



Disease management in organic greenhouse crops: prevention and treatments

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Disease management

- › Foliar diseases caused by fungal pathogen on tomato
- › Content:
 - › System approach
 - › Why organic fungicides?
 - › Which ones were effective?
 - › Conclusions

System approach to control foliar diseases

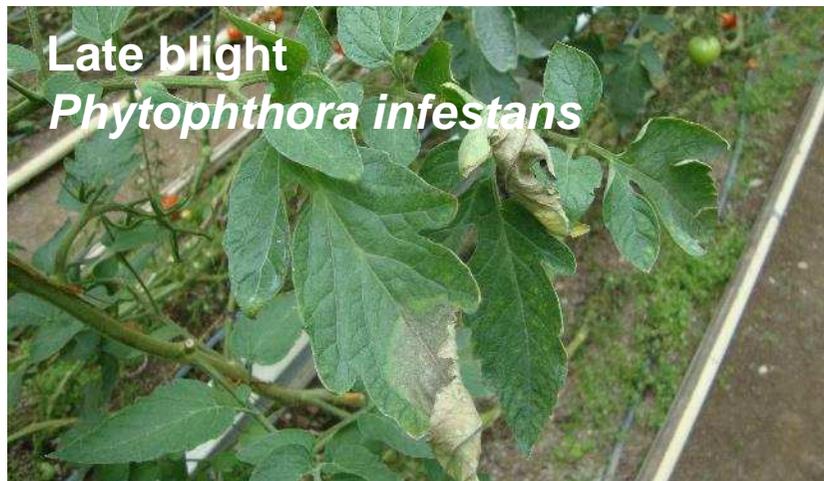
4. Plant strengtheners and organic fungicides

3. Bio control agent:
e.g. *Ampelomyces quisqualis*

2. Natural enemies:
Rather unimportant (e.g. *Psyllobora vigintiduopunctata*)

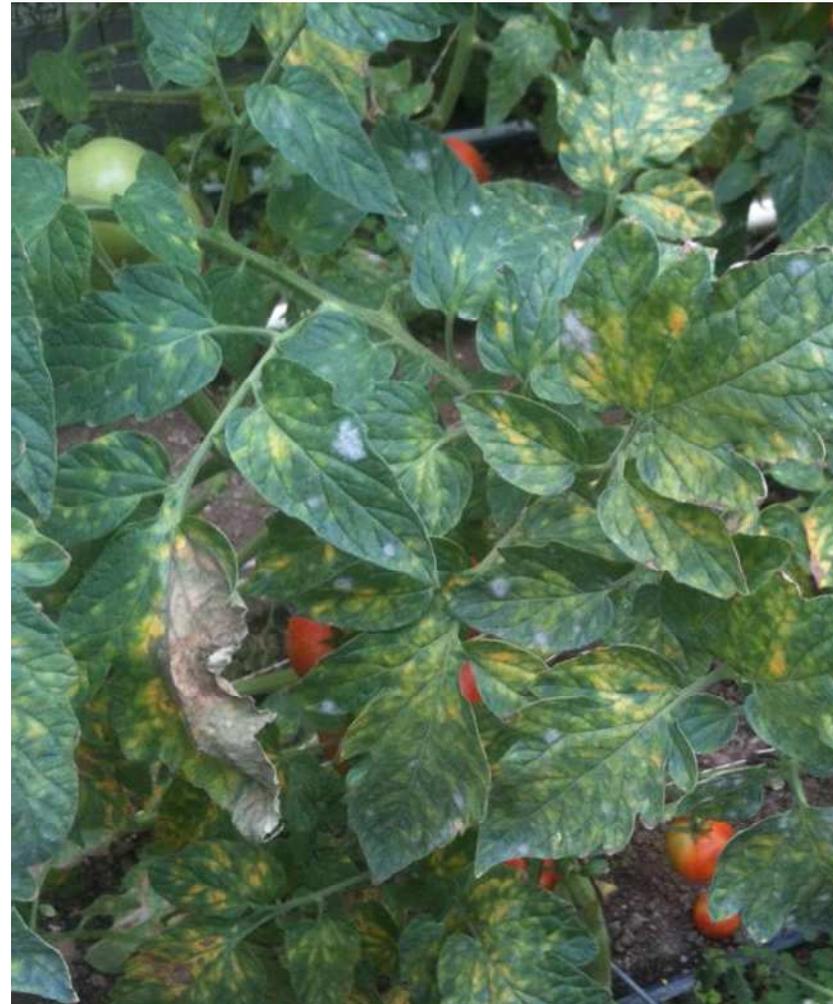
1. Cultural practises:
Resistant cultivars; Climate control;
new construction material for glasshouses

