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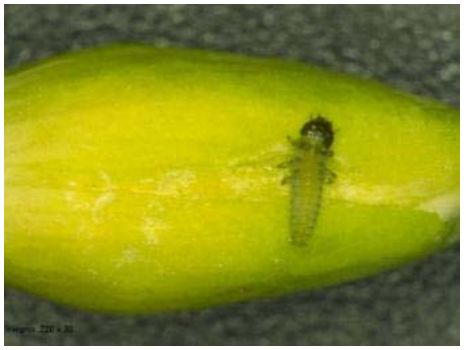

Effects of insecticide applications on population development of pollen beetle in field studies

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Introduction

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Neonicotinoid Biscaya (a.i. thiacloprid, 72 g ha^{-1})

Pyrethroid Karate Zeon (a.i. lambda-cyhalothrin, 7.5 g ha^{-1})

Pyrethroid Mavrik (a.i. tau-fluvalinate, 48 g ha^{-1})

Effects on:

- overwintered pollen beetles 
- bud infestation with eggs 
- L1- and L2-larvae of pollen beetle 
- parasitism rates of pollen beetle larvae by the parasitoids *Tersilochus heterocerus* and *Phradis* spp.
- new generation of pollen beetles 

Materials and Methods

l 2013-2015,
es

or to catch emerging new
PB

to collect dropping larvae

unting and collecting PB

s 2013
control
BBCH 53
BBCH 60
BBCH 65
n at BBCH 53,60+65

24 m

Overwintered PB 2013-15

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Pollen beetles per main stem after 1st application at BBCH 53/55

Year	Treatment	1 DAA mean ± SE	3 DAA mean ± SE	7 DAA mean ± SE
2013 BBCH 53	**Control**	**2.7 ± 0.2 A**	**9.5 ± 0.5 A**	**5.6 ± 0.2 A**
	Biscaya BBCH 53	1.4 ± 0.1 B	6.4 ± 0.4 A	5.0 ± 0.3 A
	Karate Zeon	2.8 ± 0.2 A	9.0 ± 0.4 A	5.3 ± 0.2 A
2014 BBCH 55	**Control**	**1.3 ± 0.1 A**	**0.9 ± 0.1 A**	**0.5 ± 0.1 A**
	Biscaya BBCH 55	0.4 ± 0 B	0.4 ± 0.1 B	0.4 ± 0.1 A
	Mavrik	0.2 ± 0 B	0.4 ± 0 B	0.5 ± 0.1 A
2015 BBCH 55	**Control**	**1.5 ± 0.1 A**	**1.3 ± 0.1 A**	**1.1 ± 0.1 A**
	Biscaya BBCH 55	0.5 ± 0.1 B	0.3 ± 0 B	0.3 ± 0.1 B
	Mavrik	0.1 ± 0 C	0.1 ± 0 C	0.5 ± 0 B

(GLMM, $p \leq 0.05$)

Similar results after 2nd/3rd application at BBCH 60/62 and 65

Bud infestation (main stem)

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Egg infested buds > 2 mm in field trials: **1-2, 7-9 and 14 DAA** at BBCH 53/55

Year/ Application	Treatment	1-2 DAA mean (%) ± SE	7-9 DAA mean (%) ± SE	14 DAA mean (%) ± SE
2013 BBCH 53	**Control**	**21.2 ± 2.3 AB**	**41.5 ± 2.4 A**	-
	Biscaya	20.0 ± 2.4 A	17.8 ± 2.0 B	-
	Karate Zeon	31.0 ± 2.8 B	43.7 ± 3.8 A	-
2014 BBCH 55	**Control**	**0.7 ± 0.2 A**	**5.1 ± 0.8 A**	**3.9 ± 0.7 A**
	Biscaya	3.4 ± 1.1 A	1.0 ± 0.2 B	0.6 ± 0.3 B
	Mavrik	2.6 ± 1.3 A	1.8 ± 0.6 B	1.9 ± 1.4 AB
2015 BBCH 55	**Control**	**8.3 ± 1.2 A**	**12.7 ± 4.4 A**	**20.0 ± 2.2 A**
	Biscaya	8.1 ± 1.7 A	10.0 ± 1.9 A	3.6 ± 0.5 B
	Mavrik	7.0 ± 1.8 A	7.4 ± 2.1 A	5.8 ± 1.0 B

