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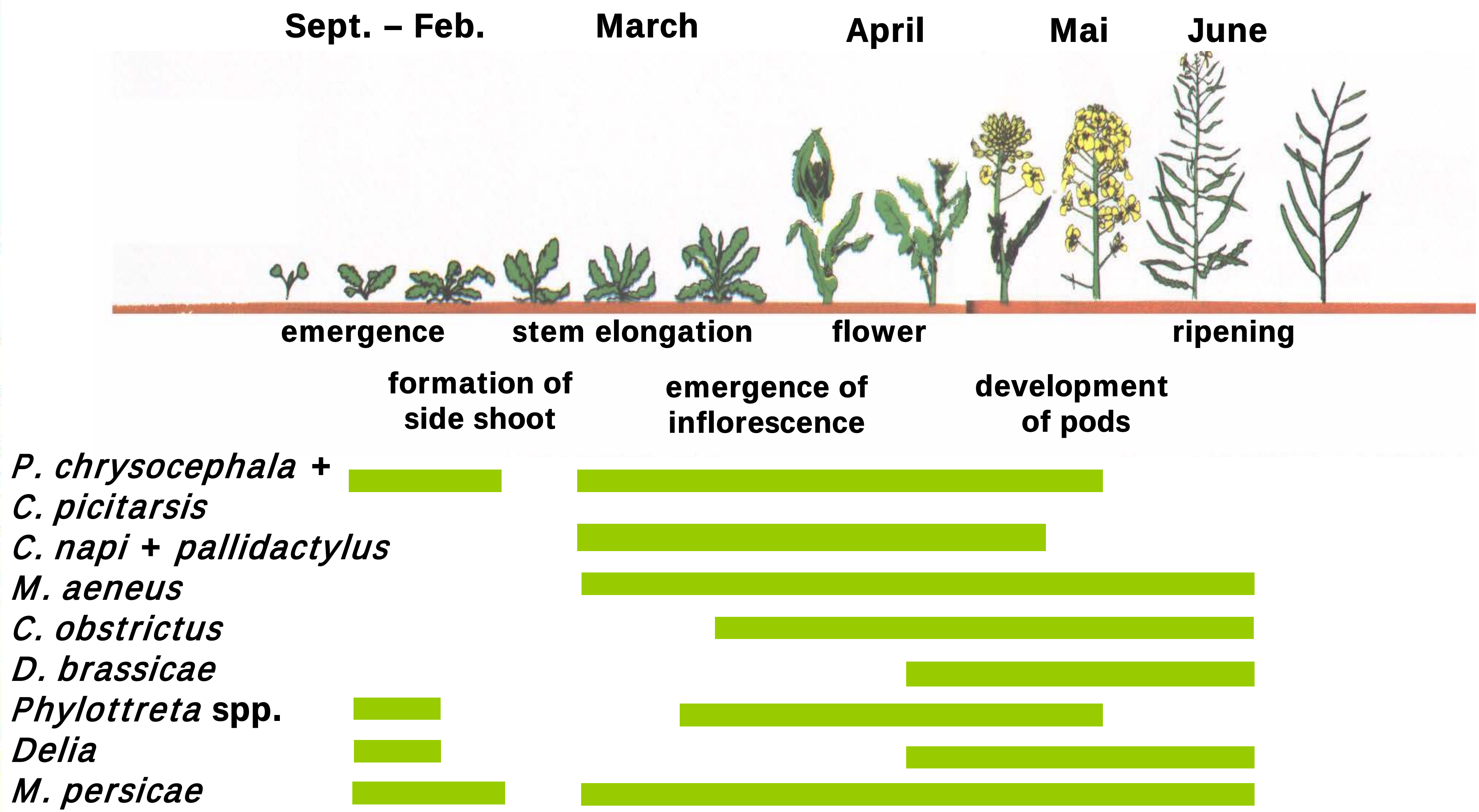
Federal Research Centre for Cultivated Plants

