

Optimisation of nematode foliar application for control of the Diamondback Moth on brassicas



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Plutella xylostella, a major problem in *brassic*as

- The Diamondback Moth developed resistance against every insecticide applied
- Immense misuse of pesticides decreased the potential of invertebrate antagonists
- *Bacillus thuringiensis* is the only alternative for specific, biological toxin is also affected by resistance
- Target of the EU-funded project DIABOLO is the substitution of broad spectrum insecticides with biological alternatives including entomopathogenic nematodes

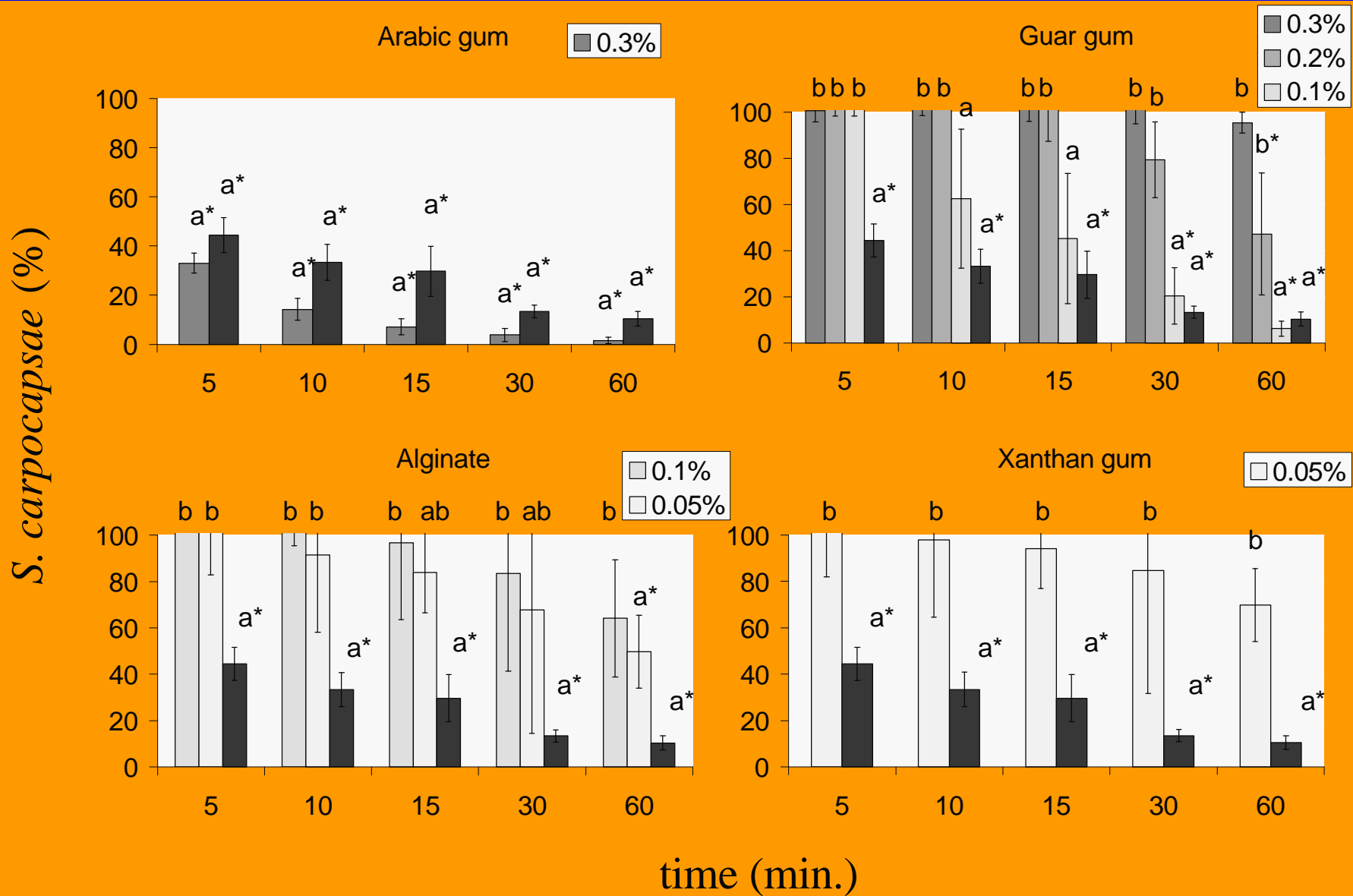
Constraints with nematode foliar application

1. Sedimentation of nematodes in tank mixes
2. Nematode run-off from foliage
3. Dose transfer and distribution on leaf
4. Nematode survival (UV-radiation, heat and drought)

Sedimentation of nematodes

- **Can polymers prevent sedimentation?**
- 1000 *Steinernema carpocapsae* / ml were equally distributed in 500 ml polymer solutions
- After 0, 5, 10, 15, 30 and 60 minutes, nematodes per 100 μ l recovered in 2cm depth were recorded

