

Effects of Neem on entomopathogenic nematodes

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Effects of Neem on entomopathogenic nematodes

- Introduction
- Material and Methods
- Results
- Summary & Conclusions

Introduction

Problems with synthetic pesticides:

- Contamination by residues
- Effects on non-targets
- Resistance

Biological Plant Protection:

- Pheromones
- Natural enemies like **EPNs**
- Biocides like **Neem**
- **Neem affects:** growth and metamorphosis, activity and reproduction of insects

Introduction

Neem



Neem tree *Azadirachta indica*



most important content : Azadirachtin



Seedkernel-extracts



Commercial products



Introduction

New Neem-formulation: NeemAzal-U (Trifolio GmbH)



Soil-application



Effects on soil-inhabiting insects, snails, fungi, mites etc.

→ Effects of **Neem** on **EPNs**?

Introduction

Idea:

- Combine Neem with EPNs

Hypotheses:

- Neem does not affect EPN-efficacy, using Wax moth larvae as model insect

Materials and Methods

- Effects of Neem on *Heterorhabditis bacteriophora*
 - Survival (toxicity)
 - Parasitization efficiency
 - Reproduction

Materials and Methods

Neem products:

Powdered formulation ‚NeemAza-U‘ by Trifolio-M GmbH



EPNs:

Clay preparation ‚nematop‘ by e-nema GmbH (*H. bacteriophora*)



Materials and Methods

Toxicity

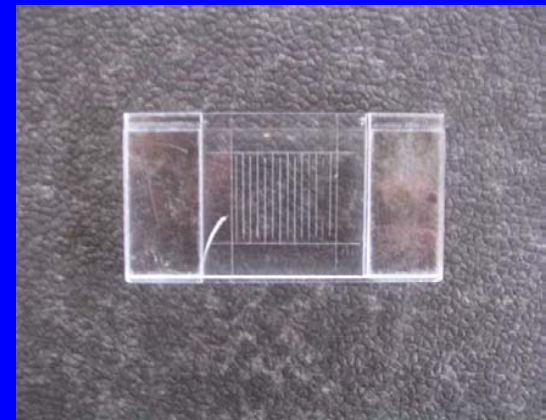
- EPNs (1,000 Infective Juvenils [IJs] / ml) suspended in different treatments
- Treatments:
 - Control (water)
 - Blank formulation (B)
 - NeemAzal-U 0.06, 0.3 and 0.6%
- 5 Replications



Materials and Methods

Toxicity

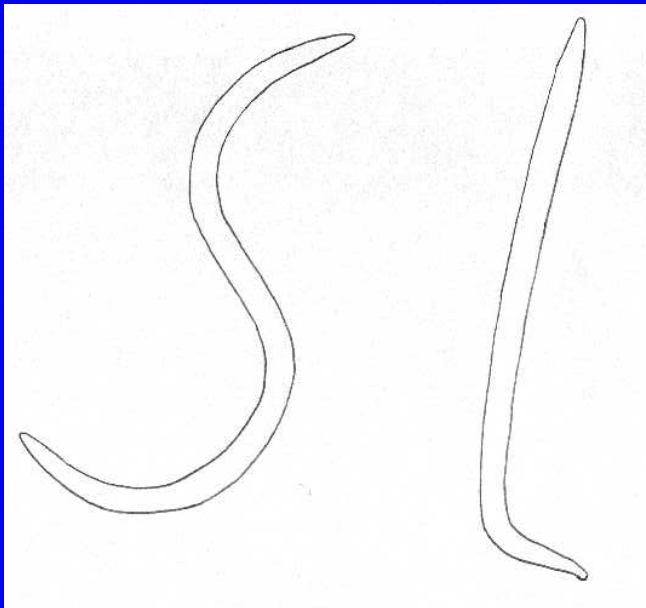
- Conditions (for all experiments) :
 - 23 °C
 - \approx 60% RH
 - Complete darkness
- Data recorded :
 - IJs counted after 24 h and 14 days



