

Changes in Weed Species Spectrum of Perennial Weeds on Arable Land, Meadows and Pastures

JAN MIKULKA¹, MARTA KORČÁKOVÁ¹, VĚRA BUREŠOVÁ² and JIŘÍ ANDR³

¹Department of of Herbology, Division of Agroecology, Crop Research Institute, Prague-Ruzyně, Czech Republic; ²Faculty od Agriculture, University of South Bohemia in České Budějovice, České Budějovice, Czech Republic; ³Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences in Prague, Prague, Czech Republic

Abstract: Occurrence of selected perennial weeds has been monitored at control sites across the Czech Republic since 1989, and trends of their occurrence have been evaluated. The monitoring has been aimed mainly at *Cirsium arvense* (L.) SCOP, *Sonchus arvensis* L., *Artemisia vulgaris* L., *Stachys palustris* L., *Bolboschoenus planiculmis*, *Bolboschoenus laticarpus*, and *Elytrigia repens* (L.) NEV. on arable land and *Taraxacum officinale* L.A. on pastures and meadows. High increase in the frequency of occurrence of *C. arvense* and *E. repens* was found out in the mid-nineties while the infestation frequency with these two weeds decreased later on. The occurrence of infestation with the other perennial weeds *Cirsium arvense*, *Elytrigia repens*, *Sonchus arvensis*, *Bolboschoenus planiculmis*, *Bolboschoenus laticarpus*, *Stachys palustris*, *Artemisia vulgaris* and *Taraxacum officinale* L. A slightly but continually increased.

Keywords: expansion; perennial weeds

Since the early nineties a considerable increase in weed infestation of arable land with perennial weeds has been observed. This trend was caused by agricultural transformation (transformation of state farms to private farms), failure of the farmers to carry cultural practices and insufficient weed control during this process (MIKULKA & CHODOVÁ 2000). Weed density increase started slowing down in the mid-nineties, but an increase in the occurrence of some weed species has continued until now. Changes in weed communities are also caused by natural influences – for example floods (WINKLER 2000). The objective of our research was to evaluate trends of occurrence of selected weed species in the Czech Republic.

Soil tillage has a significant influence on weed occurrence on arable land (BAUMAN *et al.* 2002). It is mainly the quality and accuracy of soil tillage that determines weed occurrence. There are also

differences in the regulatory effects of conventional ploughing and minimum tillage. Both methods have their advantages and drawbacks (KNEIFELOVÁ & MIKULKA 2004a, b). The controlling effect of conventional ploughing on weed plants is considerably higher than that of minimum tillage technologies (TORRESEN & SKUTERUD 2002). Differences in the effect are visible mainly in perennial weeds (DAU & GEROWITT 2004). Deficiencies of accuracy in the quality of soil tillage contribute to an increase in weed infestation (UREMIS & NEZIHI-UYHUR 2002). Reduced soil tillage must be compensated by herbicide use (SARPE *et al.* 2002).

MATERIALS AND METHODS

Weed monitoring was carried out at selected control sites in various districts of the Czech Re-

Supported by the Ministry of Agriculture of the Czech Republic, Project No. MZE 0002700604.

public from 1989 to 2008. Weed counts were always made in the same location, at the same place in five replications. Weed plants (leaf rosettes or shoots) counts were made on control plots (10 m^2). The dates of counts were regular, in the month of April in winter crops (winter oilseed rape, winter grain crops) and in the month of June in spring established crops (sugar beet, potatoes, maize).

At selected check up sites on arable land scattered in the area of the Czech Republic (in total 27 control plots) there has been observed the occurrence of selected perennial weed species; *Cirsium arvense* (L.) SCOP, *Sonchus arvensis* L., *Artemisia vulgaris* L., *Stachys palustris* L., and *Elytrigia repens* (L.) NEV. Check up points have been identified and measured in chosen locations with the occurrence of the mentioned weeds.

In sub-mountainous and mountainous areas (Jizerské hory, Orlické hory and Šumava) there has been observed the occurrence of *Taraxacum officinale* L.A. at 27 control plots according to the same methodology.

Due to an arising expansion of weeds *Bolboschoenus planiculmis* and *Bolboschoenus laticarpus* on arable land there have been established control plots in the area of Hradec Kralové, Pardubice, Doudleby nad Orlicí and Rychnov nad Kněžnou. There have been established 16 plots. Assessments were done always in June. For the area of 10 m^2 there was counted the amount of aboveground shoots. The results of the assessment were expressed in percent decrease of the occurrence of particular weed species.

The data were summarised and trends of occurrence of the particular species (*Cirsium arvense* (L.) SCOP, *Sonchus arvensis* L., *Artemisia vulgaris* L., *Bolboschoenus planiculmis*, *Bolboschoenus laticarpus*, *Stachys palustris* L., and *Elytrigia repens* (L.) NEV on arable land, pastures and meadows (*Taraxacum officinale* L.A.) were evaluated.