Sedimentation in polymer solutions compared to water

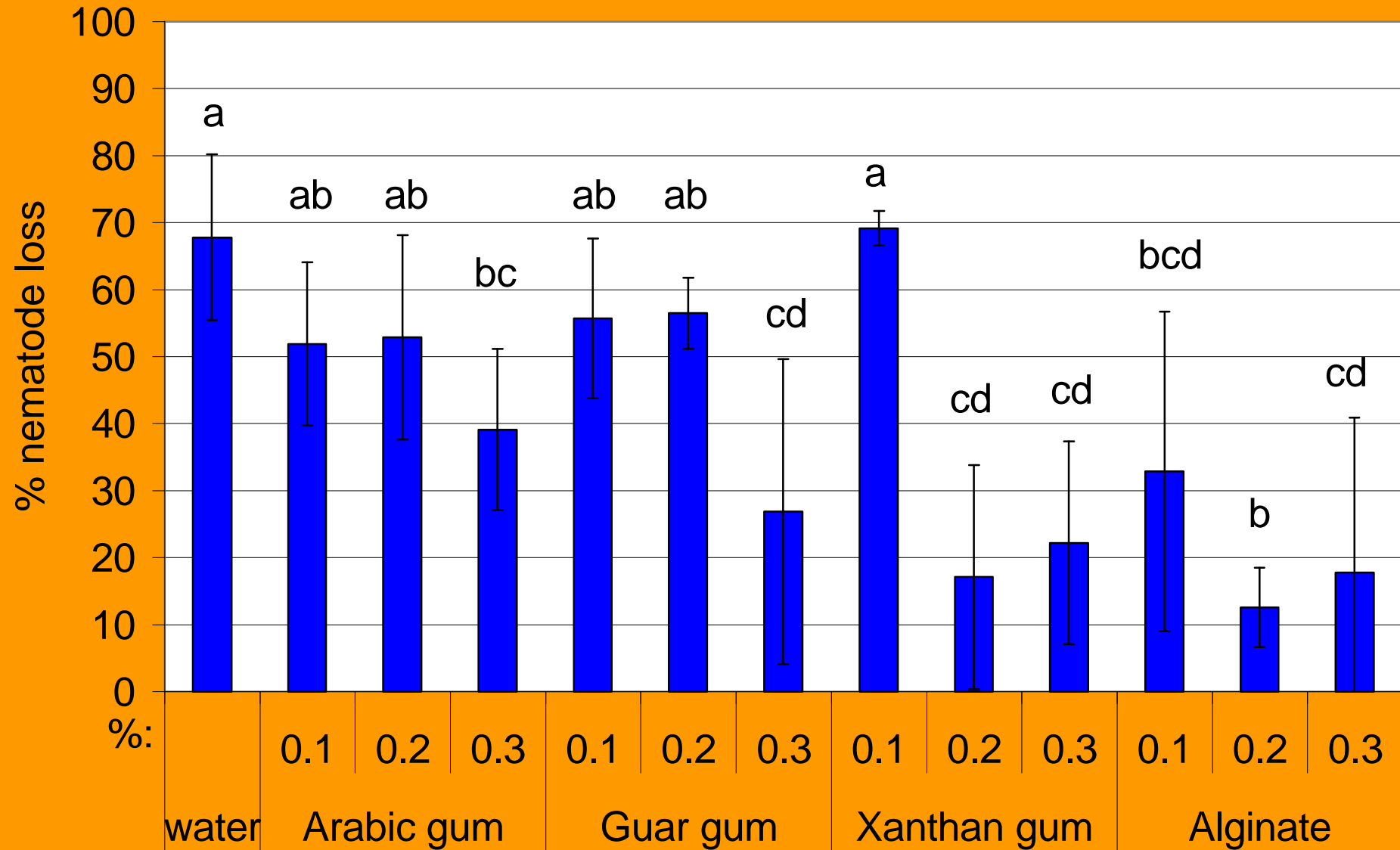


Can polymers decrease EPN run-off ?

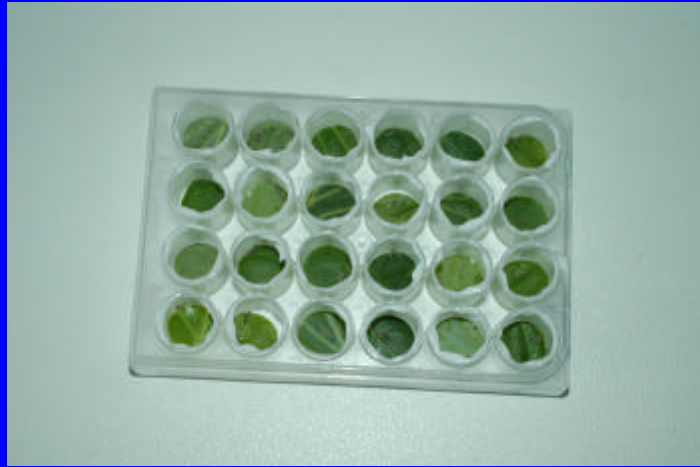


- Leaves were attached in 45° to the nozzle and leaf disks (2 cm^2) were applied in 90° angle
- After application, 2 cm^2 disks were cut out of the leaves
- The number of nematodes recovered from leaf disks were compared

