

Maps of the **published** cases of resistance to herbicides in France

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Foreword

1. The herbicide classification used in this version is the one developed by R4P for **all pesticides**

<https://www.r4p-inra.fr/fr/classification-des-ppp/>

2. The weed species mapped are exclusively those for which there is at least one published paper describing the resistance case, or for which resistance has been demonstrated in the national network of Biological Surveillance of the Territory (SBT).

➔ **the list is not exhaustive**, as some existing cases remain to be published.

3. On the maps, one French department is coloured according to the number of resistance cases reported.

➔ Obviously, this does not mean that all the fields in a coloured department are affected by resistance, even for departments where resistance is very frequent!

➔ Conversely, a department not being coloured only means that resistance has not been reported (either because it is really absent, or because it has not been searched or identified, or because the data have not been communicated).

Resistance case summary: the family picture

Legend to the pictures:

Weed

Herbicide mode(s) of action concerned by resistance (R4P classification) (year when resistance has been first reported)

Crops infested by the weed

Prevalence of the resistance in the crops concerned (first reports, moderate, common, very common)



Black-grass

D1 (1993),
F2 (2006)
Very common
D2 (2019)
F1 (2022)
First report
Major crops



Bromes

F2 (2009)
Major crops
Moderate



Rye-grasses

D1 (1993),
F2 (2001),
Very common
D2 (2014)
First reports
Major crops
F1 (2005)
Grapevine, major crops
Moderate



Wild oats

D1 (1996),
F2 (2006 approx.)
Major crops
Moderate



Silky bent-grass

D1 (1999 approx.),
F2 (2006 approx.)
Major crops
Moderate



Large crabgrass

D1 (2005)
Vegetables
F2 (2014)
Maize
First reports



Foxtails

F2 (2011) Maize
First reports



Barnyard-grass

D1 (2000 approx.)
Rice
Very common
F2 (2013)
Rice
Very common
Maize
First reports



Rice barnyard-grass

D1 (2000 approx.)
F2 (2013)
Rice
Very common

Grass weeds II



Rough meadow-
grass
F2 (2012)
Major crops
First reports



Annual
bluegrass
D1 (not
sensitive)
F2 (2015)
Major crops
First reports



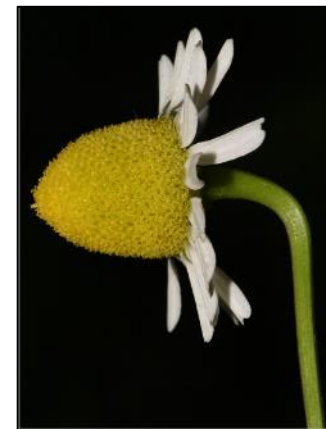
Teosinte
D1 (1995s)
Maize, soybean,
sunflower
Moderate



Common groundsel
F2 (2009)
Grapevine, major crops, vegetables...
Common



Weedy sunflower
F2 (2009)
ALS-tolerant sunflower, soybean
Moderate



Chamomiles
F2 (2010)
Major crops
Moderate



Sumatra fleabane
F1 (2010)
F2 (2016)
Grapevine
Moderate



Common ragweed
F2 (2014)
Soybean, ALS-tolerant sunflower, maize
Moderate



Spiny sow-thistle
F2 (2016)
Chicory
Very common



Gallant soldier
F2 (2017)
Chicory
First reports



Canadian horseweed
F1 (2019)
Grapevine
Moderate



Corn poppy
F2 (2007)
Major crops
Very common
L1 (2013)
Major crops
Moderate



Common lambsquarters
B1 (2005)
Sugar beet,
potatoe
Common



Chickweed
F2 (2012)
Major crops
First reports



Bitter dock
F2 (2018)
Major crops
First reports



Spear saltbush
B1 (2019)
Sugar beet,
potatoe
First reports

To sum it all:

Resistance:

- To graminicide herbicides – ACCase inhibitors (group D1)
 - To ALS inhibitors (group F2)
 - To « auxinic » herbicides (group L1)
- To photosystem II inhibitors (group B1)
- To glyphosate (EPSPS inhibitor, group F1)

Grass weeds & Asteraceae

(+ poppy, lambsquarter, speat saltbush, bitter dock & chickweed)

Updated regularly on:

www.r4p-inra.fr

Maps

Resistance to herbicides in France: **published** cases

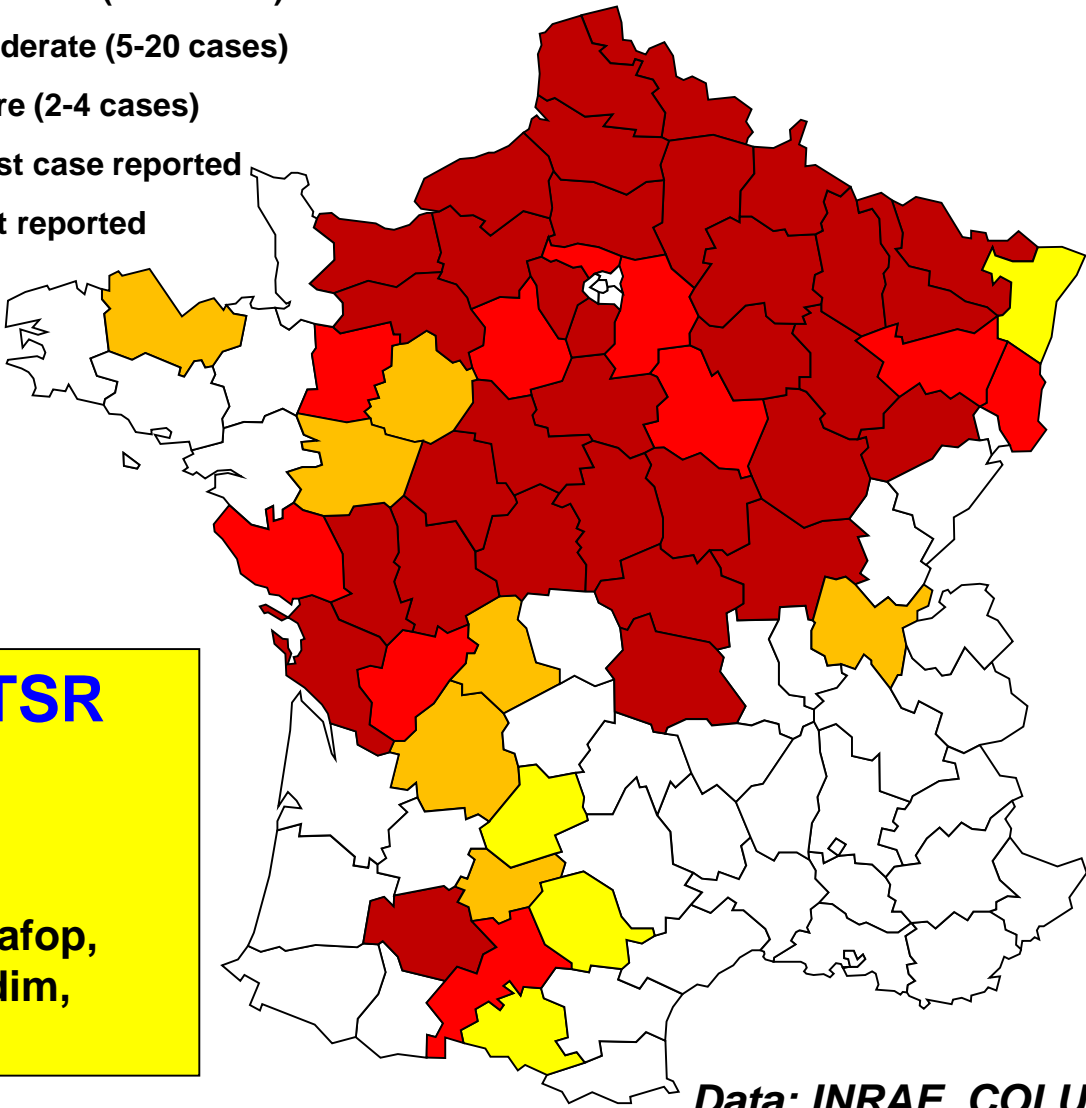
Grass weeds

Resistance of black-grass to ACCase inhibitors (group D1)



- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported

Alopecurus myosuroides



Resistance: **NTSR** + **TSR**

Cereals, rape, sugar beet...

Actives concerned: fenoxaprop, clodinafop, fluazifop, propaquizafop, quizalofop, pinoxaden, cycloxydim, clethodim...

Data: INRAE, COLUMA

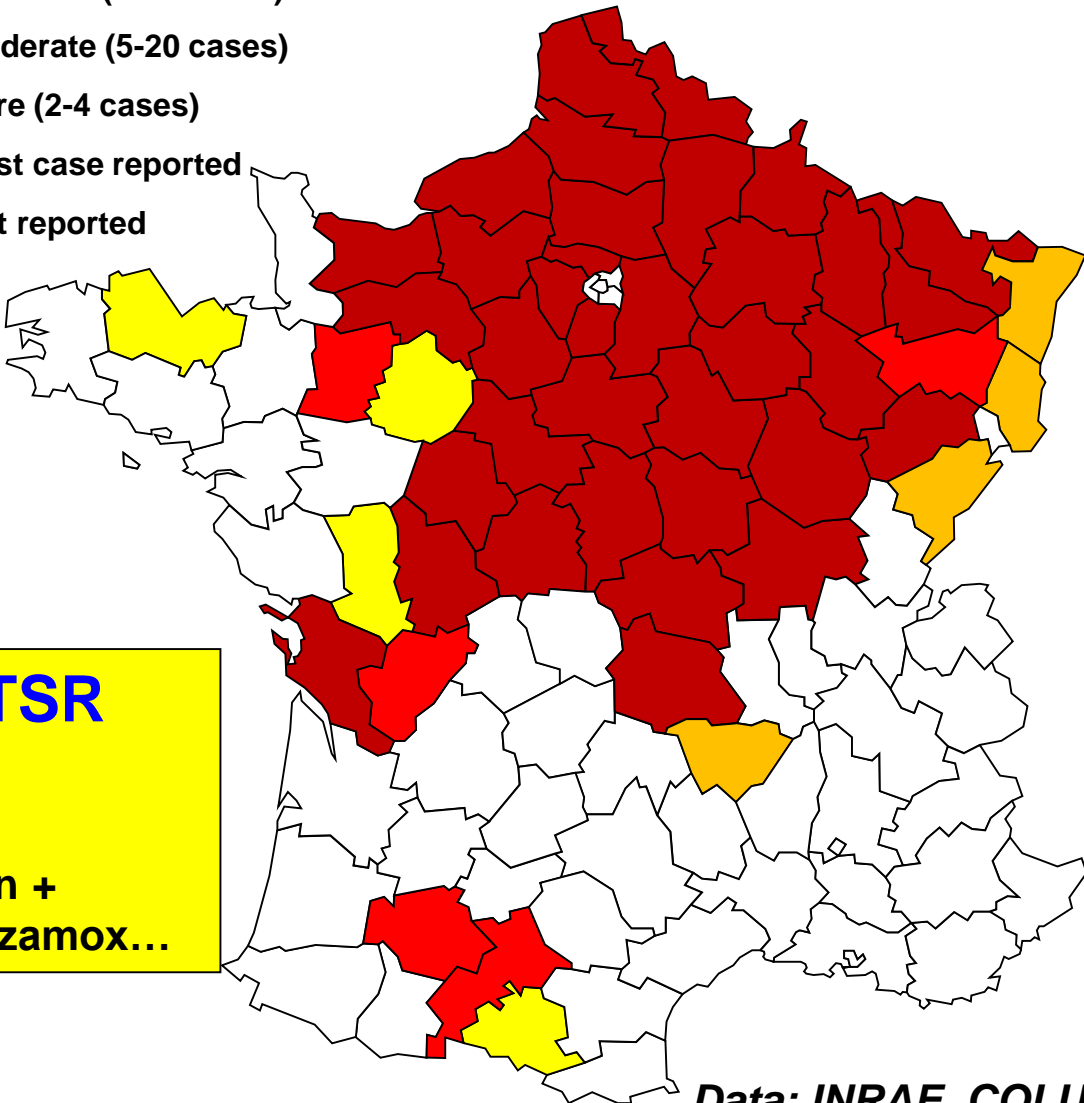
Multiple resistance / cross-**NTSR** with herbicides in groups D2 and/or F2 and/or F1

Resistance of black-grass to ALS inhibitors (group F2)



Alopecurus myosuroides

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **NTSR** + **TSR**

Cereals, rape...

Actives concerned: iodosulfuron + mesosulfuron, pyroxsulam, imazamox...

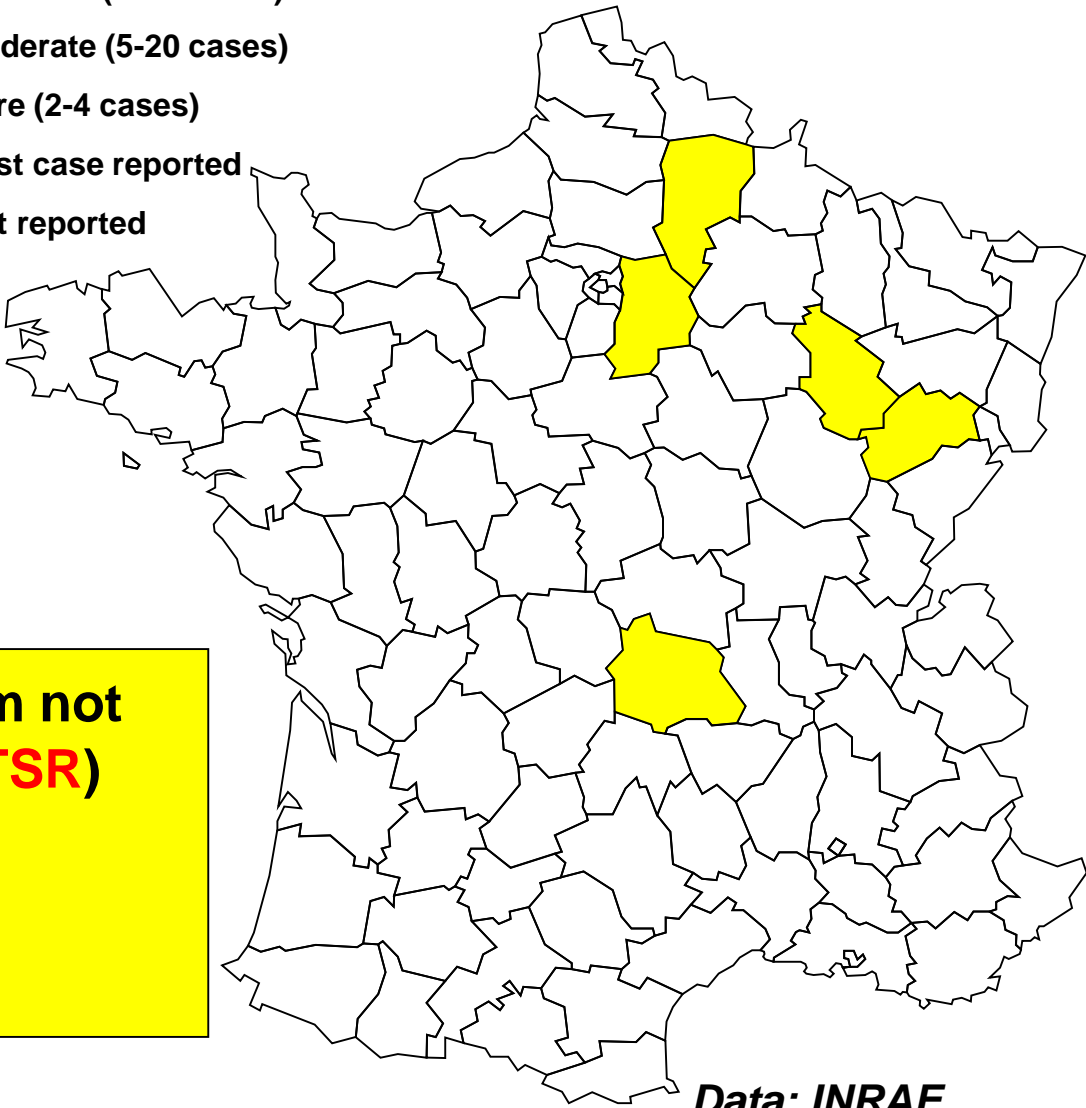
Data: INRAE, COLUMA

Multiple resistance / cross-**NTSR** with herbicides in groups D1 and/or D2 and/or F1

Resistance of black-grass to inhibitors of lipid elongation (group D2)



- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Alopecurus myosuroides

Resistance: mechanism not investigated (probably **NTSR**)

Cereals...

Actives concerned: flufenacet, prosulfocarb

Data: INRAE

Multiple resistance / cross-**NTSR** with herbicides in groups D1 and/or F2 and/or F1

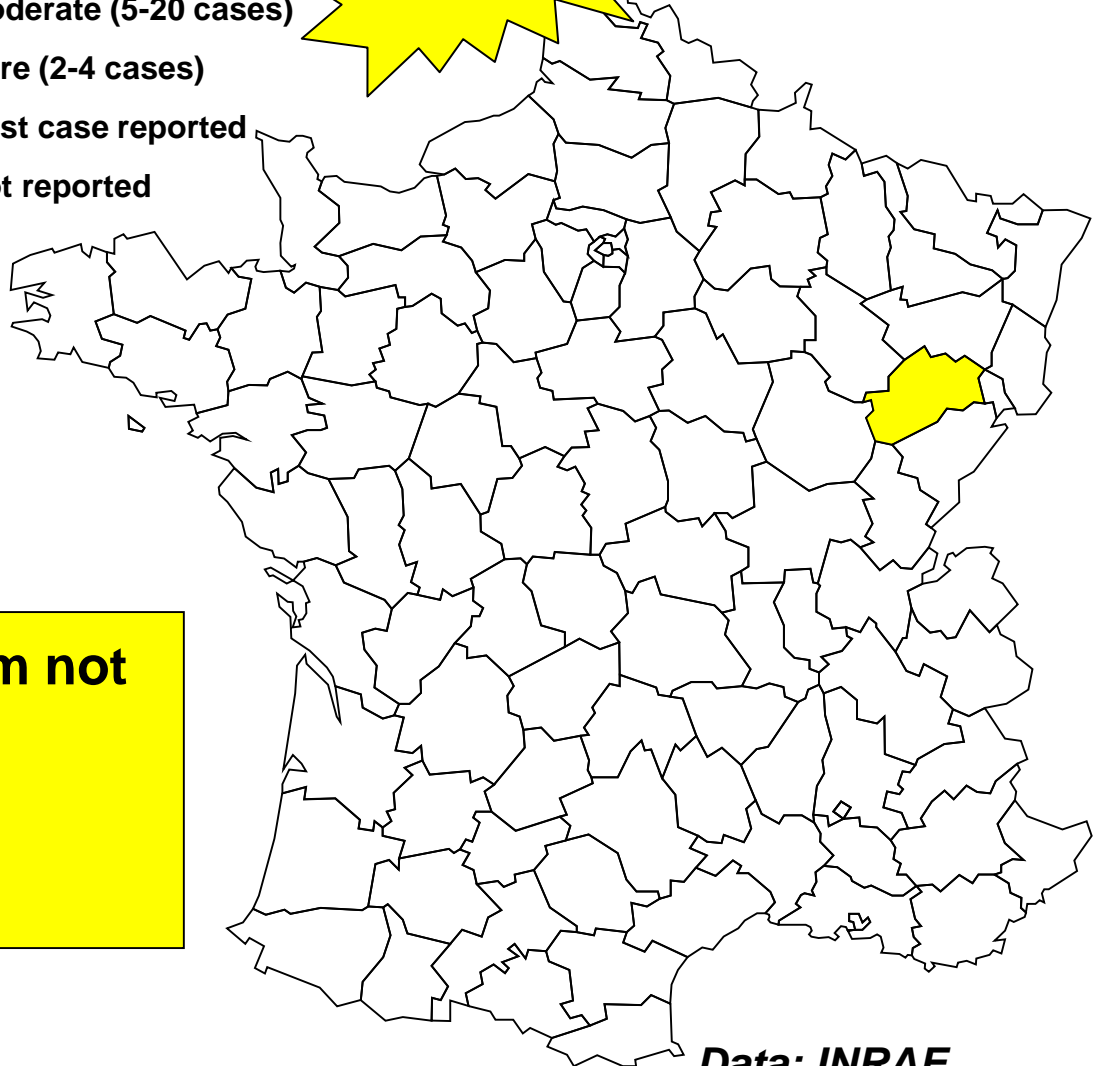
Resistance of black-grass to inhibitors EPSPS (group F1)



Alopecurus myosuroides

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported

World first!



