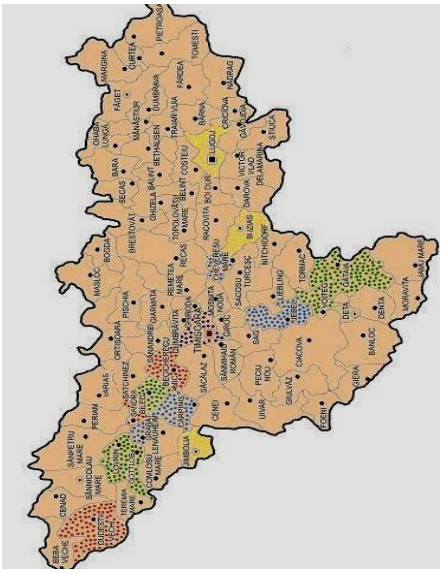

Figure 5. - Synthetic map of *Sorghum halepense* specie, in 2008 experimental year

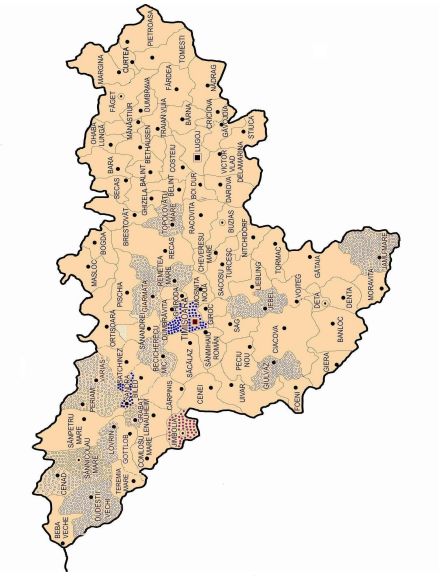

Figure 6. - Synthetic map of *Sorghum halepense* specie, in 2009 experimental year

CONCLUSIONS

Area of agricultural territory where the cane weed is found has continuously increased, parallel with the finding a growing number of exemplars on m^2 (27.23 plante/m^2). High degree of weeding recorded in corn agroecosystems, in Timis County, is explained through that cane plants had a favorable development environment with regard to soil reaction and soil type (observations were made on different subtypes of chernozem). It requires serious action to locate the infestation and control it in all units.

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