



# Conflict between red wood ants and their myrmecophile community

# INTRODUCTION

- myrmecophiles ('myrmex' = ant, 'philos' = loving)
- myrmecophiles s.l.
  - also honeydew producers:  
aphids, scale insects, some caterpillars
  - plants
  - bacteria, fungi ...



- focus on arthropods in ant nests → true myrmecophiles / ant guests /inquilines
- → PhD project: Conflict between ants and ant associated arthropods
- enormous diversity estimates up to 10.000 species!
- almost all insect groups have representatives + spiders, mites

# SPECIALIZED MYRMECOPHILES

→ treated as colony members !



*Maculinea (Phengaris) alcon*



*Ecitomorpha (Staphylinidae)*



*Lomechusa (Staphylinidae)*



*Paussinae (Carabidae)*



*Claviger (Pselaphinae)*

# RED WOOD ANT MYRMECOPHILES



# RED WOOD ANT MYRMECOPHILES



- diverse
- unspecialized species

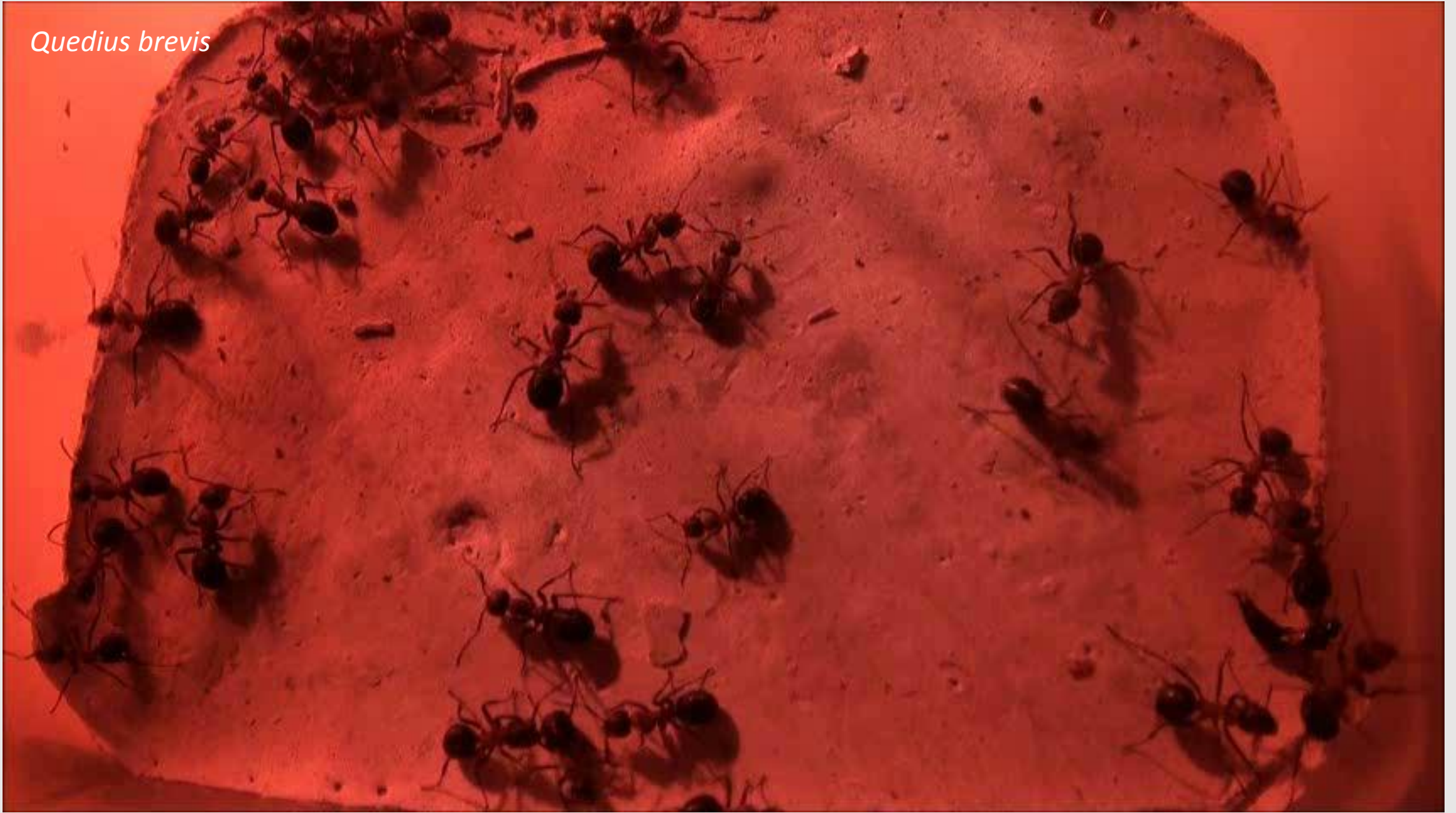
*Thyreosthenius biovatus*



*Thiasophila angulata*

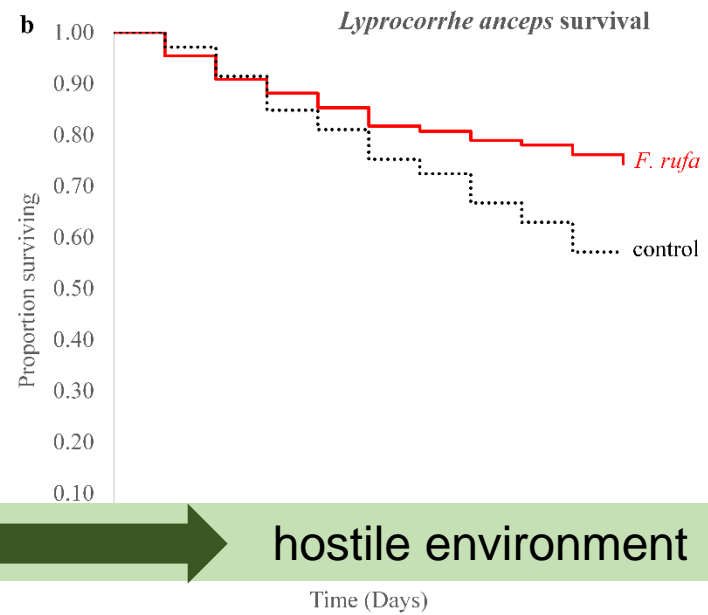
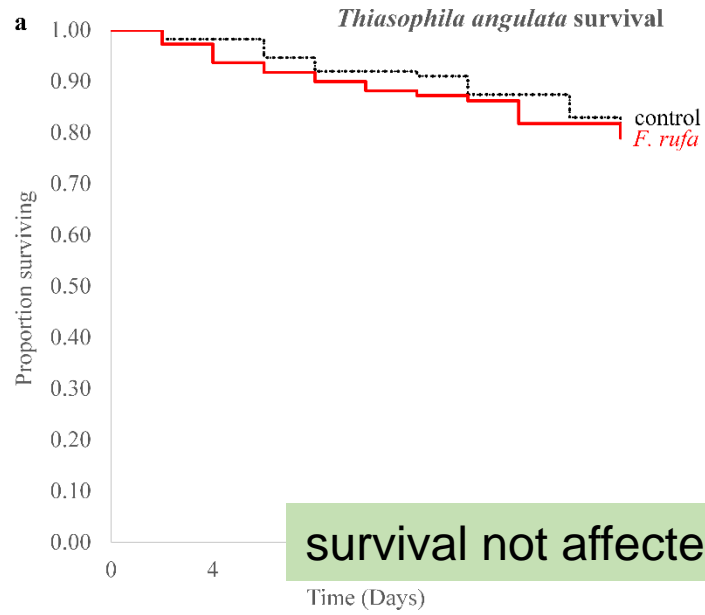


*Quedius brevis*



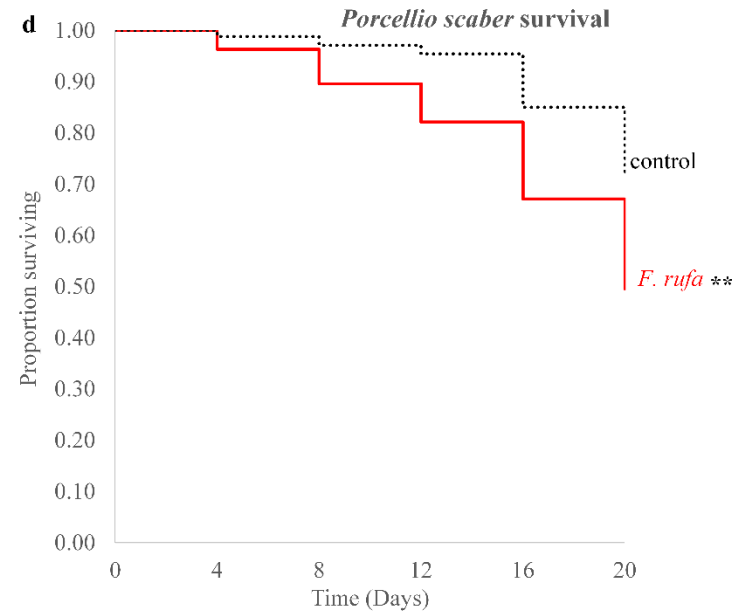
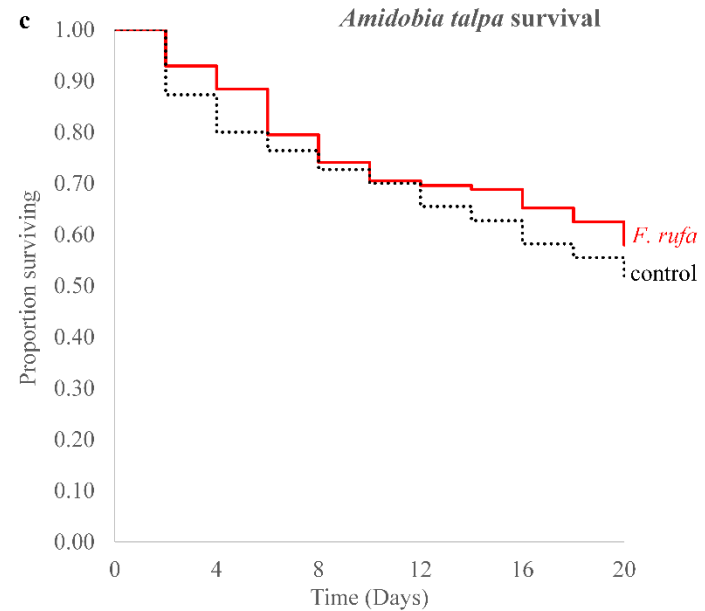