Impact of polymers on nematode run-off

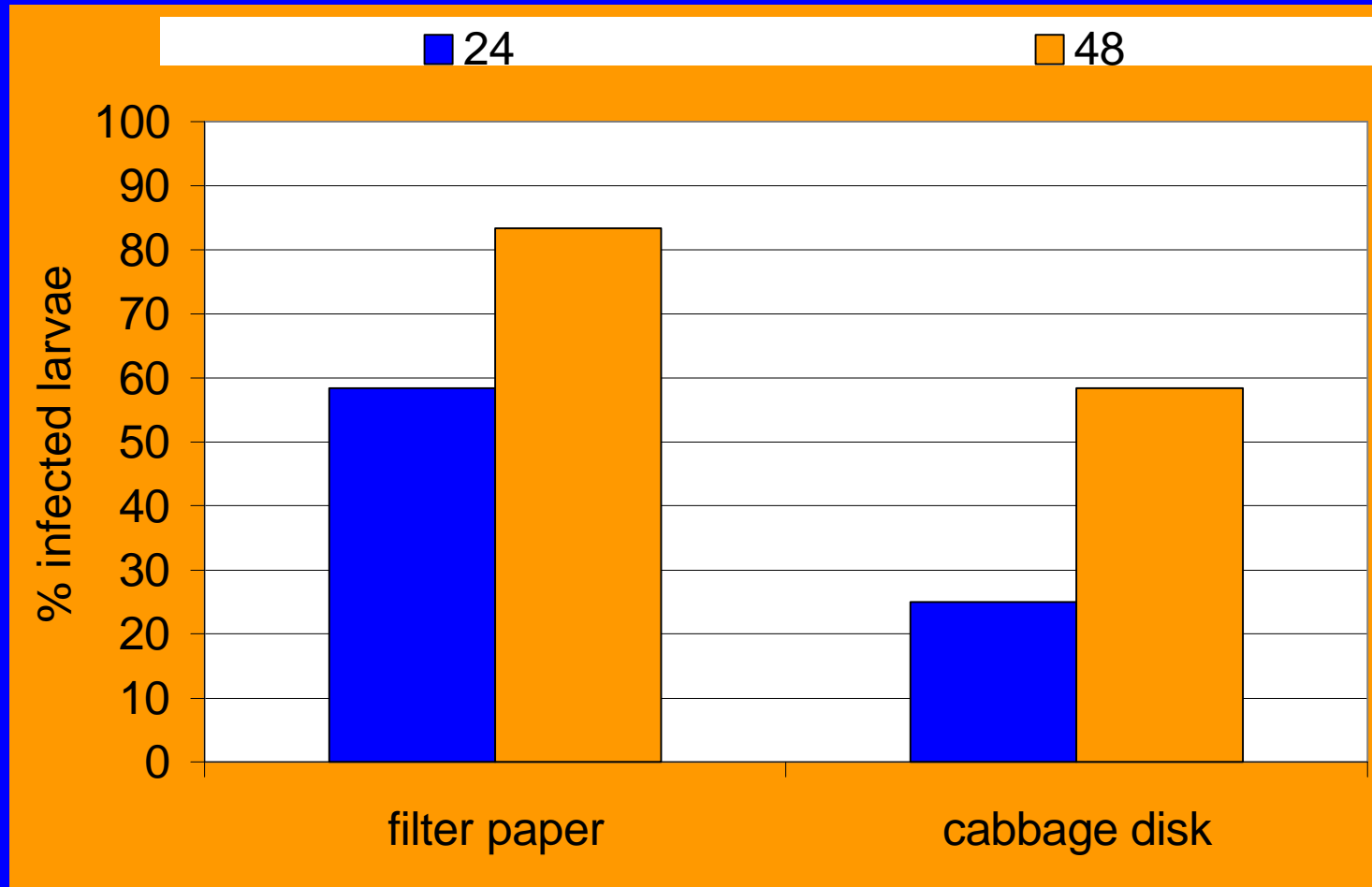


How to improve efficacy on the leaf ?



- 2 cm² leaf disks and filter paper were treated
- Disks were applied into 24-well dishes
- Single 3rd instar larva was added per well
- Incubation at 25°C and 80% RH for 24 and 48h

Food supply does not increase efficacy



Are EPN ingested or is active penetration major way of entry ?