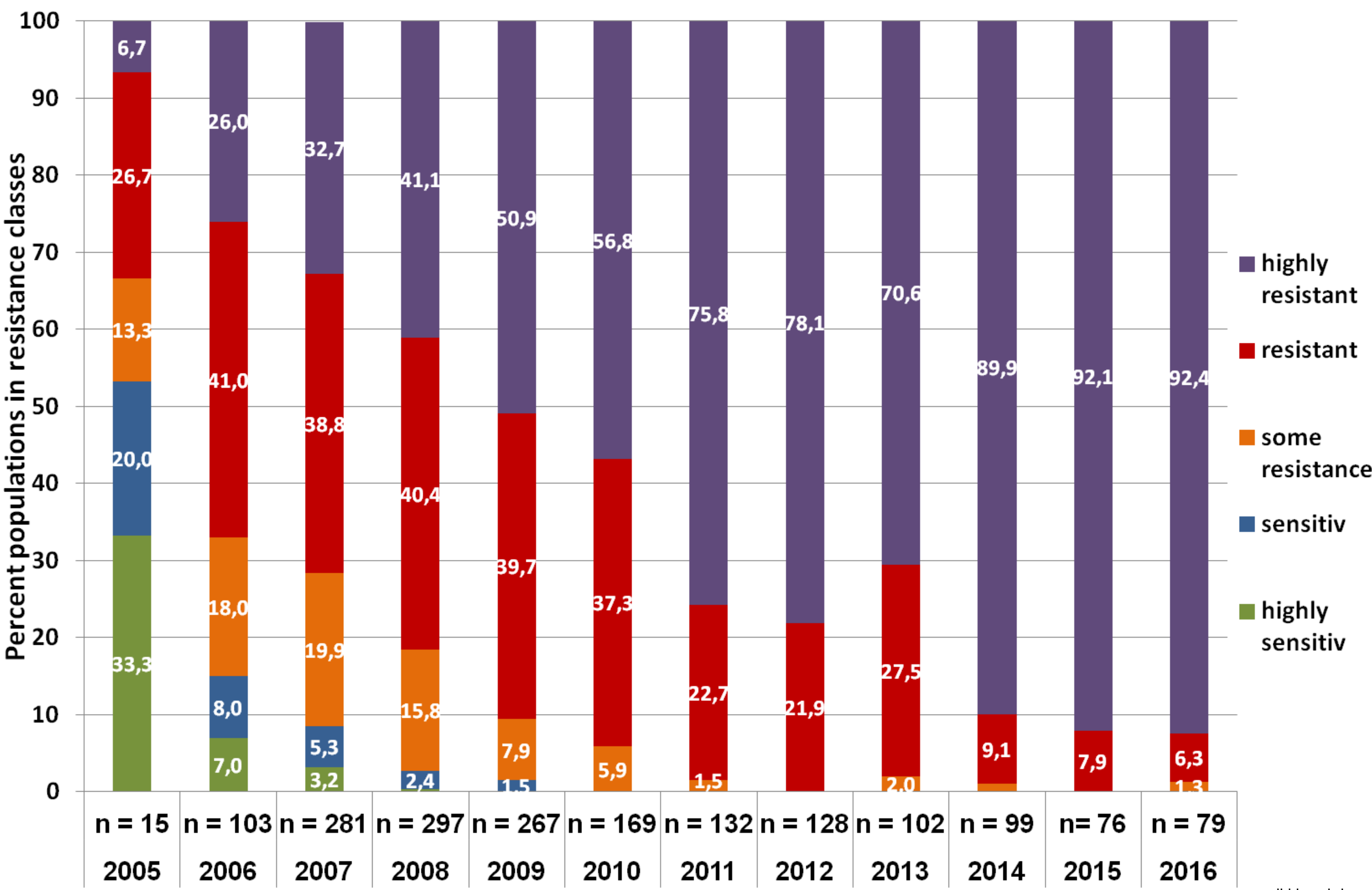
Pyrethroid resistance of insect pests in oilseed rape in Germany since 2005

U. Heimbach, M. Brandes

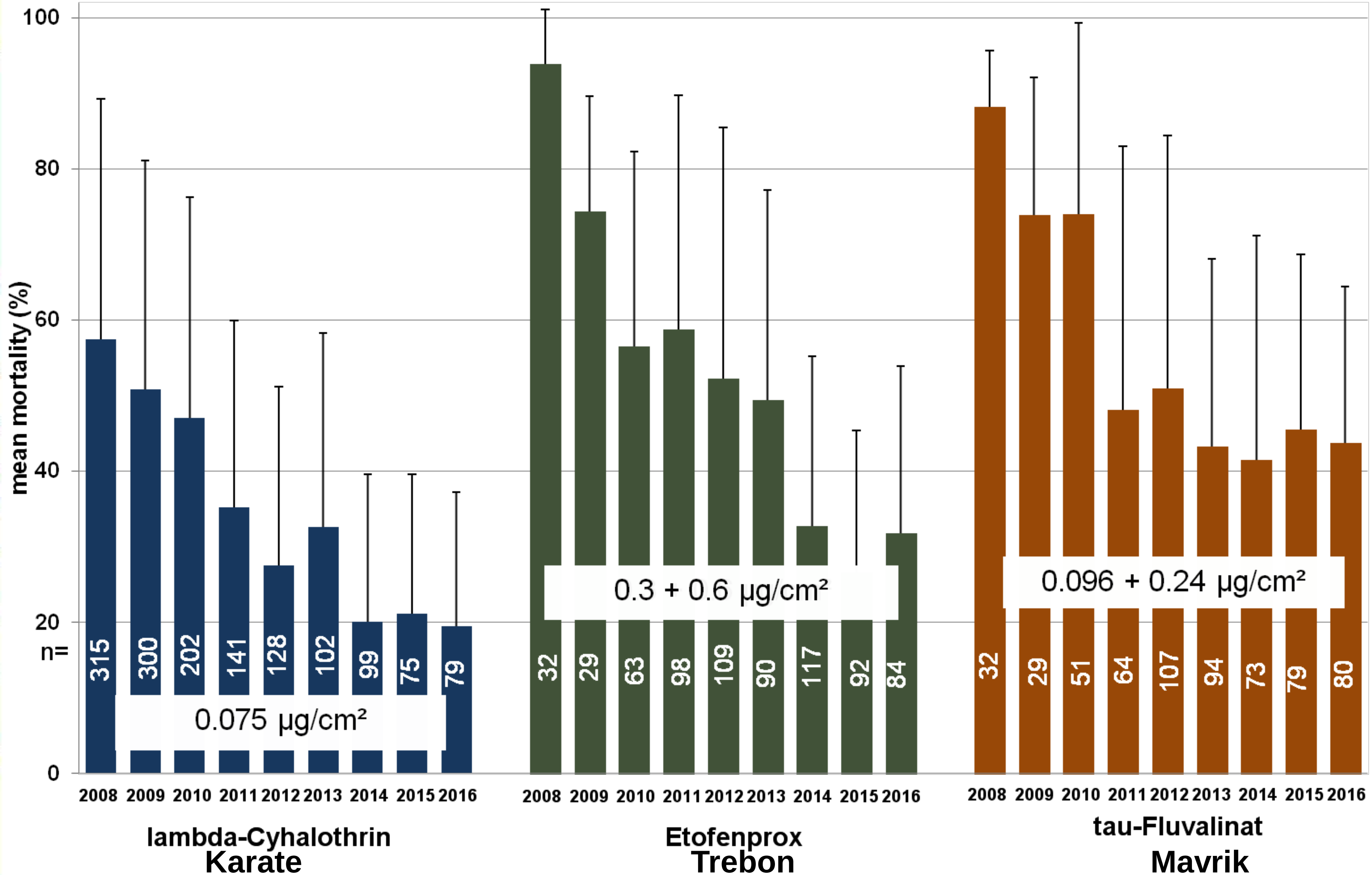
Exposition of insects in oilseed rape, adults and larvae
Resistance selection by each application