# A) SURVIVAL ANALYSES

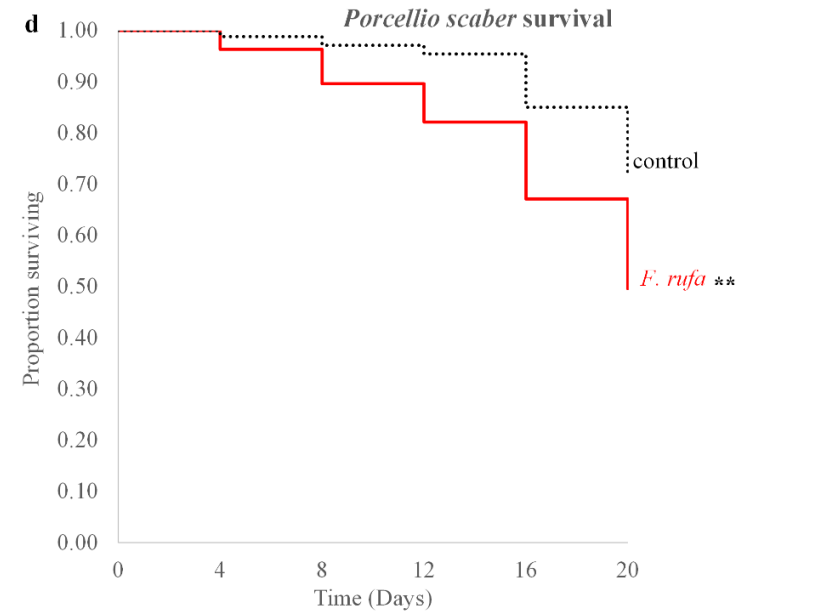
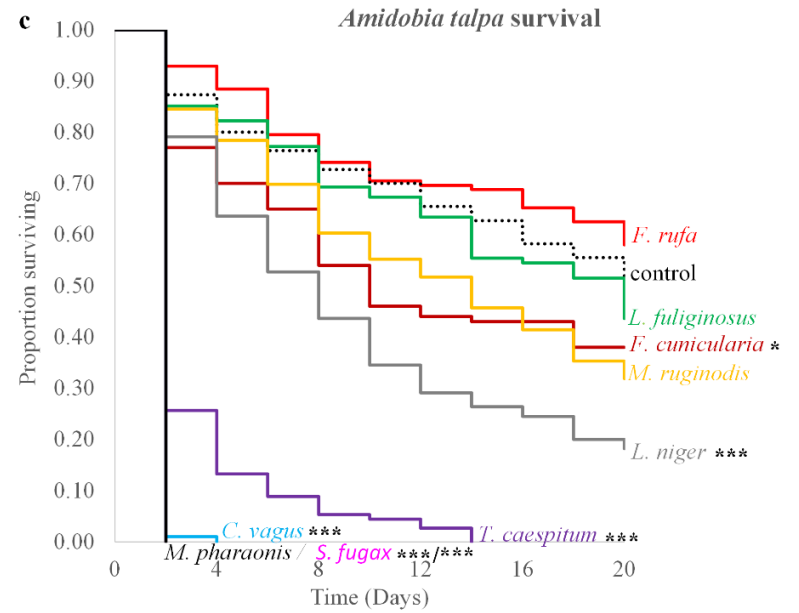
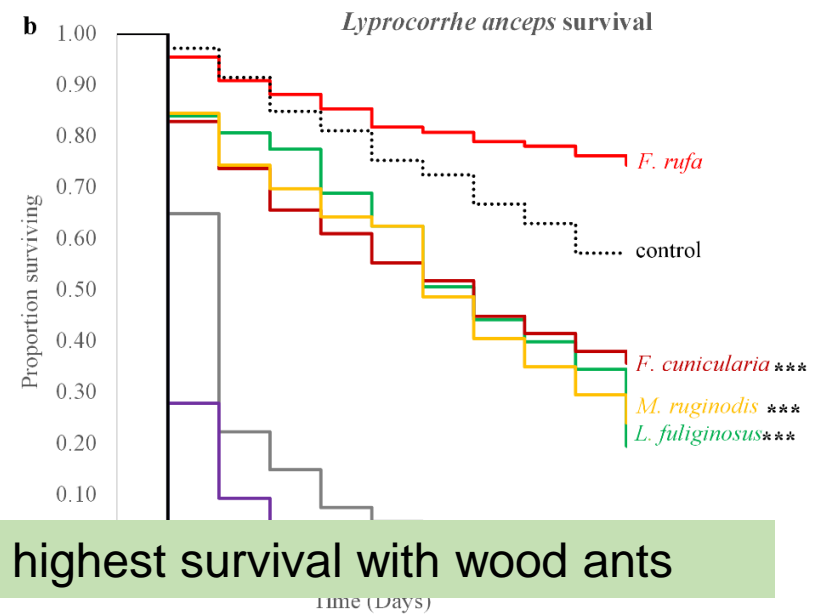
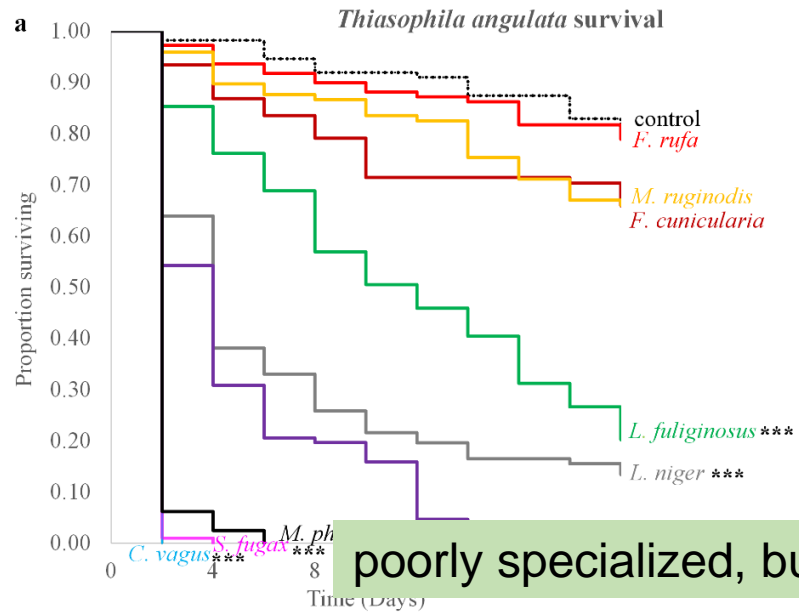


survival not affected

hostile environment



# A) SURVIVAL ANALYSES



## B) FOOD WEB

- direct preference tests
- stable isotopes

Different food sources offered:

- ↗ ant associated food (eggs, larvae, pupae, dead ants, trophallaxis)
- ↘ other (living) myrmecophiles: prey-predator interactions