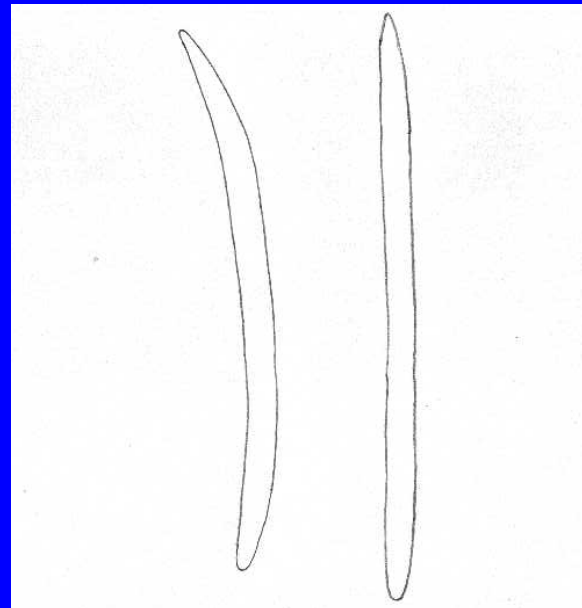
Materials and Methods

Toxicity

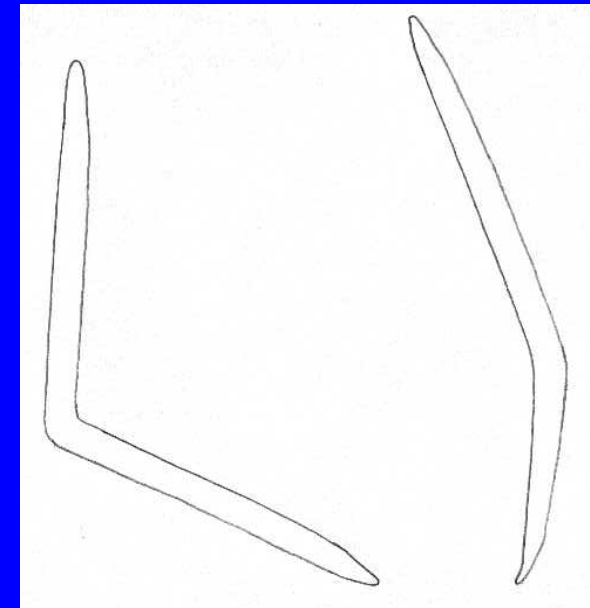
After 14 days IJs were characterised in the following way:



alive



dead



motionless

Materials and Methods

Parasitization efficiency

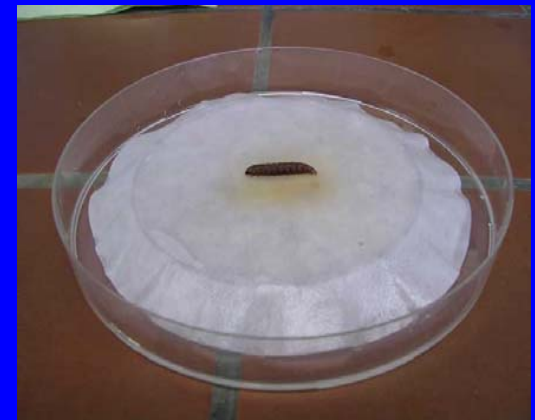
- Treatments: Control, B, BB (IJs suspended in blank formulation), 0.06, 0.3, 0.6% NeemAzal-U
- EPNs remained for 1 week in different treatments
- Individual *Galleria melonella* were infected with 10 IJs
- 5 *G. melonella* larvae per treatment
- Replicated 5 times
- Numbers of dead insects evaluated after 24, 48, 72, 96 and 120 hrs