Penetration into the larva

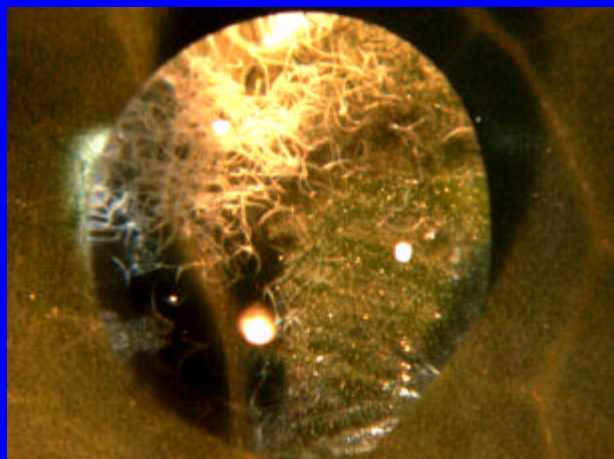


S. carpocapsae try to enter spiracles, but without success

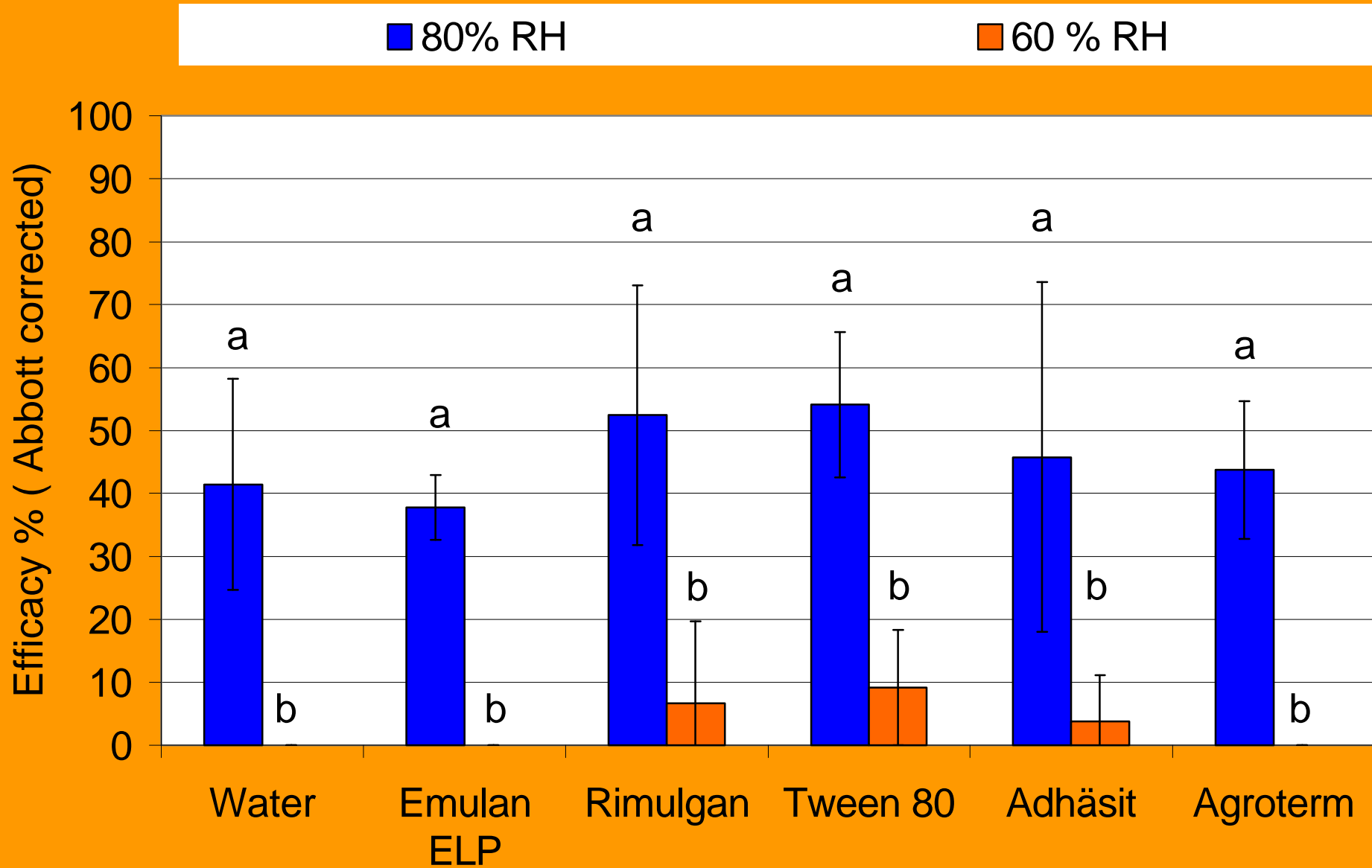


Nematodes invade via the anus

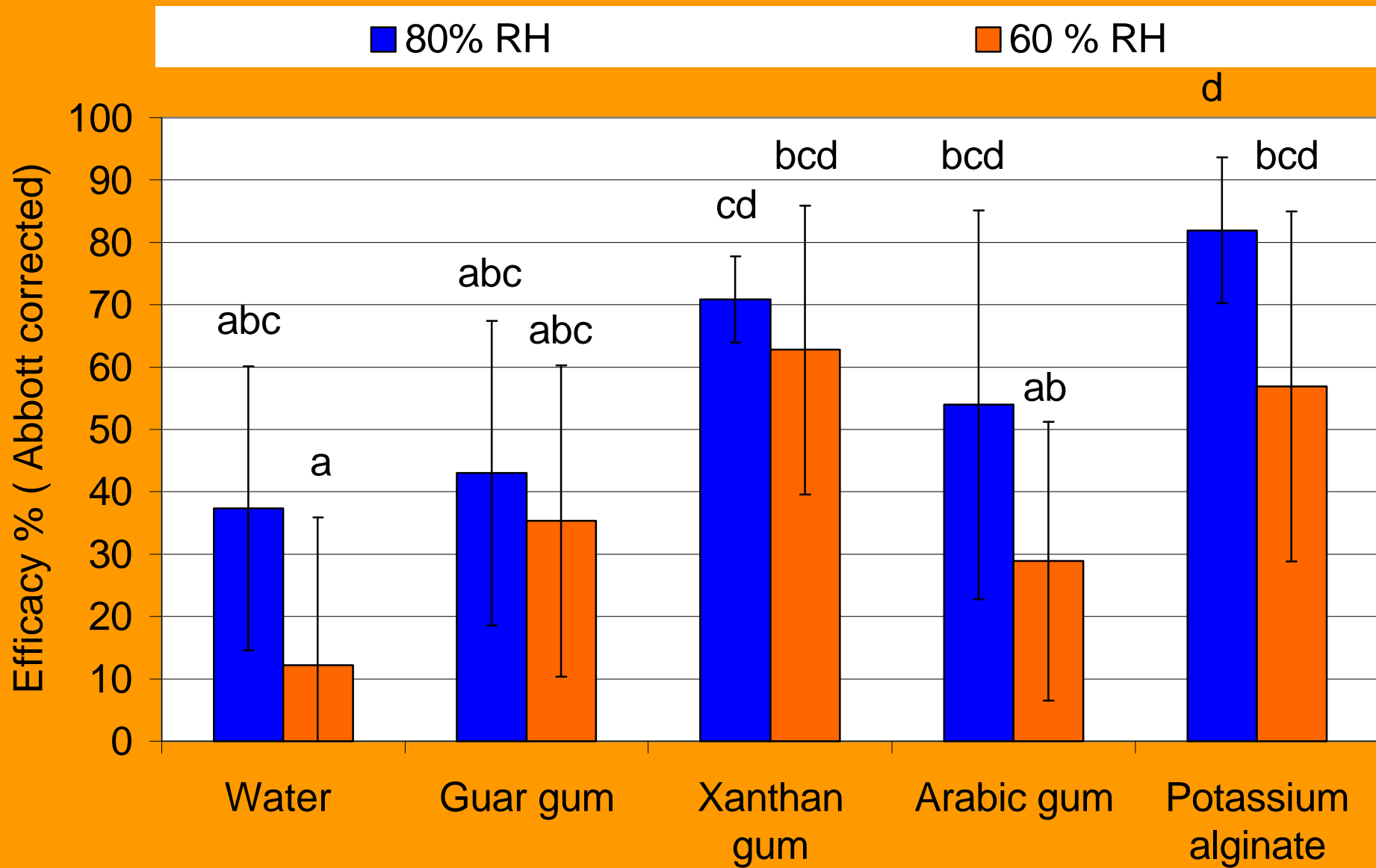
How to provide optimal conditions for Diamondback Moth infection ?