The «Dirty Four» fungal diseases on tomato leafs

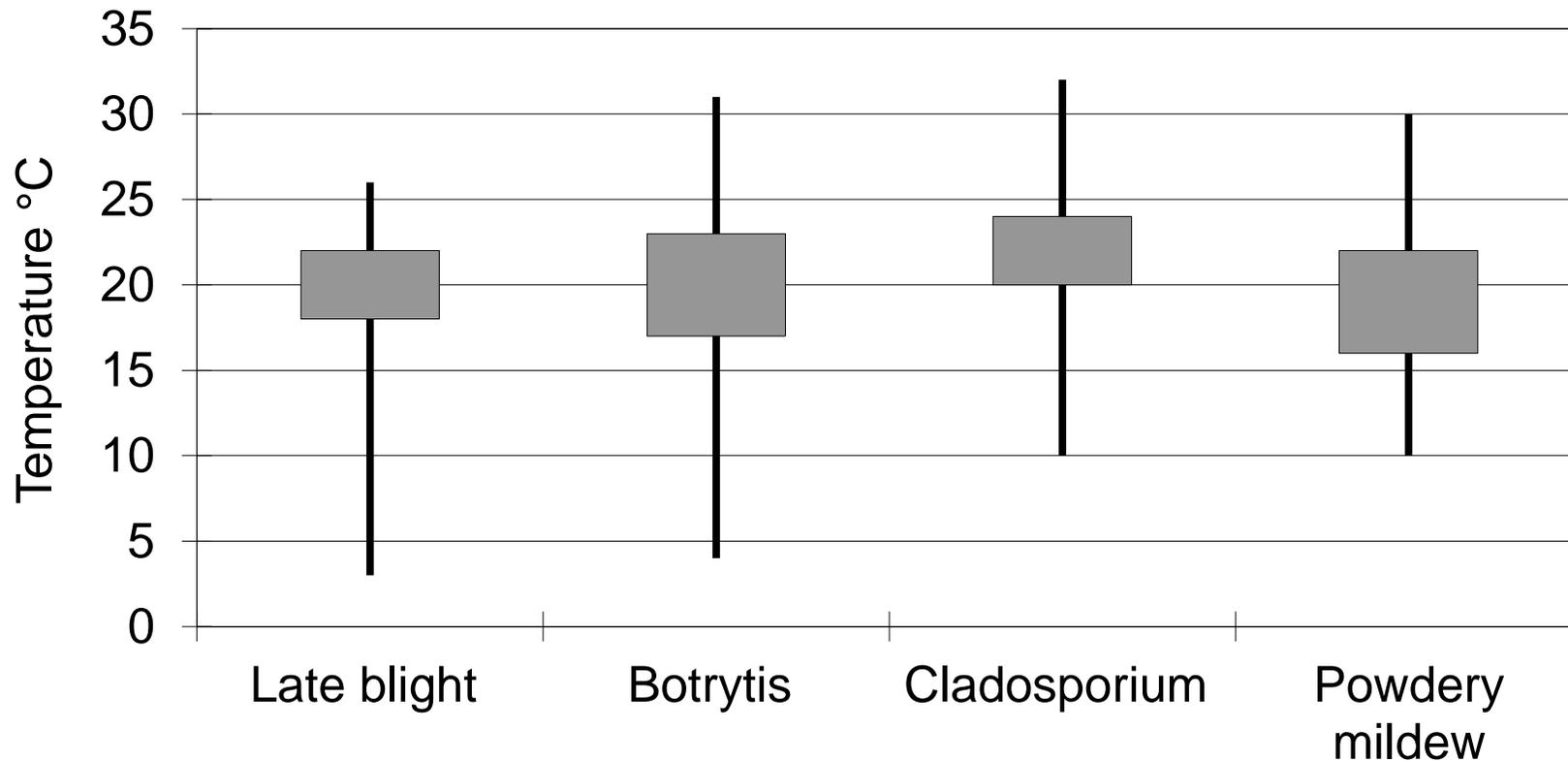


Why fungicides in organic greenhouse crops?