Resistance: mechanism not investigated

Cereals

Active concerned: glyphosate

Data: INRAE

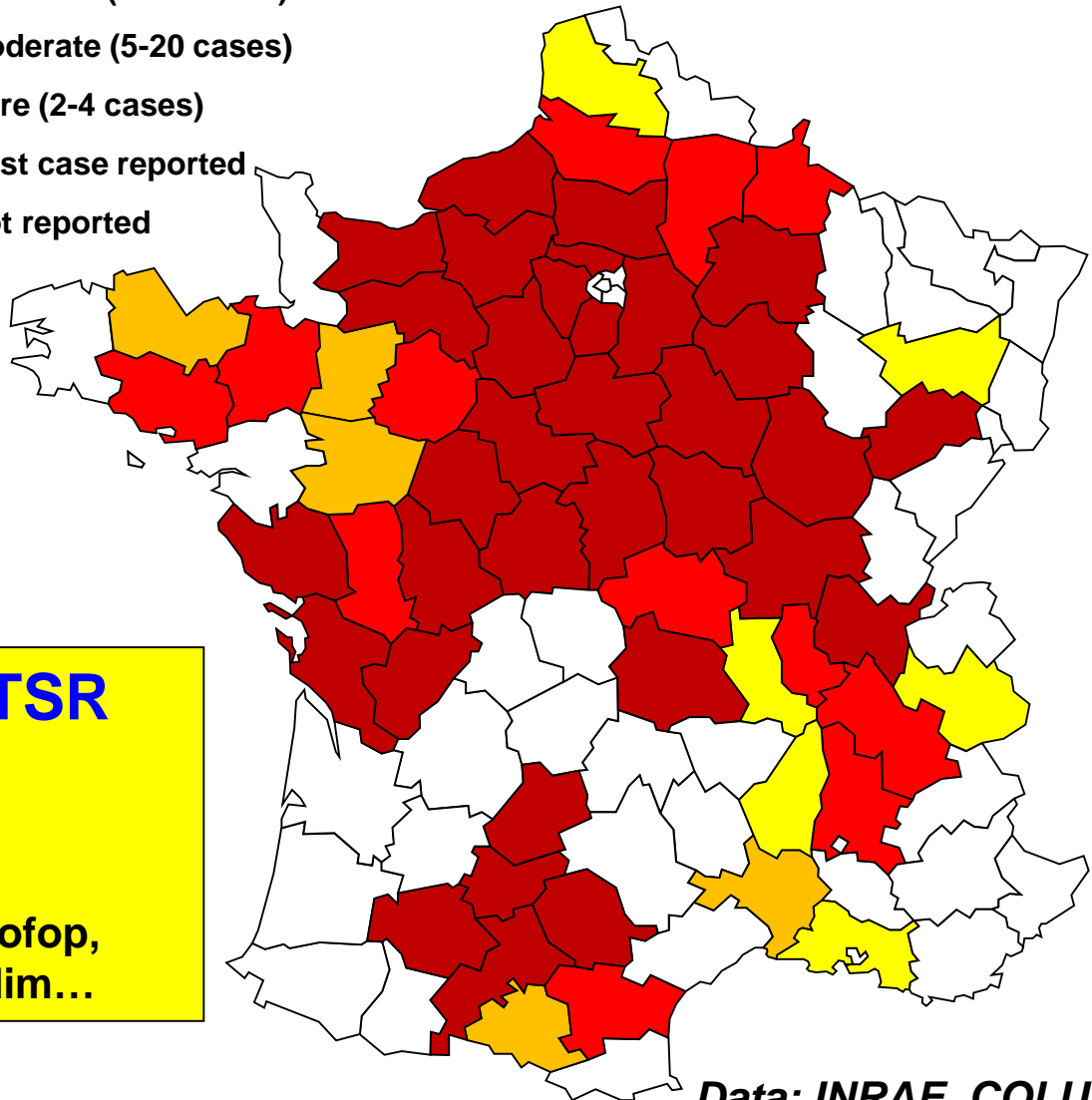
Multiple resistance with herbicides in groups D1 and/or D2 and/or F2

Resistance of rye-grasses to ACCase inhibitors (group D1)



Lolium sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **NTSR** + **TSR**

Cereals, rape, sugar beet...

Actives concerned: clodinafop, fluazifop, propaquizafop, quizalofop, pinoxaden, cycloxydim, clethodim...

Data: INRAE, COLUMA

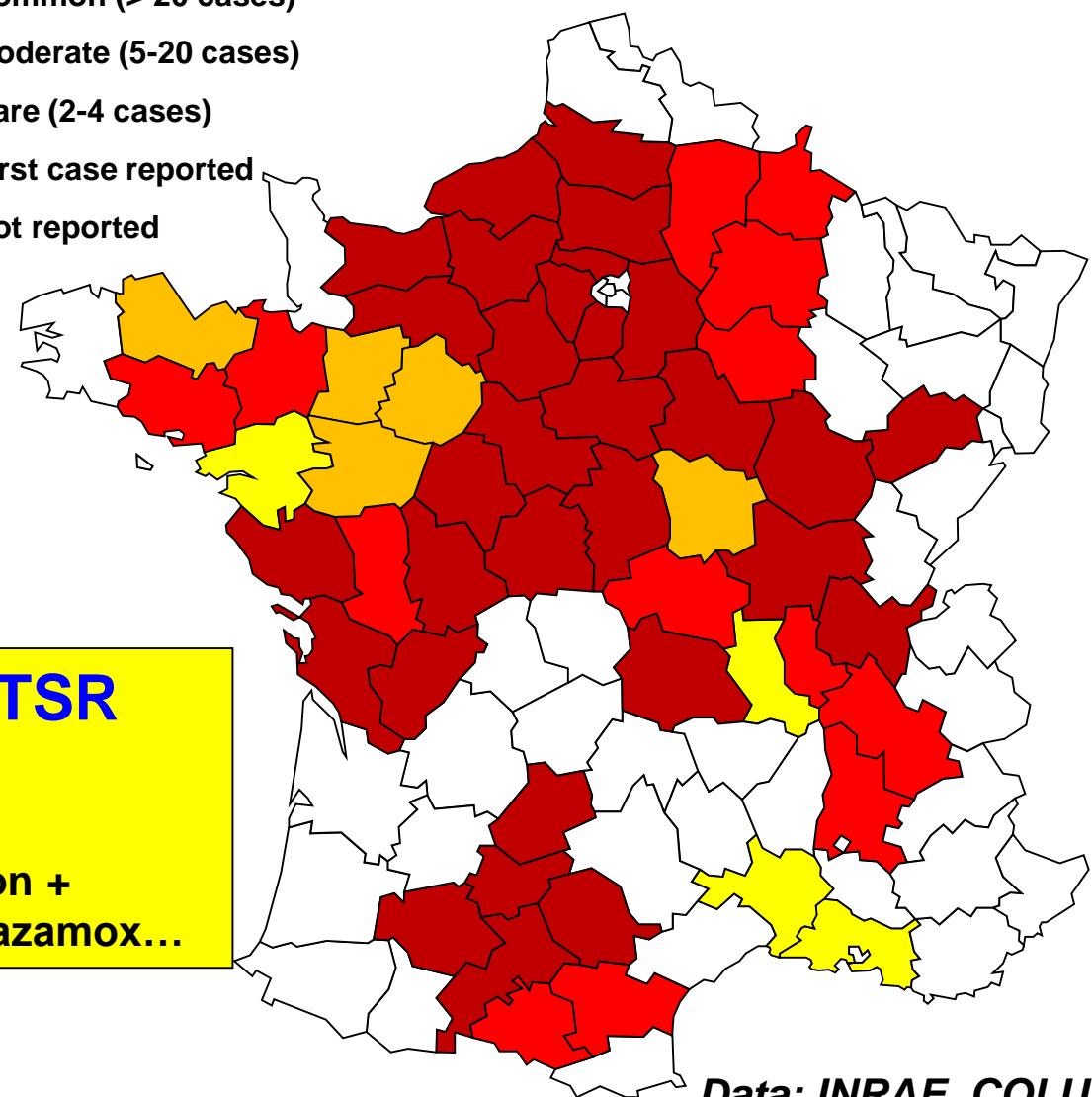
Multiple resistance / cross-**NTSR** with herbicides in groups D2 and/or F2 and/or F1

Resistance of rye-grasses to ALS inhibitors (group F2)



Lolium sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **NTSR** + **TSR**

Cereals, rape...

Actives concerned: iodosulfuron + mesosulfuron, pyroxsulam, imazamox...

Data: INRAE, COLUMA

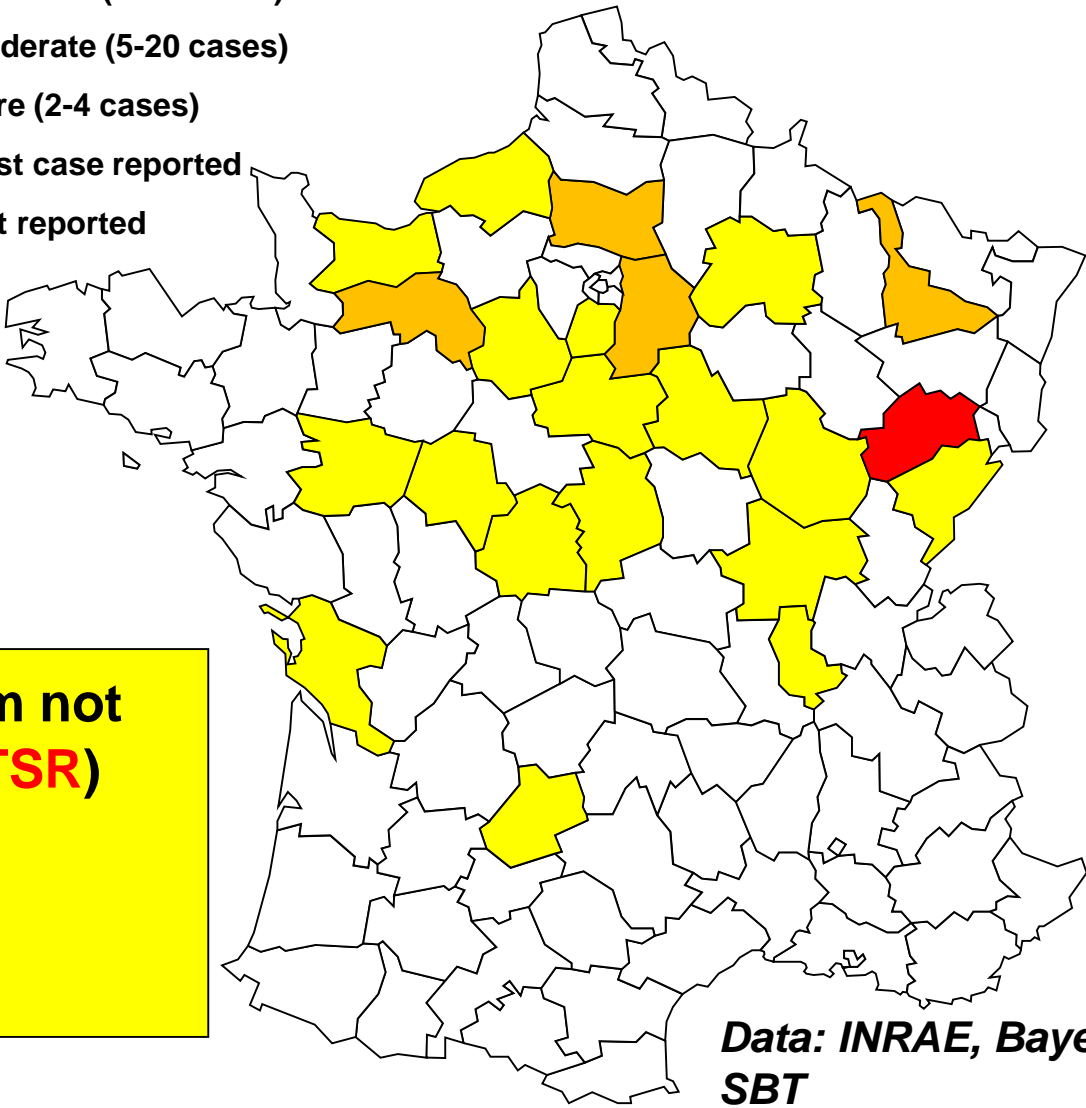
Multiple resistance / cross-**NTSR** with herbicides in groups D1 and/or D2 and/or F1

Resistance of rye-grass to inhibitors of lipid elongation (group D2)



Lolium sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: mechanism not investigated (probably **NTSR**)

Cereals...

Actives concerned: flufenacet, prosulfocarb

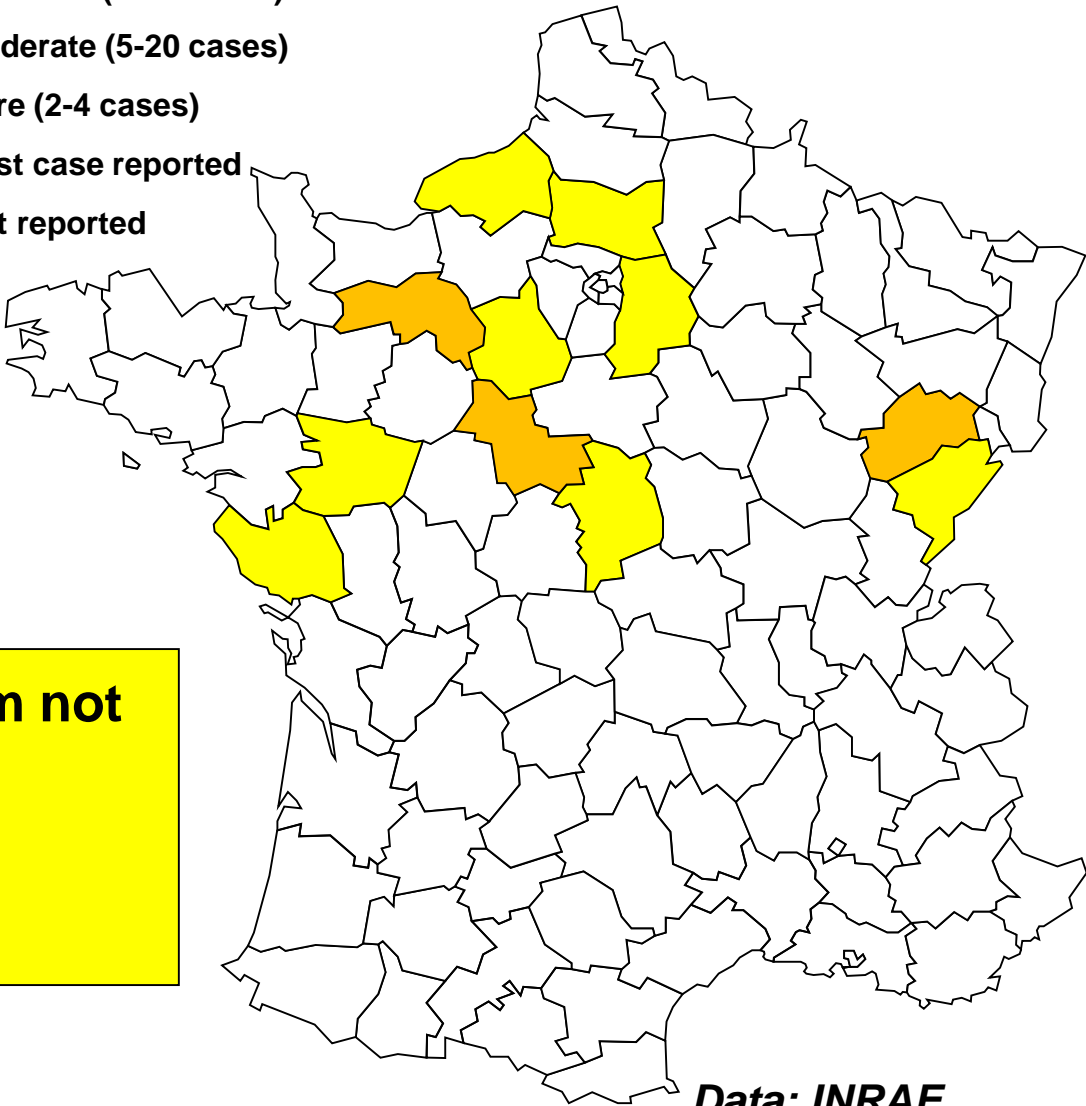
Data: INRAE, Bayer, SBT

Multiple resistance / cross-**NTSR** with herbicides in groups D1 and/or F2 and/or F1



Lolium sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: mechanism not investigated

Cereals

Active concerned: glyphosate

Data: INRAE

Multiple resistance with herbicides in groups D1 and/or D2 and/or F2

Resistance of rye-grasses to EPSPS inhibitors (group F1)

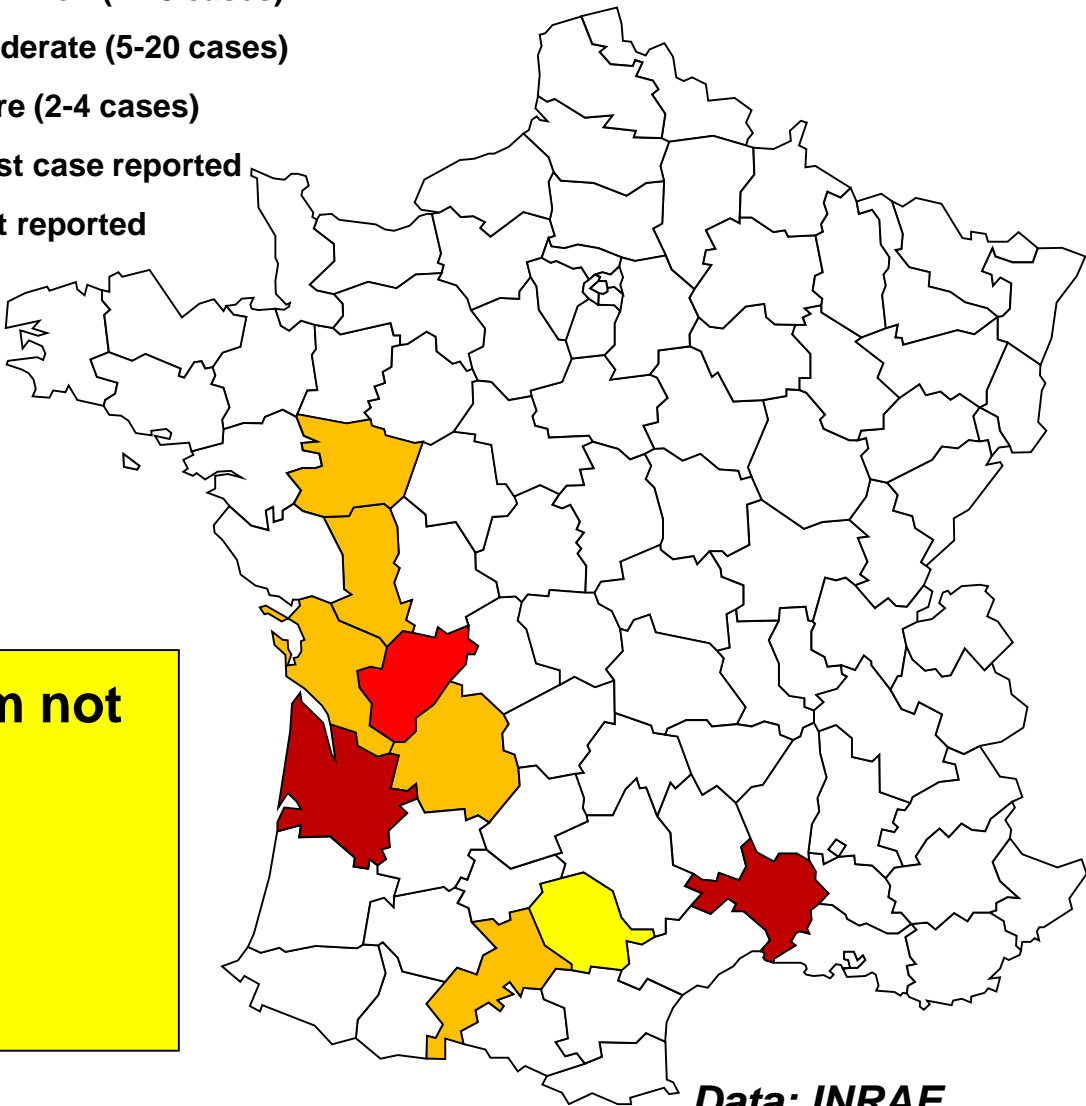
Data last updated in 2012

Updated: June 2023



Lolium sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: mechanism not investigated / altered translocation (**NTSR**)