(GLMM, $p \leq 0.05$)

Similar results for the side shoots

Greenhouse trials

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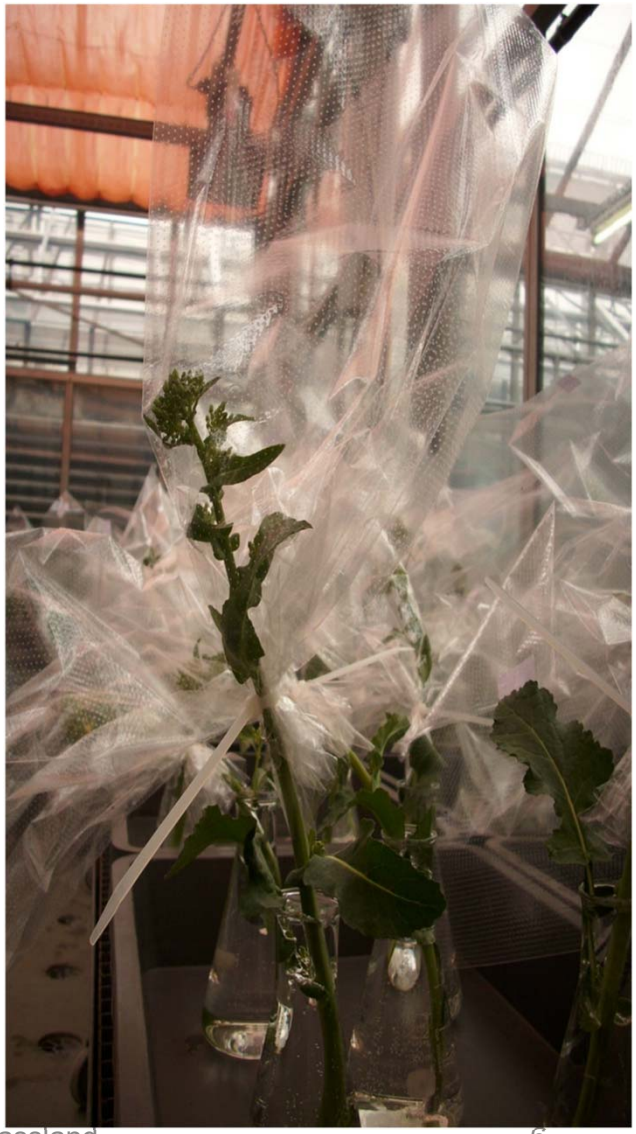
- Trials with 8 different treatments

Plants:	**PB:**
untreated	untreated
Biscaya treated	Biscaya treated
Mavrik treated	Mavrik treated

- 10 plants/treatment
- 10 PB/plant caged with plastic bags
- After 3-4 d assessment of vitality and end of the trial



Greenhouse trials 2013-14

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Egg infested buds > 2 mm (main stem) in greenhouse trials

