Current status of herbicide resistance in *Alopecurus myosuroides* in Europe

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Black-grass (ALOMY) – a major grass weed

- Most noxious grass weed in N-W Europe (Moss et al., 2007, Weed Technology 21:300-309)
- Adapted to winter crops (esp. cereals) (life cycle & herbicide resistance)

Alopecurus myosuroides

ALOMY highest infestation

History of herbicide resistance in black-grass

- Data source: Heap 2014
Resistance mechanisms in ALOMY

- enhanced metabolic resistance (start of evolution and still ongoing – multiple resistance to many mode of actions, today max. 6)
- 7 SNP’s in ACCase lead to 5 amino acid substitutions
  - pos. 1781
  - pos. 2027
  - pos. 2041
  - pos. 2078
  - pos. 2096
- 3 SNP’s in ALS lead to 2 amino acid substitutions
  - pos. 197
  - pos. 574
- Combinations of different mutations/EMR quite common
# ALOMY infested area (ha) and occurrence of resistance in Europe

<table>
<thead>
<tr>
<th>country</th>
<th>(tsd. ha)</th>
<th>resistance (%)</th>
<th>area (tsd. ha)</th>
<th>ACCase</th>
<th>ALS</th>
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<td>8851</td>
<td>52.6</td>
<td>4656</td>
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</table>
Alopecurus resistance profile by country as % frequency of resistance classes RR+RRR

- pinoxaden
- clodinafop
- fluazifop
- cycloxydim
- tepraloxydim
- metazachlor
- flufenacet
- pendimethalin
- methalin
- prosulfocarb
- imazamox
- pyroxsulam
- mesosulfuron/iodosulfuron

- Germany (54)
- France (76)
- BE & NL (53)
- UK (55)

n= 238 populations
(2009-2012)
BASF Sievernich 2013
Distribution of Alopecurus resistance mechanism by country

- not resistant
- NTSR
- TSR(A)+NTSR
- TSR(B)+NTSR
- TSR(A+B)+NTSR
- TSR(A)
- TSR(B)
- TSR(A+B)

Germany 53%
France 43%
Great Britain 88%
BE & NL 87%

NTSR involved

n= 238 population (2009-2012)
BASF – Sievernich 2013
Development of Cycloxydim resistance in Germany 2008-2013

2008 (n = 111)
2009 (n = 68)
2010 (n = 53)
2011 (n = 35)
2012 (n = 117)
2013 (n = 91)
Development of ACCase resistance in ALOMY at the German Baltic coast line

Rosenhauer et al. 2013
biotype 1

Meso. + iodos. Pyroxsulam Pinoxaden
Cycloxydim
Pyroxsulam + Prosulfocarb + Pinoxaden
Summary / conclusions

- Area of ALOMY infestation in Europe is still increasing (> 9 mio. ha)
- In all countries where ALOMY is present, there are also herbicide resistant biotypes – resistance on ~ 4.5 mio. ha
- There is a gradient from west to east (more problems in western parts)
- In most cases evolution steps are:
  1. moderate NTSR (e.g. CTU, fenoxaprop, flupyrsulfuron)
  2. + ACCase TSR
  3. + ALS TSR
  4. or/and strong NTSR
- Not only problems in monocropping of cereals – more and more in wider rotations incl. dicot crops
- also problems controlling ALOMY in dicot crops and maize
- More use of herbicides (sequential applications, glyphosate treatments)
- Need to integrate more agronomic control options
- Need to site specific choice of herbicides that correspond to current herbicide resistant status on each individual field (how?)
Distribution of ACCase TSR in ALOMY between 2004 and 2012 (n = 654)

Rosenhauer et al. 2013
Distribution of meso-/ iodosulfuron resistance in ALOMY between 2007-2013