RESULTS AND DISCUSSION

Increase of the weeds *Cirsium arvense*, *Elytrigia repens* and *Artemisia vulgaris* occurrence from 1989 to 1993 was very high (Figure 1). It was a period of agriculture transformation, state farms and cooperatives used to be closed down, privatization began. It had a significant impact on breaking agrotechnical standards and on lack of financial resources in agriculture mainly in the systems of plant protection. Faults in using of herbicides as well as other aspects resulted in weed infestation increase on arable land as well as on grassland. Since 1994 there has been observed certain stabilisation in occurrence of weeds *Cirsium arvense* and *Elytrigia repens* even though the occurrence of these weeds has been still high compared to 1989 (KNEIFELOVÁ & MIKULKA 2004a, b). The rapid increase of the occurrence of the weed *Artemisia vulgaris* continued up to 1995. Since that year the increase has significantly slowed down. The expansion of this species can be explained by changes in crop rotation, high share of cereals and oilseed rape and mainly by preferred usage of reduced tillage.

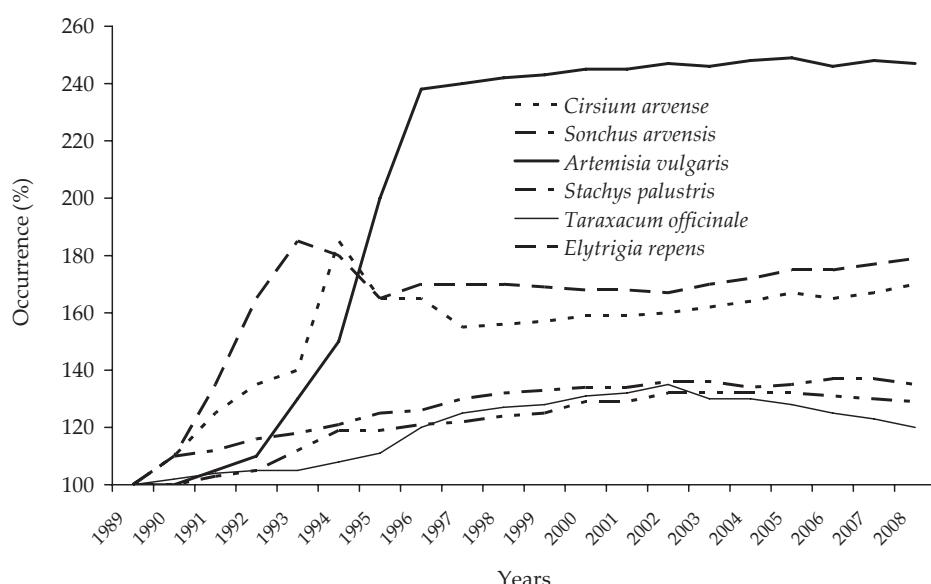


Figure 1. Trends of occurrence of perennial weeds on agriculture land

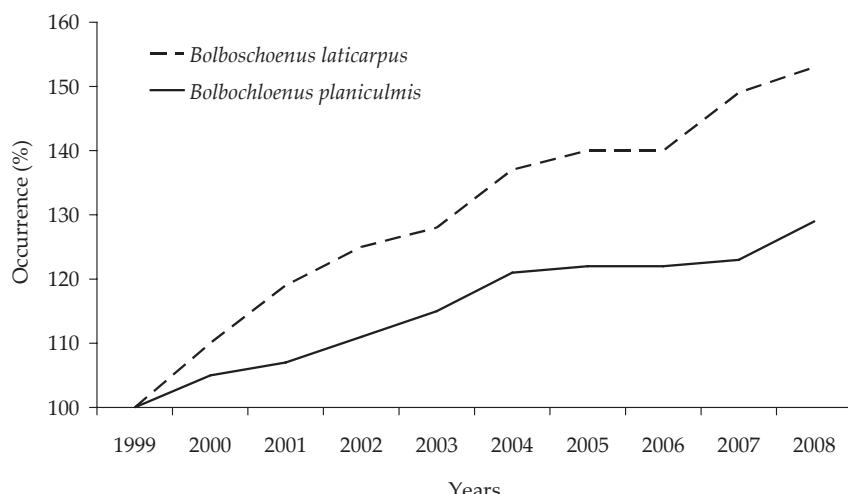


Figure 2. Trends of occurrence of *B. laticarpus* and *B. planiculmis* on arable land

These technologies facilitate vegetative reproduction of perennial weeds. *Artemisia vulgaris*, due to the fact that it does not produce either rhizomes or rootstocks, can be quickly reproduced by eroded clusters just when using minimum tillage.