Materials and Methods

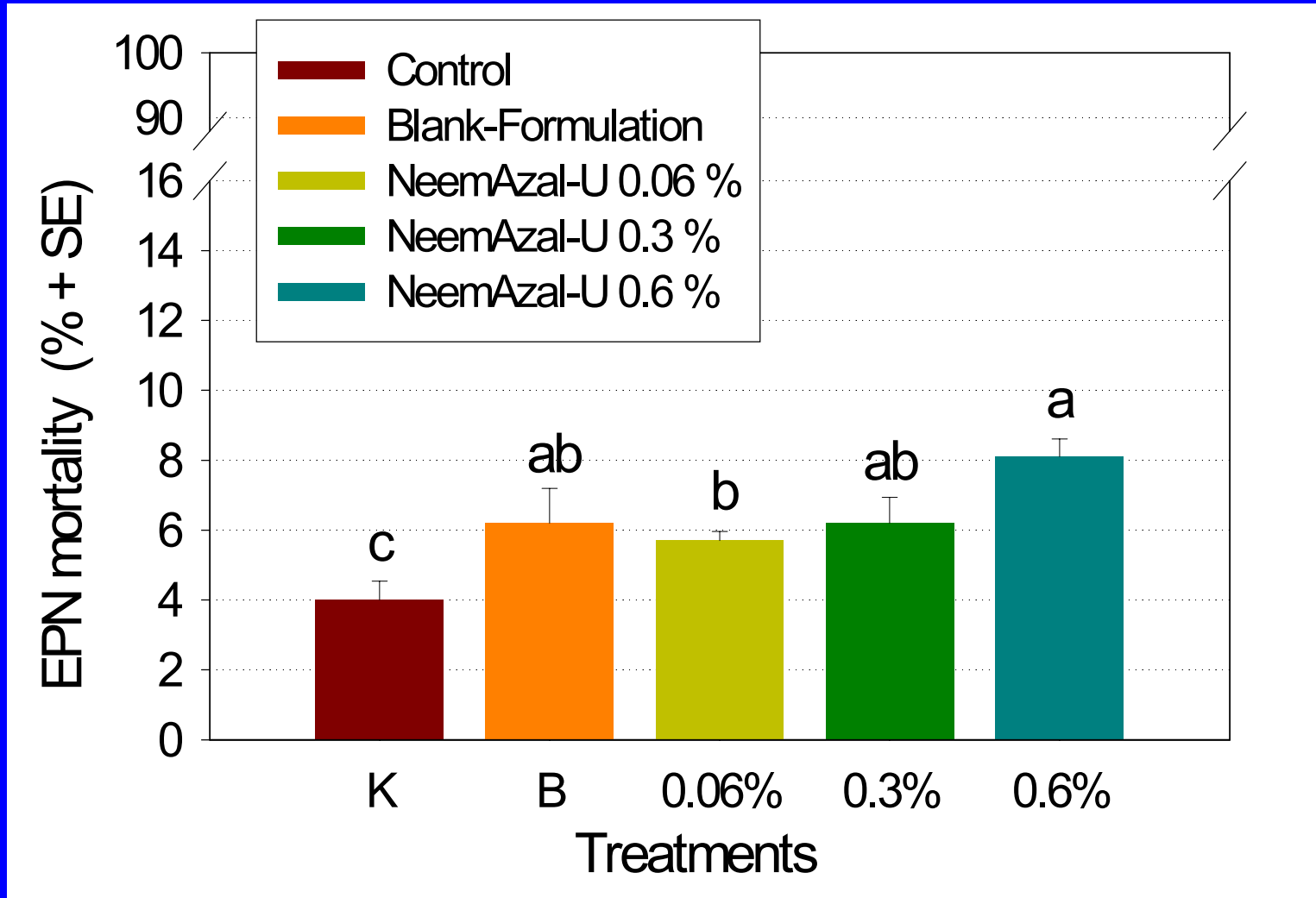
Reproduction

- 1 *G. melonella* per Petridish, originating from the previous parasitization experiment
- 5 *G. melonella* larvae per treatment
- Offspring (IJs) were counted after 14, 16, 18, 20, 22, 24, 27, 30 and 34 days



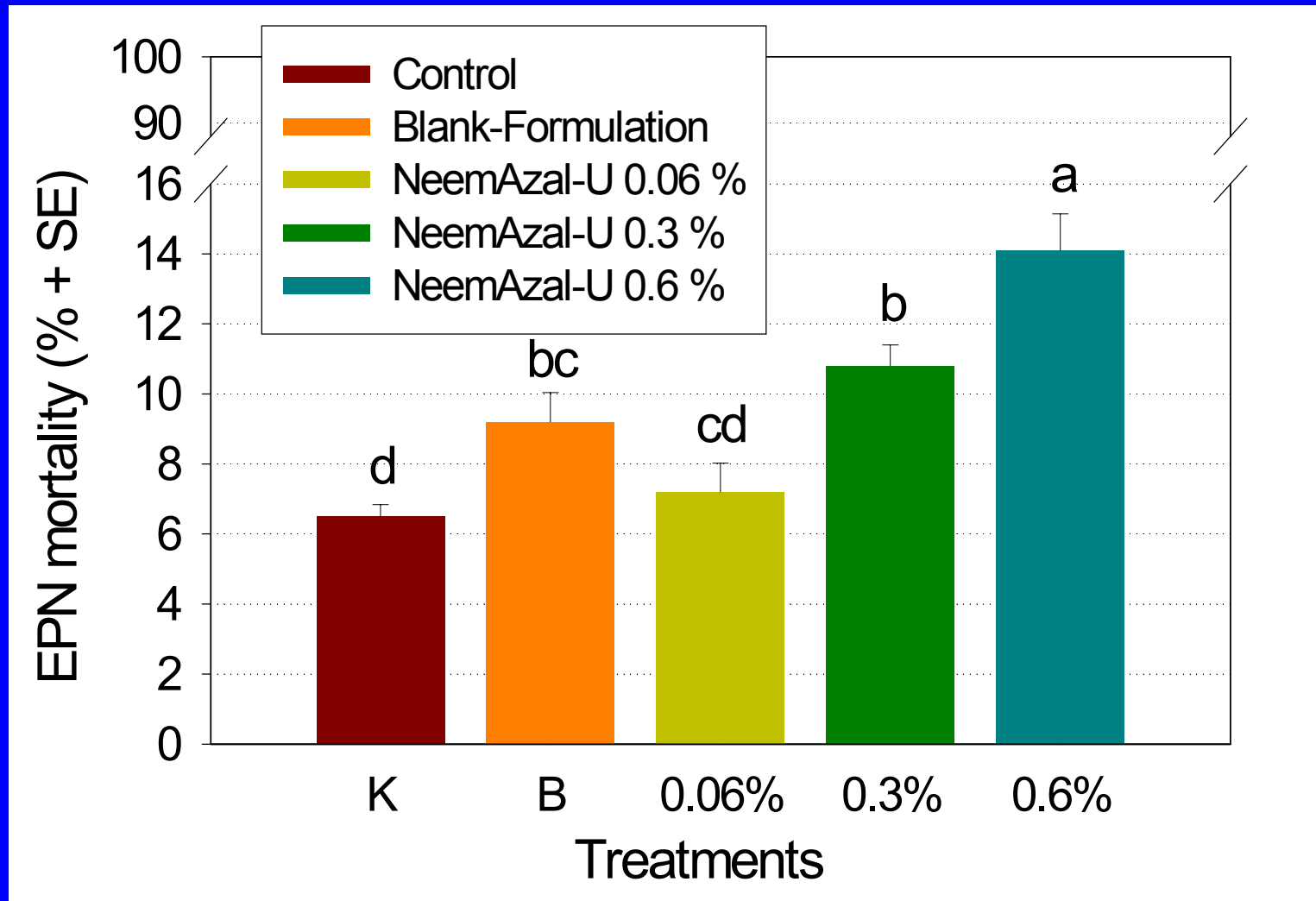
Results

Toxicity (Short term – toxicity after 24h)