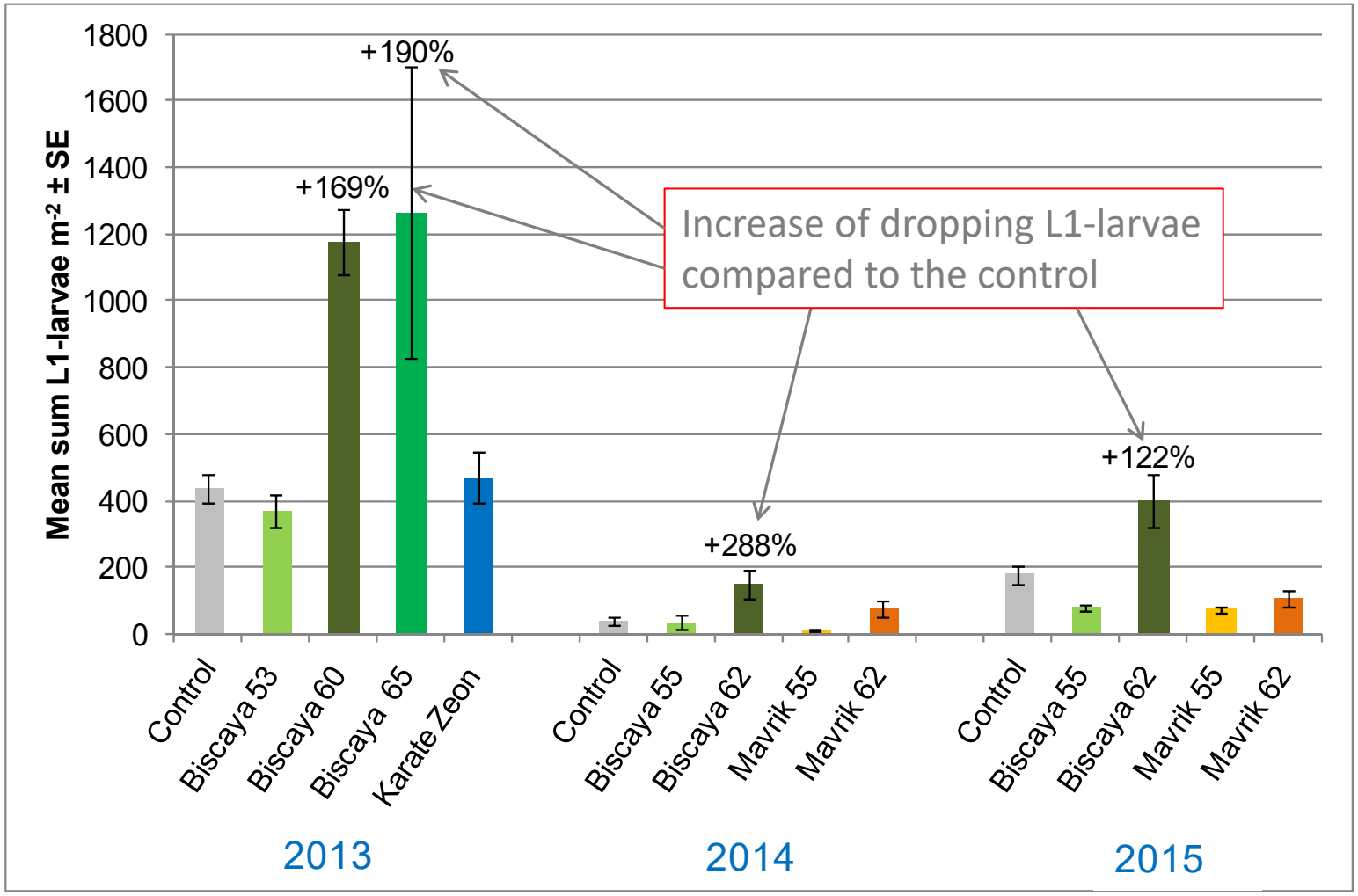
Treatment	2013 mean (%) ± SE	2014 mean (%) ± SE
Untreated plants without PB (preinfestation)	15 ± 2 AC	2 ± 1 A
Untreated plants + untreated PB	**54 ± 5 B**	**25 ± 3 B**
Untreated plants + Mavrik treated PB	not assessed	24 ± 3 B
Untreated plants + Biscaya treated PB	48 ± 6 B	23 ± 6 B
Biscaya treated plants + untreated PB	**8 ± 5 A**	**6 ± 2 A**
Biscaya treated plants + Biscaya treated PB	**14 ± 4 C**	**17 ± 3 B**
Mavrik treated plants + untreated PB	not assessed	20 ± 4 B
Mavrik treated plants + Mavrik treated PB	not assessed	23 ± 4 B

(GLMM, $p \leq 0.05$)