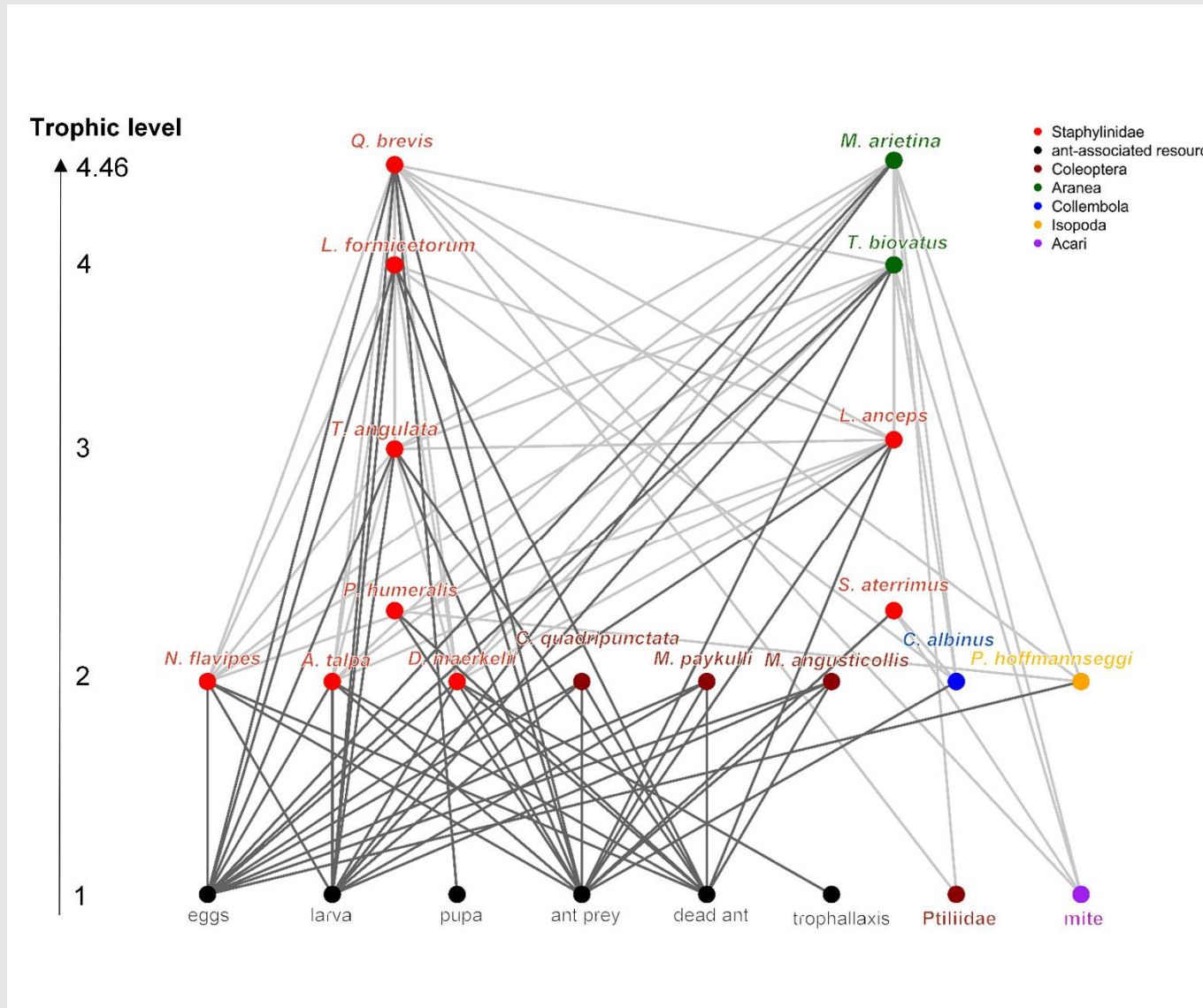
Analysis:

- video-recording under dark conditions during 1 hour
- acceptance after 1 day
- gut analysis after 1 day