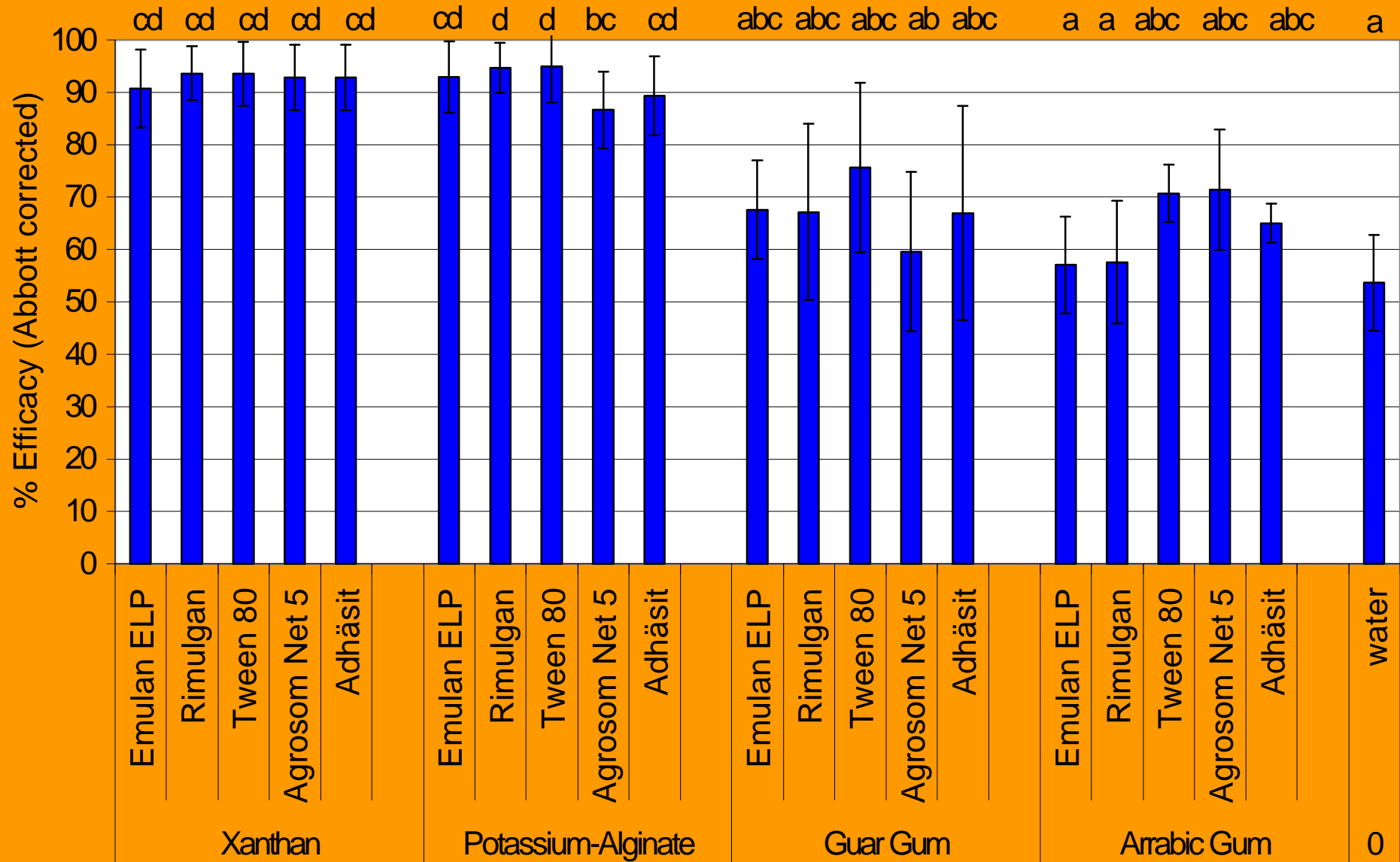
Impact of surfactants



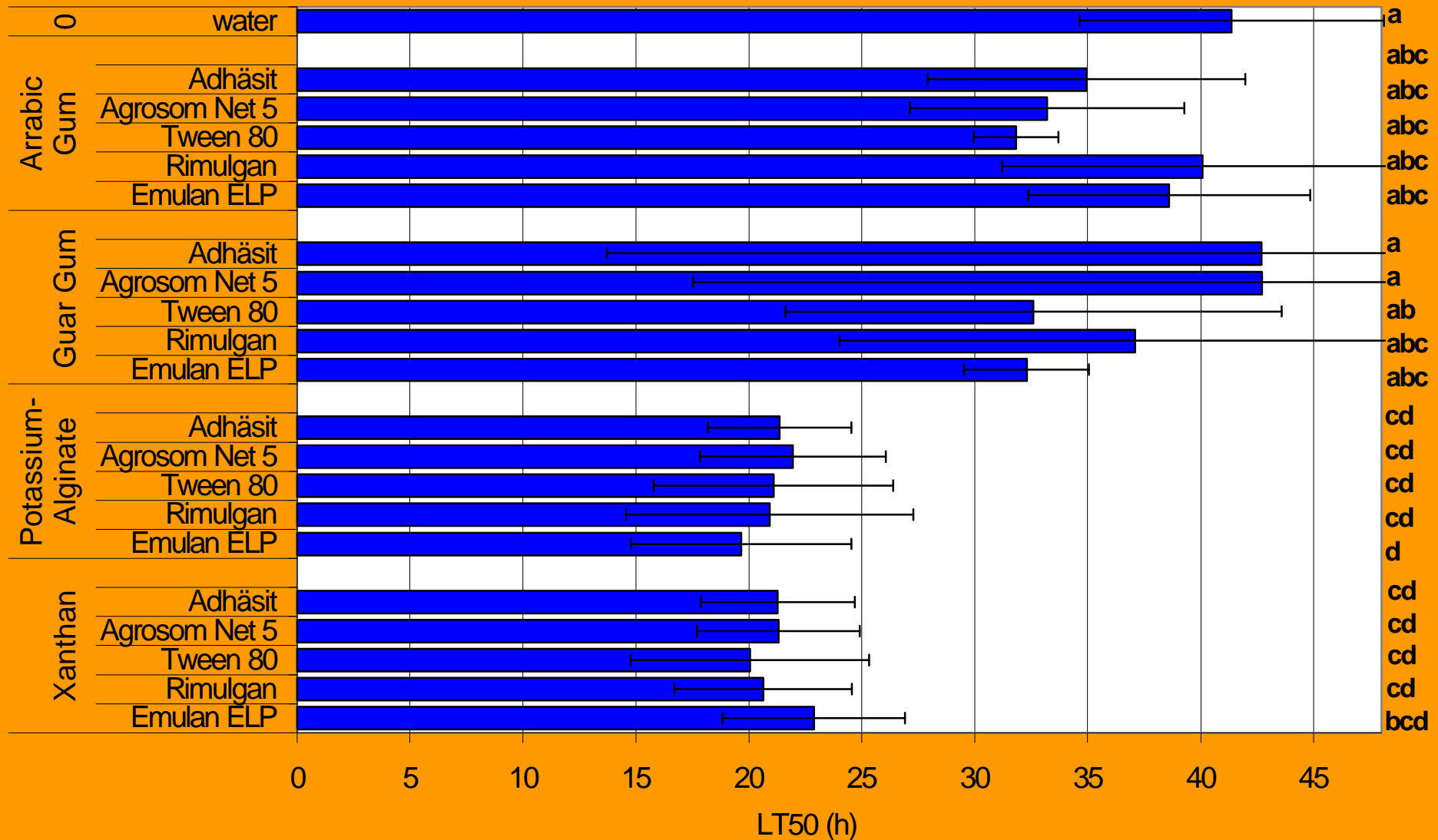
Impact of polymers



Impact of surfactant-polymer-formulation

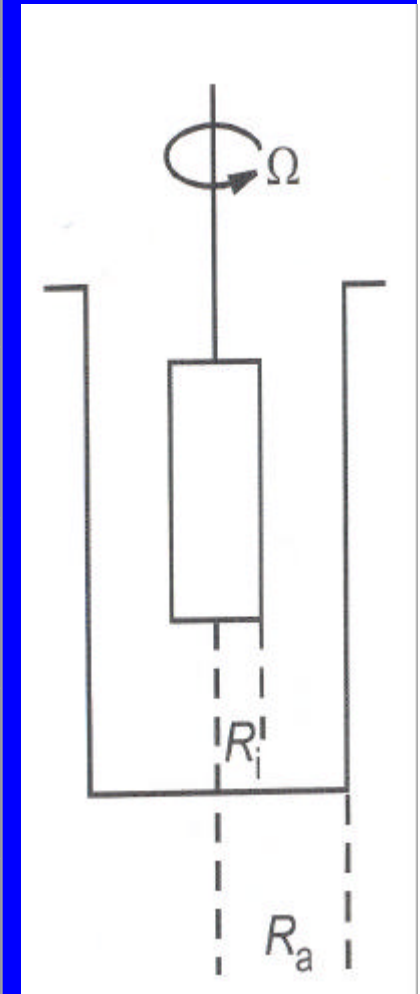


Impact of surfactant-polymer-formulation on the lethal time

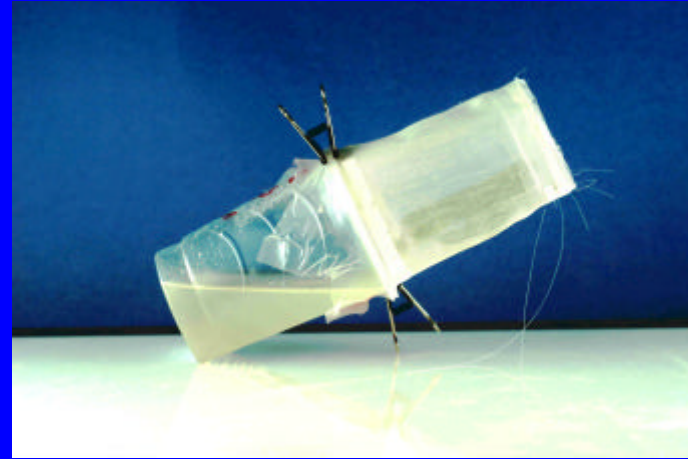
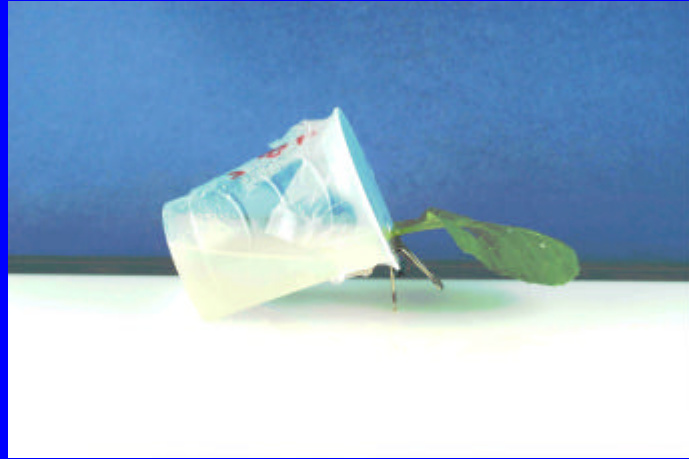


Viscosity

	Viscosity (mPa*s) (spindle, rotation)			
	0.1%	0.2%	0.3%	0.3% +0.3% Rimulgan
Arabic gum	6 (L1, U200)	6 (L1, U200)	6 (L1, U200)	6 (L1, U200)
Guar gum	9 (L1, U200)	22 (L1, U100)	80 (L1, U30)	80 (L1, U30)
Xanthan gum	26 (L1, U100)	380 (L1, U10)	410 (L2, U20)	450 (L2, U20)
Alginate	6 (L1, U200)	16 (L1, U200)	450 (L2, U30)	430 (L2, U30)