Meligethes resistance classes 2005 – 2016, lambda-cyhalothrin, biotest after 5 h



Meligethes mortality using different pyrethroids 2008 – 2016, biotest after 5 h

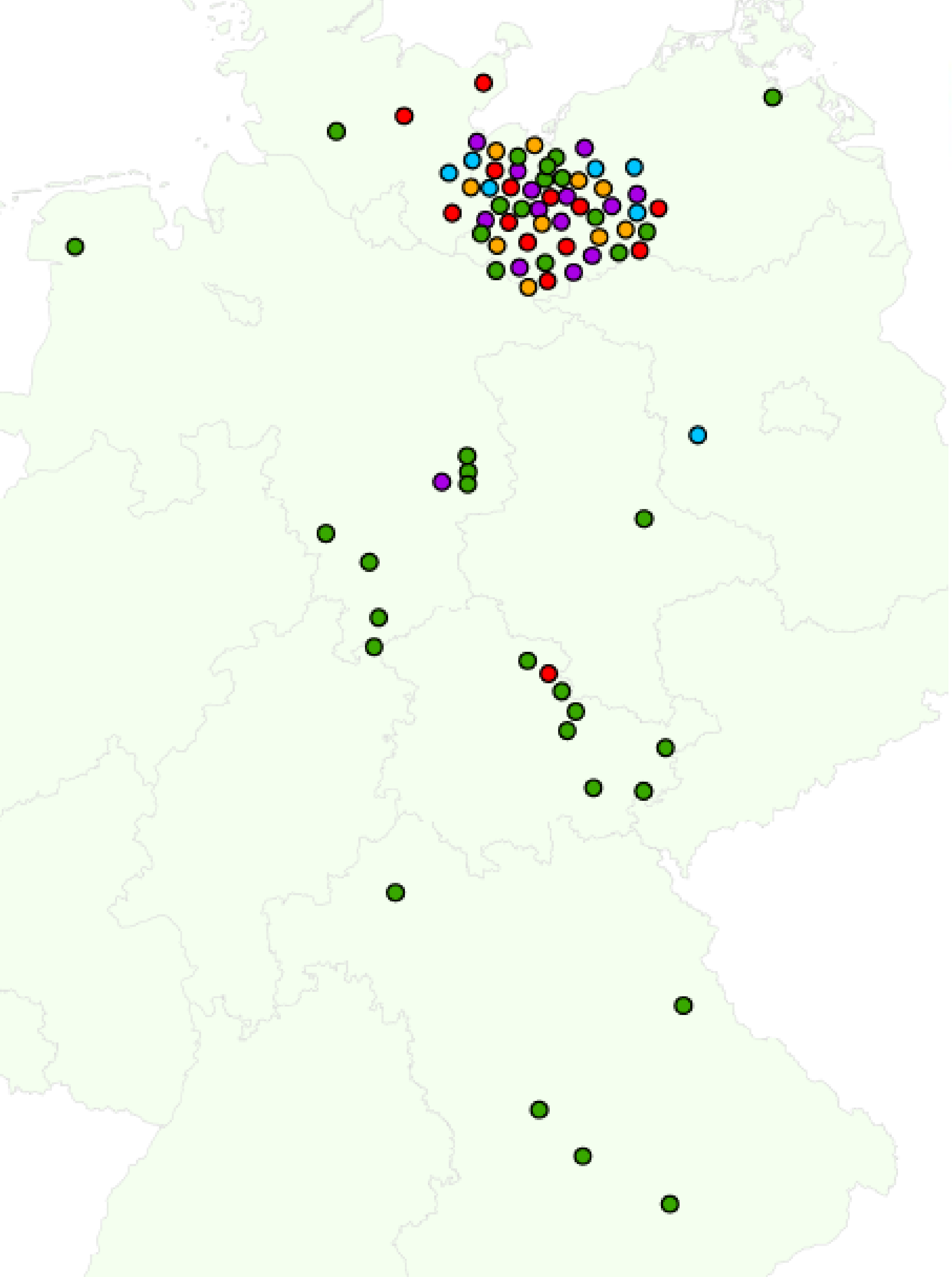


Pyrethroid resistance,
biotest after 5 h
Germany 2007-2016
Psylliodes chrysocephala