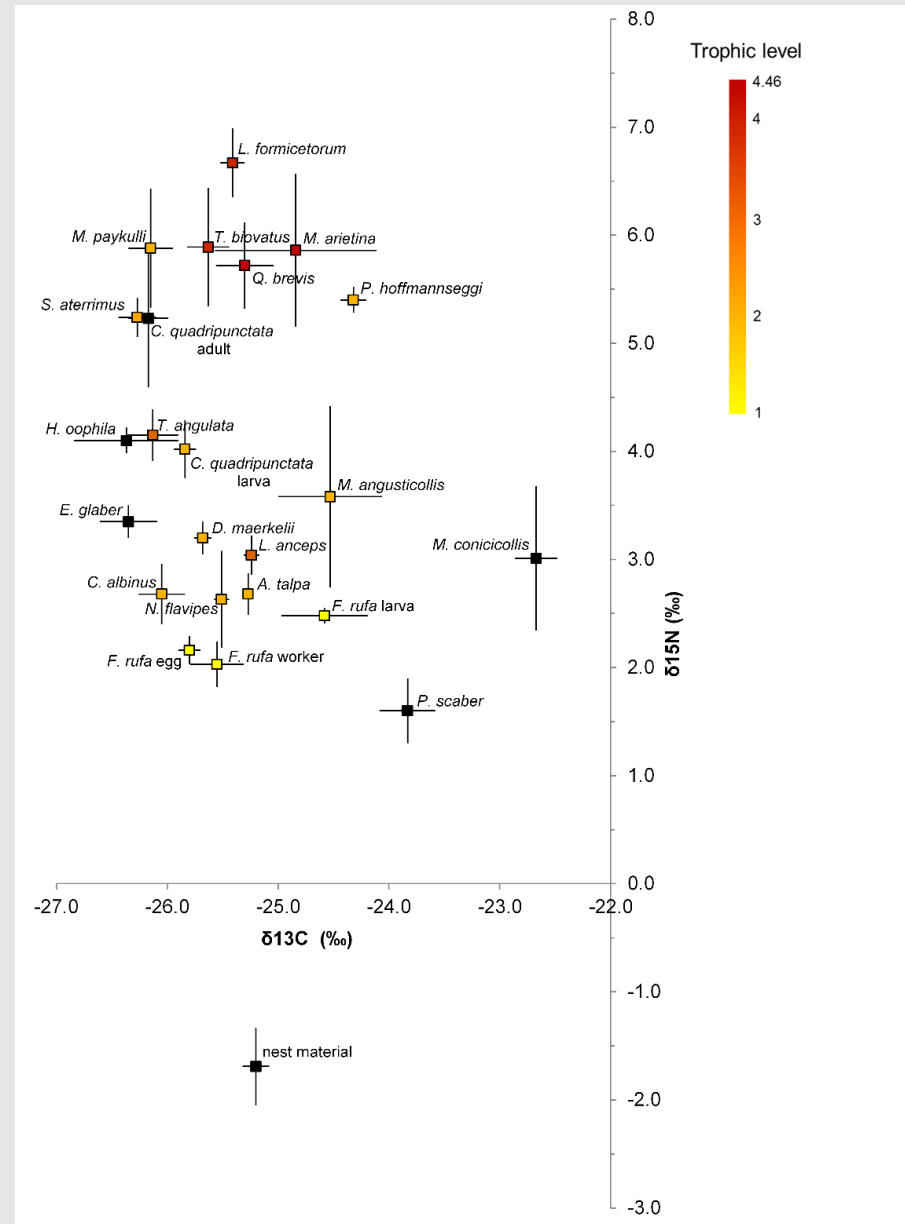




# B) FOOD WEB: DIRECT PREFERENCE TESTS



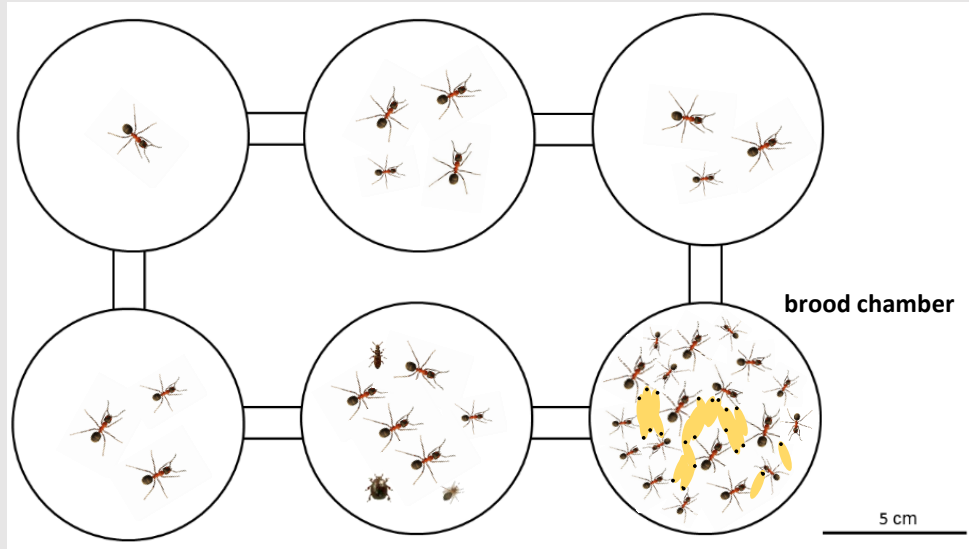
# B) FOOD WEB: STABLE ISOTOPE ANALYSIS



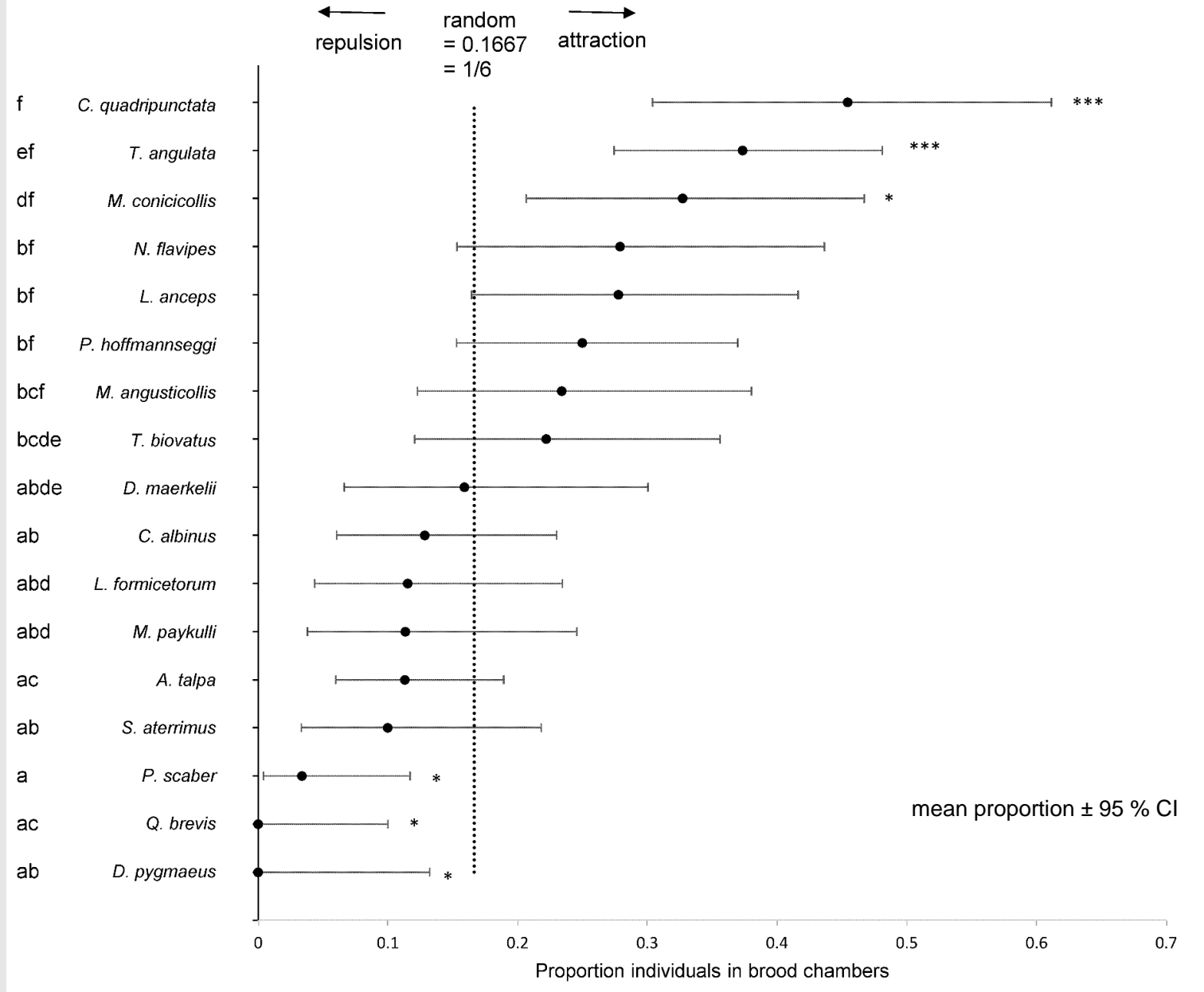


# C) NEST LOCATION PREFERENCE (well-integrated vs poorly integrated)

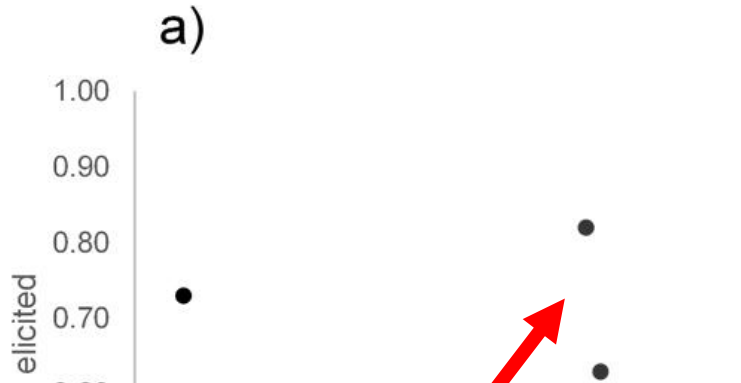
48 hours later



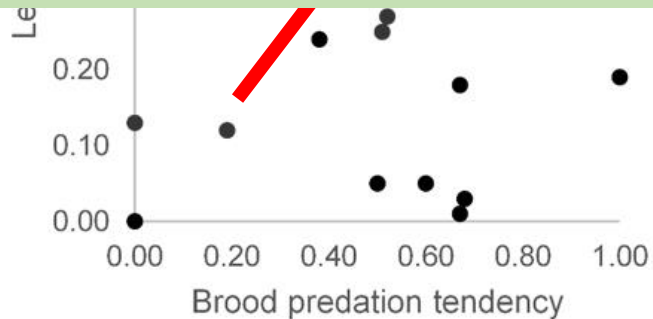
- 360 workers
- 100 larvae / 50 pupae 🐛
- → brood + most workers : brood chamber



# C) LEVEL OF INTEGRATION VS. AGGRESSION VS. BROOD PREDATION



- no direct correlations between life history parameters