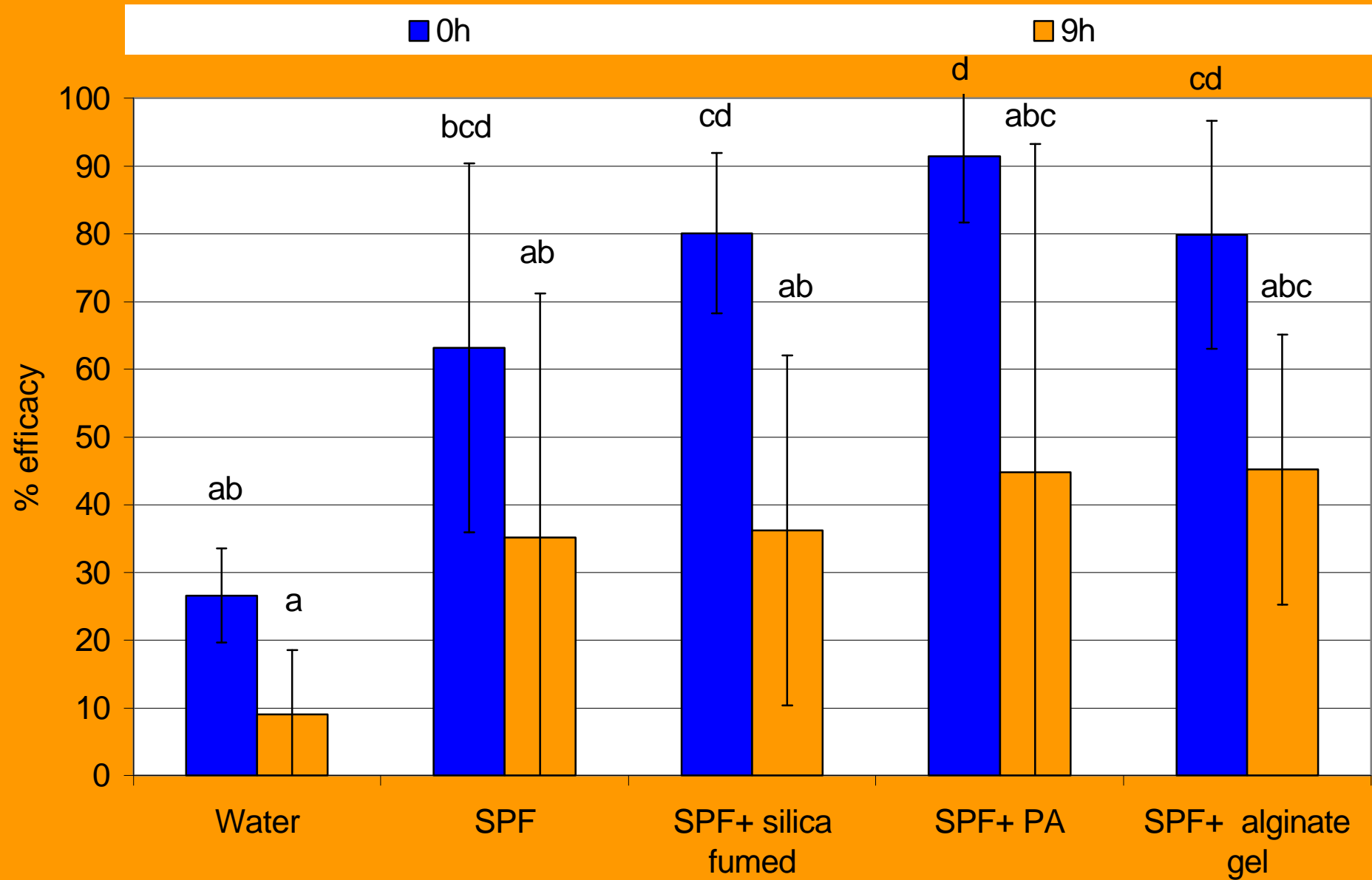


Nematode activity and persistence on the leaf

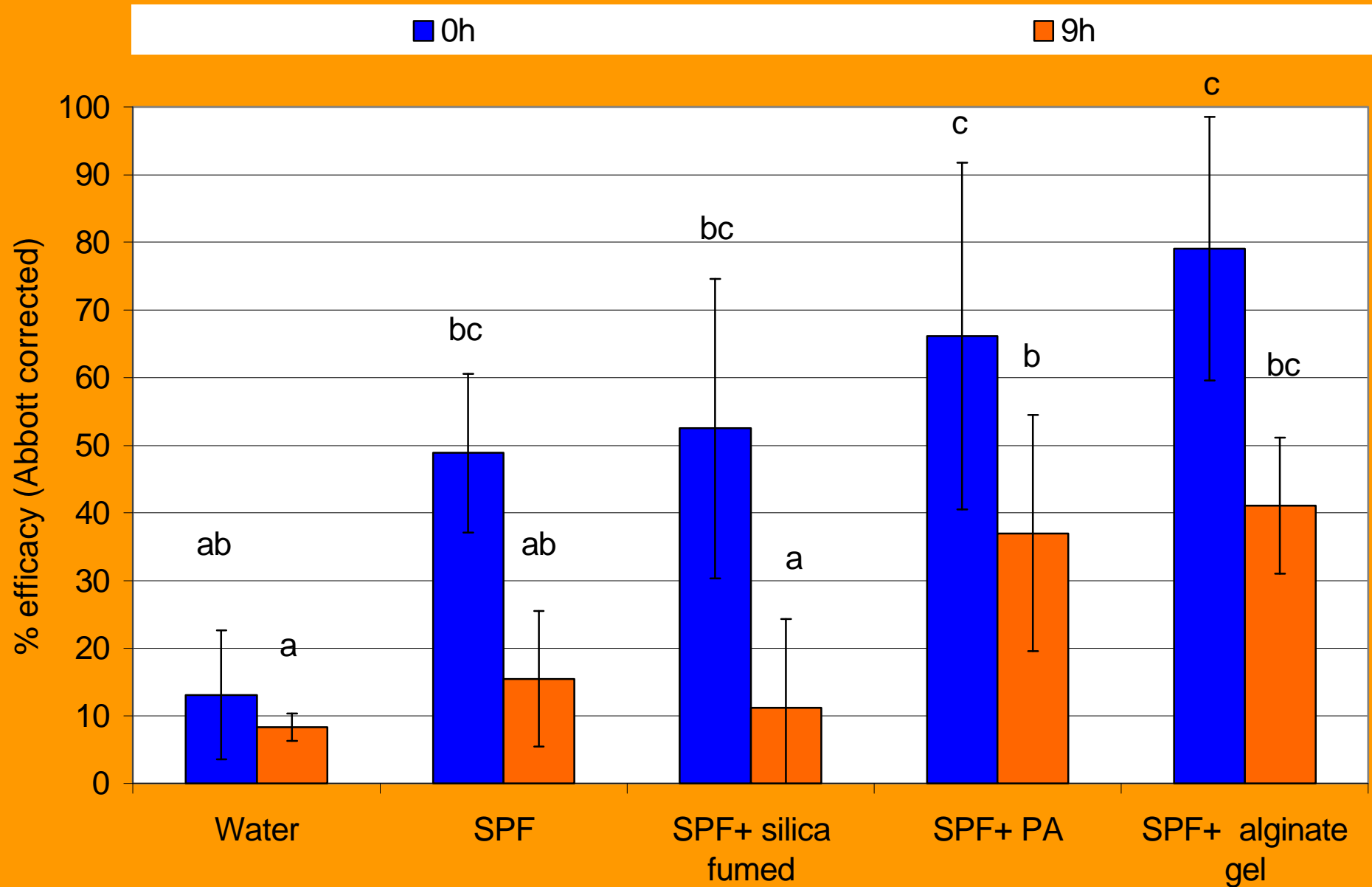


- Nematode + formulations (SPF) were applied to single cabbage leaves
- Leaves were transferred to water agar in cups
- Experimental area (leaf) was separated with parafilm
- Ten larvae were added to each leaf 0 and 9h after EPN application
- Cups were incubated at 25°C and 60% RH for 48h