Resistance factor: 20.6

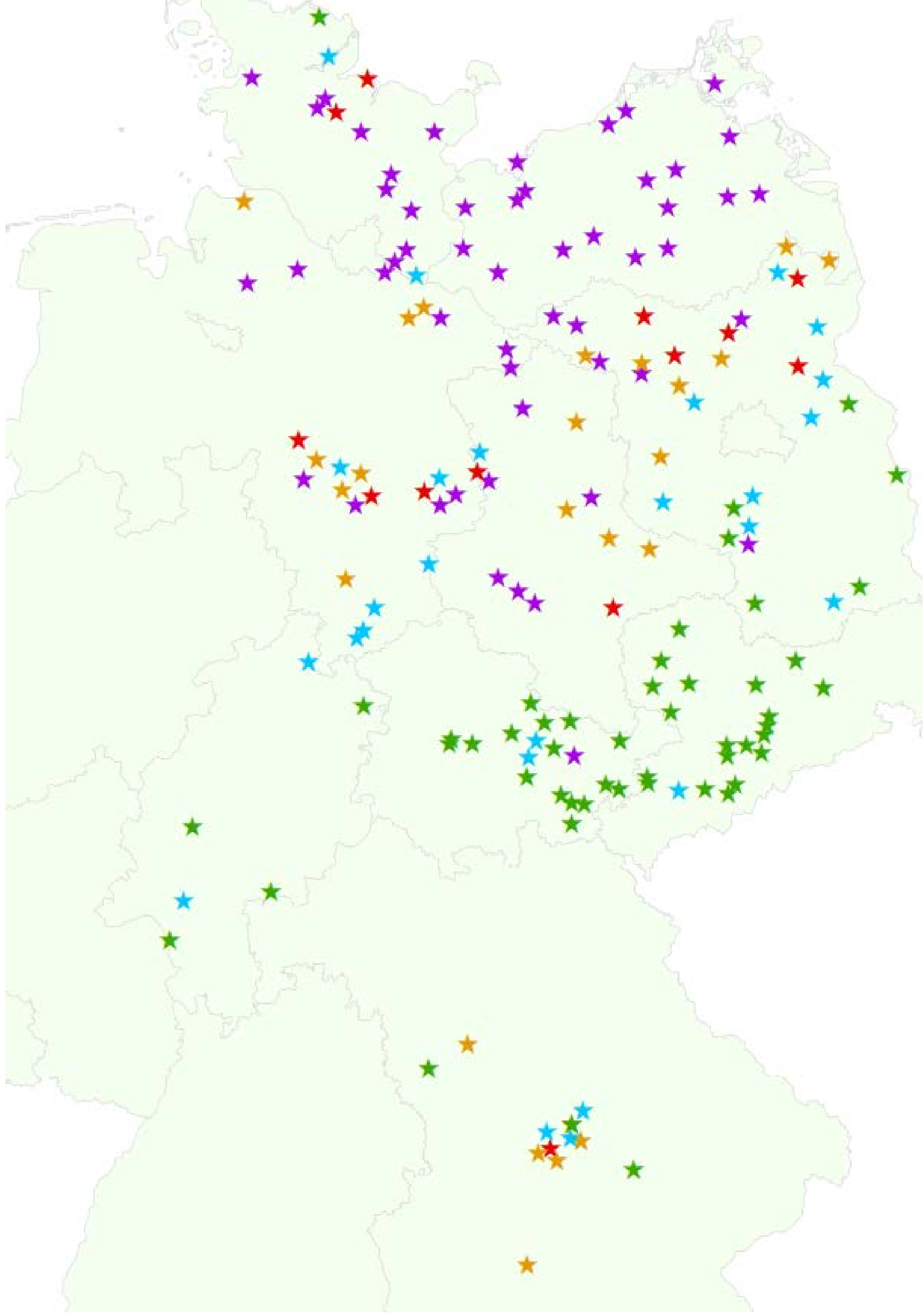
LD_{50} values of 10 most sens. to 10 most res. N = 70