Grapevine

Active concerned: glyphosate

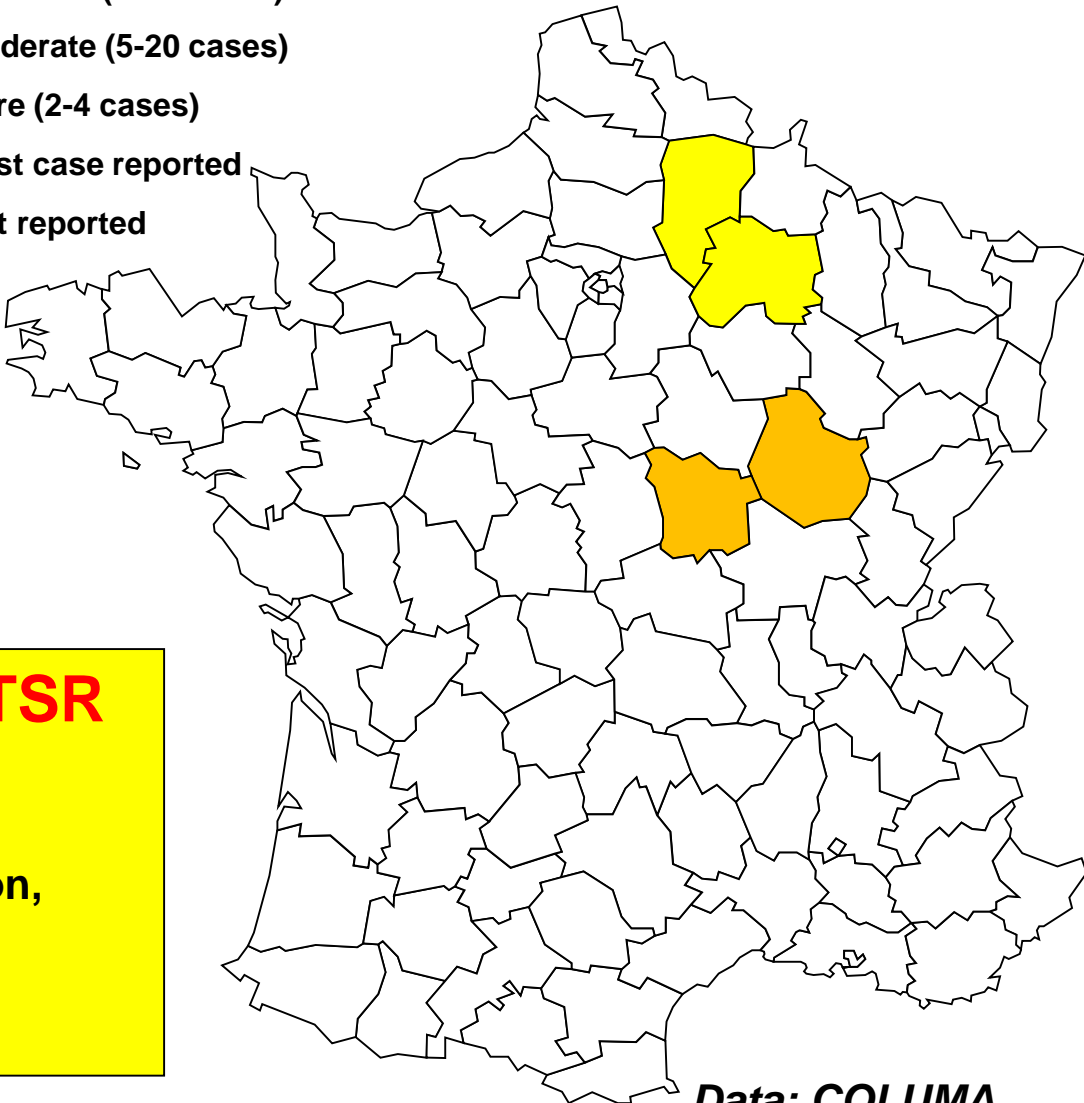
Data: INRAE,
Monsanto, SBT

Resistance of Bromes to ALS inhibitors (group F2)



Bromus sterilis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** + **NTSR**

Cereals, rape

Actives concerned: sulfosulfuron,
iodosulfuron + mesosulfuron,
pyroxsulam, imazamox,
propoxycarbazone...

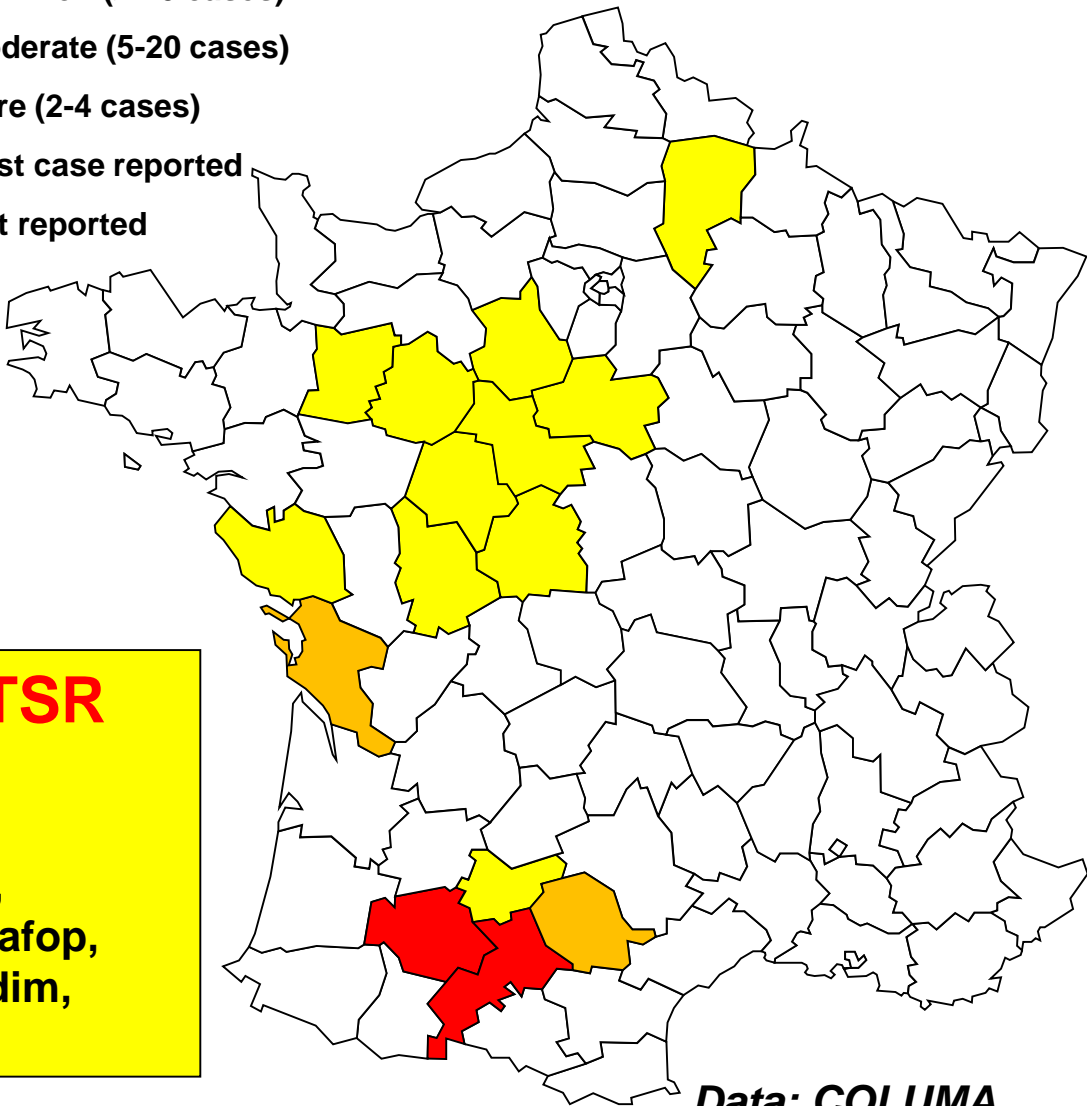
Data: COLUMA

Resistance of wild oats to ACCase inhibitors (group D1)



Avena sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** + **NTSR**

Cereals, rape

Actives concerned: fenoxaprop, clodinafop, fluazifop, propaquizafop, quizalofop, pinoxaden, cycloxydim, clethodime...

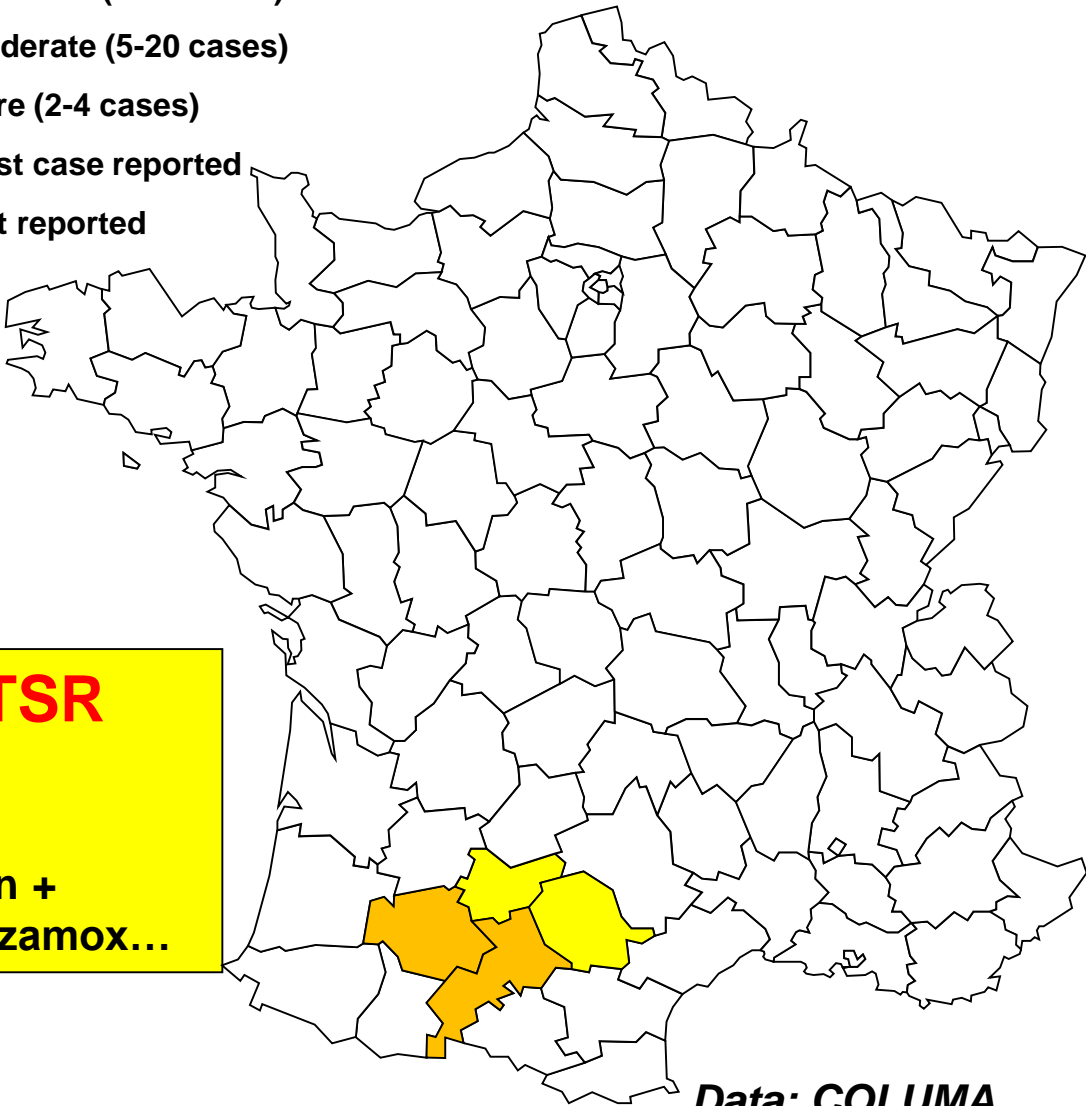
Data: COLUMA

Resistance of wild oats to ALS inhibitors (group F2)



Avena sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR + NTSR**

Cereals, rape

Actives concerned: iodosulfuron + mesosulfuron, pyroxsulam, imazamox...

Data: COLUMA

Resistance of silky bent-grass to ACCase inhibitors (group D1)

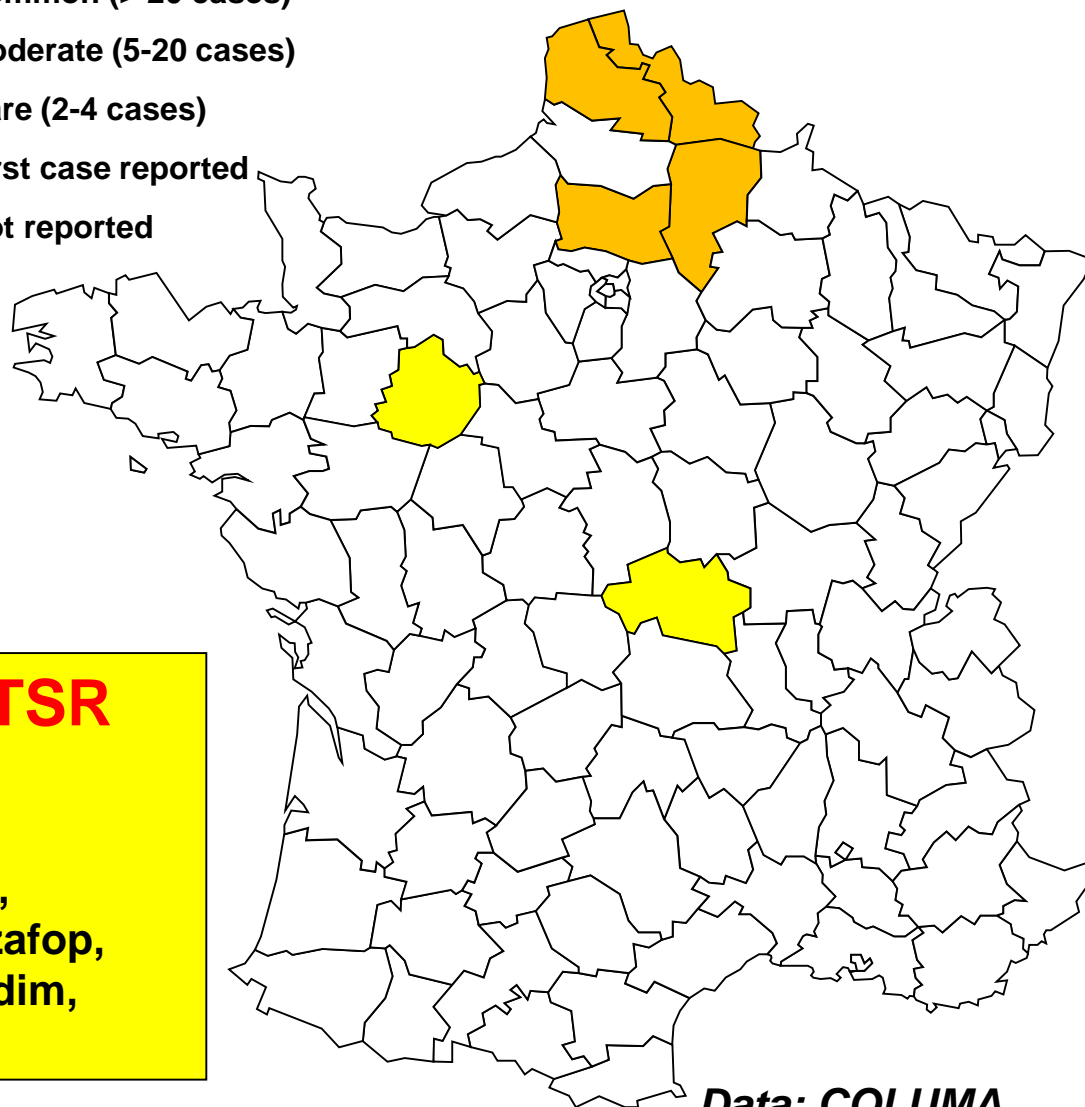
INRAE

Updated: June 2023



Apera spica-venti

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: TSR + NTSR

Cereals, rape

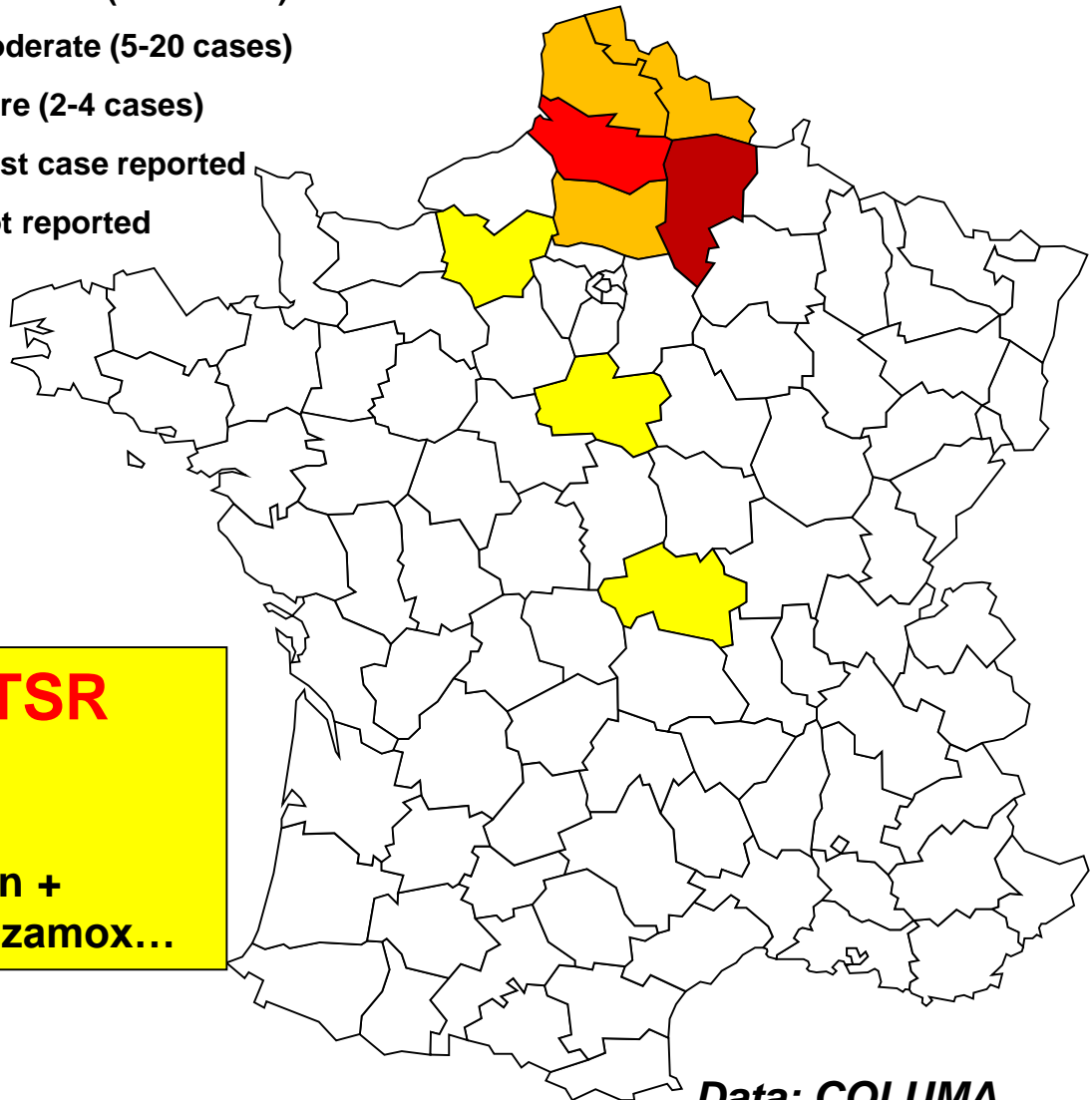
Actives concerned: fenoxaprop,
clodinafop, fluazifop, propaquizafop,
quizalofop, pinoxaden, cycloxydim,
clethodime...