- brood predators can live within the brood chambers
- ants do not succeed to deter some brood parasites from the brood chambers



**more aggressive  
towards more severe parasites**

# D) CHEMICAL ADAPTATION

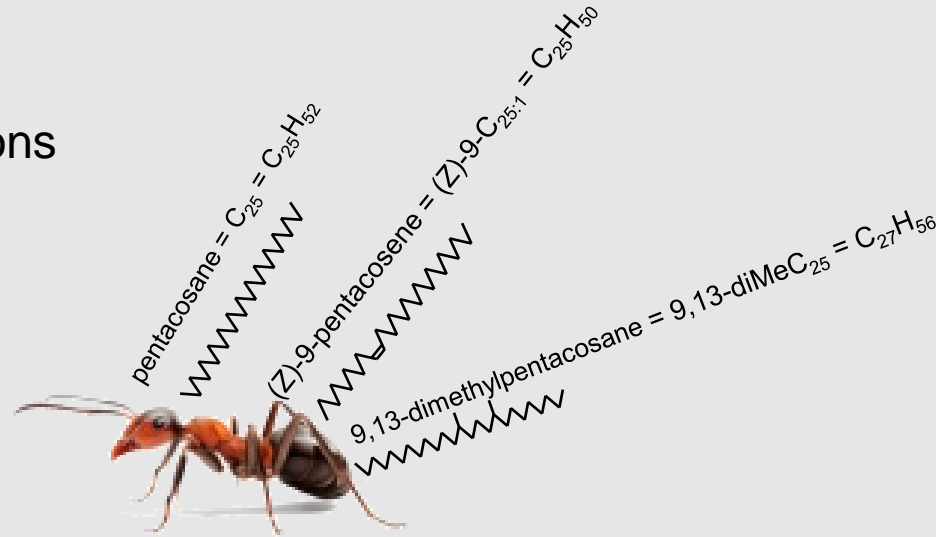
cuticular compounds: colony specific recognition cue in social insects: **BREAKING THE CHEMICAL CODE**



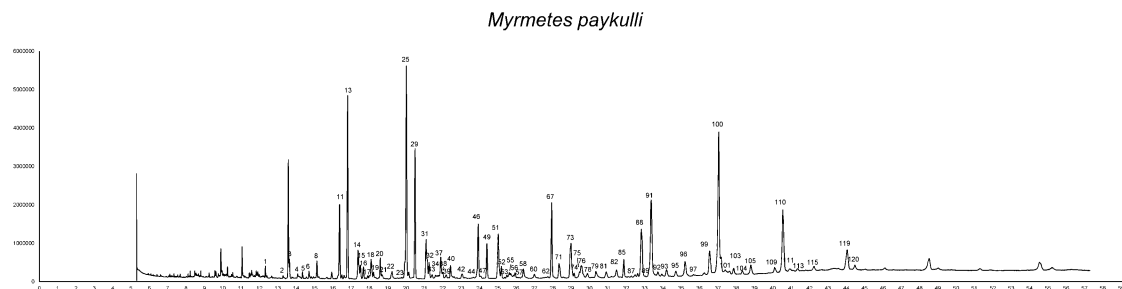
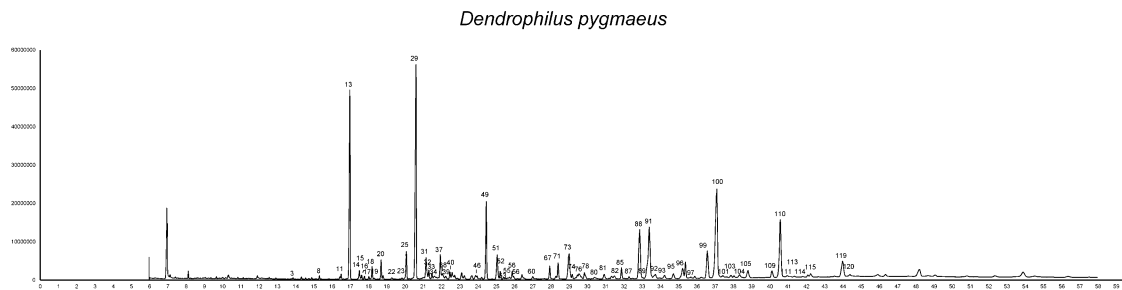
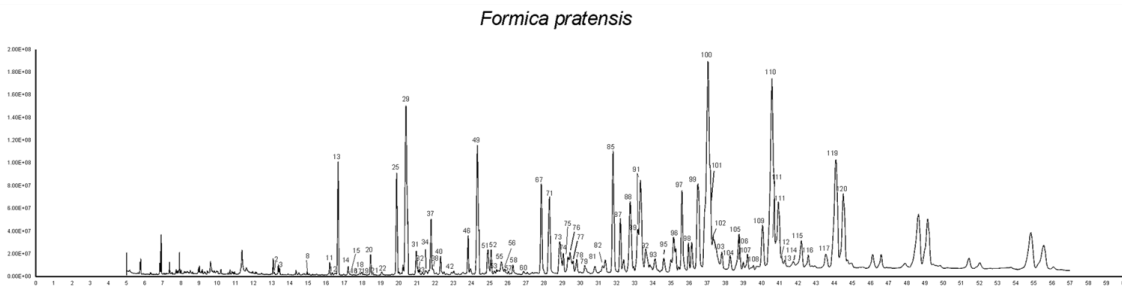
Chemical camouflage: compound passively acquired