- › **Climate control can only prevent some diseases (e.g. not powdery mildew)**
- › **Resistant cultivars are not against all 4 diseases and for all crop segments available**



Optimal range of temperature of some foliar diseases on tomatoes

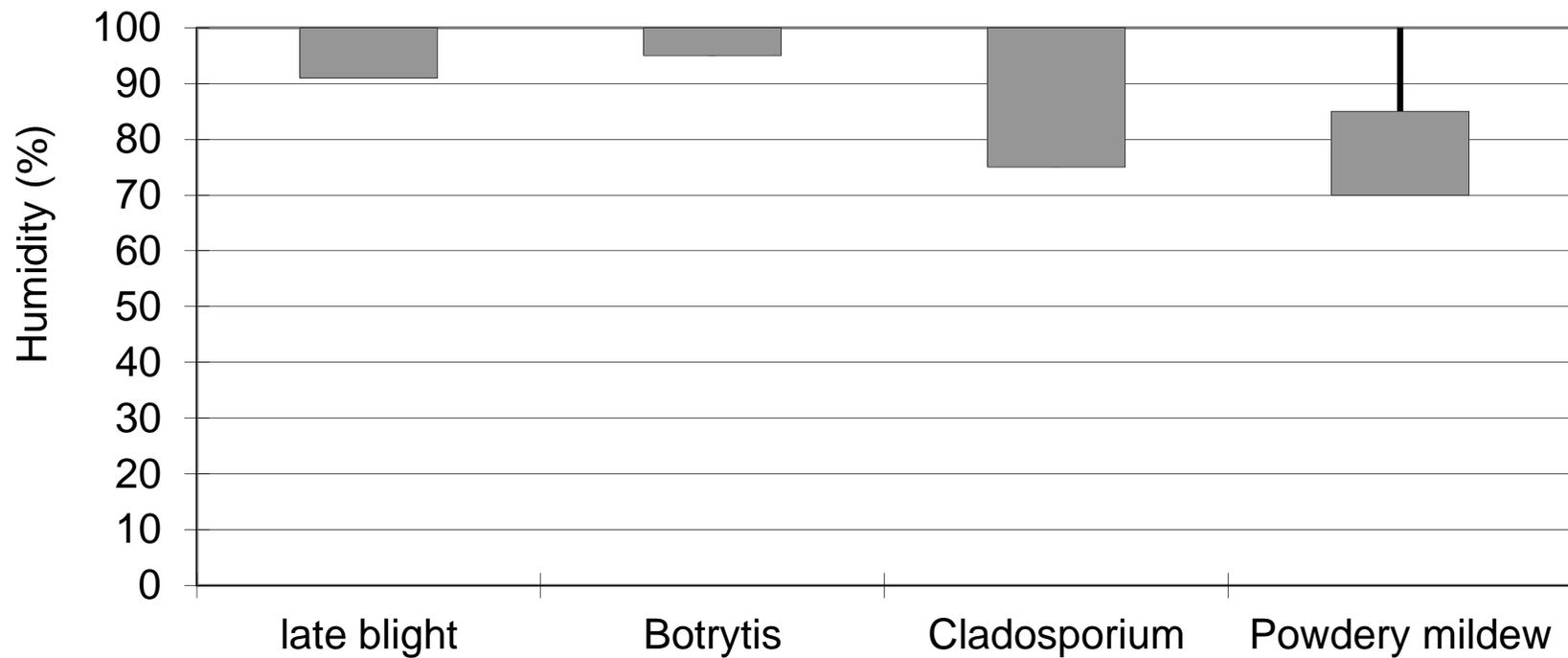