Perennial weeds *Sonchus arvensis* and *Stachys palustris* responded to the change in agriculture by gradual increase of their occurrence (Figure 1). In the course of observation since 1989 there has been reported a 40% increase. These weed species occurred only locally in the past. Nowadays it can be claimed that they are scattered in our area from lowlands to sub-mountainous areas. Pastures and meadows have a significant share in agricultural land. The change of economic conditions hit also these areas. *Taraxacum officinale* L.A belongs to significant weeds. It provides high quality fodder however it significantly disqualifies grasslands. It spreads quickly in generative way to its surrounding. From 1989 to 2002 there was reported a stable occurrence increase, since 2003 there have been reported a slight decline at the control plots.

From the beginning there was reported a relatively quick increase of the occurrence of the *Bolboschoenus* sp. weeds in the areas of our country. Therefore there were established control plots focused on the observation of the occurrence of perennial weeds *Bolboschoenus planiculmis* and *Bolboschoenus laticarpus* (KNEIFELOVÁ & MIKULKA 2006). The observation began in 1999. The results are obvious from Figure 2. *Bolboschoenus laticarpus* weed plants are bigger, higher and they produce bigger tubers. They produce more above-ground and belowground biomass. It determines a proportionate pace of expansion. At *Bolboschoenus laticarpus* weed there has been reported nearly

doubled increase of the occurrence compared to *Bolboschoenus planiculmis* weed (KNEIFELOVÁ & MIKULKA 2004a, b).

The results reached at the assessment of the occurrence of the selected perennial weeds on the agricultural land are relevant to general state of weed infestation in the Czech Republic. The higher weed infestation is relevant to current spectrum of grown crops (grains, winter oilseed rape). Root crops share (sugar beet, potatoes) has significantly decreased. Both perennial forage crops and annual forage crops in connection with a dramatic drop of cattle breeding are nearly not grown. It leads to a lack of natural fertilisers. Plant nutrition focuses mainly on nitrogen fertilising. Other nutrients are rarely used for fertilising. It results in insufficiently developed crop stands. When referring to soil tillage minimum tillage technologies prevail. Due to a high price of efficient herbicides they are not used sufficiently. This group of aspects leads to the weed infestation increase when mainly perennial weeds have better predispositions for their expansion due to their capacity of generative and vegetative reproduction.

References

- BAUMAN D.T., BASTIANS L., KROPF M.J. (2002): Optimization of weed suppression, yield and quality in an intercropping system. In: 12th EWRS Symposium 2002, Wageningen, No. 12: 12–13.
- DAU A., GEROWITT B. (2004): Cultural control of *Cirsium arvense* in a cereal-based crop rotation. Journal of Plant Diseases and Protection (Special Issue), XIX: 475–482.

- KNEIFEROVÁ M., MIKULKA J. (2004a): Regenerative ability of *Cirsium arvense* after herbicide application. Journal of Plant Diseases and Protection (Special Issue), **XIX**: 717–723.
- KNEIFEROVÁ M., MIKULKA J. (2004b): Biology and occurrence of *Bolboschoenus* sp. on arable land in the Czech Republic. In: XIIth International Conference on Weed Biology, September 2004, Dijon: 289–295.
- KNEIFEROVÁ M., MIKULKA J. (2006): Study of biomass production and growth dynamic of *Bolboschenus laticarpus* nom. Prov. Journal of Plant Diseases and Protection, **XX**: 331–338.
- MIKULKA J., CHODOVÁ D. (2000): Changes in weed societies in the Czech Republic. In: XVth Czech and Slovak Plant Protection Conference, September 12–14, 2000, Brno, No. 15: 287–288.
- MIKULKA J., KNEIFEROVÁ M. (2004): Vegetative reproduction of *Cirsium arvense* (L.) Scop., *Sonchus arvensis* L., *Polygonum amphibium* L. and *Elytrigia repens* (L.) Desv. Acta Herbologica, **13**: 179–184.
- SARPE N. et al. (2002): The results of no-tillage winter wheat culture in Romania conditions. In: 12th EWRS Symposium 2002, Wageningen, No. 12: 40–41.
- SPRENGER B. et al. (2002): Population dynamics of weeds in different tillage systems. In: 21th German Conference on Weed Biology and Weed Control, March 5–7, 2002, Stuttgart-Hohenheim: 120–126.
- TORRESEN K., SKUTERUD R. (2002): Effect of tillage on emergence on top and sides of carrot ridges. In: 12th EWRS Symposium 2002, Wageningen, No. 12: 16–17.
- WINKLER J. (2000): The changes of species structure of weed communities influence by flood. In: XVth Czech and Slovak Plant Protection Conference, September 12–14, 2000, Brno, No. 15: 315–316.
- UREMIS I., NEZIHI-UYHUR F. (2002): Effects of crop rotation systems on the relationship between seed bank and weed flora. In: 12th EWRS Symposium 2002, Wageningen, No. 12: 44–45.

Corresponding author:

Ing. JAN MIKULKA, CSc., Výzkumný ústav rostlinné výroby, v.v.i., odbor agroekologie, oddělení ekologie polních plodin a herbologie, 161 06 Praha 6-Ruzyně, Česká republika
tel.: + 420 233 022 231, e-mail: mikulka@vurv.cz