- highly sensitive
- sensitive
- some resistance
- resistant
- highly resistant

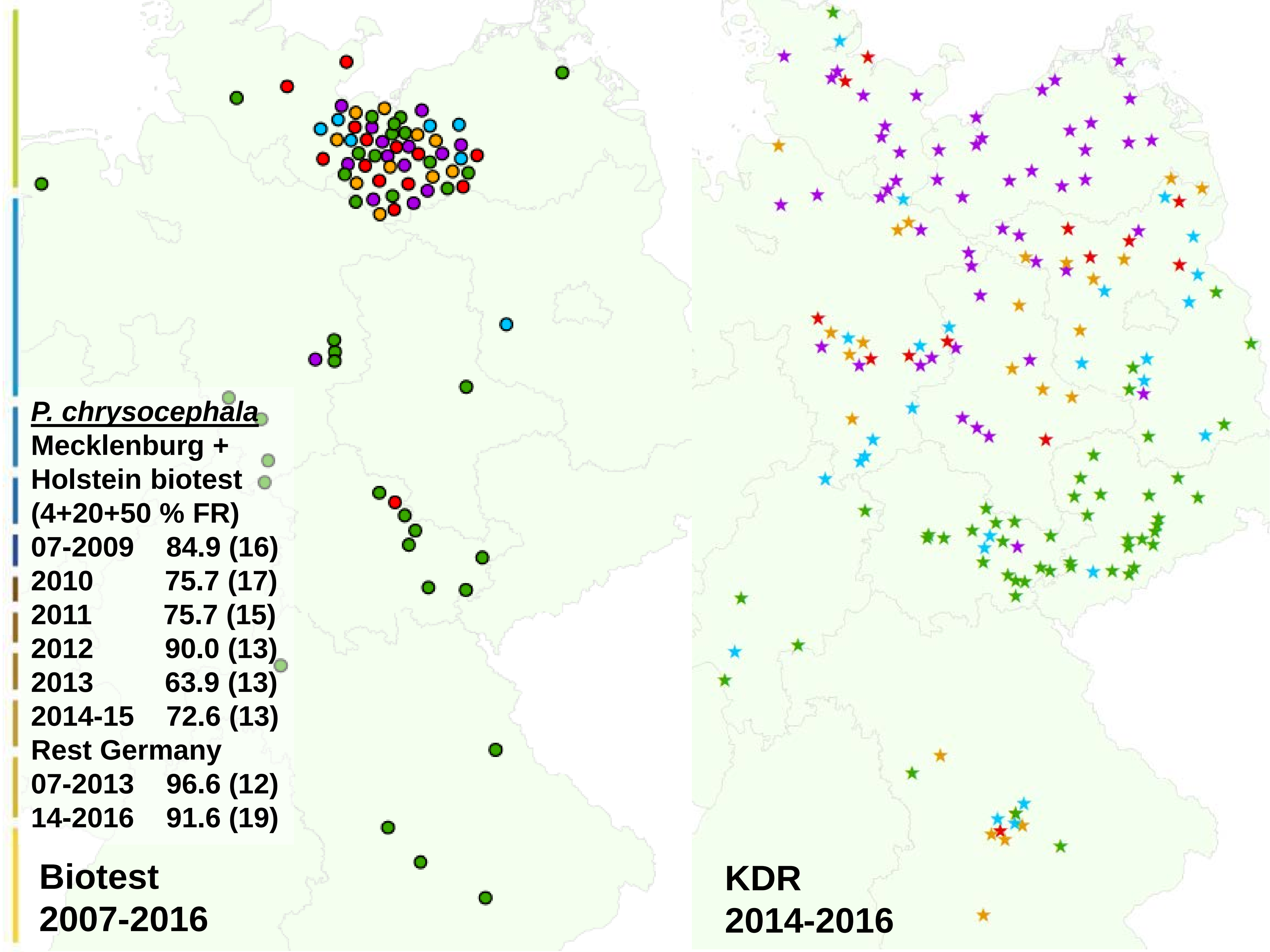


Pyrethroid resistance, **KDR** Germany 2014-2016 ***Psylliodes chrysocephala***

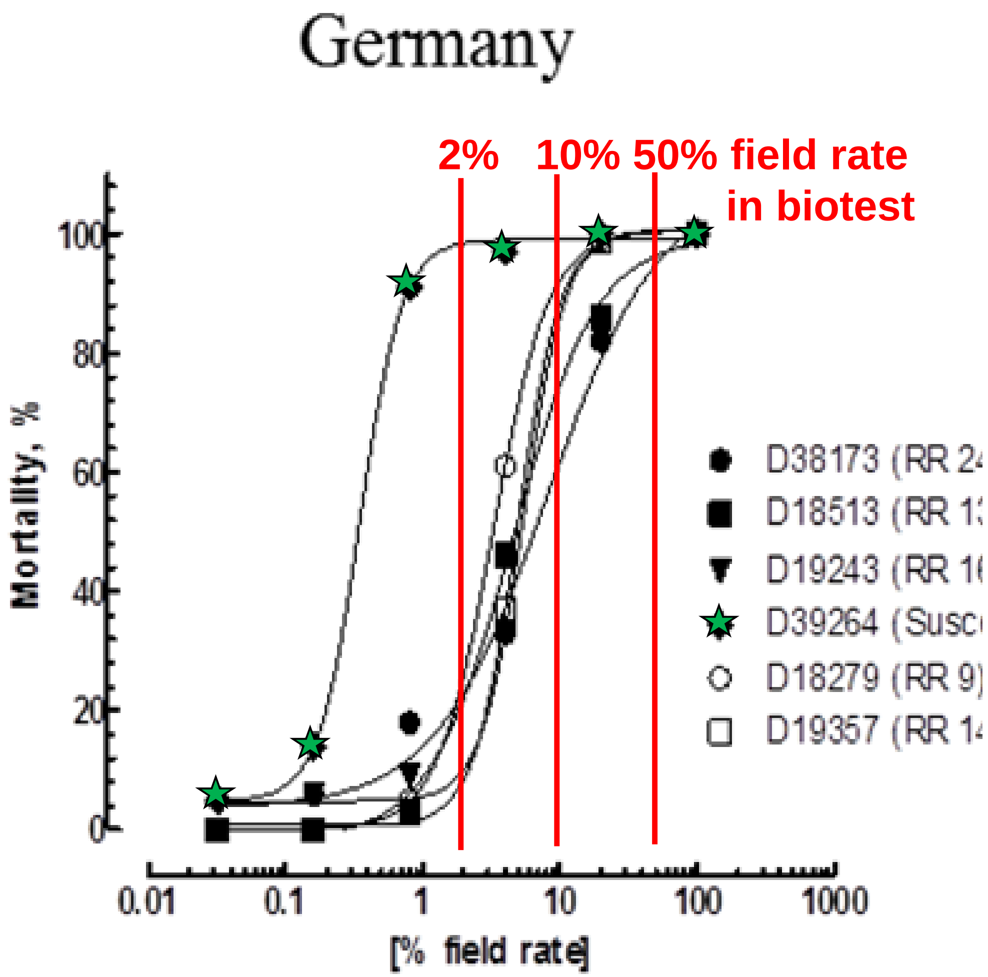
- no KDR
- some KDR
- medium KDR
- high KDR
- full KDR