Box: optimal

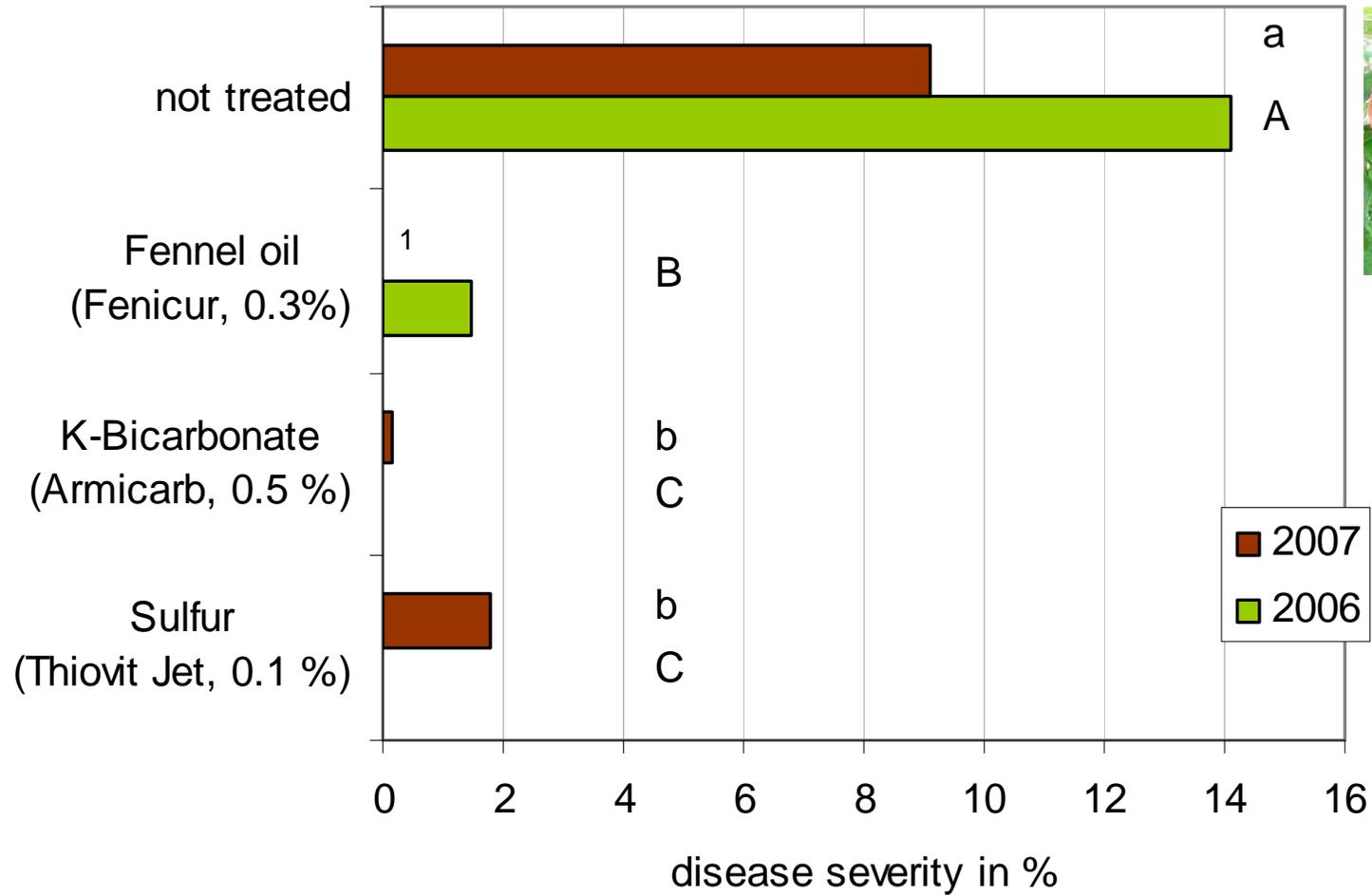
Line: suboptimal, possible growth/infection

Jones et al., 1992, Bedlan 2012

Optimal range of humidity of some foliar diseases on tomatoes



Effects on powdery mildew in tomatoes (2006/07)