Data: COLUMA



Apera spica-venti

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR + NTSR**

Cereals, rape

Actives concerned: iodosulfuron + mesosulfuron, pyroxsulam, imazamox...

Data: COLUMA






Resistance of barnyard-grass to ACCase inhibitors (group D1)

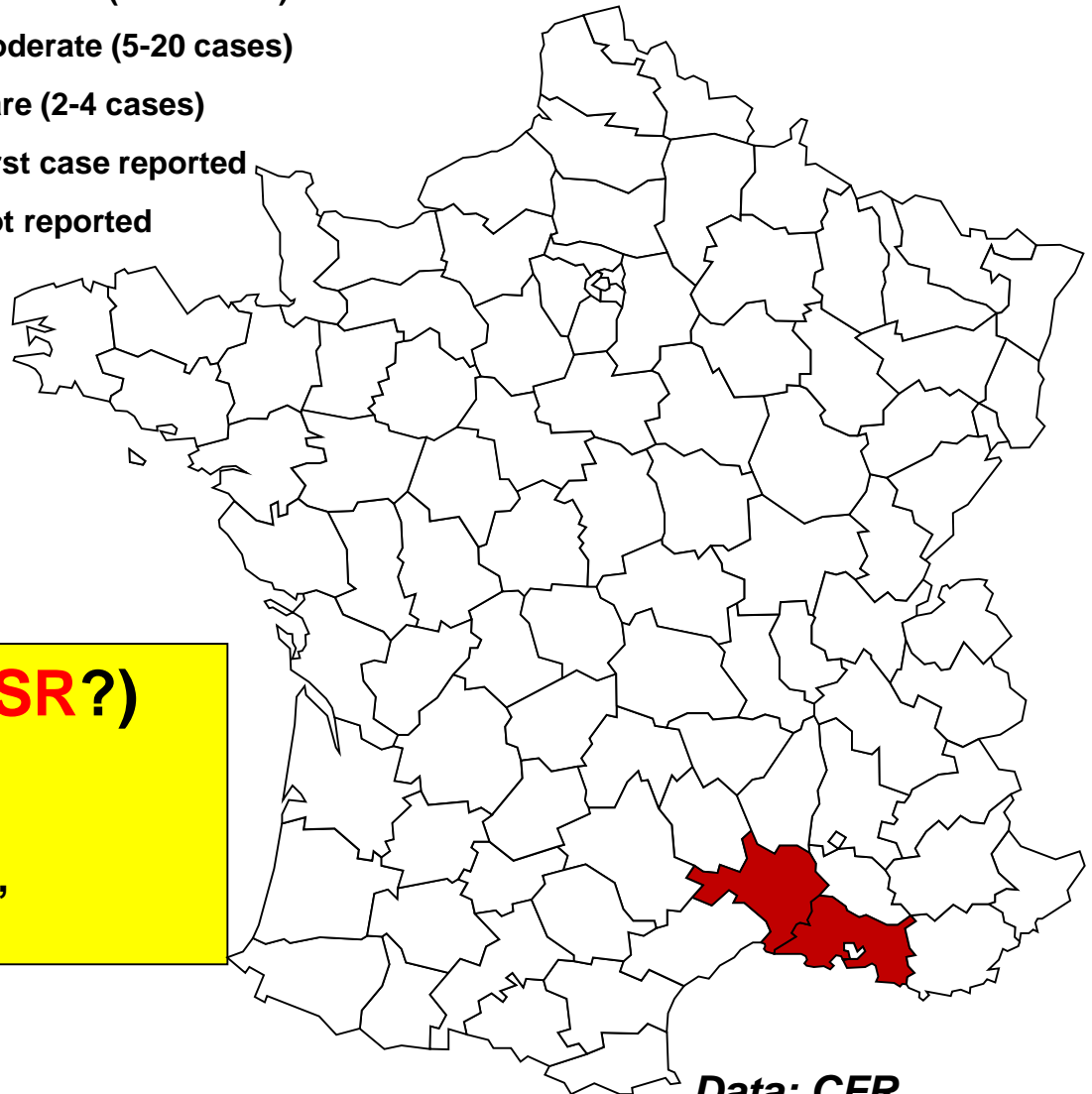
INRAE

Updated: June 2023



Echinochloa crus-galli

-  Common (> 20 cases)
-  Moderate (5-20 cases)
-  Rare (2-4 cases)
-  First case reported
-  Not reported



Resistance: **TSR** (**NTSR?**)

Rice

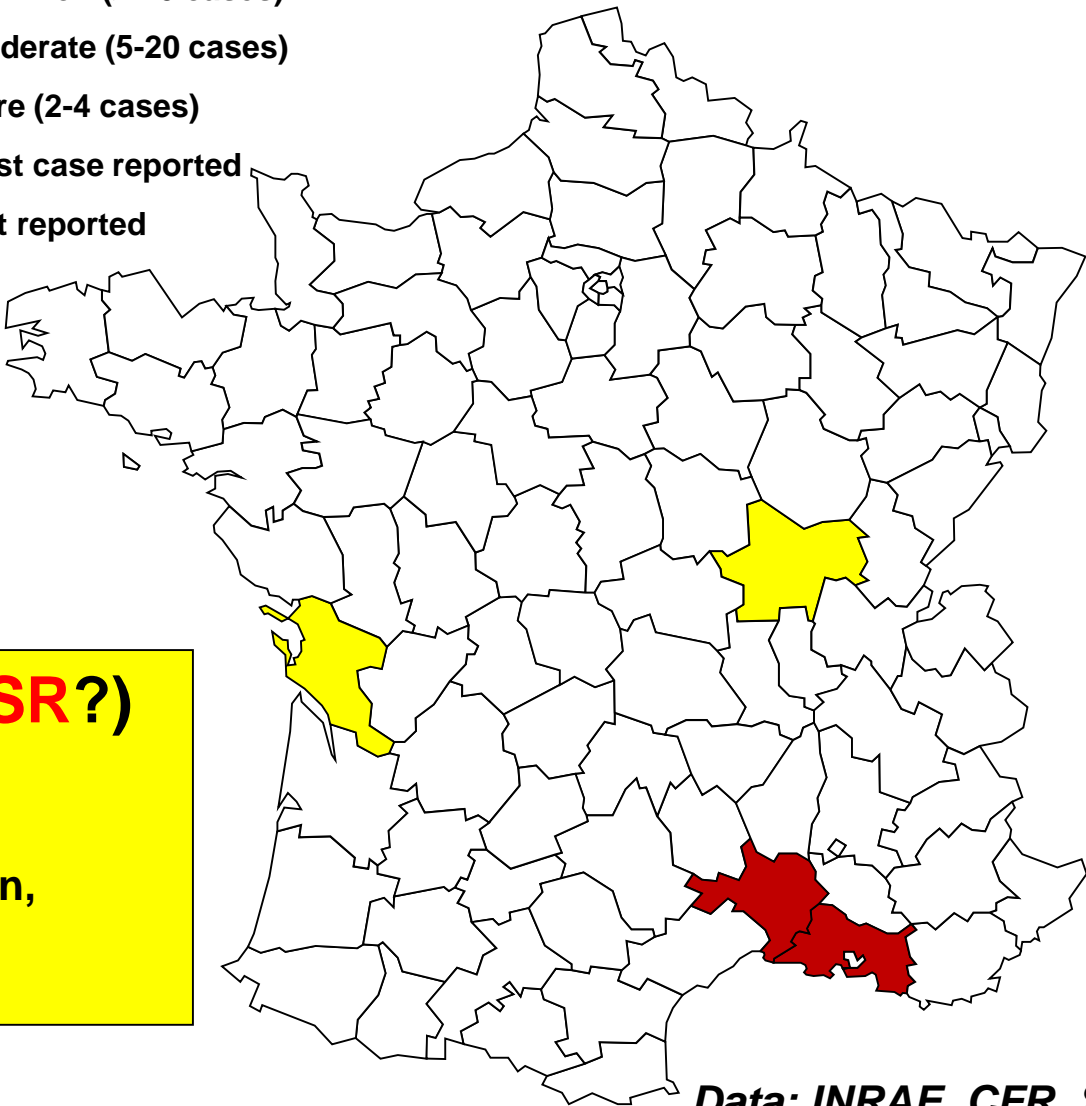
Actives concerned: cycloxydim,
cyhalofop

Data: CFR



Echinochloa crus-galli

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (**NTSR?**)

Rice, maize

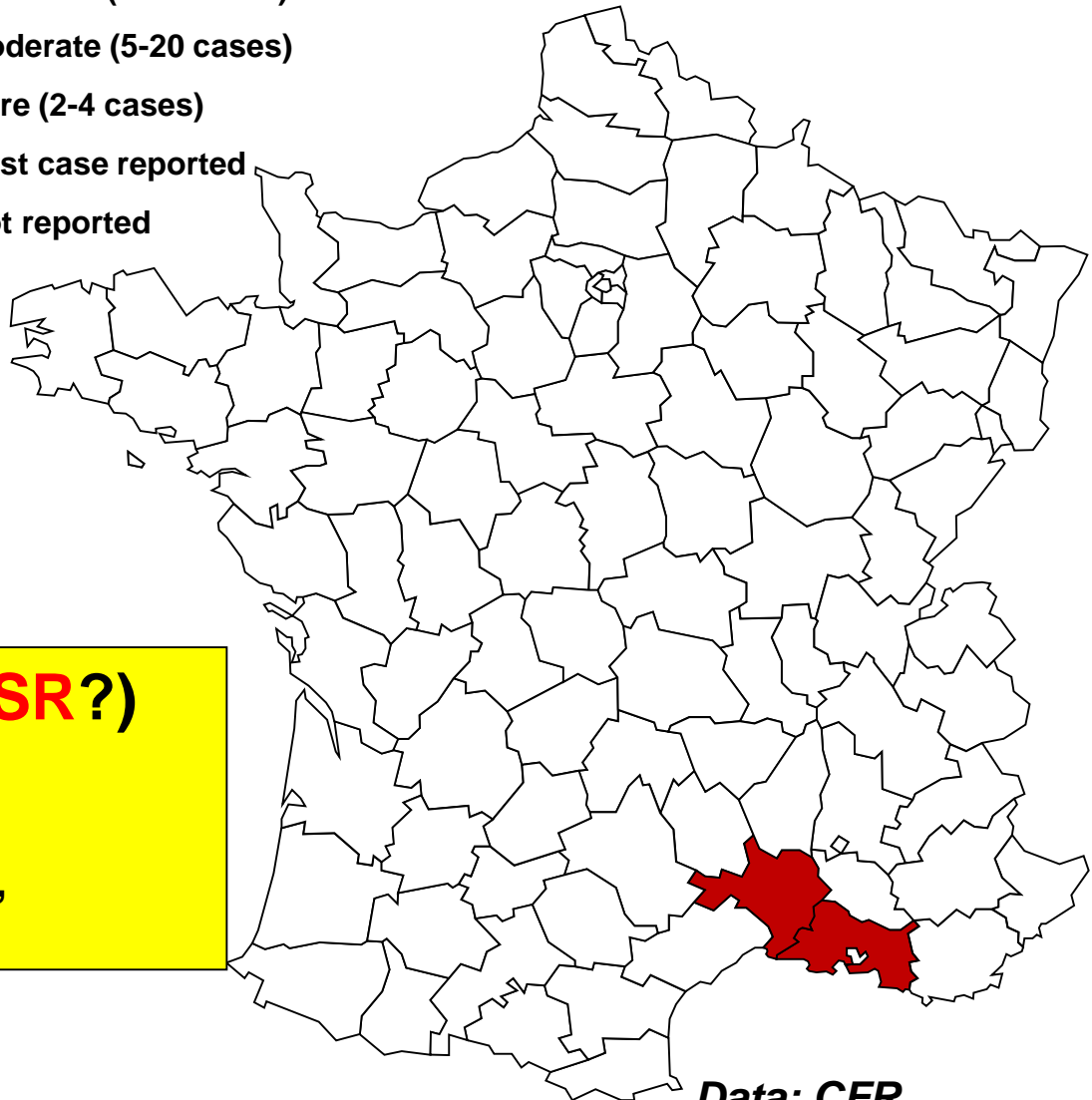
Actives concerned: azimsulfuron,
prosulfuron, foramsulfuron,
nicosulfuron, penoxsulam...

Resistance of rice barnyard-grass to ACCase inhibitors (group D1)



Echinochloa oryzicola

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (**NTSR?**)

Rice

Actives concerned: cycloxydim, cyhalofop

Data: CFR

Resistance of rice barnyard-grass to ALS inhibitors (group F2)

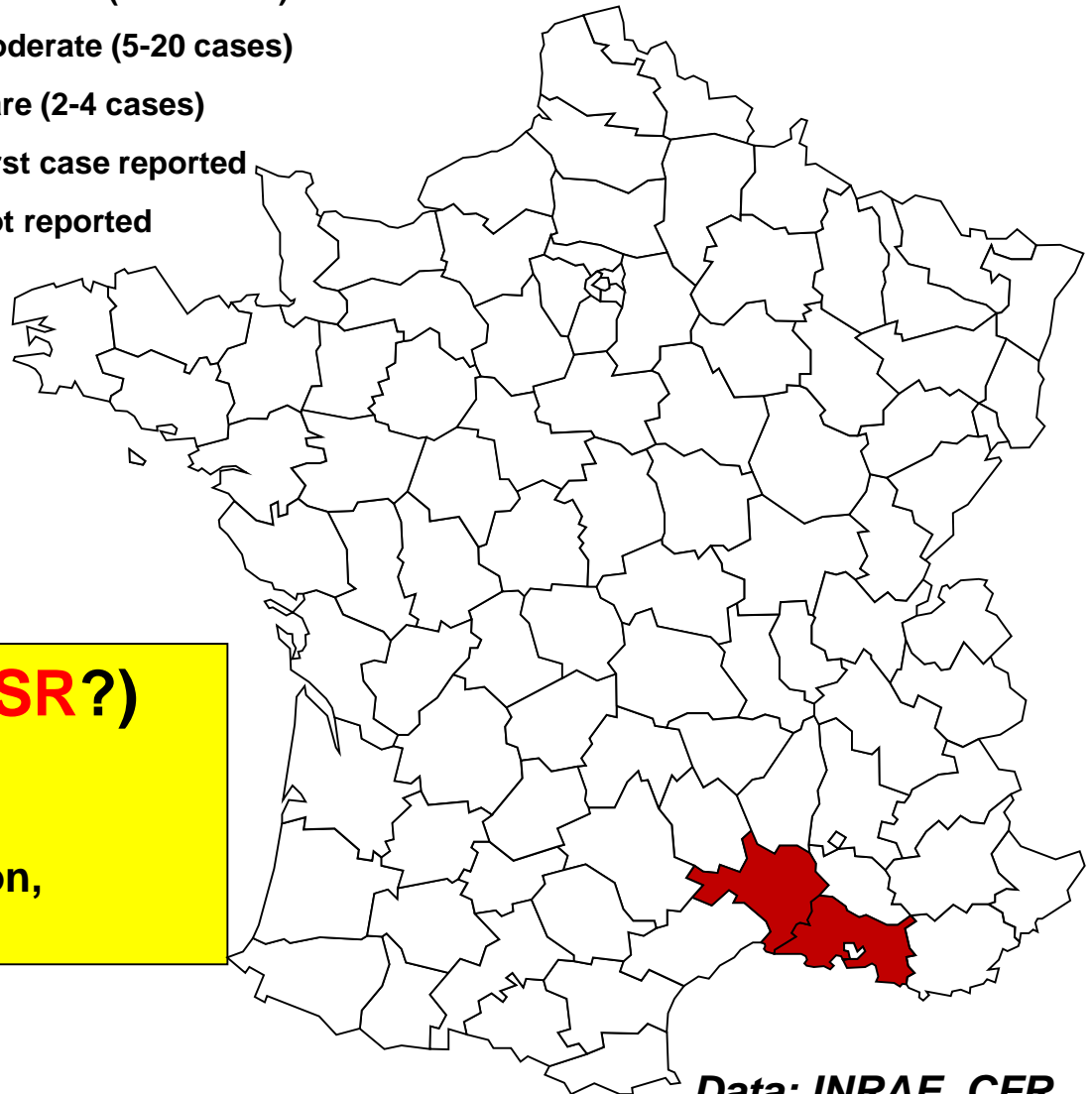
INRAE

Updated: June 2023



Echinochloa oryzicola

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (NTSR?)

Rice

Actives concerned: azimsulfuron,
penoxsulam

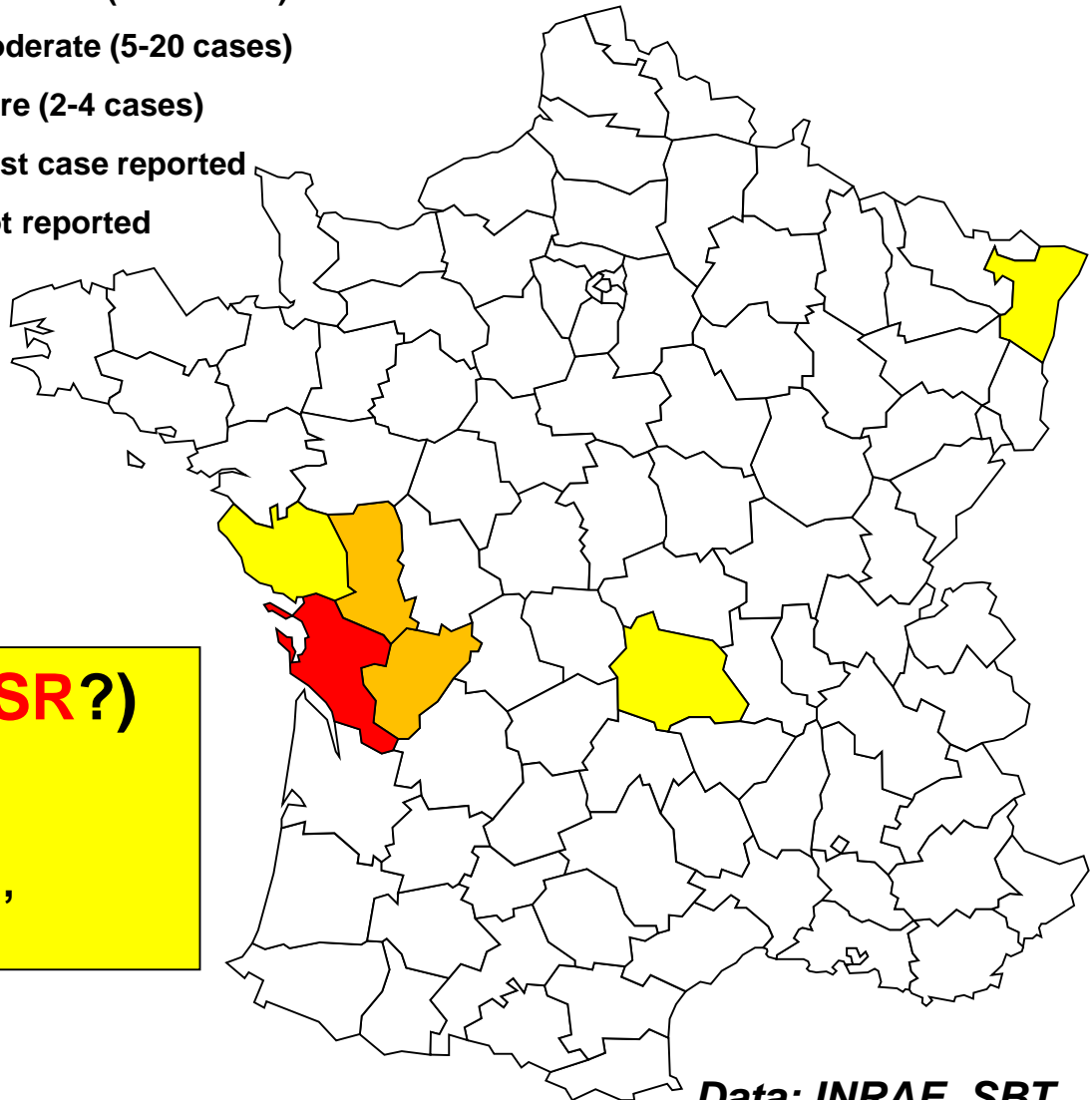
Data: INRAE, CFR

Resistance of foxtails to ALS inhibitors (group F2)



Setaria viridis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (**NTSR?**)

Maize

Actives concerned: prosulfuron, foramsulfuron, nicosulfuron...