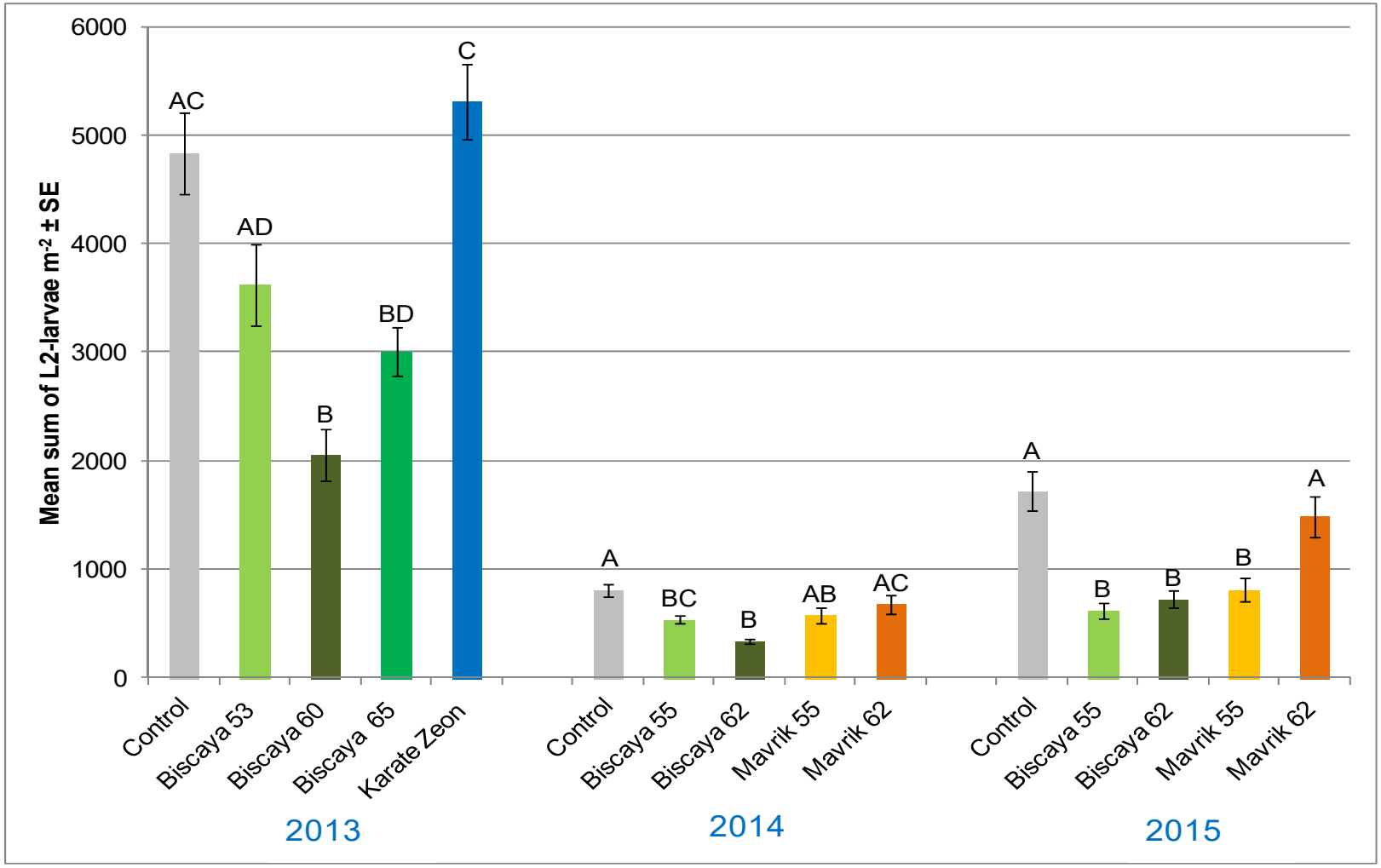
Similar results for the side shoots

Dropping of L1-larvae 2013-15

L1-larvae per m², summed up over 14 DAA



Dropping of L2-larvae for pupation

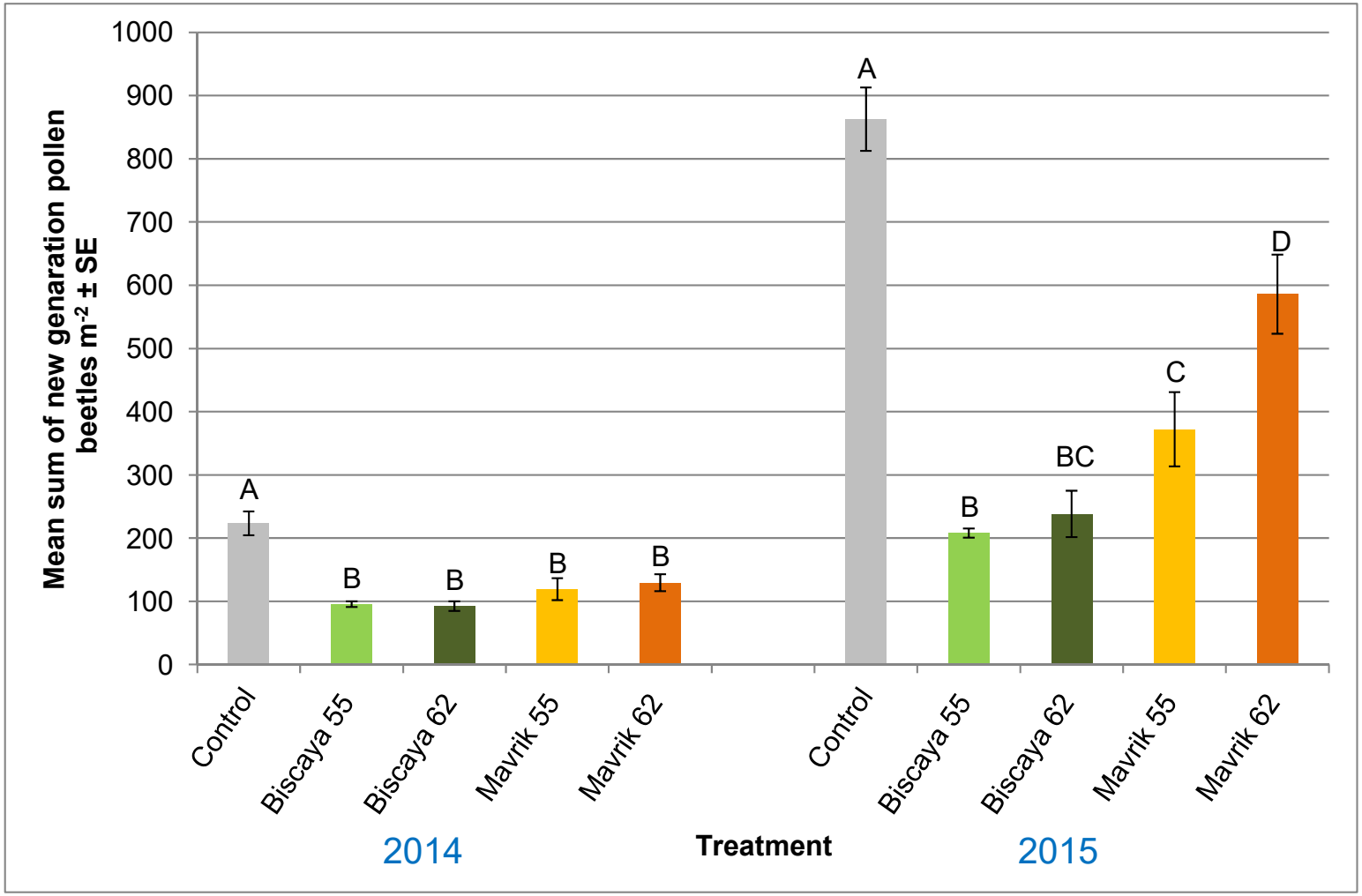


Tukey HSD-Test, $p \leq 0.05$

Parasitization

Phradis spp. und *Tersilochus heterocerus*

New generation PB



Tukey HSD-Test, $p \leq 0.05$

Summary

- **Overwintered pollen beetles:**
  Biscaya and Mavrik reduced pollen beetle density up to 7 DAA,
  Karate Zeon had no effect

- **Bud infestation with eggs:**
  Biscaya: Ø 84% efficacy in the field; confirmed in greenhouse trials,
  Mavrik: Ø 61% efficacy in the field; not confirmed in the greenhouse
  Karate Zeon had no effect