¹ 2006 not in the experiment included

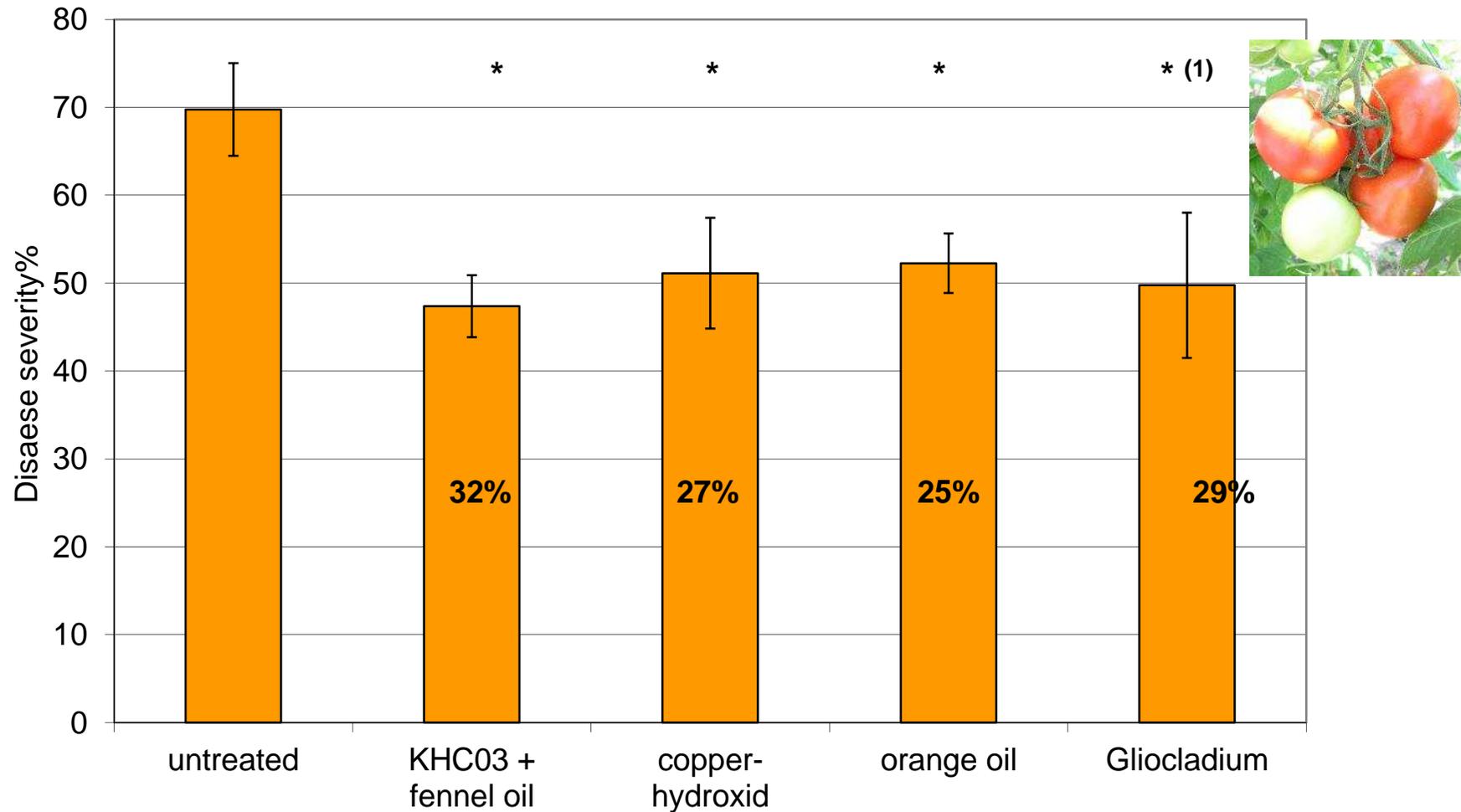
Control of Cladosporium and powder mildew (2010)

- › **Cultivar: heritage variety «Baselbieter Röteli»**
- › **11 treatments between week 22 and 33,**
- › **11 l water /100 m²**



PPP (product name and distributing company)	Active substance	Konzentration
Armicarb (Stähler) and Fenicur (BioControl)	Potassium hydrogencarbonate (KHCO ₃) and fennel oil	0.5 + 0.4%
Microperl (Burri, CH)	Copper hydroxid (40 % Cu)	0.125%
Prev-AM™ (Oro Agri)	Orange oil	0.4%
Test product	<i>Gliocladium sp.</i>	0.5%