Resistance of large crabgrass to ACCase inhibitors (group D1)

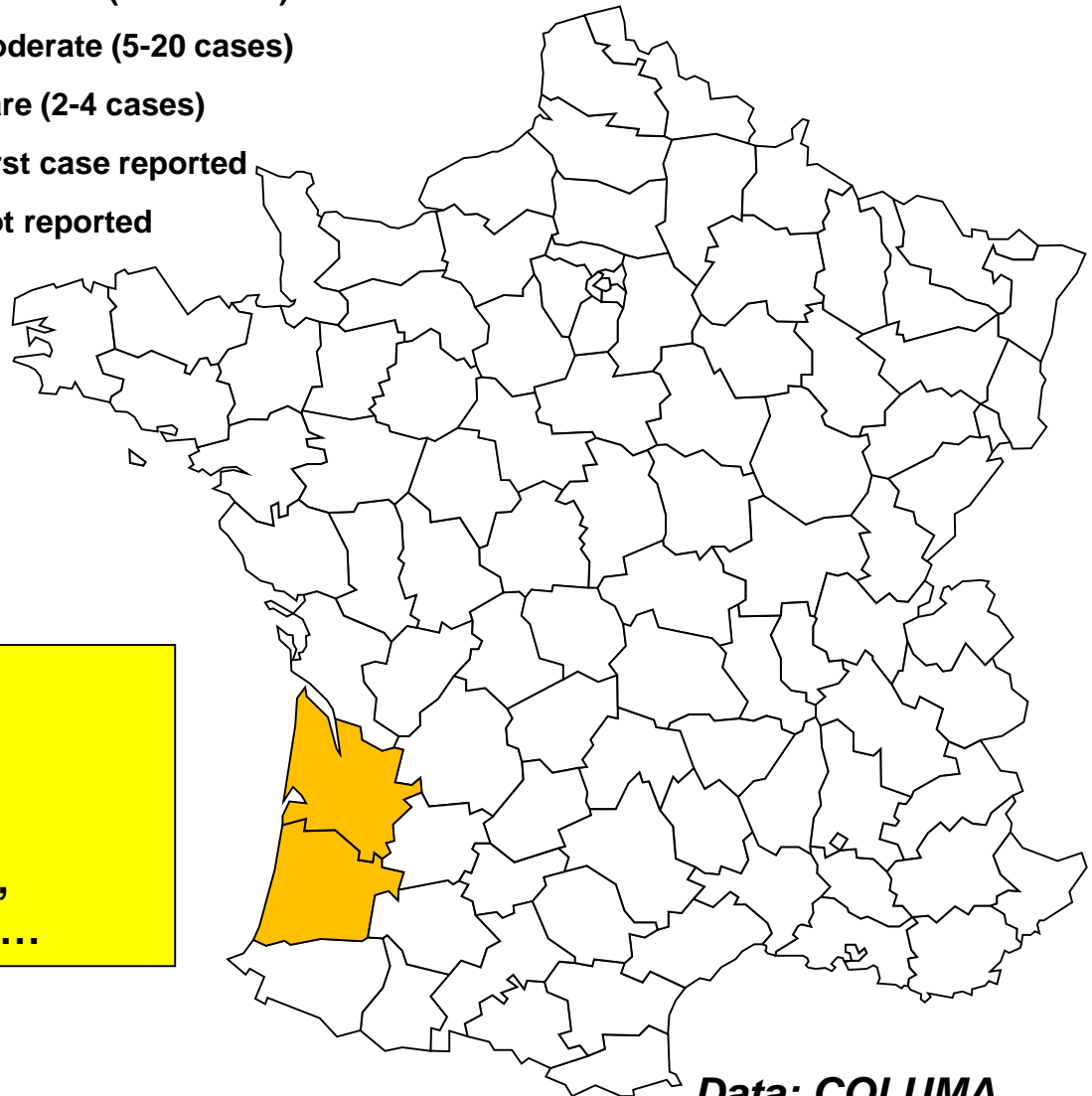
INRAE

Updated: June 2023



Digitaria sanguinalis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR**

Vegetables

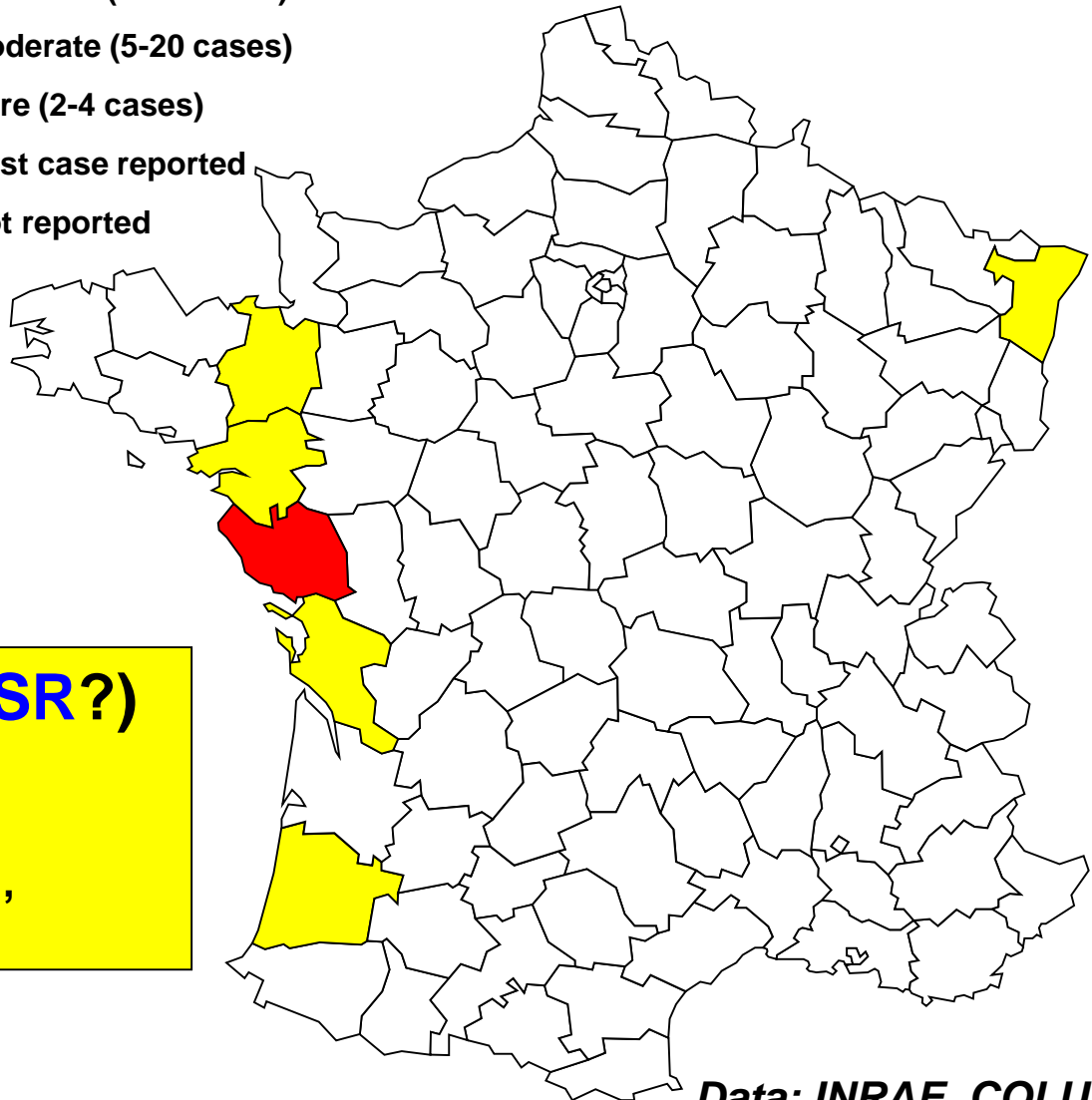
Actives concerned: cycloxydim,
clethodim, fluazifop, quizalofop...

Data: COLUMA



Digitaria sanguinalis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: NTSR (TSR?)

Maize

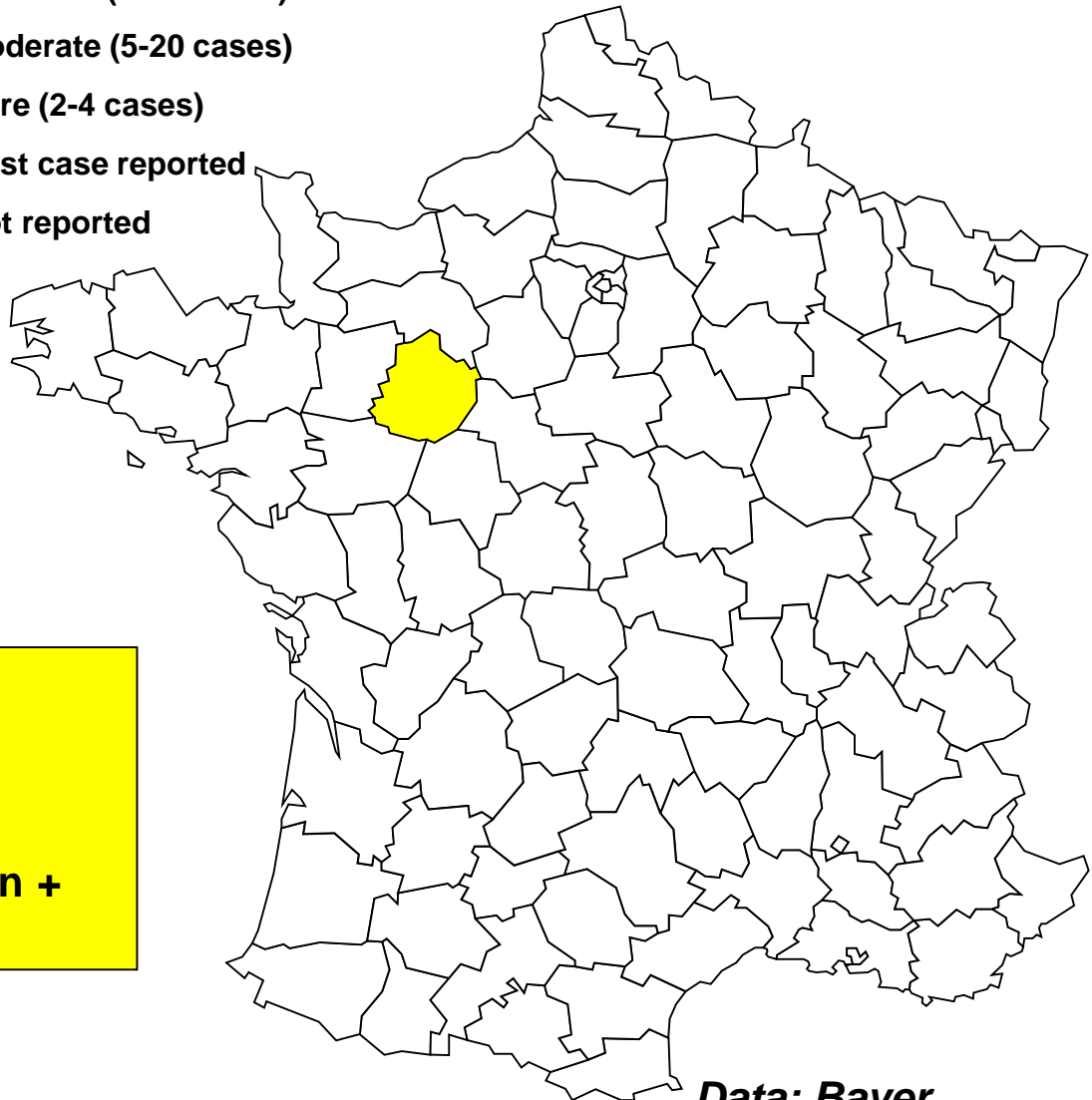
Actives concerned: prosulfuron, foramsulfuron, nicosulfuron...

Resistance of rough meadow-grass to ALS inhibitors (group F2)



Poa trivialis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: TSR

Cereals

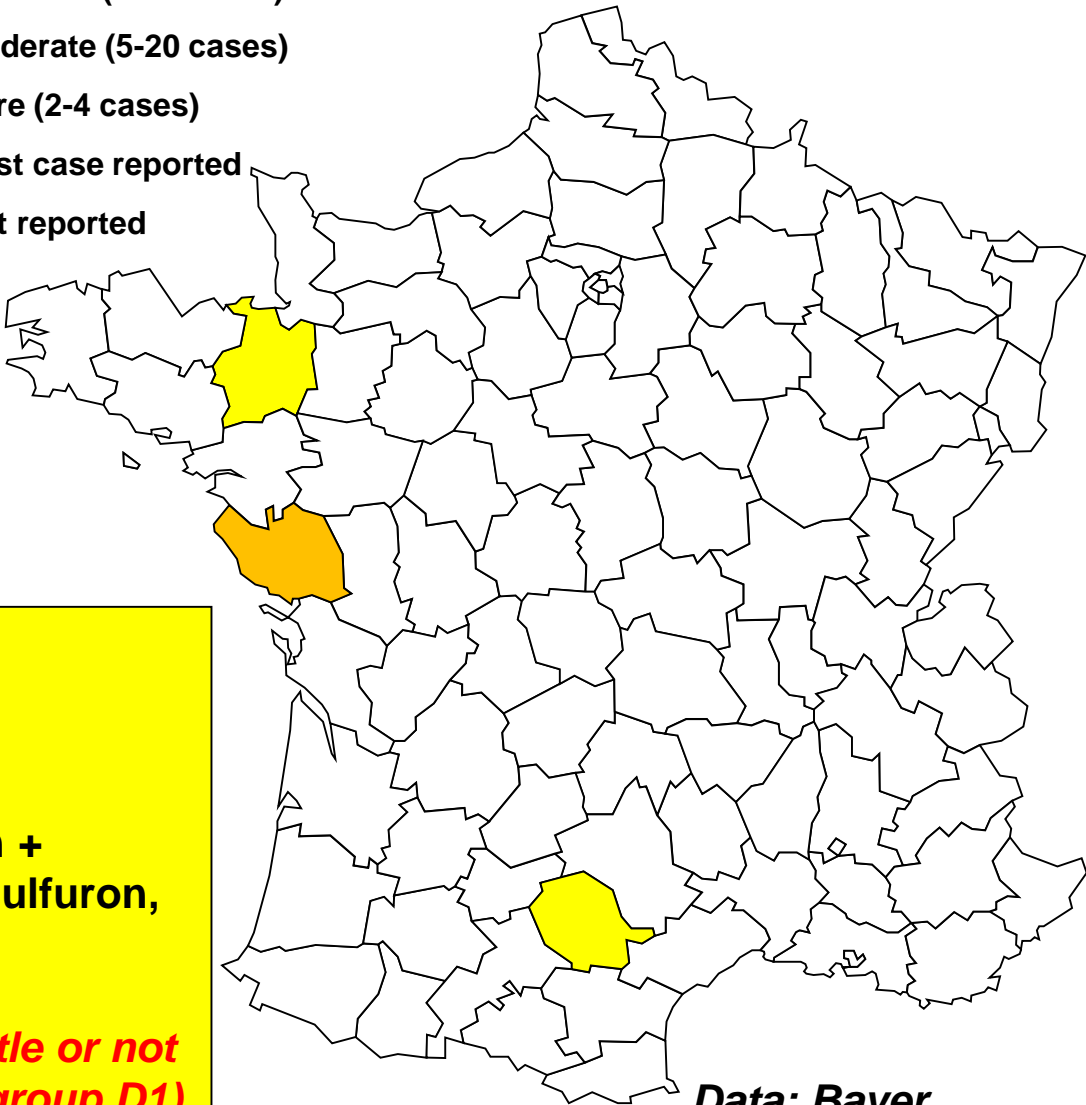
Actives concerned: iodosulfuron + mesosulfuron, pyroxsulam...

Data: Bayer



Poa annua

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR?**

Cereals, maize...

Actives concerned: iodosulfuron + mesosulfuron, pyroxsulam, prosulfuron, foramsulfuron, nicosulfuron ...






Note: this species is naturally little or not sensitive to ACCase inhibitors (group D1)

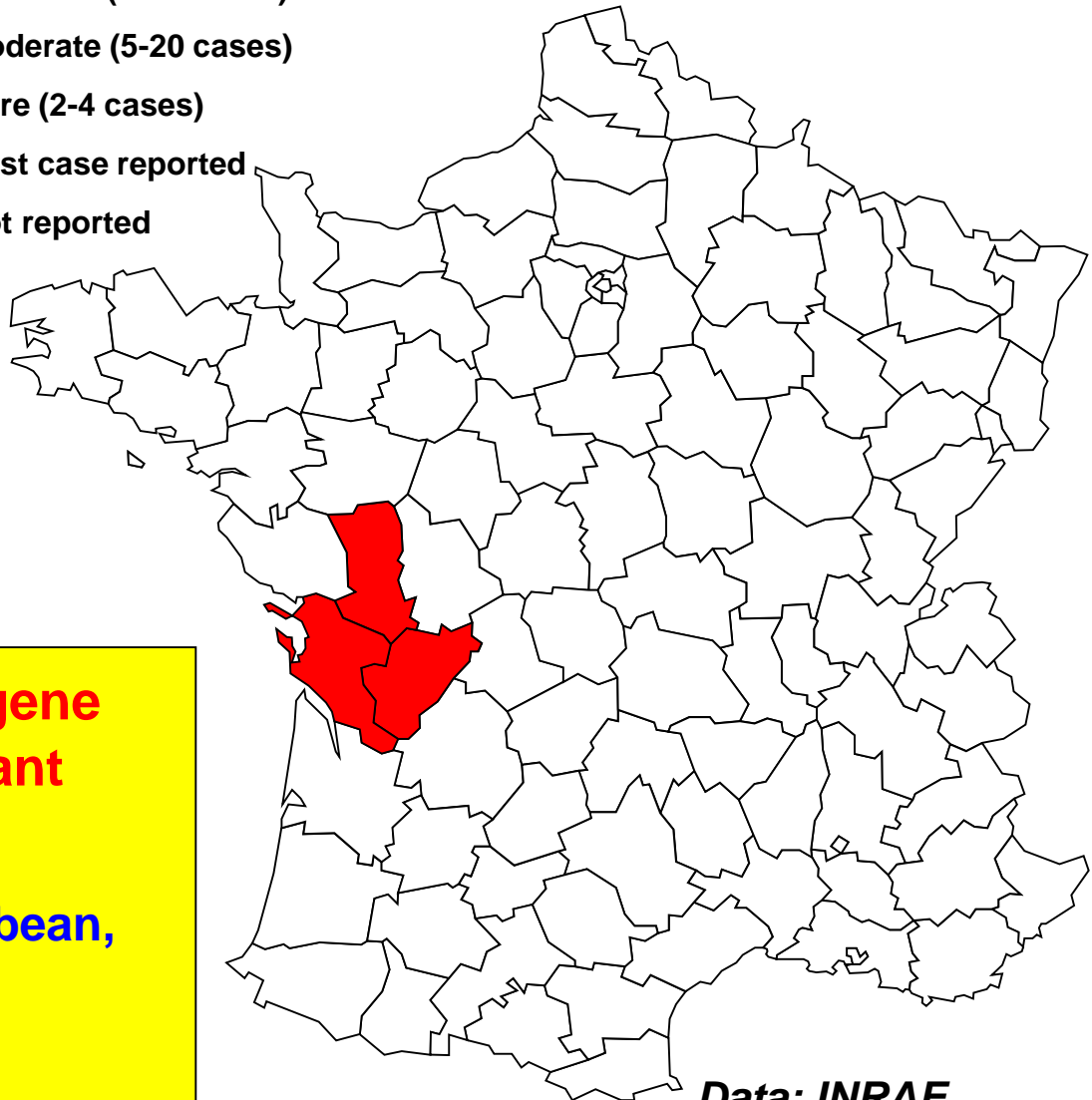
Data: Bayer

Resistance of Teosinte to ACCase inhibitors (group D1)



Zea mays ssp. mexicana

-  Common (> 20 cases)
-  Moderate (5-20 cases)
-  Rare (2-4 cases)
-  First case reported
-  Not reported



Resistance: TSR (by gene flow from herbicide-tolerant maize)