Results

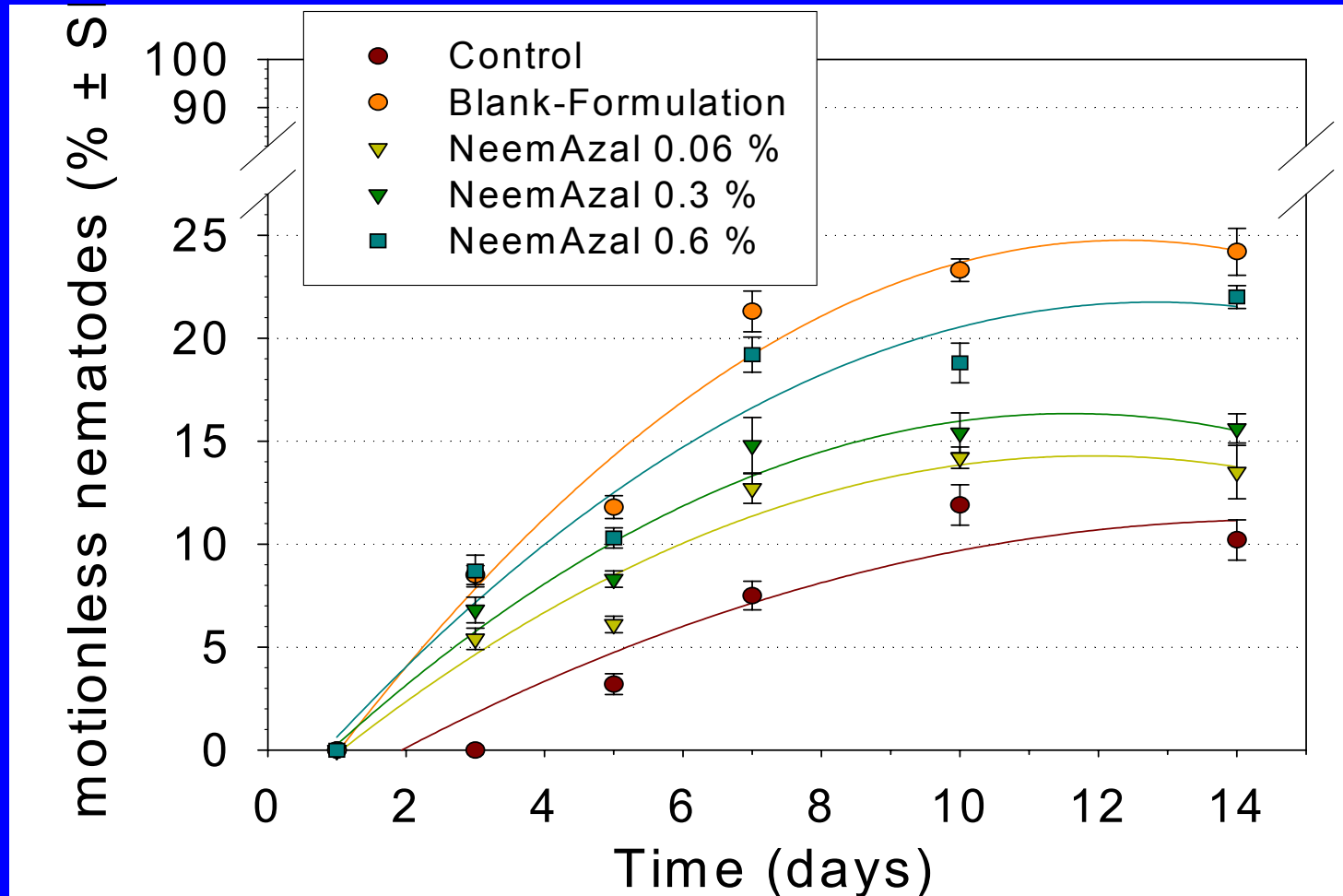
Toxicity (Long term – toxicity after 14 days)



Results

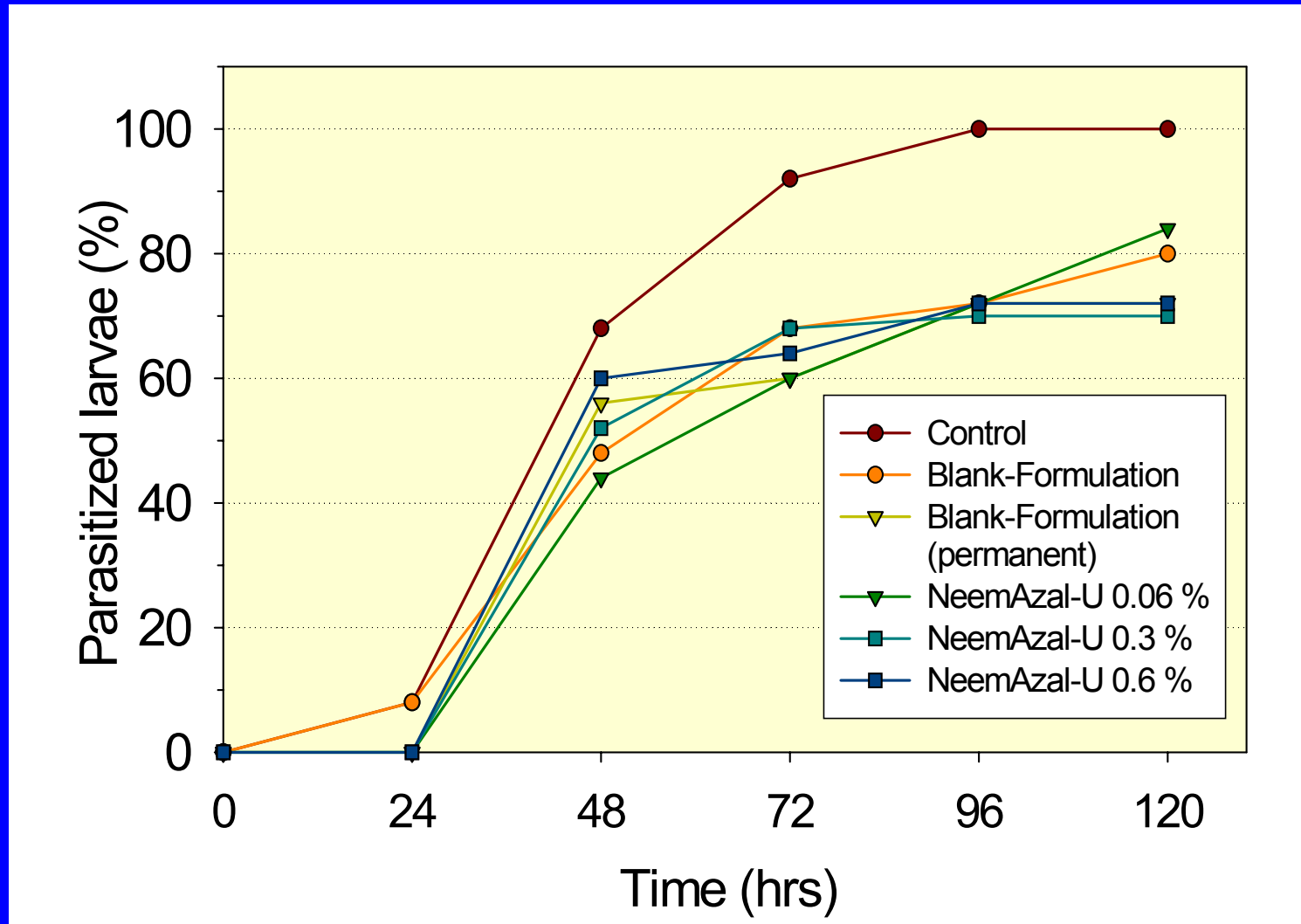
Toxicity (motionless EPNs)