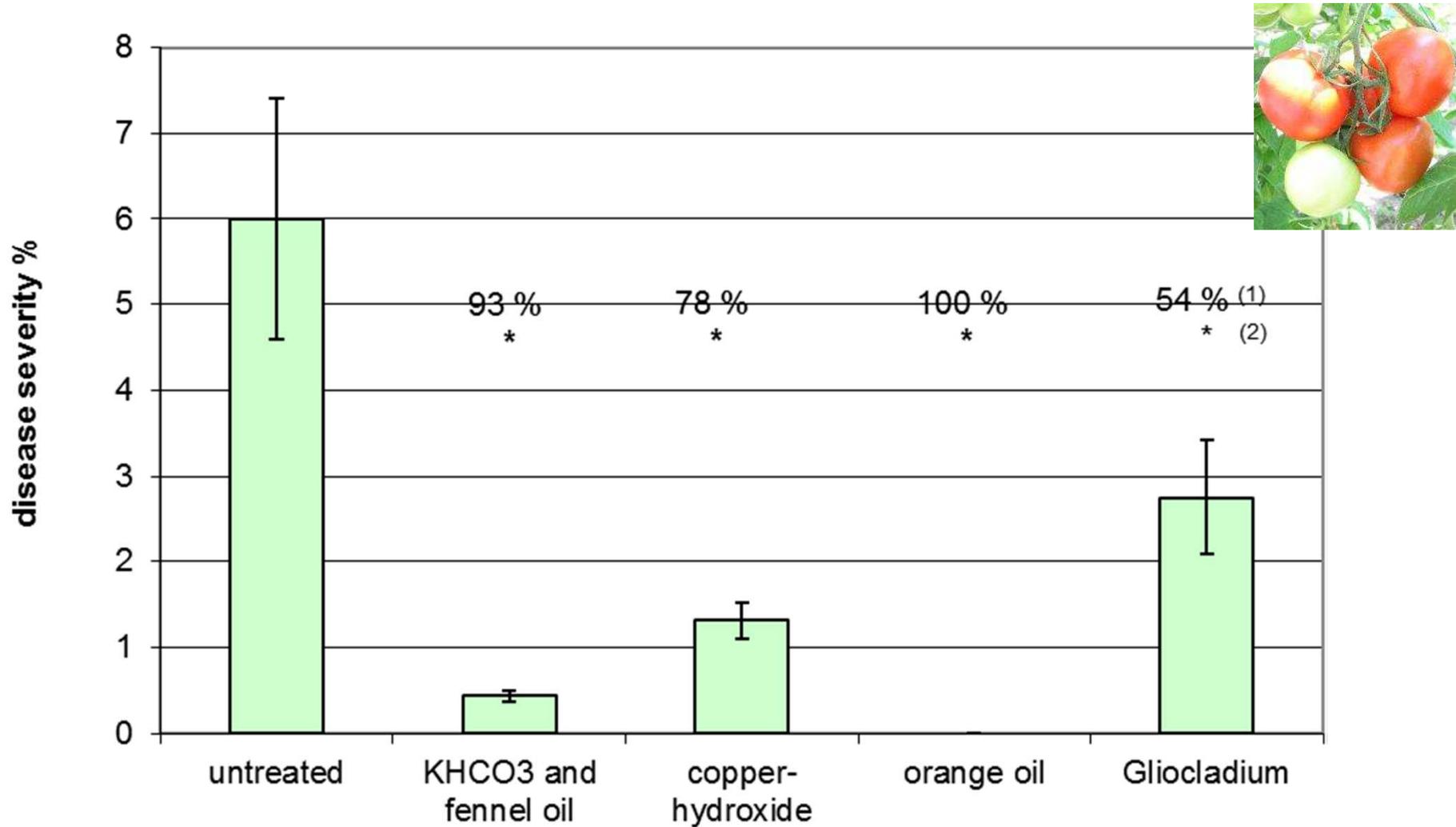
Efficay of organic fungicides on *Cladosporium*



(1) * = significant different to untreated (Student-T)