ACCase-tolerant maize, soybean, sunflower

Active concerned: cycloxydim

Data: INRAE

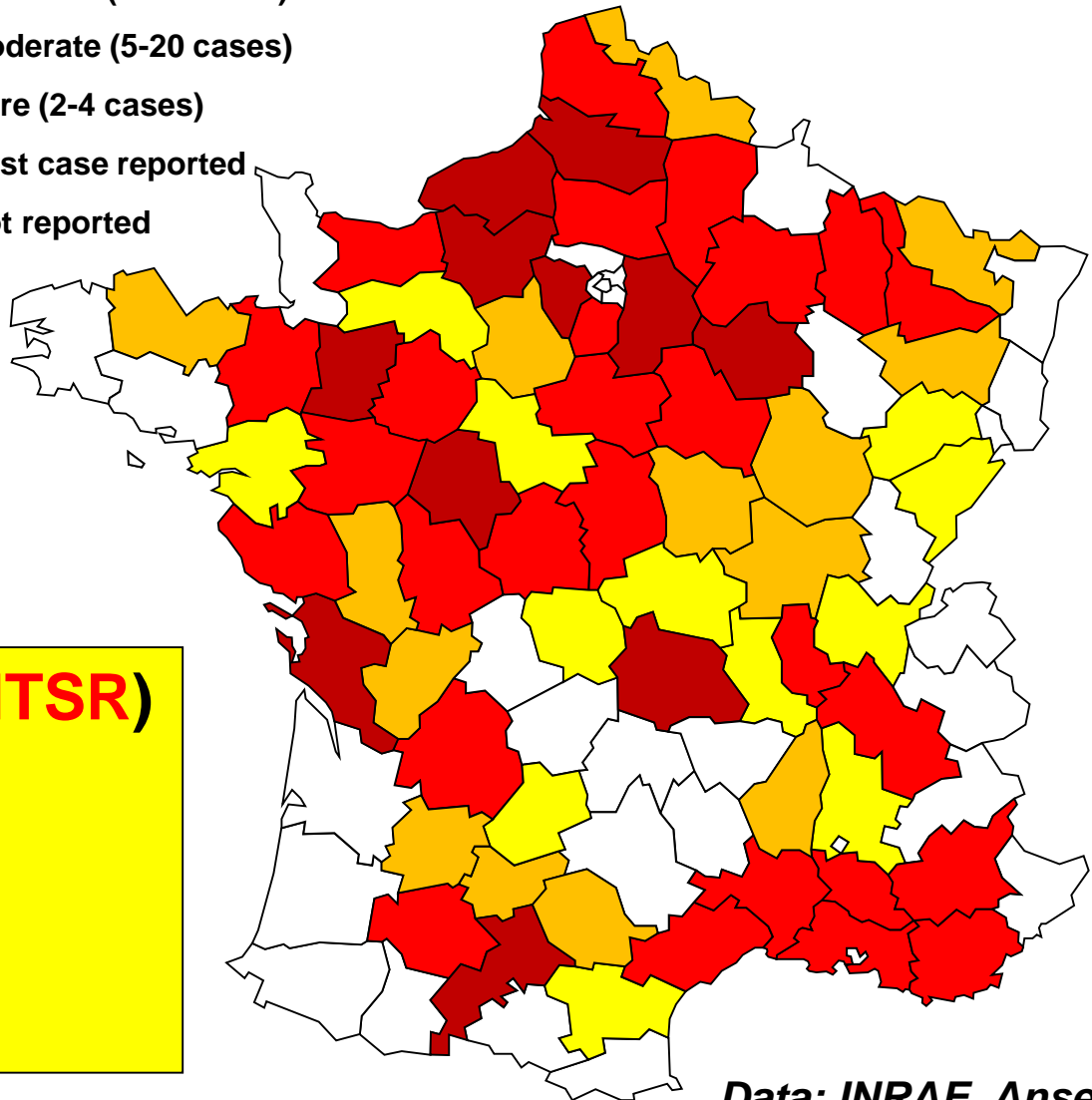
Broadleaves- Papaveraceae

Resistance of corn poppy to ALS inhibitors (group F2)



Papaver rhoeas

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (+ **NTSR**)

Cereals, rape

Actives concerned: tribenuron, metsulfuron, tritosulfuron, iodosulfuron + mesosulfuron, florasulam, imazamox...

Multiple resistance with herbicides in group L1

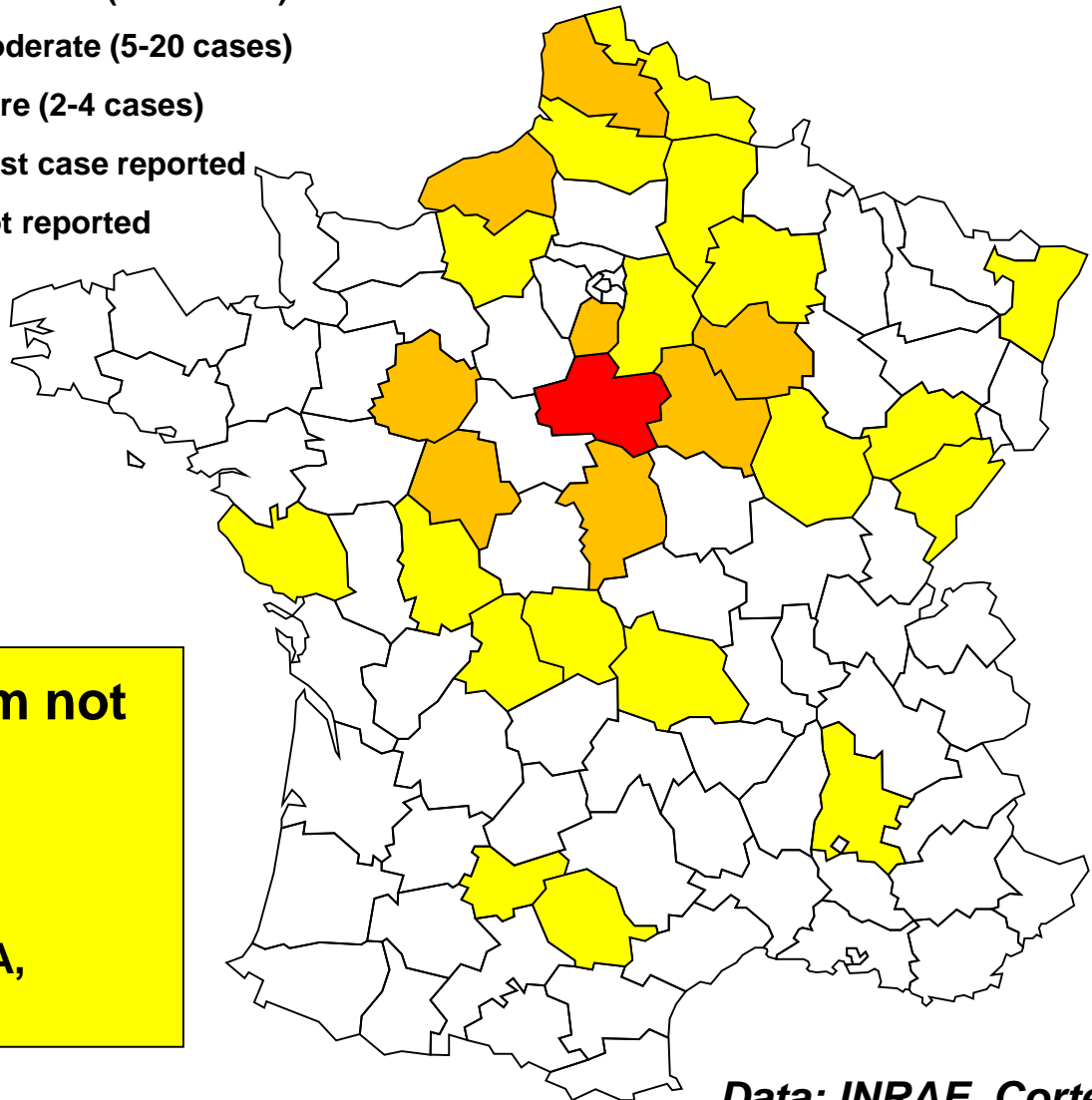
Data: INRAE, Anses, COLUMA, SBT, Corteva

Resistance of corn poppy to auxinic herbicides (group L1)



Papaver rhoeas

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: mechanism not investigated (NTSR?)

Cereals, rape

Actives concerned: 2,4-D, MCPA, aminopyralid...

Data: INRAE, Corteva,

Multiple resistance with herbicides in group F2

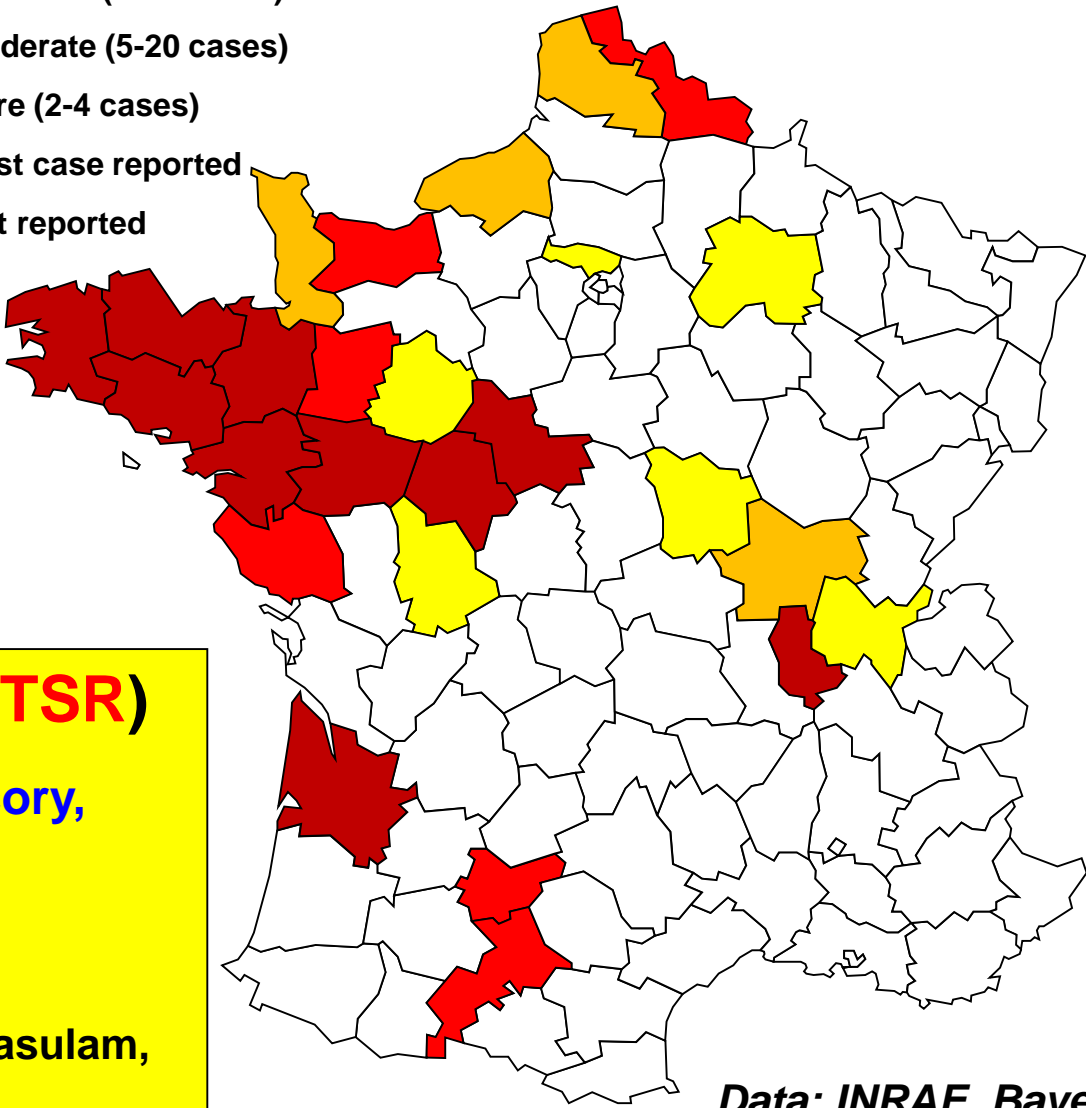
Broadleaves - Asteraceae

Resistance of common groundsel to ALS inhibitors (group F2)



Senecio vulgaris

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (+ **NTSR**)

Major crops, grapevine, chicory, vegetables

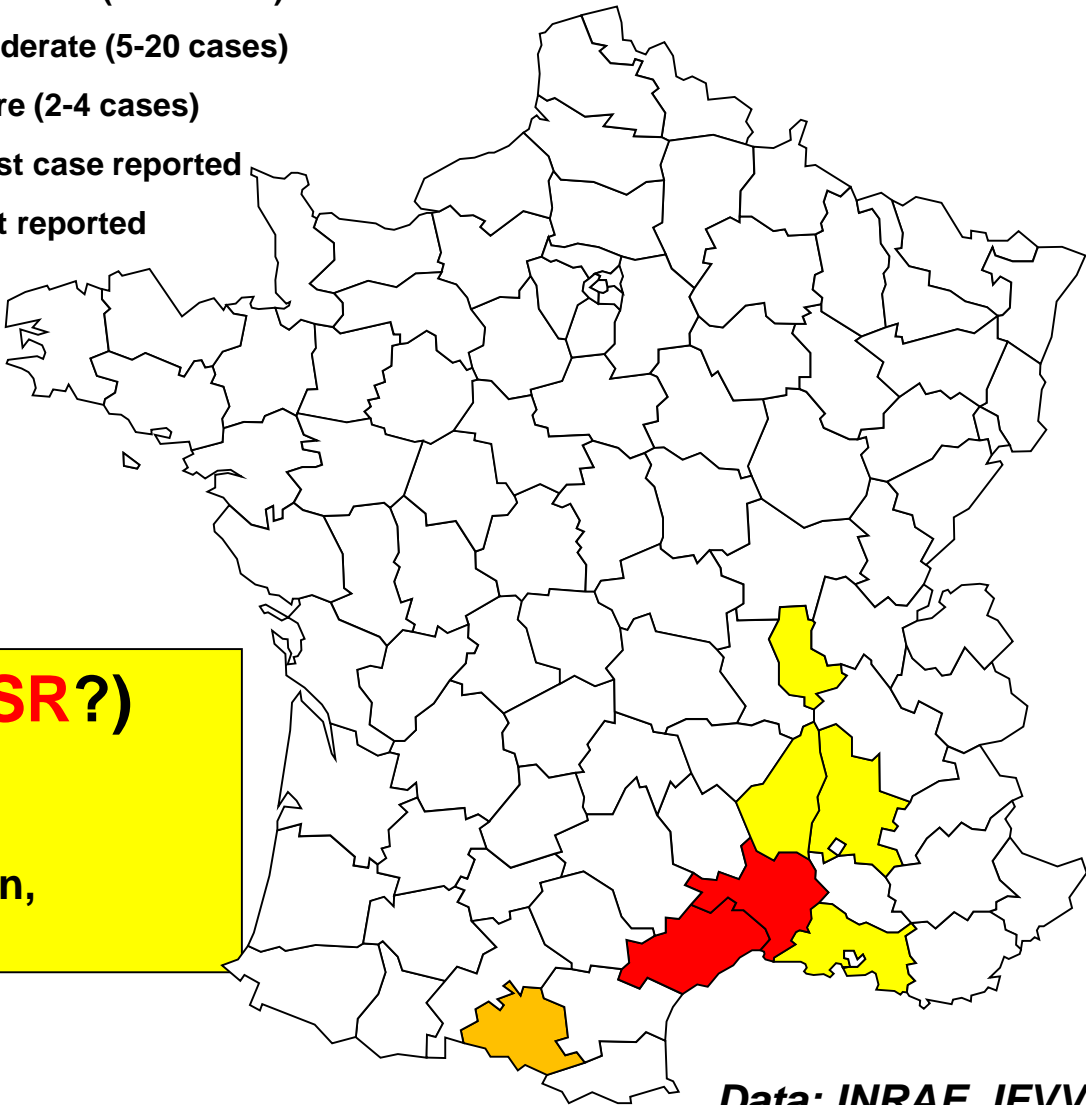
Actives concerned: tribenuron, metsulfuron, iodosulfuron + mesosulfuron, pyroxsulam, florasulam, imazamox, thienencarbazone...

Data: INRAE, Bayer, SBT, Corteva



Erigeron sumatrensis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR** (**NTSR?**)

Grapevine

Actives concerned: flazasulfuron,
penoxsulam...

Multiple resistance with herbicides in group F1

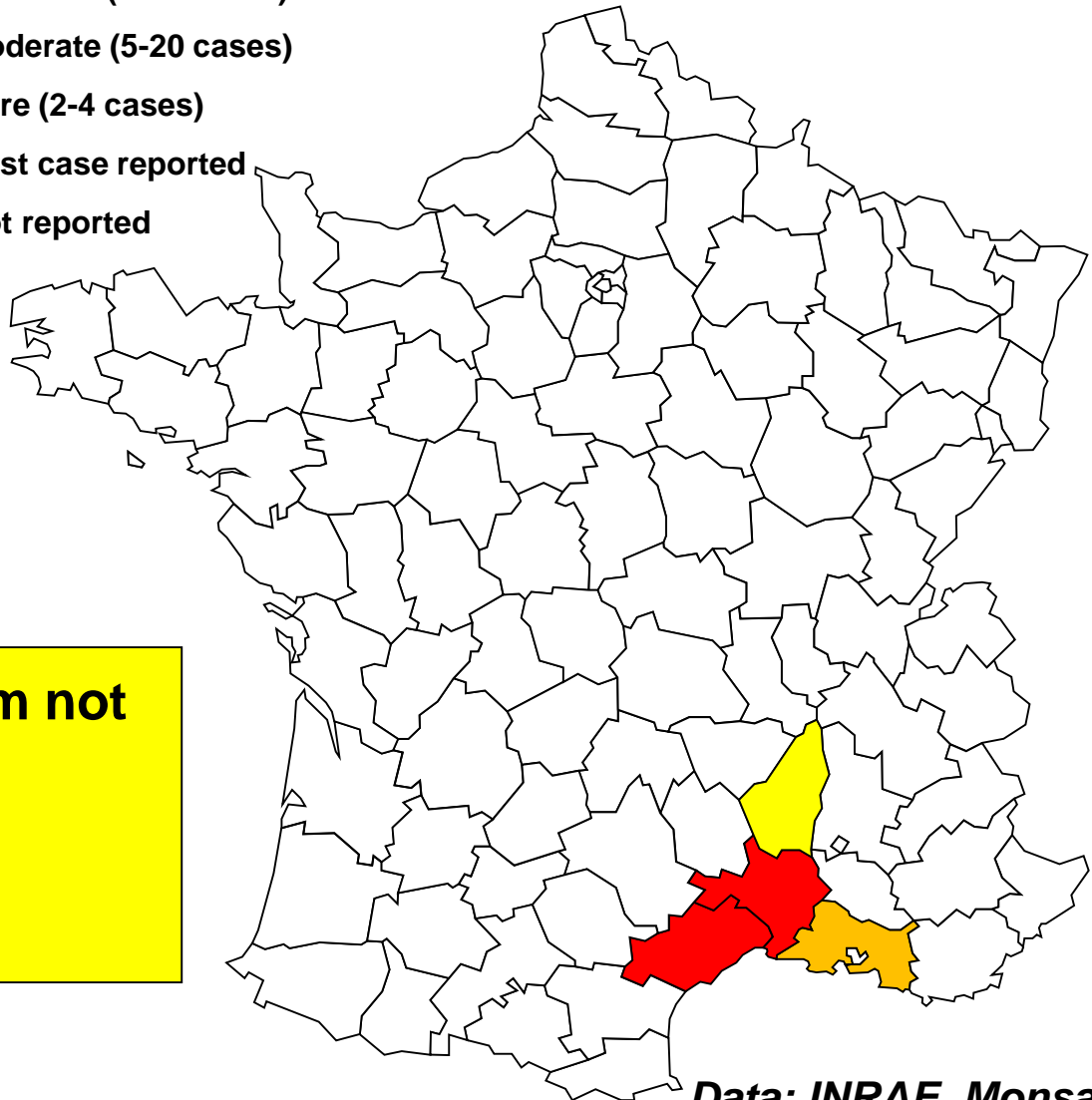
Data: INRAE, IFVV,
Belchim, SBT

Resistance of Sumatra fleabane to EPSPS inhibitors (group F1)



