

INTERACTION BETWEEN INVASIVE WEED SPECIES

J. HORVÁT¹ – G. KAZINCZI² – A. TAKÁCS² - M. TORMA³ - A. KOVÁCS¹

¹University of Veszprém, Georgikon Faculty of Agricultural Sciences, Plant Protection Institute, Keszthely, Hungary

²Office for Academy Research Groups Attached to Universities and Other Institutions, Virological Group, University of Veszprém, Georgikon Faculty of Agricultural Sciences, Plant Protection Institute, Keszthely, Hungary

³Szeged University, College of Agriculture, Hódmezővásárhely, Hungary

Introduction

Invasive plant species mean a real threat for the biological diversity of Hungarian natural flora. A part of them, invasive weeds can cause considerable economical injuries in the plant production. These species have strong competitive ability in weed-crop ecosystems due to their advantageous biological characteristics (Mihály - Botta-Dukát 2004). *Asclepias syriaca* and *Solidago gigantea* are one of the most serious plants among them. The former can cause considerable injuries in the forestry, arable and horticultural crops, mainly in vineyards and fruit stands. The latter occurs in wet lands and cause mainly nature conservation problems (Szabó et al. 1994, Dancza et al. 1998, Varga 2003). *Abutilon theophrasti* originates from China and it is one of the most serious weeds of maize in Hungary. The impact and use of natural substances for integrated plant protection is one of the focus of research works all over the world. A large number of weeds is known to have allelopathic potential and their role in biological weed control is also discussed (Kazinczi 1999). Allelochemicals –together with other factors – can also influence nutritional status and yield of recipient species (Kazinczi et al. 2001, Baser et al. 2004, Bencze et al. 2004, Kovacevic et al. 2004, Pakurar et al. 2004, Kádár 2005). The aim of our investigation was to study the interactions between some invasive species.

Methods

Fresh shoots and roots of *A. syriaca* and *S. gigantea* were collected at the beginning of flowering near Keszthely in 2005 year. Plant parts were cut into small pieces in a grinder. After grinding, 25 g fresh biomass was stirred into 100 ml distilled water and left for a day. Then the mixtures were filtered. Pot experiments (each in six replicates) were set up under glasshouse condition, in which the recipient test plants (*A. theophrasti* and *A. syriaca*) were sprayed or watered (50 ml water extract pot⁻¹) daily with the plant water extracts. 60 days after the first application the fresh and dry weight of the plant shoots were measured, and nitrogen (N), phosphorus (P) and potassium (K) content was also determined. Analysis of variance (ANOVA) was used to evaluate statistically the results.

Results and discussion

All treatments – except *A. syriaca* sprayed shoot extract – significantly reduced fresh and dry weight of *A. theophrasti* shoots. Generally, inhibitory effect was stronger, when extracts were used for watering as compared to those ones used for spraying. *S. gigantea* root extract had the strongest inhibitory effect, causing over 90 % reduction in biomass production of *A. theophrasti* (Tab.1).

Tab 1. The fresh and dry weight of *A. theophrasti* due to the different treatments

Fresh weight (g plant ⁻¹)					
Treatments*	1	2	3	4	5
	8.56±1.13	1.55±0.46	1.31±0.19	2.81±0.88	0.6±0.16
Treatments	6	7	8	9	LSD _{5%}
	12.4±1.79	3.05±1.19	4.85±1.30	2.16±1.22	1.23
Dry weight (g plant ⁻¹)					
Treatments	1	2	3	4	5
	1.56±0.24	0.32±0.07	0.22±0.05	0.5±0.07	0.13±0.05
Treatments	6	7	8	9	LSD _{5%}
	2.10±0.22	0.5±0.07	0.55±0.08	0.36±0.10	0.16

*1, control; 2, sprayed with *S. gigantea* shoot extract; 3, sprayed with *S. gigantea* root extract; 4, watered with *S. gigantea* shoot extract; 5, watered with *S. gigantea* root extract; 6, sprayed with *A. syriaca* shoot extract; 7, sprayed with *A. syriaca* root extract; 8, watered with *A. syriaca* shoot extract; 9, watered with *A. syriaca* root extract

The effect of plant extracts on *A. syriaca* was not so strong. Sprayed *S. gigantea* shoot extract significantly enhanced both the fresh and dry weight of *A. syriaca* (Tab.2).

Tab. 2. The fresh and dry weight of *A. syriaca* due to the different treatments

Fresh weight (g plant ⁻¹)						
Treatments*	1	2	3	4	5	LSD _{5%}
	1.03±0.39	2.16±0.78	1.75±0.26	0.86±0.32	1.2±0.45	0.74
Dry weight (g plant ⁻¹)						
Treatments	1	2	3	4	5	LSD _{5%}
	0.18±0.04	0.3±0.03	0.26±0.06	0.13±0.04	0.15±0.02	0.05

*1, control; 2, sprayed with *S. gigantea* shoot extract; 3, sprayed with *S. gigantea* root extract; 4, watered with *S. gigantea* shoot extract; 5, watered with *S. gigantea* root extract

N content of *A. theophrasti* shoots reduced, enhanced or did not change, depending on treatments. Changings in P content was not so considerable, while K content rather enhanced due to the treatments (Tab 3.).