Nematode efficacy at 80% RH



Nematode efficacy at 60% RH

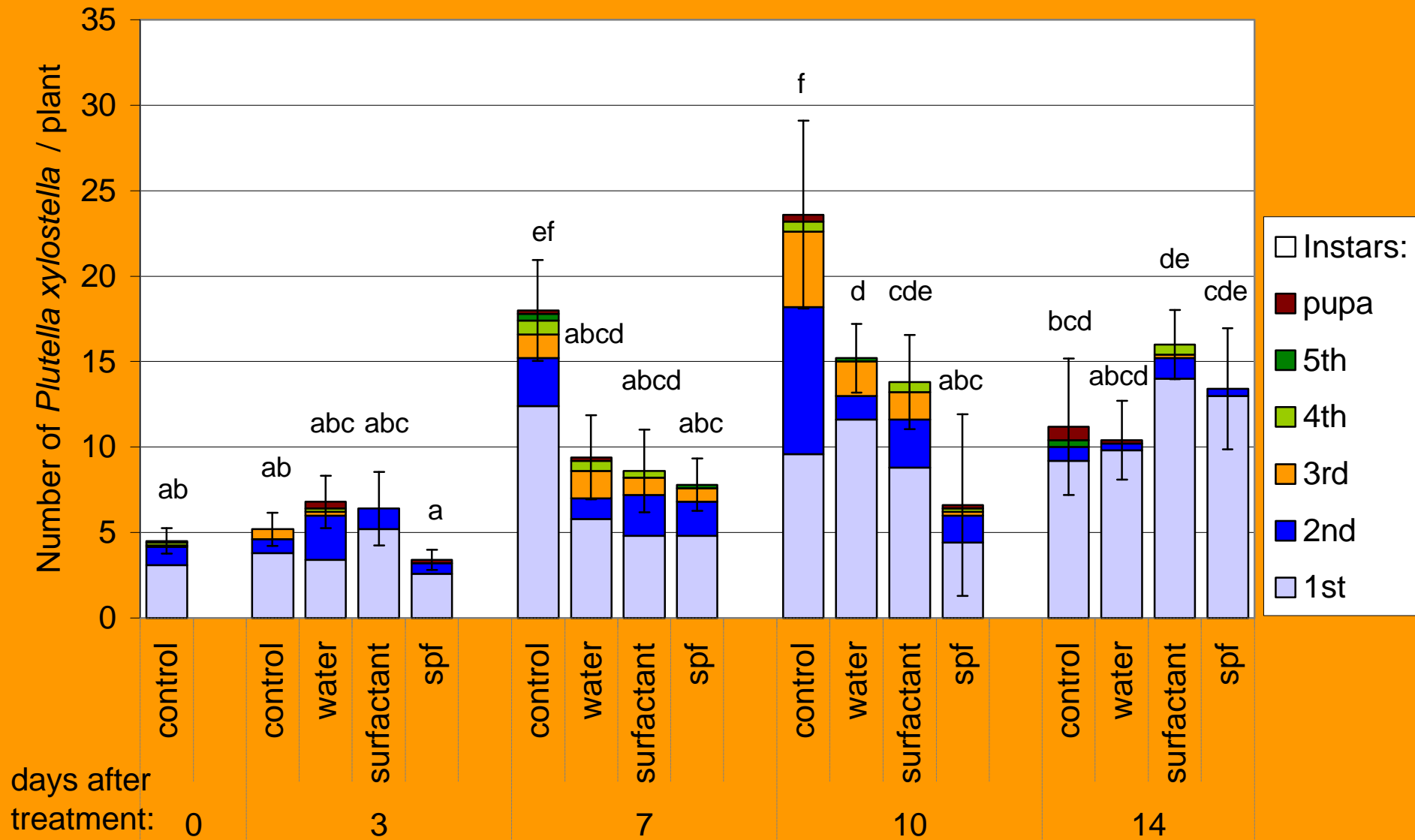


Field experiments



At Bromo mountain, East Java, Indonesia
March / April 2004

Evaluating the SPF in the field



Conclusion

- Xanthan and alginate retard nematode sedimentation
- Adherence to foliage is improved by polymers
- Major way of host penetration is via anus
- Surfactant-polymer-formulation improves nematode efficacy and decreases the time of infection
- The further addition of antidessicants has no impact on nematode efficacy on foliage
- SPF increases reliability of nematode activity particularly at low humidity

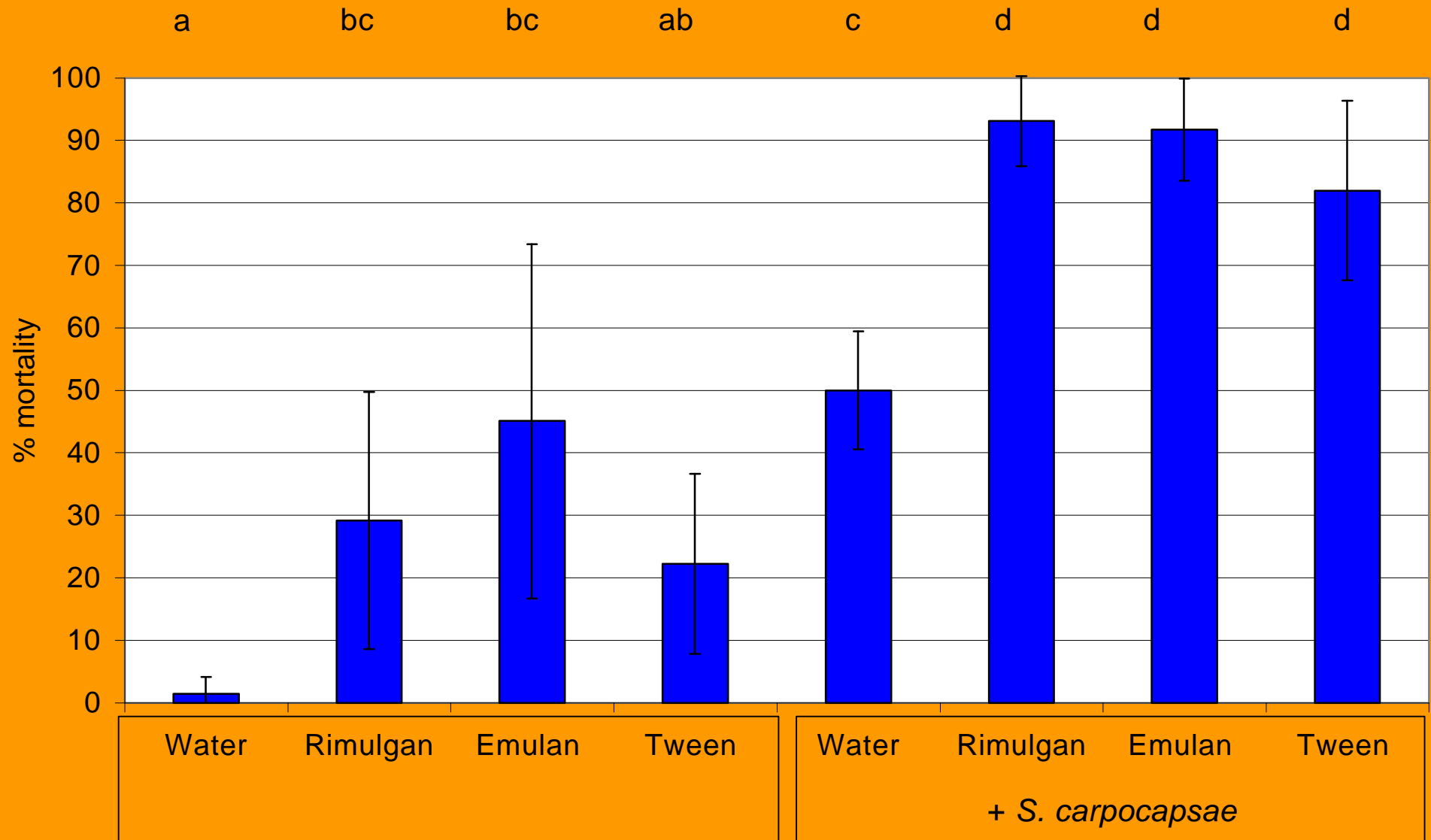
Acknowledgement:

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Thank you for your attention!

Efficacy of the surfactant-polymer-formulation with or without nematodes



Nematode activity in the field