Erigeron sumatrensis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: mechanism not investigated

Grapevine

Active concerned: glyphosate

Multiple resistance with herbicides in group F2

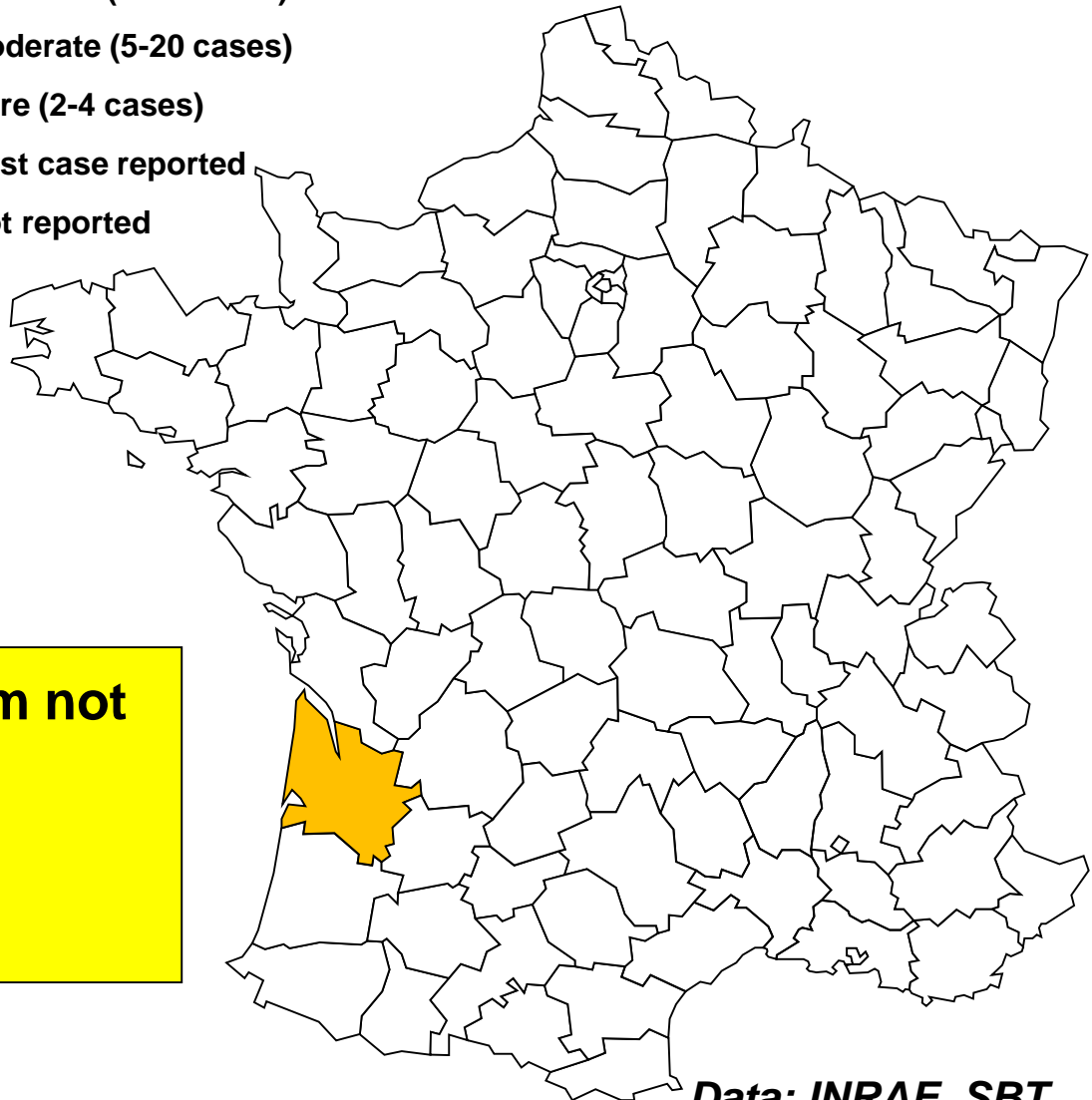
Data: INRAE, Monsanto, SBT

Resistance of Canadian horseweed to EPSPS inhibitors (group F1)



Erigeron canadensis

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: mechanism not investigated






Grapevine

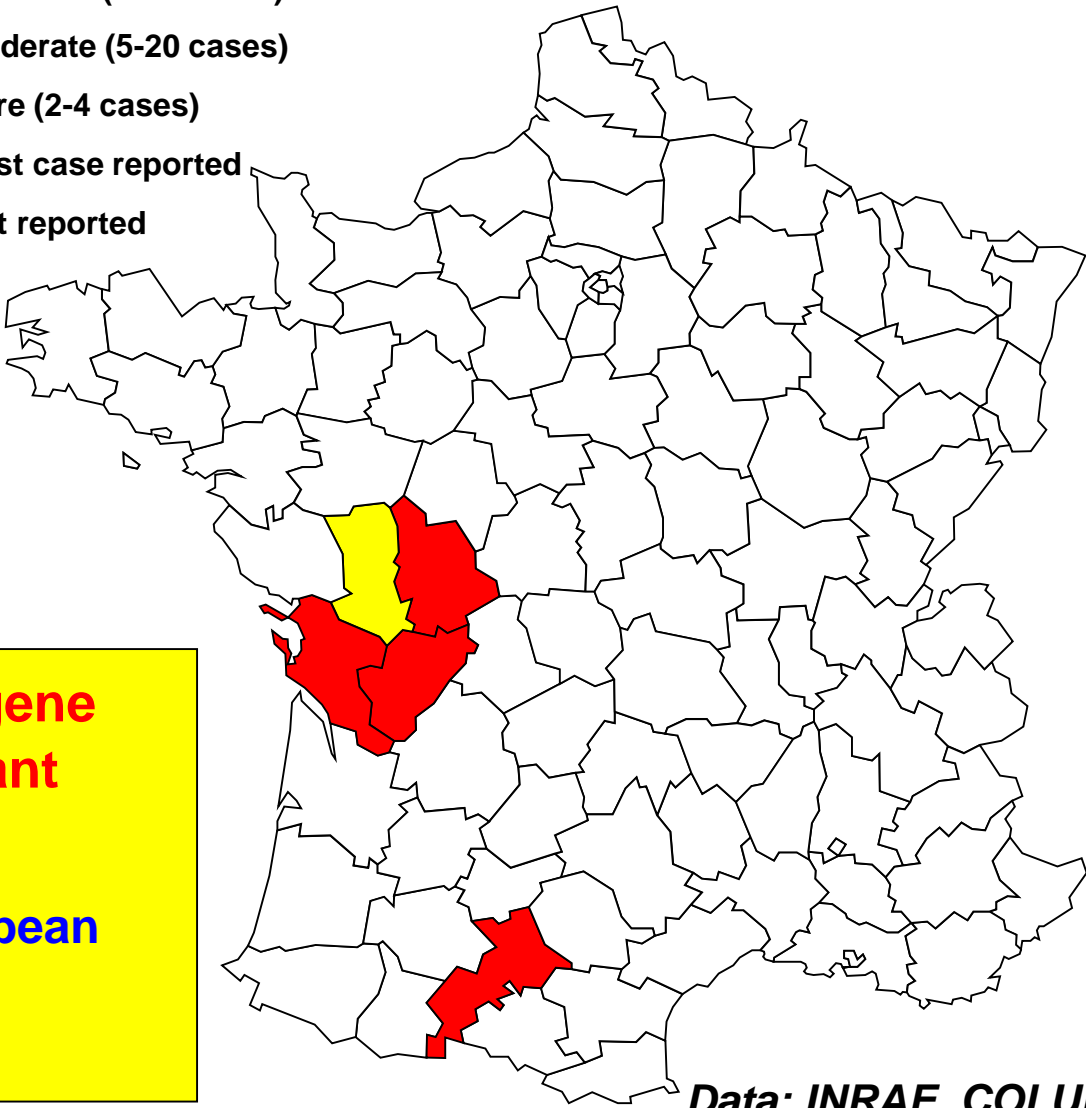
Active concerned: glyphosate

Resistance of weedy sunflower to ALS inhibitors (group F2)



Helianthus annuus

-  Common (> 20 cases)
-  Moderate (5-20 cases)
-  Rare (2-4 cases)
-  First case reported
-  Not reported



Resistance: TSR (by gene flow from herbicide-tolerant sunflower)

ALS-tolerant sunflower, soybean

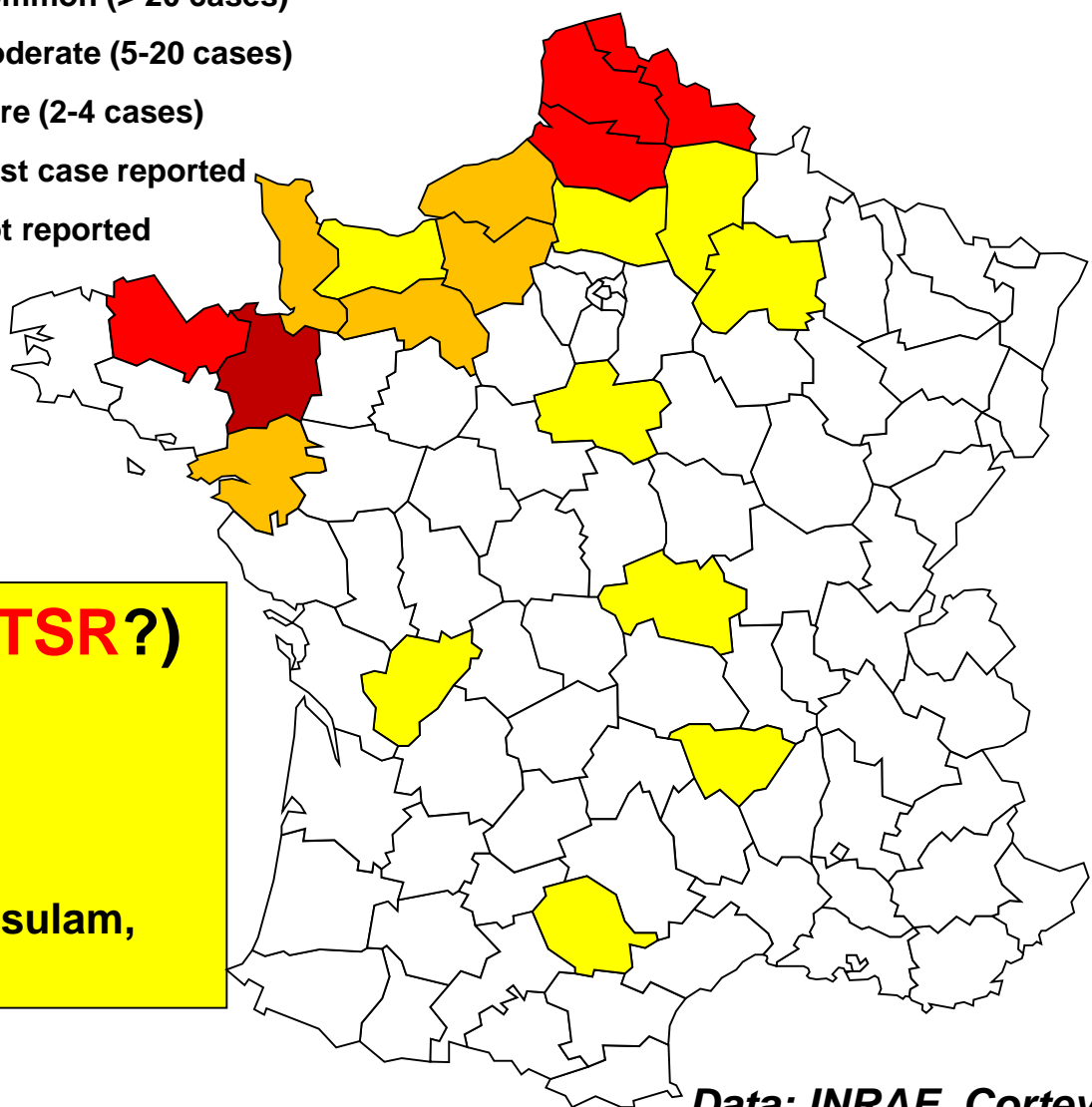
Actives concerned: imazamox, tribenuron

Data: INRAE, COLUMA, Terres Inovia, SBT



Matricaria sp.

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: TSR (& NTSR?)

Cereals, rape






Actives concerned: tribenuron, metsulfuron, iodosulfuron + mesosulfuron, pyroxsulam, florasulam, imazamox...

Data: INRAE, Corteva, COLUMA

Resistance of common ragweed to ALS inhibitors (group F2)

Updated: June 2023



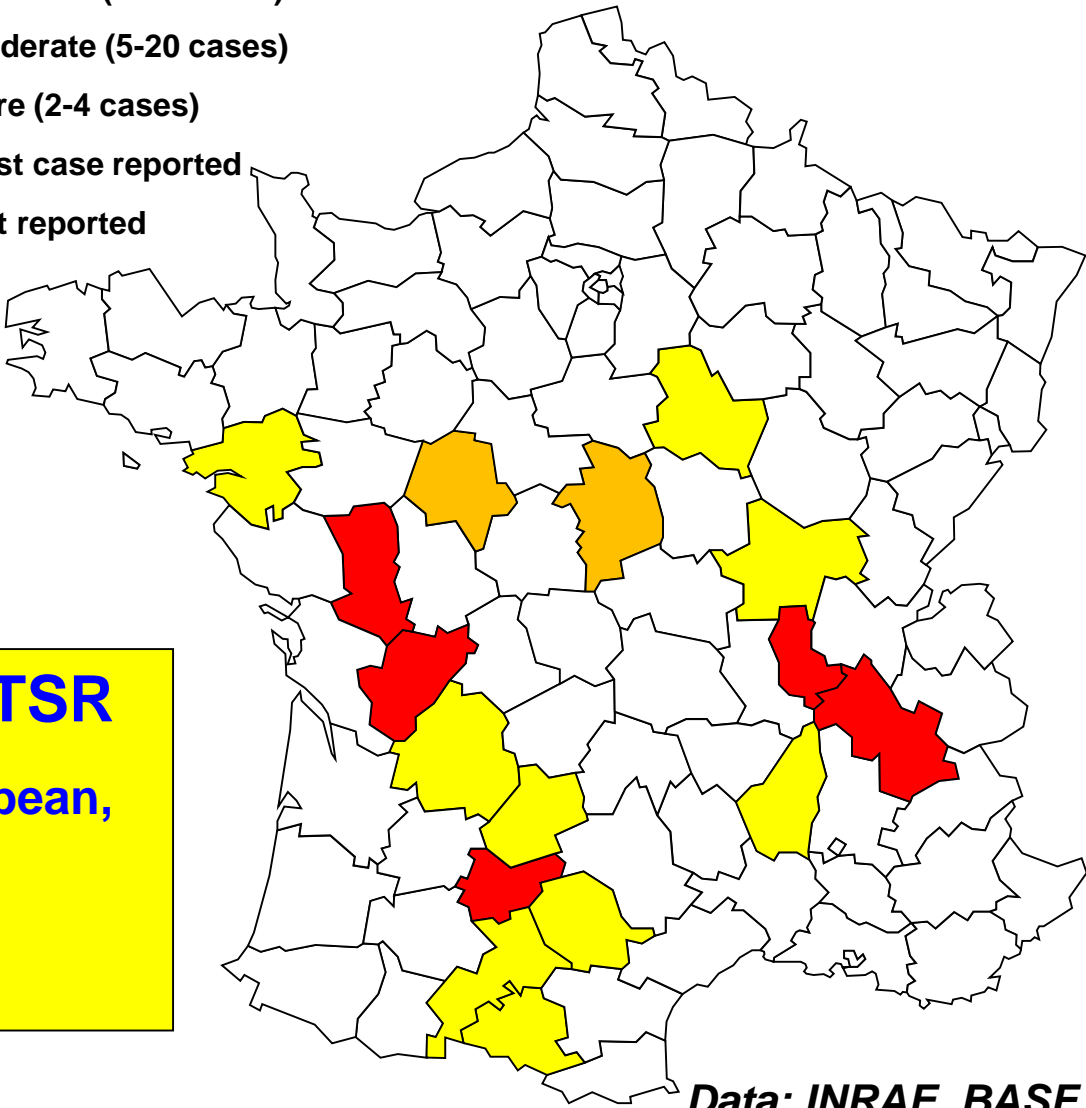
-  Common (> 20 cases)
-  Moderate (5-20 cases)
-  Rare (2-4 cases)
-  First case reported
-  Not reported

Ambrosia artemisiifolia

Resistance: **NTSR** & **TSR**

ALS-tolerant sunflower, soybean, maize

Actives concerned: imazamox, tribenuron,...