Tab 3. NPK content of *A. theophrasti* shoots due to the different treatments

	N (%)				
Treatments*	1	2	3	4	5
	1.73±0.03	2.46±0.07	1.80±0.12	2.10±0.12	1.64±0.06
Treatments	6	7	8	9	LSD _{5%}
	1.34±0.03	2.07±0.09	2.84±0.05	1.57±0.04	0.10
	P (%)				
Treatments	1	2	3	4	5
	0.28±0.02	0.30±0.04	0.26±0.02	0.26±0.05	0.25±0.03
Treatments	6	7	8	9	LSD _{5%}
	0.19±0.03	0.30±0.04	0.32±0.02	0.27±0.02	0.04
	K (%)				
Treatments	1	2	3	4	5
	1.53±0.07	3.27±0.08	2.31±0.10	2.49±0.10	1.49±0.09
Treatments	6	7	8	9	LSD _{5%}
	1.45±0.06	2.41±0.03	3.15±0.04	1.55±0.10	0.09

*Key of the treatments see Tab.1.

All treatments significantly enhanced NPK content of *A. syriaca* shoots, especially when extracts was used for watering. It is concluded that roots were able to uptake more nutrients from the plant extracts, as compared to the shoots (Tab. 4).

Tab. 4. NPK content of *A. syriaca* shoots due to the different treatments

	N (%)					
Treatments*	1	2	3	4	5	LSD _{5%}
	2.36±0.09	3.77±0.08	3.26±0.07	5.34±0.06	3.58±0.15	0.15
	P (%)					
Treatments	1	2	3	4	5	LSD _{5%}
	0.20±0.01	0.34±0.04	0.33±0.03	0.49±0.05	0.71±0.04	0.06
	K (%)					
Treatments	1	2	3	4	5	LSD _{5%}
	2.13±0.08	3.94±0.08	3.70±0.11	5.65±0.15	5.60±0.07	0.12

*Key of the treatments see Tab.2.

Conclusions

The role of *A. theophrasti*, *A. syriaca* and *S. gigantea* as donor plants in allelopathic research has been already studied earlier (Kazinczi et al. 1999, 2001, 2005, Botta-Dukát – Dancza 2004), but their role as recipient species is less known. More detailed examinations need, regarding the strong inhibitory effect of *S. gigantea* roots and their utilization as natural substances in biological plant protection.

Acknowledgements

Authors wish to express their thank the National Research Found (project No. T049093) for their financial help.

References

- Baser, I., Seirali, S., Orta, H. et al.: 2004. Effect of different water stresses on the yield and yield components of winter wheat. *Cereal Research Commun.* 32, 217-223.
- Bencze, S., Veisz, O., Bedő, Z.: 2004. Effects of high atmospheric CO₂ and heat stress on phytomass yield and grain quality of winter wheat. *Cereal Research Commun.* 32, 75-82.
- Botta-Dukát Z., Dancza I. 2004. Magas aranyvessző és kanadai aranyvessző. In: Mihály B., Botta-Dukát Z. (szerk.), *Özönnövények*. Természettudományi Alapítvány Kiadó, Budapest pp. 293-318.
- Dancza, I., Almádi, L., Botta-Dukát, Z., Szabó, I. 1998. Occurrence of adventive weeds in the eastern part of Zala county (South-West Hungary). *Z. PflKankh. PflSchutz Sonderh.* 16, 139-140.
- Kádár I. 2005. A műtrágyázás hatása a kölesre (*Panicum miliaceum* L.) csernozjom talajon. *Agrokémia és Talajtan* 54, 77-92.
- Kazinczi, G. 1999. Research on allelopathy in Hungary. In: Narwal, S.S.(ed.), *Allelopathy Update*. Vol. 1. International Status. Oxford & IBH Publishing CO. PVT. LTD. New Delhi, Calcutta 1999. pp. 49-64.
- Kazinczi, G., Béres, I., Narwal, S.S. 2001. Allelopathic plants. 3. Velvetleaf (*Abutilon theophrasti* Medic.). *Allelopathy Journal* 8, 179-188.
- Kazinczi, G., Horváth, J., Takács, A.P., Béres, I., Gáborjányi, R., Nádasy, M. 2005. The role of allelopathy in host-virus relations. *Cereal Research Commun.* 33, 105-108.
- Kazinczi, G., Mikulás, J., Horváth, J., Torma, M. and Hunyadi, K. 1999. Allelopathic effects of *Asclepias syriaca* roots on crops and weeds. *Allelopathy Journal* 6, 267-270.
- Kovacevic, V., Banaj, D., Brkic, I., Antunovic, M., Petosic, D. 2004. Fertilization impacts on the yield and nutritional status of maize (*Zea mays* L.). *Cereal Research Commun.* 32, 403-410.
- Mihály B., Botta-Dukát Z. 2004. *Özönnövények*. Természettudományi Alapítvány Kiadó, Budapest, 408 pp.
- Pakurar, M., Nagy, J., Jagendorf, S. et al.: 2004. Fertilization and irrigation effects on maize (*Zea mays* L.) grain production. *Cereal Research Commun.* 32, 151-158.
- Szabó I., Botta-Dukát Z., Dancza I 1994. On the biology and control of *Solidago gigantea* Ait. *Növényvédelem* 3, 467-470.
- Varga L. 2003. A selyemkóró (*Asclepias syriaca*) biológiája és a védekezés esélyei. *Gyomnövények, gyomirtás* 4, 1-33.