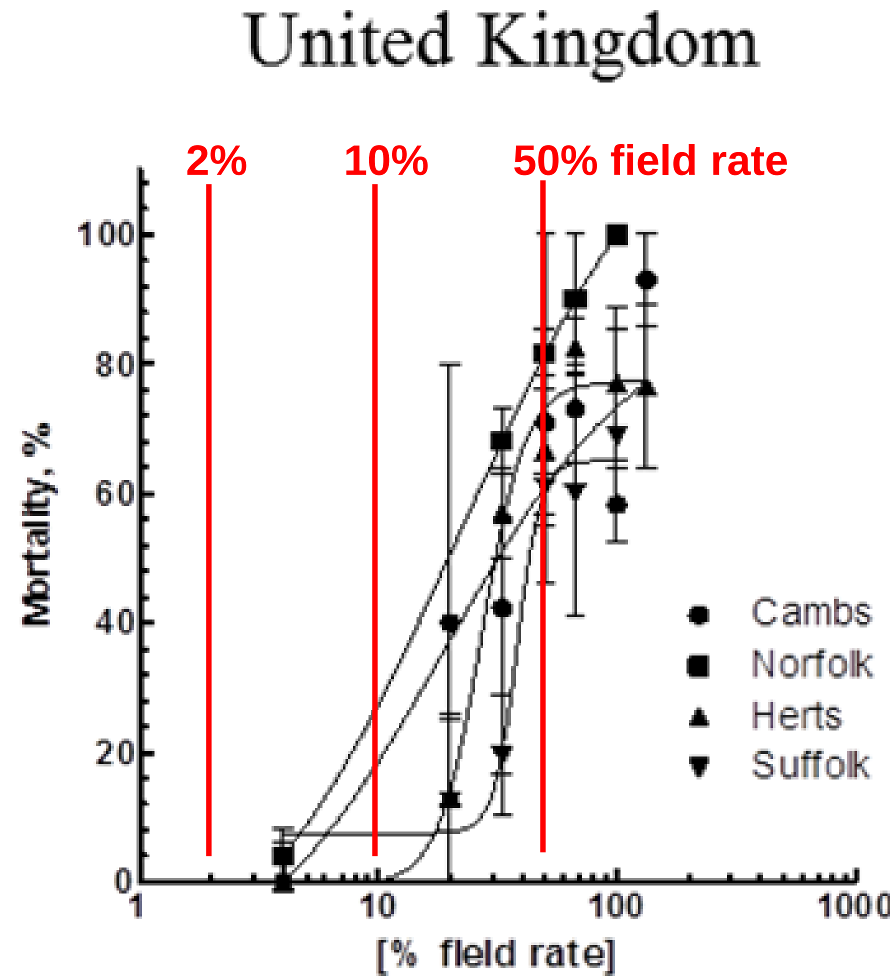


KDR analysis by R. Nauen (BCS), J. Elias (Syngenta), T. Thieme (BTL)


P. chrysocephala
Mecklenburg +
Holstein biotest
(4+20+50 % FR)
07-2009 84.9 (16)
2010 75.7 (17)
2011 75.7 (15)
2012 90.0 (13)
2013 63.9 (13)
2014-15 72.6 (13)
Rest Germany
07-2013 96.6 (12)
14-2016 91.6 (19)
Biotest
2007-2016
KDR
2014-2016