(2) Efficacy (%) after Abbott

Efficacy of organic fungicides on powdery mildew

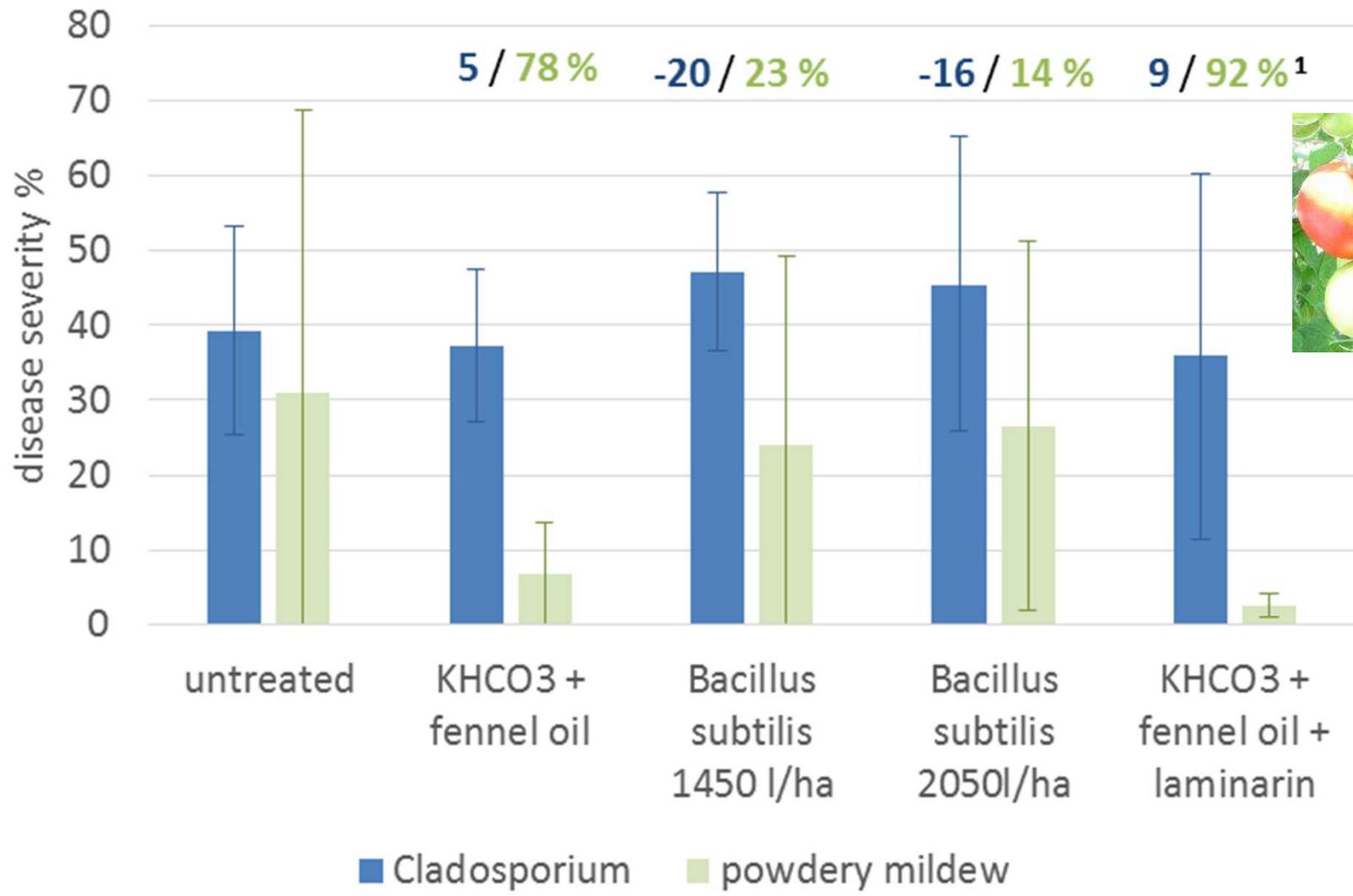


(1) * = significant different to untreated (Student-T)