EPN appearance was controlled after 1, 3, 5, 7, 10 and 14 days



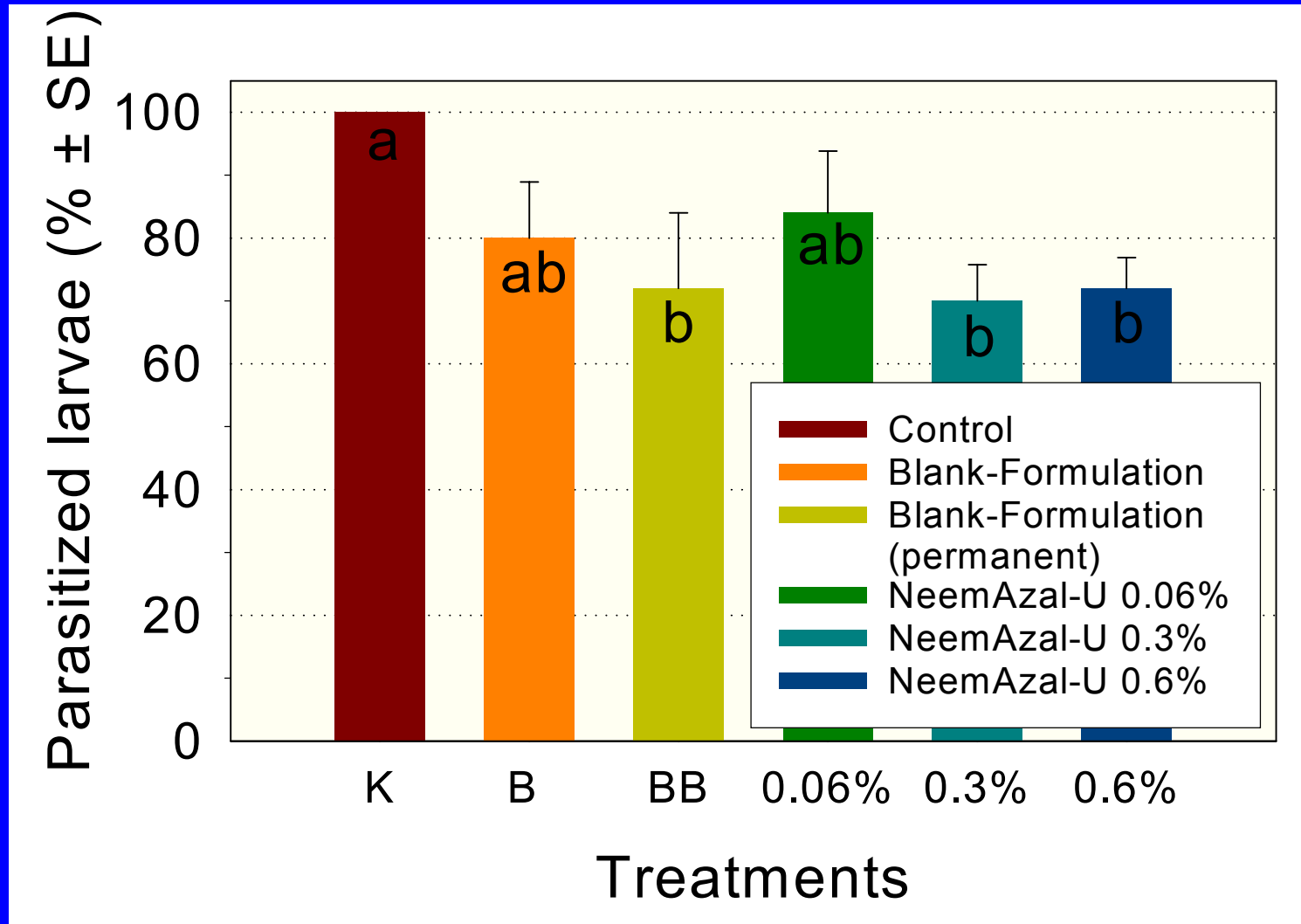
Results

Parasitization efficiency (over time)