Chemical mimicry: compound are biosynthesized a priori

•cuticular hydrocarbons



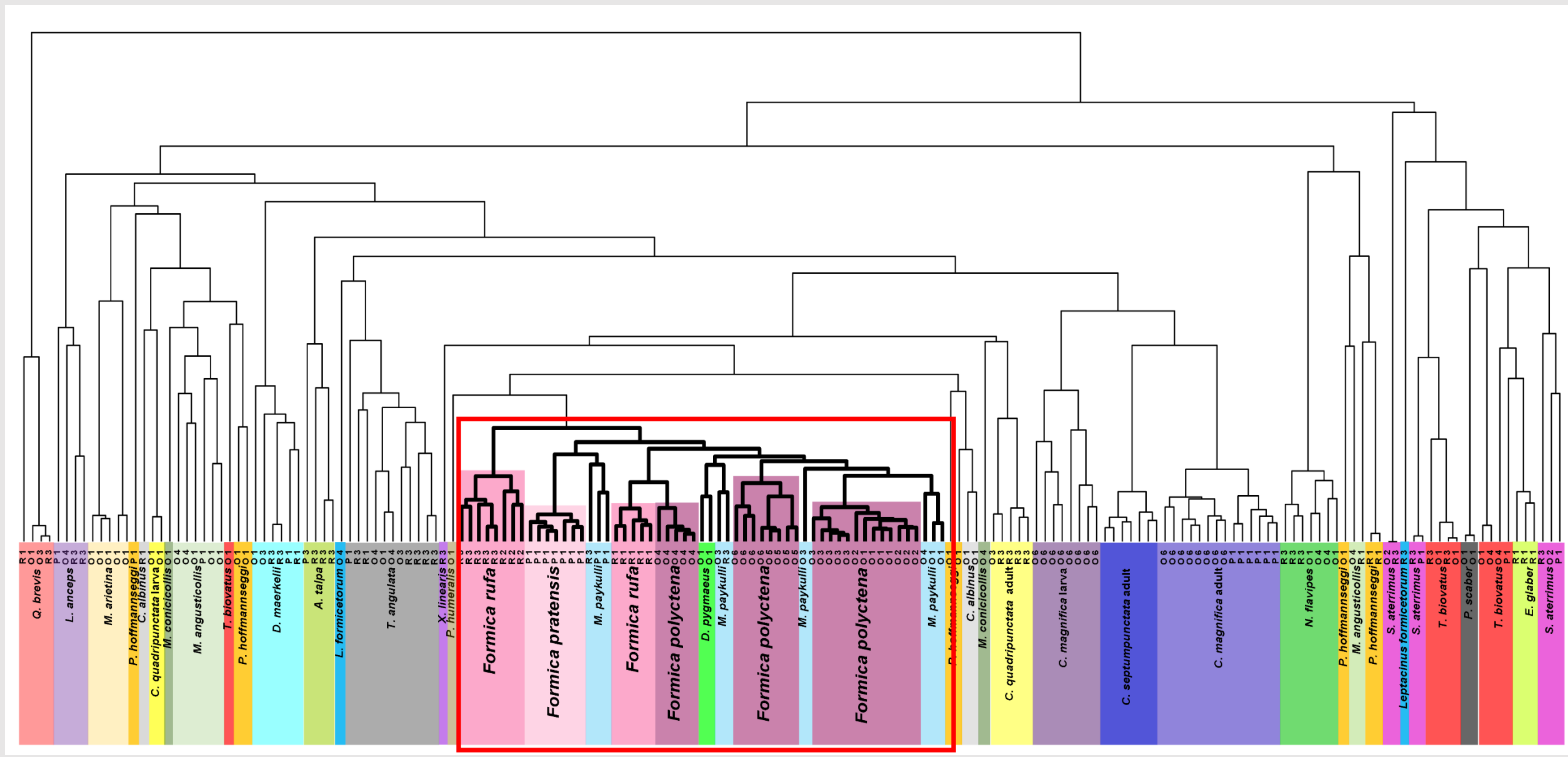
Chemical odourless