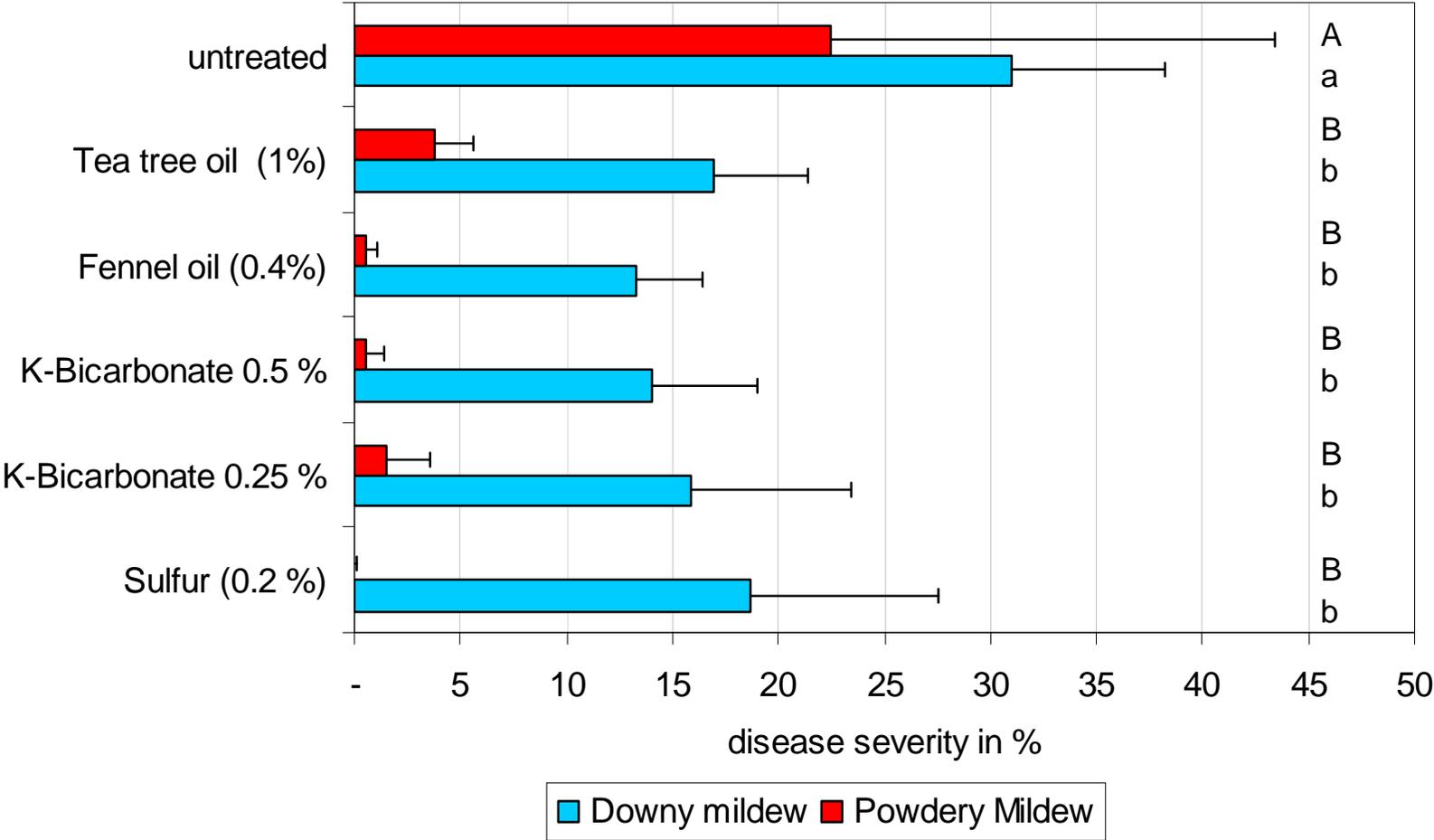
(2) Efficacy (%) after Abbott

Gallmeister and Koller 2010

Efficacy of organic fungicides on powdery mildew and *Cladosporium* 2014



Effects on powdery and downy mildew in cucumbers



Fungicides in organic horticulture:

Examples against foliar diseases on greenhouse crops

Active substance	Permitted EU organic EC 889/2008	Listed in EU as PPP EC 1107/2009	EU Countries with registrations
Copper (-hydroxid, -oxychlorid)	✓	✓	22
Sulphur	✓	✓	24
K-Bicarbonate	✓	✓	16
Laminarin	✓	✓	10
Orange oil	✓	✓ (Insecticide)	BE, CY, FR, IT, RO
Tea tree oil	✓	✓	BG, PL
Fennel oil	✓	✗	(CH)
Lecithin	✓	✓ (Basic substance)	(CH)
<i>Gliocladium</i>	✓	✓	13
<i>Ampelomyces quisqualis</i>	✓	✓	12
COS-OGA	✗	✓	BE, FR, NL

Fungicides on organic tomatoes: Experience and estimation on efficacy in Switzerland

Active substance	Late blight	Powdery mildew	Clado-sporium	Botrytis
Copper	+++	+ / -	+ / -	-
Sulphur	-	+++	-	-
K-Bicarbonate	-	+++	+ / -	-
Laminarin	-	+	-	+
Orange oil	-	+++	+ / -	-
Tea tree oil	-	++	?	-
Fennel oil	-	++	+	-
Lecithin	-	+	-	-
<i>Gliocladium</i>	-	+ / -	+ / -	+
<i>Ampelomyces q.</i>	-	+	-	-
COS-OGA	-	++	-	?

Fungicides on organic tomatoes: Experience and estimation on efficacy in Switzerland

Measurements	Late blight	Powdery mildew	Clado-sporium	Botrytis
Climate control (e.g. decrease of humidity)	+++	–	+	+++
Resistant cultivars	Only few	+++	Few against new strains	–
Organic fungicides (& bio control)	Only copper (yet)	+++	–	(+)

› Outlook

- › Late blight: projects on copper alternatives (e.g. Co-free)
 - › Some products are in the pipeline
- › Botrytis: new bio controls (e.g. *Aureobasidium pullulans*) and elicitors in the pipeline, potential still unclear

Conclusions

- › **Climate control**
 - › Control on late blight and botrytis (outside of rainy weather)
 - › Poor control on powdery mildew
- › **Resistant cultivars are not against all 4 diseases and for all crop segments available**
 - › Wide range of cultivars with HR against powdery mildew
- › **Organic fungicides**
 - › Late blight: copper «to help through rainy weather»
 - › CH: 0.2 kg Cu ha⁻¹ a⁻¹ in tomato (Speiser et al. 2015)
 - › Powdery mildew: several organic fungicides available
 - › Botrytis and Cladosporium: not solved yet