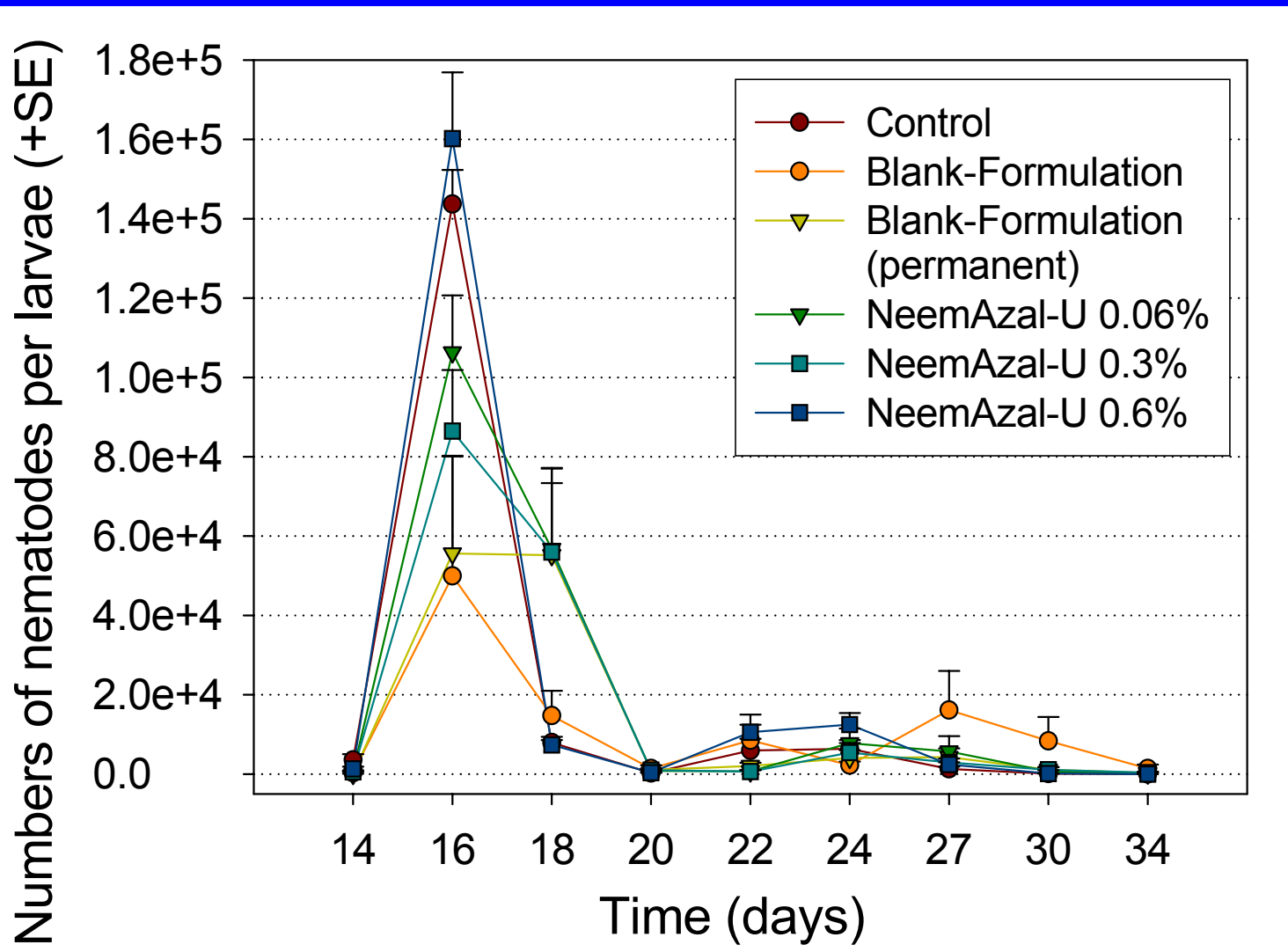
Results

Parasitization efficiency (After 120 h)



Results

Reproduction (over time)



Results

Reproduction (total number IJs per Galleria)

| Treatment | Emerged IJs (total) |
|------------------|----------------------------|
| Control | 177659.4 ± 4889.9a |
| Blank-F. | 138311.6 ± 25388.6a |
| Blank-F.(perm.) | 133595.6 ± 13712.7a |
| Neem 0.06% | 149871.7 ± 49070.0a |
| Neem 0.3% | 157078.2 ± 25391.8a |
| Neem 0.6% | 181343.6 ± 17838.7a |

means followed by common letter do not differ significantly (Tukey test, P < 0.05)

Summary

- NeemAzal-U has :
 - significant effect on survival of EPNs
 - significant effect on parasitization efficiency of EPN
 - but not on reproduction of EPNs
- However, the effects and their significance depended on the Neem concentration, with no significant effects at low concentrations in most of the experiments
- The blank formulation had similar effects (in most of the cases) as the highest Neem concentration.
- Thus, the effects of NeemAzal-U on EPNs probably derive from its formulation.