Effects on *P. chrysocephala* in biotests, additional resistance mechanism in UK





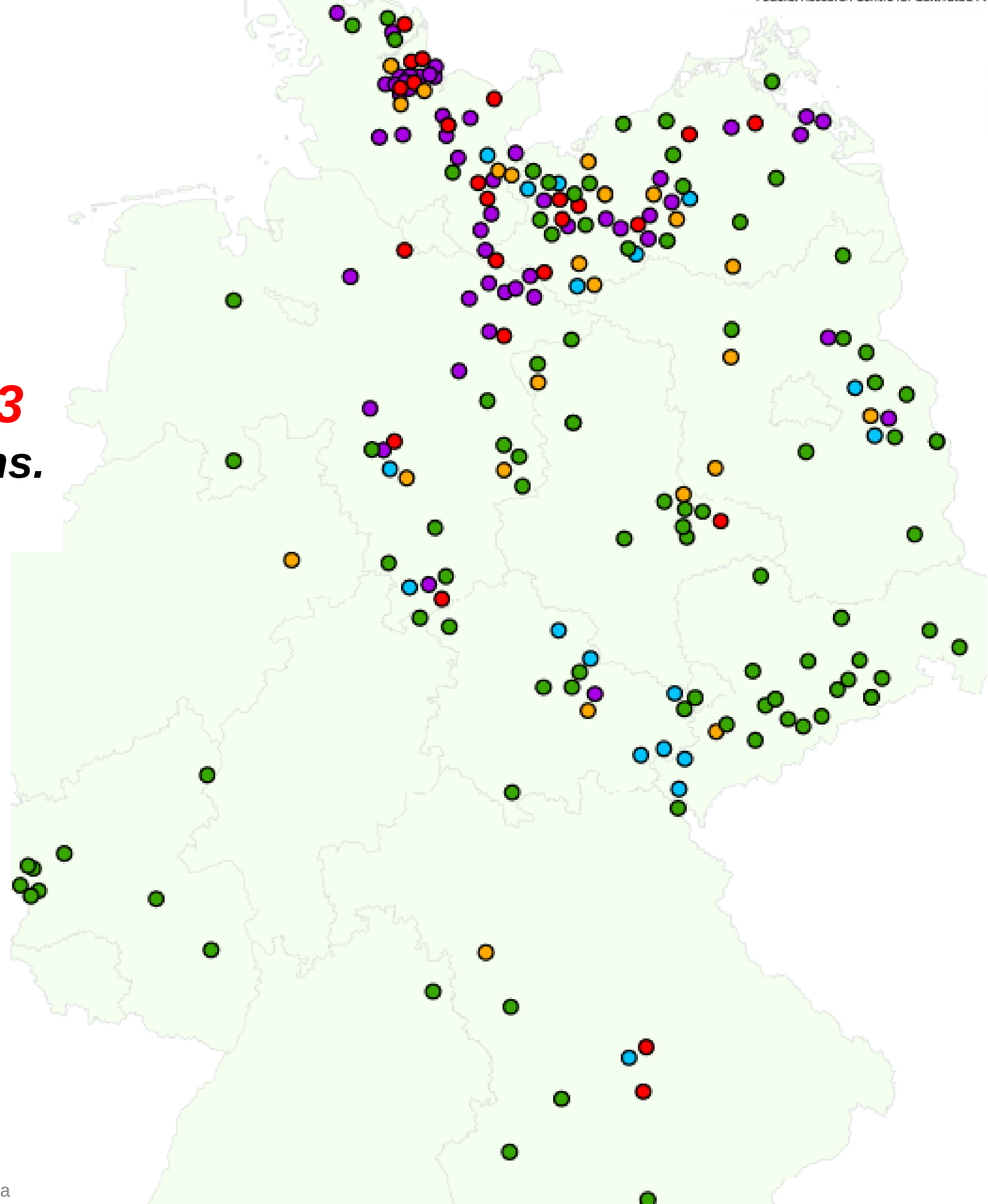
adapted to: Hojland, Nauen, Foster, Williamson, Kristensen. PLOS ONE, Dez. 2015, DOI:10.1271/journal.pone.0146045

Pyrethroid resistance,
biotest after 5 h
Germany 2005-2016
Ceutorhynchus obstrictus

Resistance factor: 67.3

LD_{50} values of 10 most sens. to 10 most res. N = 98

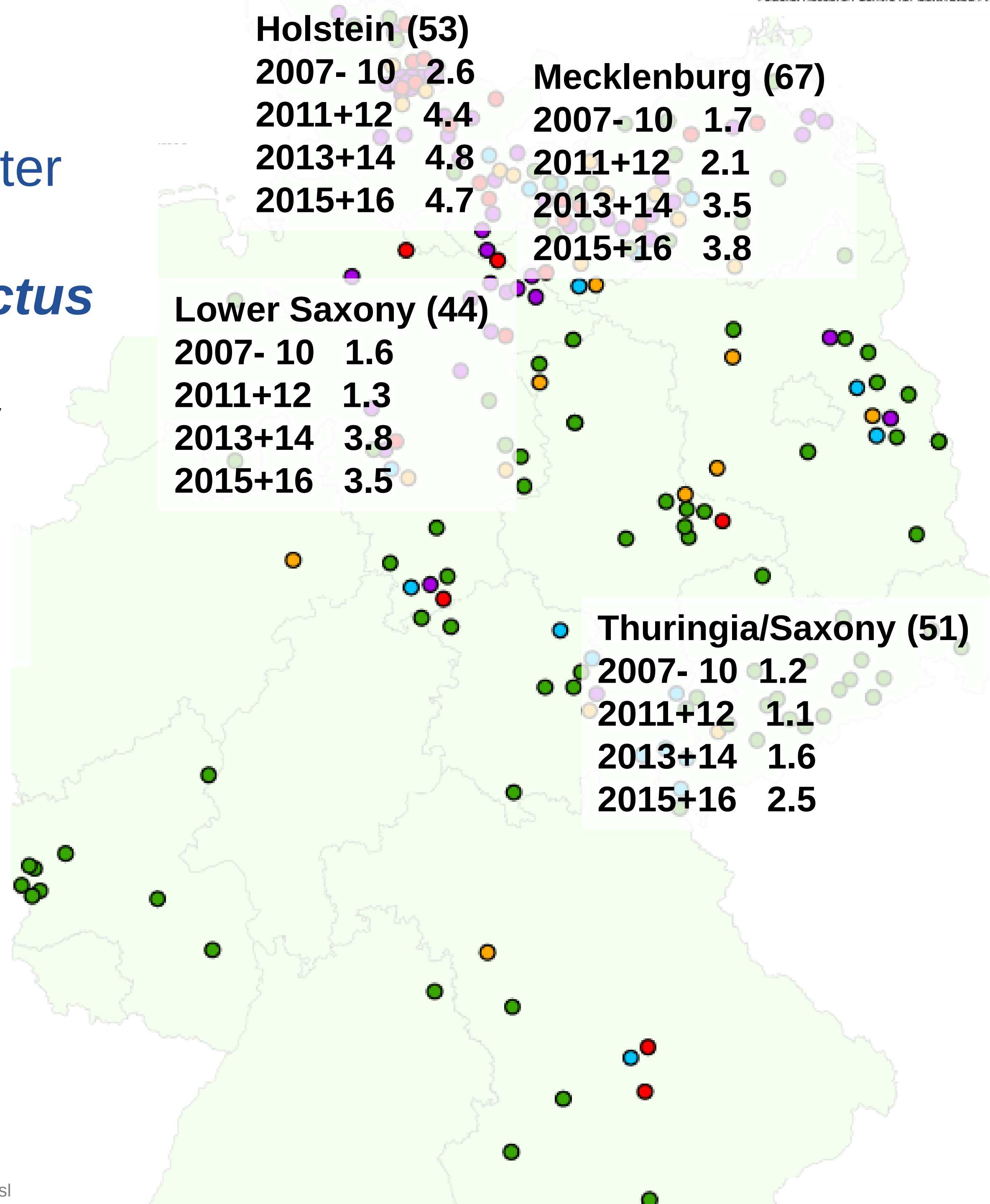
- highly sensitive
- sensitive
- some resistance
- resistant
- highly resistant