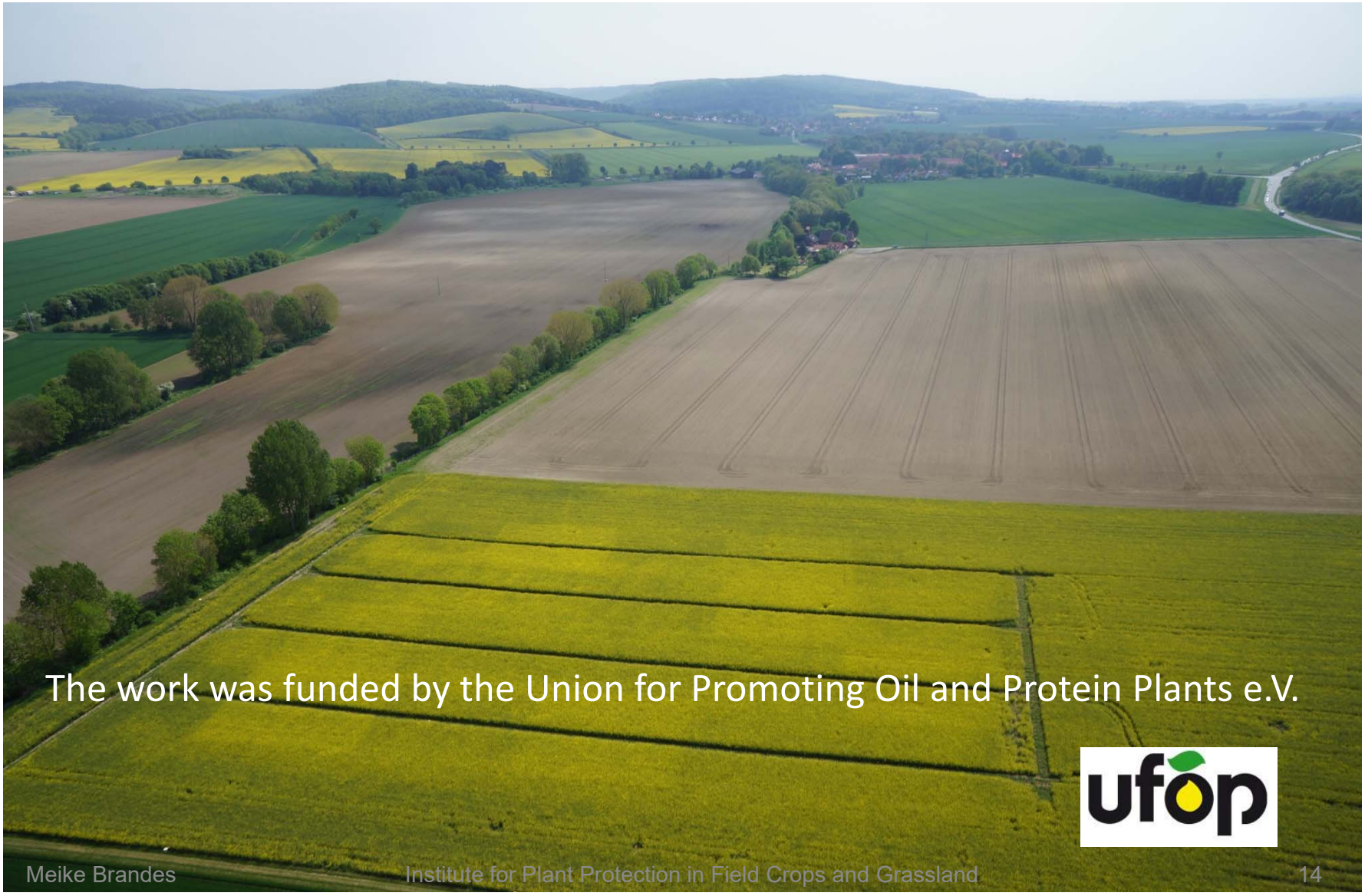
- **L1-larvae of pollen beetle:**
  Biscaya application at BBCH 62/65 : significant effects on L1-larvae
  Mavrik + Karate Zeon: effects on L1-larvae were missing

- **L2-larvae and new generation of pollen beetles:**
  the number of offspring was reduced by insecticides (except Karate Zeon)

Conclusion

- Biscaya and Mavrik reduced population growth of pollen beetle without affecting parasitism rates of larvae
- In addition to damage control Biscaya showed effects on population development that are not assessed during the usual efficacy evaluation of insecticides according to EPPO
- Additional effects on insect pest population development should be taken into account for sustainable IPM strategies
- Insecticides that prevent crop damage, reduce the number of offspring and as well do not harm beneficial organisms should be preferred for IPM, resulting in a lower need for insecticide treatments

Thank you for your attention!