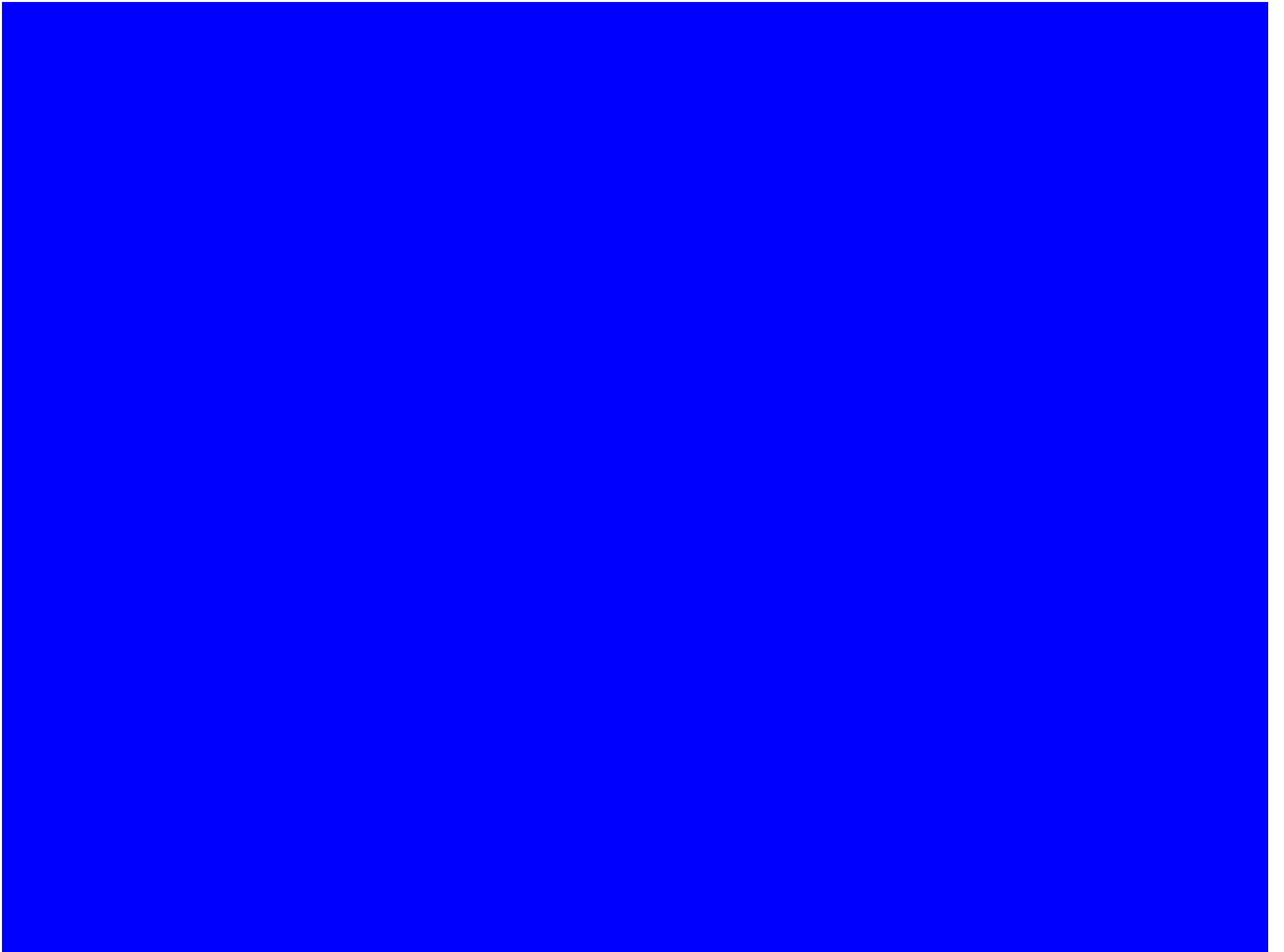
Conclusion

- Results have to be confirmed in field experiments
- Combination of NeemAzal-U & EPNs is possible at low concentration of the Neem product. At high Neem concentrations potential side-effects on the nematodes. This could be overcome by improved formulation of the Neem product.
 - Combined use against pests like WFT should be tested

Acknowledgement

Edmund Hummel, Trifolio-M GmbH, for providing the
Neem product & e-nema GmbH for the EPNs

  Thanks for Your Attention !  



Results (Infection rate) (Phytopathogenic nematodes)

