

HERBICIDE-RESISTANT WEEDS – PRESENT STATE OF RESEARCH

Plevelle rezistentní vůči herbicidům - současný stav výzkumu

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V České republice byly prokázány plevelle rezistentní vůči inhibitorům fotosystému II a enzymu acetolaktát syntáze. Byly stanoveny některé biologické a fyziologické rozdíly mezi citlivými a rezistentními biotypy, stanovena citlivost těchto plevelů vůči herbicidům.

Rezistence plevelů vůči herbicidům, fotosystém II, acetolaktát syntáza, triaziny, sulfonylmočoviny

Summary, keywords

Weeds resistant to photosystem II inhibitors and the enzyme acetolactate synthase were proved to occur in the Czech Republic. Some biological and physiological differences between susceptible and resistant biotypes were described, and susceptibility of these weeds to herbicides was determined.

Herbicide-resistance of weeds, photosystem II, acetolactate synthase, triazines, sulfonyleureas

Introduction

Herbicide-resistant weeds occur on all continents. The highest number of species (49) occurs in the USA while in European countries the highest number of these species exists in France and Spain (24), United Kingdom (16) and Germany (15). The highest number of weed species is included in the family Poaceae, Amaranthaceae, Polygonaceae and Chenopodiaceae. In the Czech Republic 13 weed species were proved to be resistant to herbicides. Many weed species were discovered in the railroad environs, on non-agricultural land, in orchards, and on arable land in corn and sugar beet crops. Weeds were proved to be resistant to herbicides – inhibitors of photosystem II and acetolactate synthase.

Methods

Seeds of herbicide-resistant weeds are collected in localities where we have already confirmed their occurrence or in localities where we suspect that these weeds can be encountered. To diagnose the weeds resistant to inhibitors of photosystem II (triazines) a slow fluorescence method and biological assays are used, and photochemical activity of chloroplasts is determined. Biological assays and determination of free amino acids by gas chromatography are used for diagnostics of acetolactate synthase inhibitors (sulfonyleureas), and currently the method of determining the activity of the enzyme acetolactate synthase has been elaborated. To test biological differences between biotypes standard laboratory methods are applied – germination and emergence tests, determination of dry matter and photosynthetic activity.

Results

Eleven biotypes resistant to triazine herbicides were proved to occur in the Czech Republic's territory. Area distribution on arable land was found in *Amaranthus retroflexus* and *Chenopodium album*. *Ch. album* shows cross-resistance to other inhibitors of photosystem II – chloridazone and lenacil. A study of biological differences between atrazine resistant and susceptible biotypes

revealed lower photochemical activity of chloroplasts and lower photosynthesis rate than in susceptible biotype in resistant biotype of *Amaranthus retroflexus*; resistant *Senecio vulgaris* showed higher values of basic relative and variable fluorescence. The latter weed species had worse growth parameters similarly like *Poa annua*.

Triazine-resistant weeds were susceptible to herbicides such as lenacil and chloridazon. Herbicides acting as photosystem II inhibitors should not be used for their control in practice.

Kochia scoparia, which is resistant to acetolactate synthase inhibitors, displayed cross-resistance to other sulfonyleureas (and imazapyr from the imidazolinone group).

Higher germination and dry matter content were determined in resistant biotype at a temperature of 10° C, and in susceptible biotype at a temperature of 30° C. Seed emergence in *Kochia scoparia* was highest from a depth of 1 and 10 mm both in the susceptible and resistant biotype. Resistant biotype has a higher content of free amino acids valine and leucine.

In our experiments *Kochia scoparia* (chlorsulfuron resistant) was resistant to these herbicides for example: imazapyr, nicosulfuron, tribenuron, triflurosulfuron. The occurrence of particularly this weed species must be monitored carefully because besides on the railroad its large-area occurrence has been confirmed in the CR territory.

References

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