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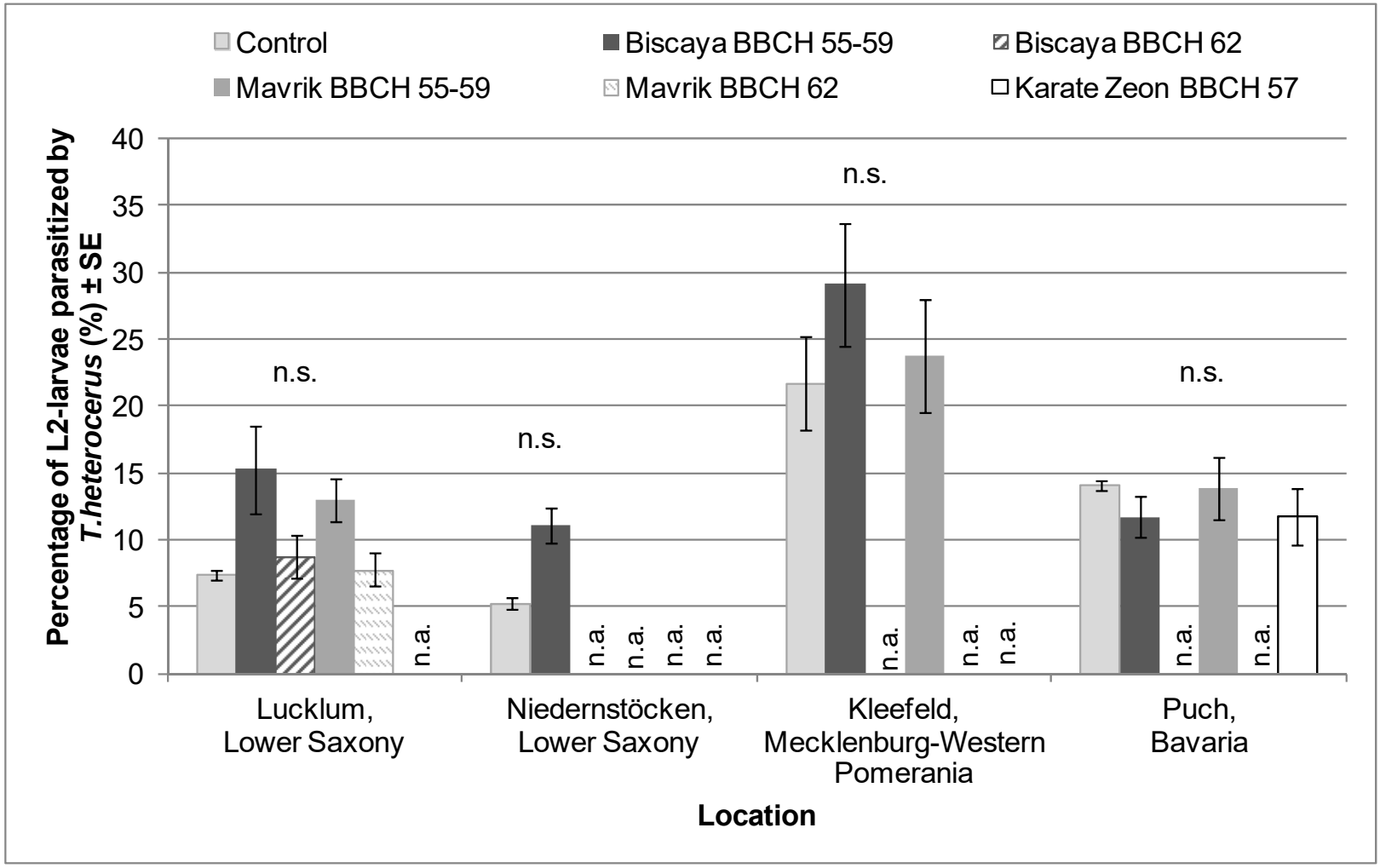
Parasitization 2015

Tersilochus heterocerus



(GLM, $p \leq 0.05$)

Parasitization 2015

Phradis spp.