Resistance class development, **biotest** after 5 h, 2005 to 2016 ***Ceutorhynchus obstrictus***

Mean class, all Germany

2007-10 1.6 N = 56
2011+12 2.3 N = 111
2013+14 3.1 N = 55
2015+16 3.7 N = 48



- highly sensitive
- sensitive
- some resistance
- resistant
- highly resistant

Ceutorhynchus obstrictus populations in biotests exposed to etofenprox and lambda-cyhalothrin

resistance class lambda-cyhalothrin	mean % effect	sd	mean % effect	sd	N populations
	etofenprox		lambda-cyhaltohrin		
highly sensitive (1)	**96.9**	**5.4**	**95.7**	**5.7**	**22**
sensitive + some resistance (2+3)	**90.6**	**9.2**	**76.2**	**14.2**	**10**
resistance + highly resistant (4+5)	**52.5**	**28.4**	**53.9**	**21.0**	**21**

Ceutorhynchus obstrictus populations in biotests exposed to tau-fluvalinate and lambda-cyhalothrin

resistance class lambda-cyhalothrin	mean % effect	sd	mean % effect	sd	N populations
	tau-fluvalinate		lambda-cyhaltohrin		
highly sensitive (1)	**71.0**	**24.5**	**94.2**	**6.8**	**18**
sensitive + some resistance (2+3)	**74.1**	**27.8**	**68.4**	**14.6**	**12**
resistance + highly resistant (4+5)	**44.8**	**23.2**	**55.7**	**22.0**	**24**

Ceutorhynchus pallidactylus and *C. napi* populations exposed to lambda-cyhalothrin in biotests, 5 h assessment

C. pallidactylus

20% fieldrate N= 150: 35.3% no effect

50% fieldrate N= 139: 4.3% no effect

100% fieldrate N= 139: 0% no effect

LD_{50} (N= 58)	10 most sens.	10 most res.	Res. factor
	0.00097	0.01262	**13.08**

C. napi

20% fieldrate 119: 6.7% no effect

50% fieldrate 119: 0% no effect

LD_{50} (N= 20)	5 most sens.	5 most res.	Res. factor
	0.00071	0.00451	**6.33**

Ceutorhynchus pallidactylus populations exposed to lambda-cyhalothrin in biotests, 5 h assessment

Collection period	N populations	% effect at 4+20 % FR
2005 – 2016	137	73.3
2005 – 2007	44	82.2
2008 – 2010	34	61.2
2011 – 2012	32	83.8
2013 – 2016	27	61.9

Insect pests in oilseed rape in DE in autumn

Insect pest	Chemical control in DE	Resistance data	Pop tested
Delia brassicae	-	nn	-
Psylliodes	Pyrethroids	KDR present; +	>100
Phyllotreta	Pyrethroids	no resistance in DE	about 10
C. picitarsis	Pyrethroids	1 pop. with KDR; +	<10
Athalia rosae	Pyrethroids	nn	-
Phytomyza rufipes	-	nn	-
Myzus persicae	Pyrethroids	KDR + metabolism; ++	>100 by others

Insect pests in oilseed rape in DE in spring

Insect pest	Chemical control in DE	Resistance data	Pop tested
C. pallidactylus	Pyrethroids	No resistance	>100
C. napi	Pyretrhoids	No resistance	>100
M. aeneus	Pyrethroids, Neonic, pymetrozin indoxacarb	Metabolic resistance + KDR, ++	>1000
C. obstrictus	Pyrethroids Neonics	KDR Resistance + metabolic??, ++	>100
D. brassicae	Pyrethroids Neonics	No resistance	about 10

Summary

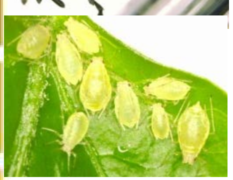
Resistant oilseed rape pests

P. chrysocephala: kdr distributed (in UK additional metabolic resistance, control problems in the field)

C. picitarsis: kdr in Baden-Wuerttemberg in autumn 2015 (in France distributed, problems in the field)

M. aeneus: metabolic resistance (widely distributed throughout Europe, problems in the field)

C. obstrictus: kdr distributed (partly problems in the field)



M. persicae: kdr, metabolic, MACE (worldwide, almost all active ingredients affected, problems in the field)

Summary

Resistance has developed and spread with increasing intensity in the last years.

Insecticides are to competitive (cheap) to allow for other IPM and even to follow threshold values.

Less insecticidal actives will be available in future because of environmental concerns and politics.

There is an urgent need for non chemical control methods including resistant crops.

Oilseed rape is one of the most sensitive arable crops for insect pests and cropping area will be reduced if no control options are available.

Thank you for the attention!

Acknowledgement:

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