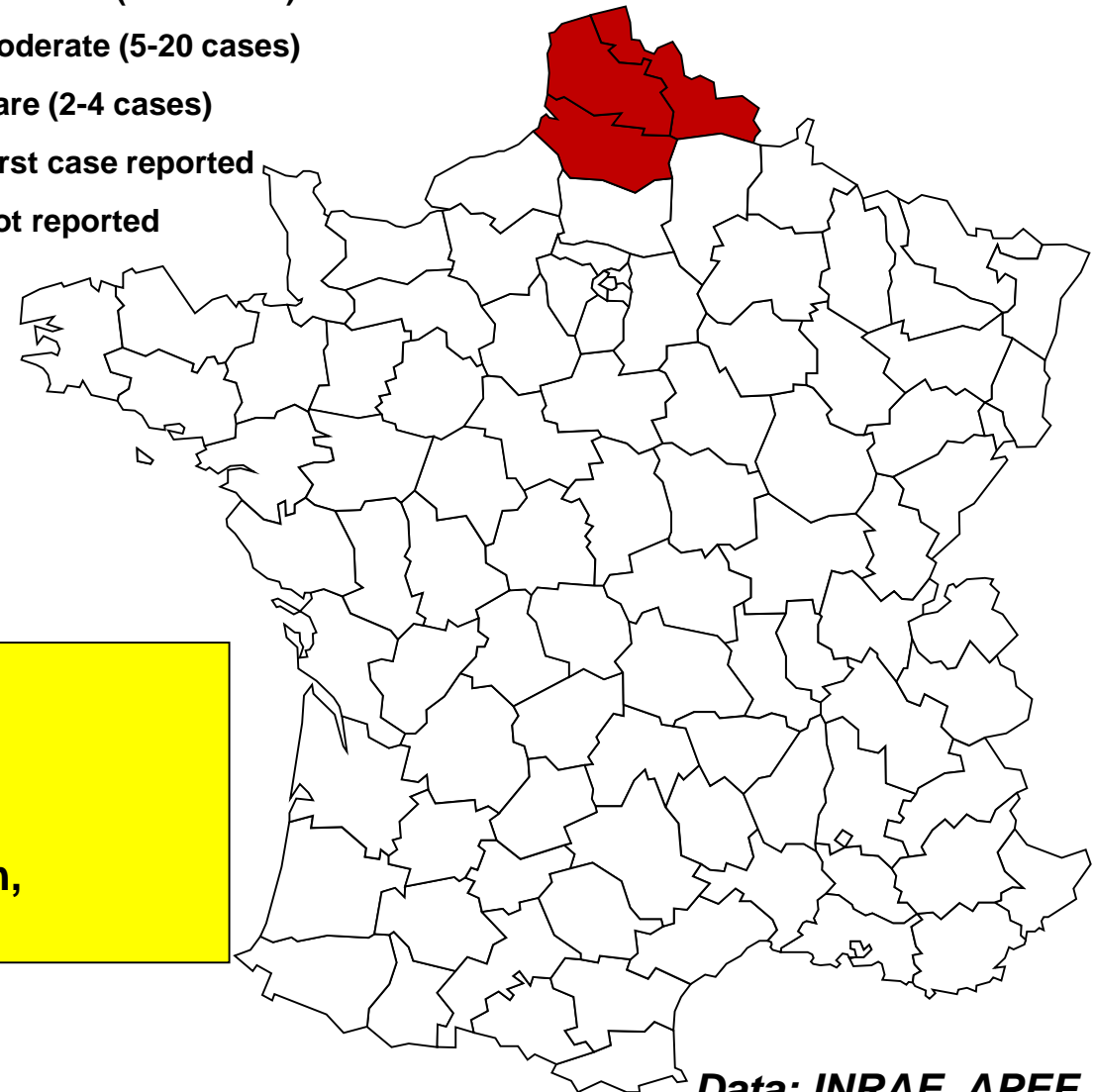


Data: INRAE, BASF, SBT



Sonchus asper

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: TSR

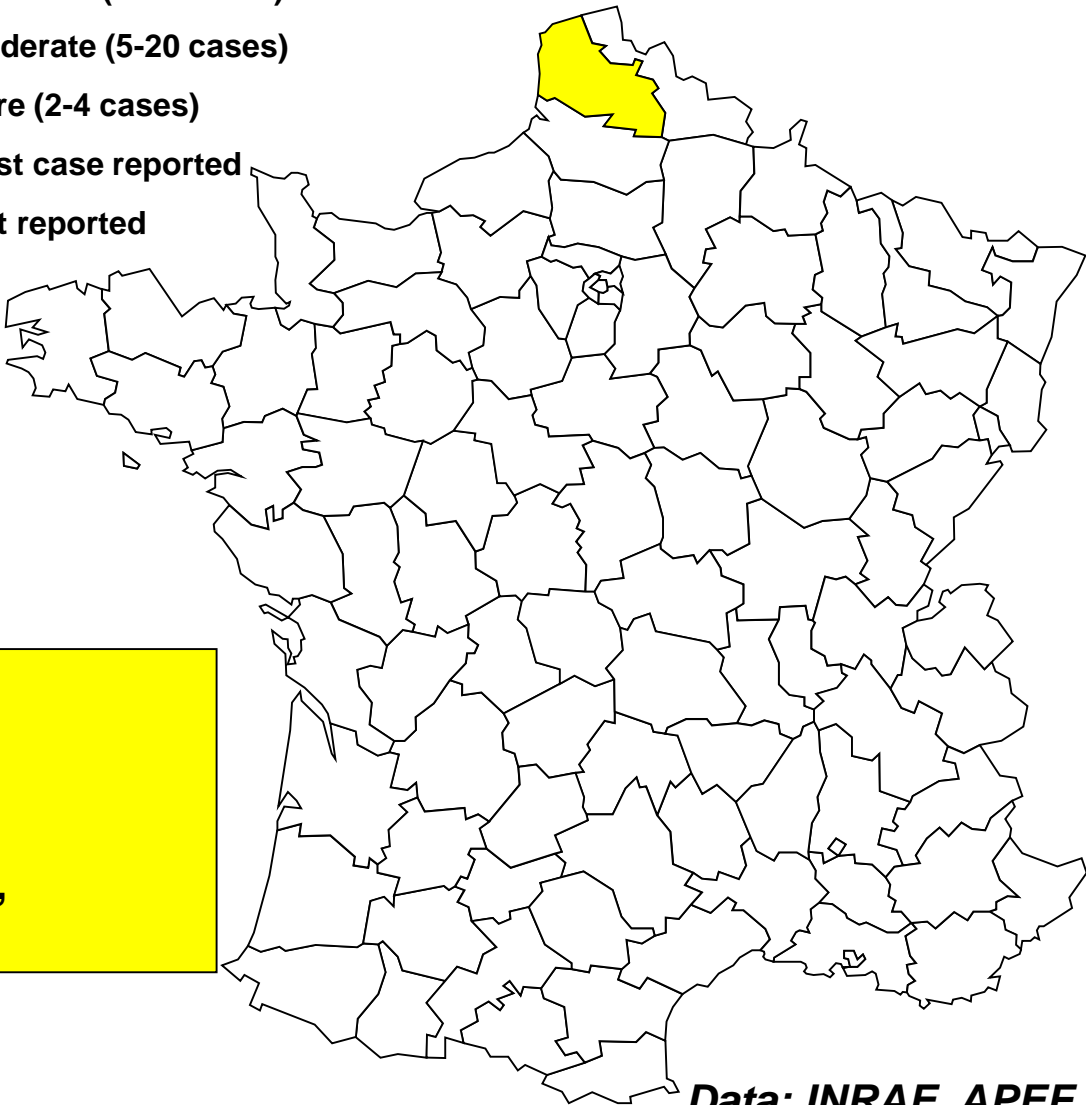
Chicory (major crops)

Actives concerned: rimsulfuron, triflusulfuron, penoxsulam, ...



Galinsoga parviflora

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR**

Chicory (major crops)

Actives concerned: rimsulfuron, triflusulfuron, penoxsulam, ...

Data: INRAE, APEF

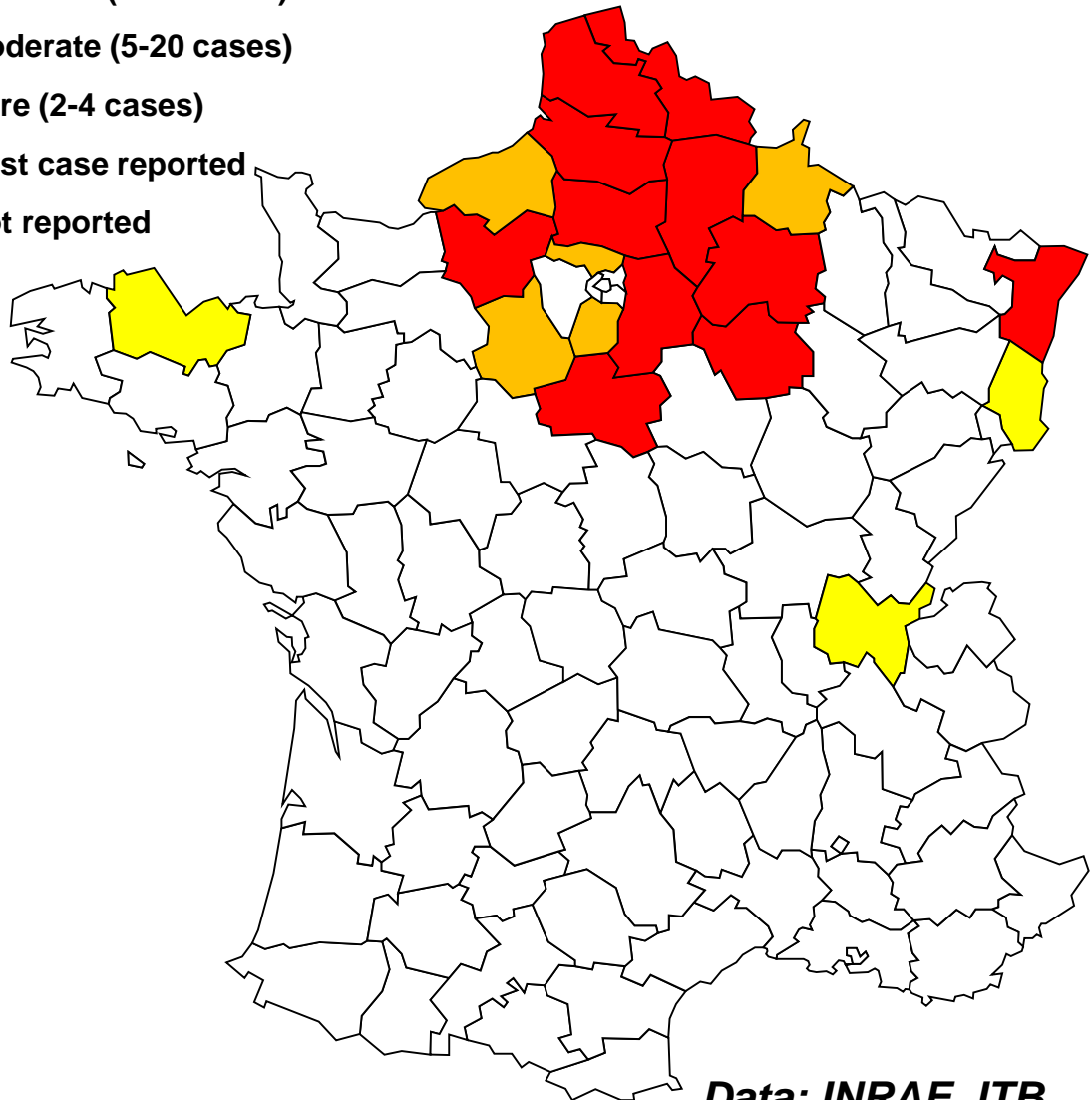
Broadleaves - Others

Resistance of common lambsquarters to photosystem II inhibitors (group B1)



Chenopodium album

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR**

Sugar beet, potatoe

Actives concerned:
metamitron, metribuzin...

Resistance of spear saltbush to photosystem II inhibitors (group B1)

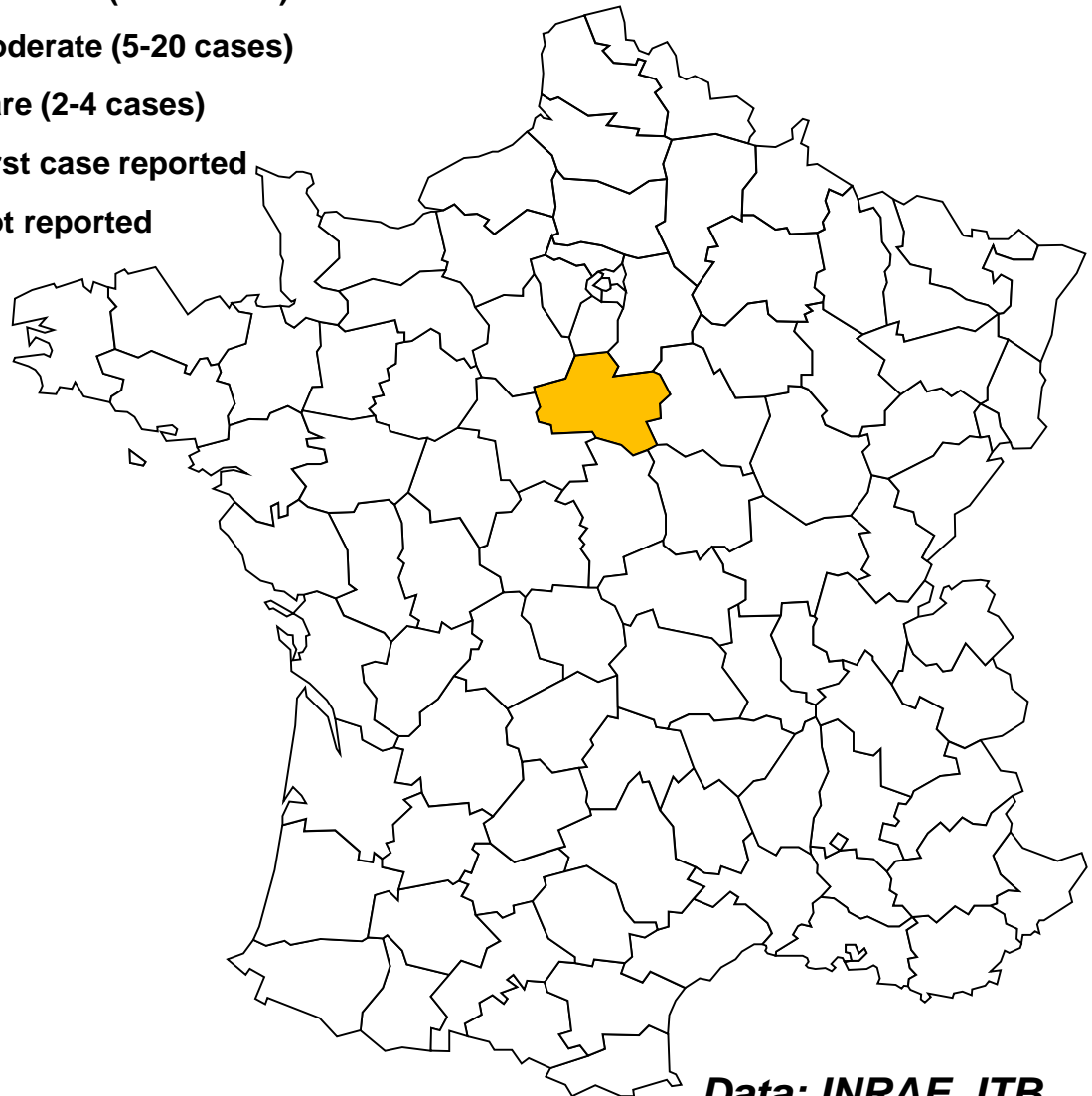
INRAE

Updated: June 2023



Atriplex patula

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: TSR

Sugar beet, potatoe

**Actives concerned:
metamitron, metribuzin...**

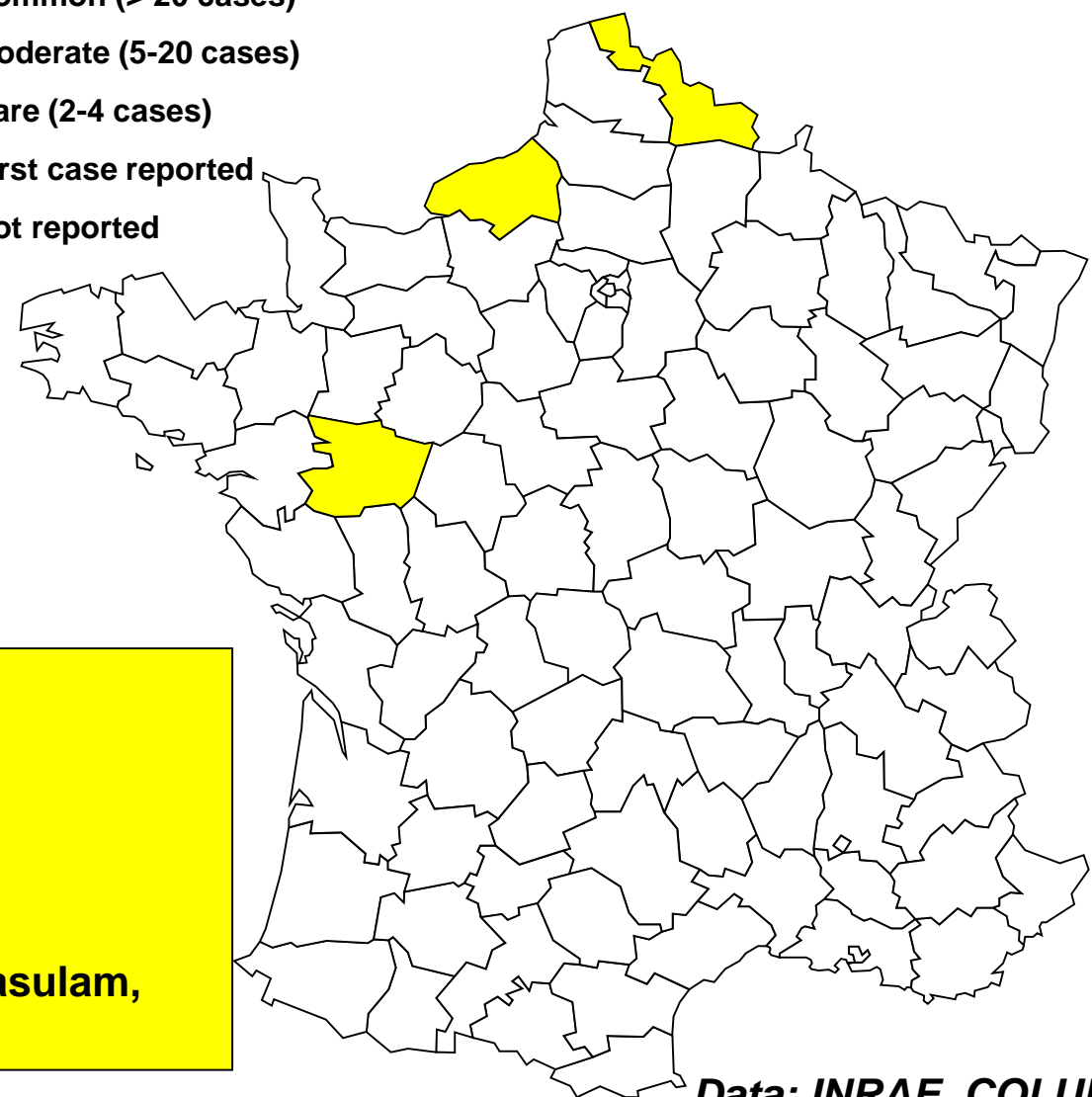
Data: INRAE, ITB

Resistance of chickweed to ALS inhibitors (group F2)



Stellaria media

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: TSR

Cereals

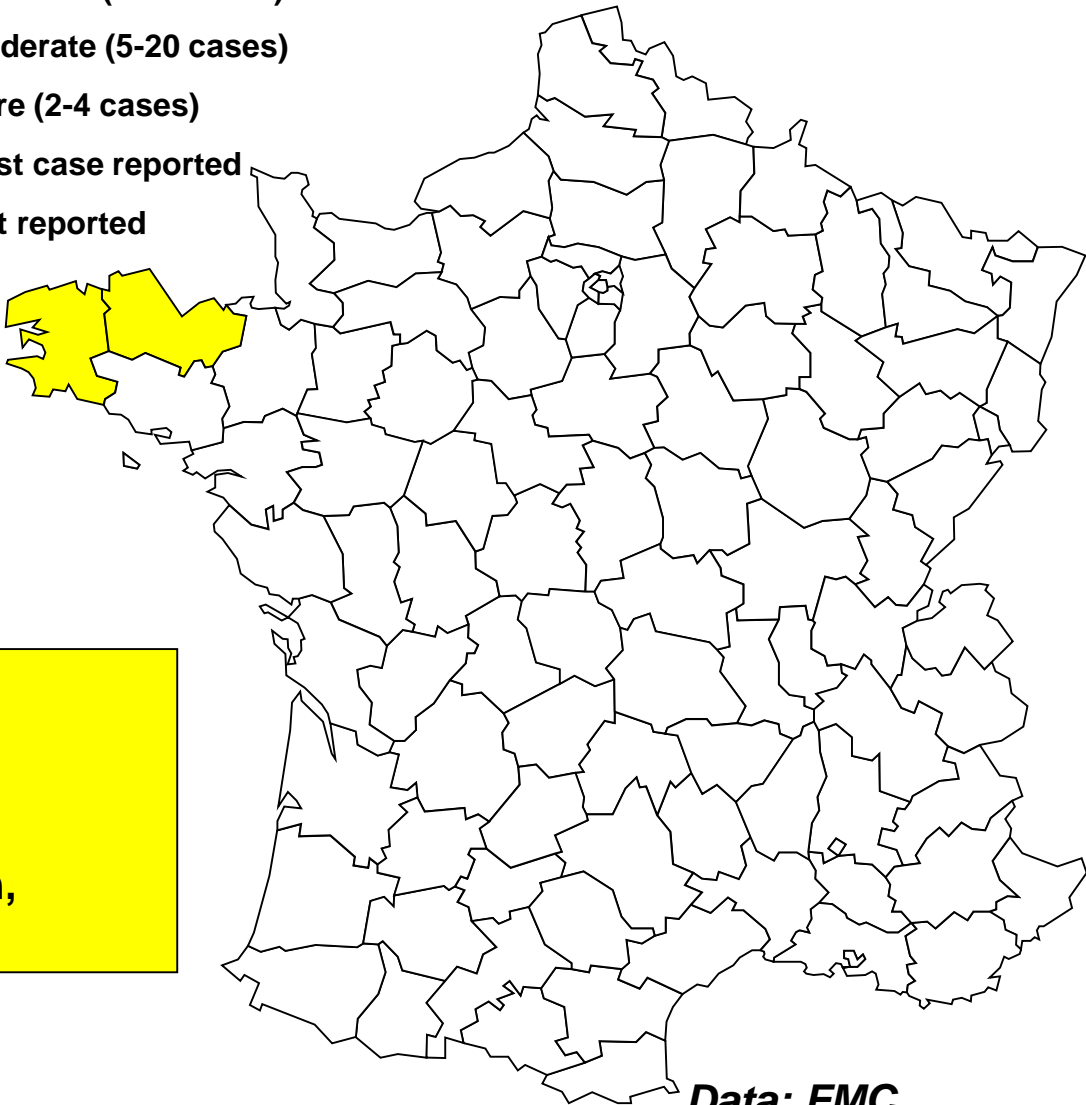
Actives concerned: tribenuron, metsulfuron, iodosulfuron + mesosulfuron, pyroxsulam, florasulam, imazamox...

Resistance of bitter dock to ALS inhibitors (group F2)



Rumex obtusifolius

- Common (> 20 cases)
- Moderate (5-20 cases)
- Rare (2-4 cases)
- First case reported
- Not reported



Resistance: **TSR**

Cereals

Actives concerned: metsulfuron, thifensulfuron, florasulam...

Data: FMC