Phytotoxic effects of NeemAza-U



NeemAza-U 0,6 %



Blank formulation

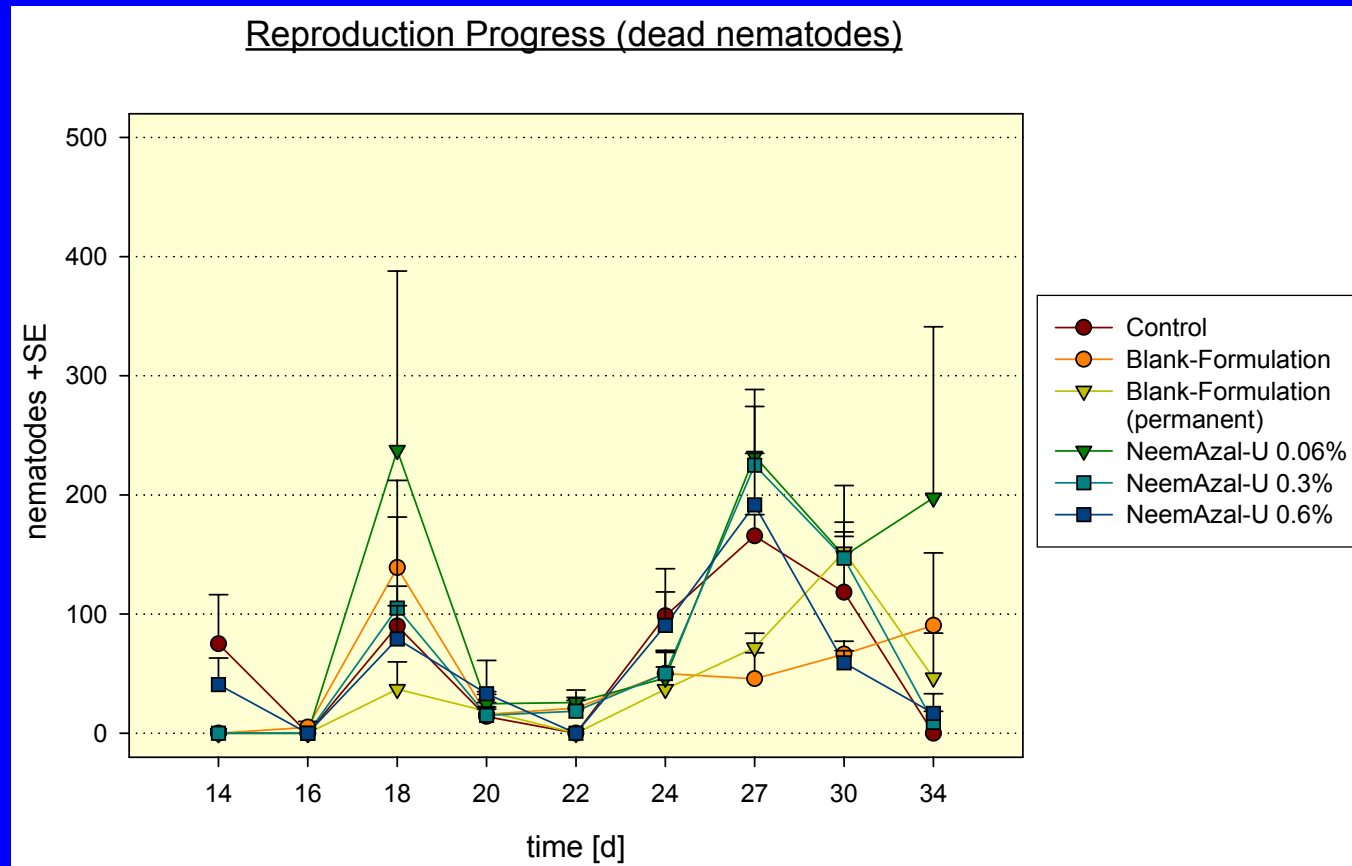
Results (Reproduction)

(Entomopathogenic nematodes)

| Time | Treatment | | | | | |
|------|---------------------|--------------------|----------------------|--------------------|---------------------|---------------------|
| | Control | Blank formulation | Blank f. (permanent) | 0,06% | 0,30% | 0,60% |
| 14 | 3554.1 ± 1444.49 | 308.1 ± 188.92 | 32.8 ± 32.78 | 554.4 ± 259.02 | 643.7 ± 269.84 | 1292.2 ± 552.11 |
| 16 | 143700.56 ± 8611.74 | 49982.9 ± 30242.09 | 55575.6 ± 24459.16 | 86451.5 ± 15396.39 | 106306.2 ± 14335.70 | 160161.0 ± 16715.21 |
| 18 | 7944.2 ± 1417.82 | 14699.3 ± 6291.27 | 55187.3 ± 21963.45 | 55987.7 ± 17338.38 | 56725.9 ± 20259.73 | 7364.9 ± 1211.05 |
| 20 | 259.3 ± 43.94 | 1413.6 ± 778.80 | 1010.8 ± 458.47 | 980.9 ± 224.50 | 745.8 ± 75.89 | 354.9 ± 51.98 |
| 22 | 5922.8 ± 2961.48 | 8477.6 ± 3954.03 | 2020.3 ± 820.12 | 629.9 ± 424.17 | 662.3 ± 315.32 | 10540.5 ± 4412.18 |
| 24 | 6382.1 ± 2180.54 | 2245.9 ± 858.81 | 4042.2 ± 1963.08 | 5414.12 ± 2407.11 | 7780.8 ± 3690.49 | 12463.5 ± 2935.91 |
| 27 | 1314.7 ± 526.36 | 16098.4 ± 9885.35 | 4286.0 ± 2168.62 | 2903.4 ± 1007.12 | 5680.7 ± 3845.51 | 2369.8 ± 590.86 |
| 30 | 81.7 ± 26.59 | 8356.7 ± 6052.27 | 1108.4 ± 644.21 | 1079.5 ± 627.66 | 643.6 ± 358.58 | 137.6 ± 51.80 |
| 34 | 0 ± 0 | 1413.3 ± 952.28 | 295.5 ± 192.67 | 367.8 ± 221.62 | 144.0 ± 143.98 | 6.2 ± 6.20 |

Results (Reproduction)

(Entomopathogenic nematodes)



Materials and Methods



Extraction of EPN