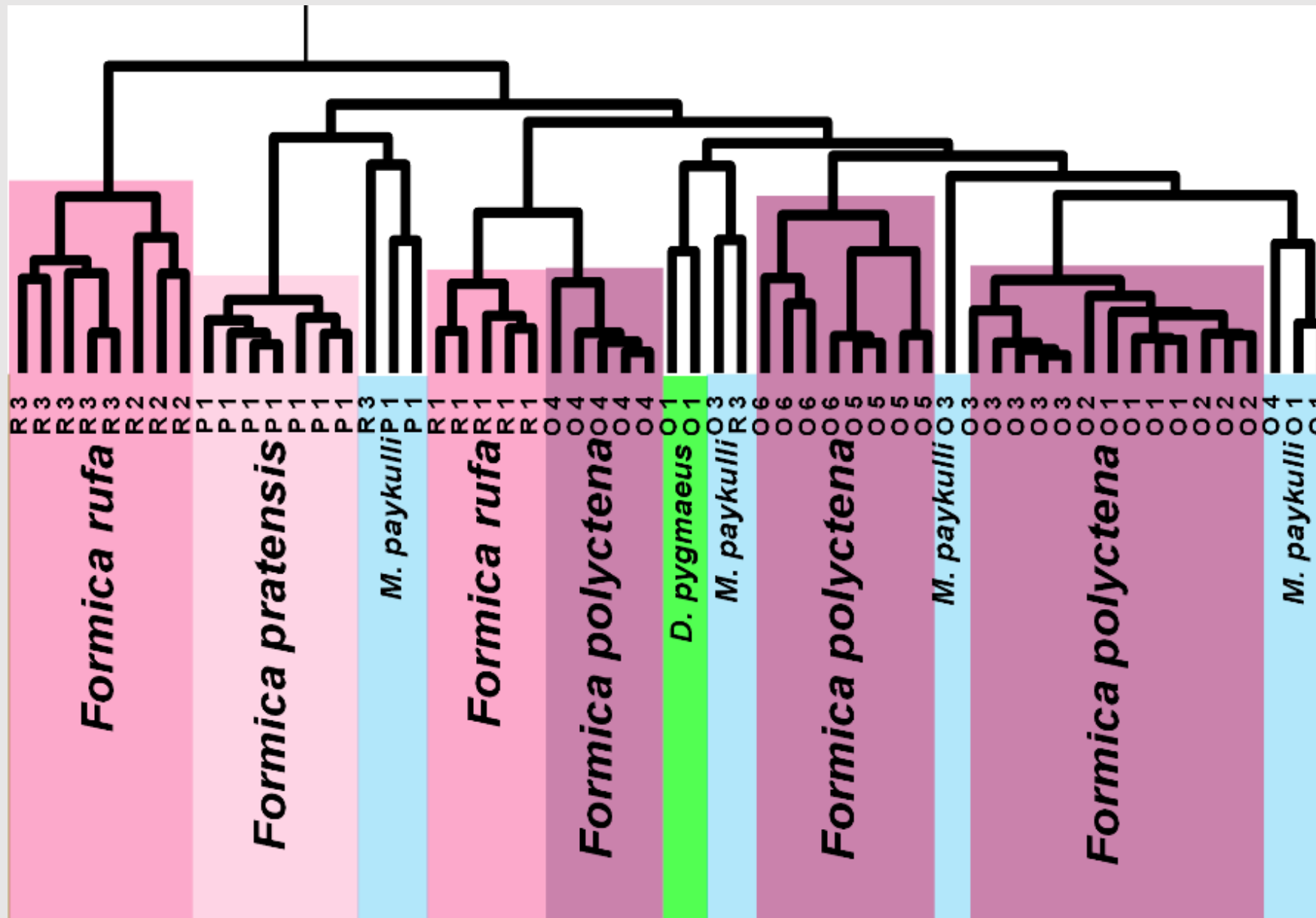




# D) CHEMICAL ADAPTATION: CUTICULAR HYDROCARBON SIMILARITY

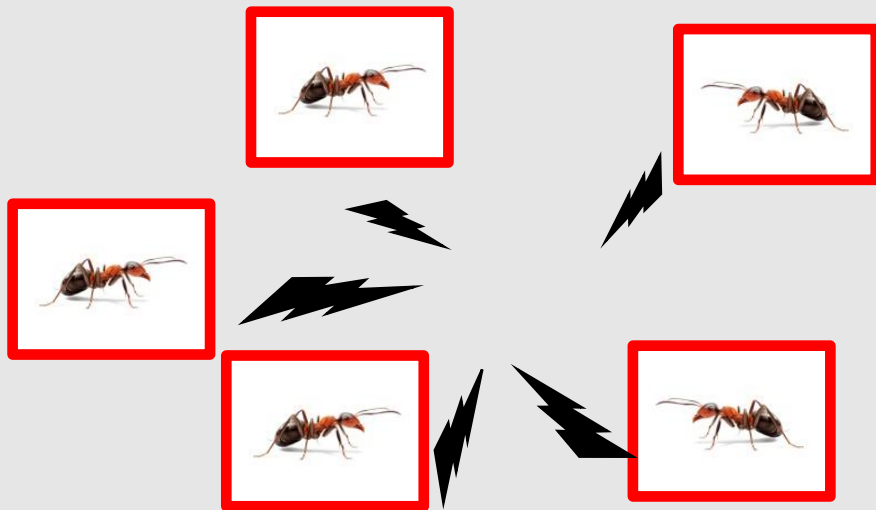
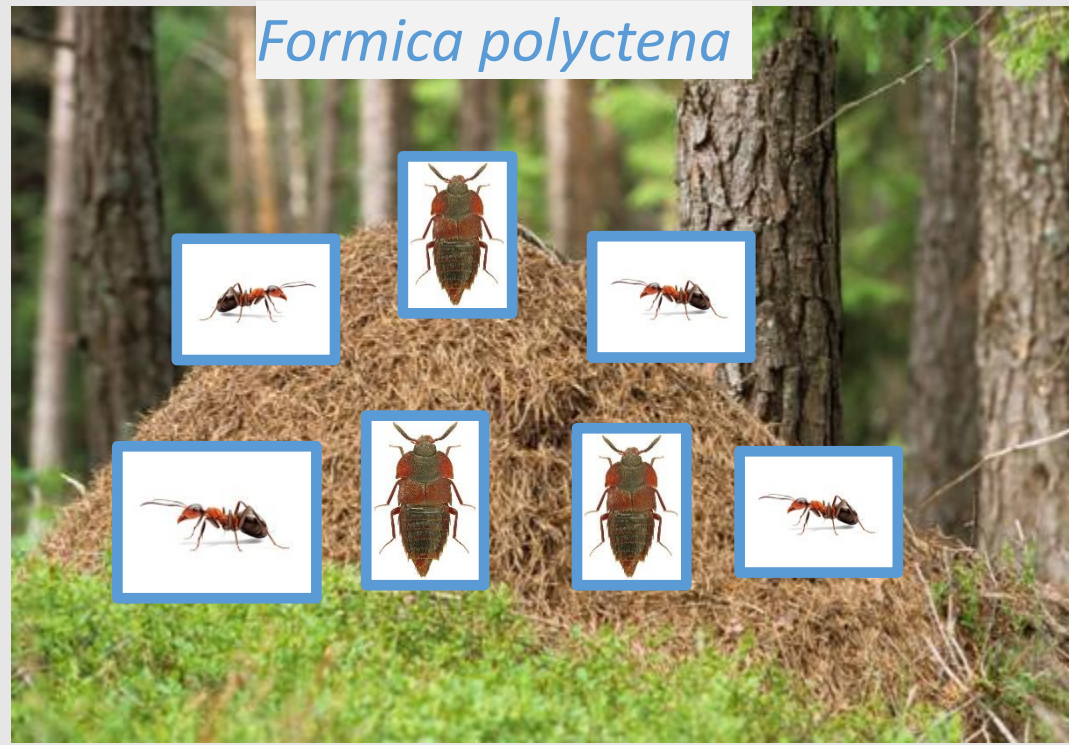
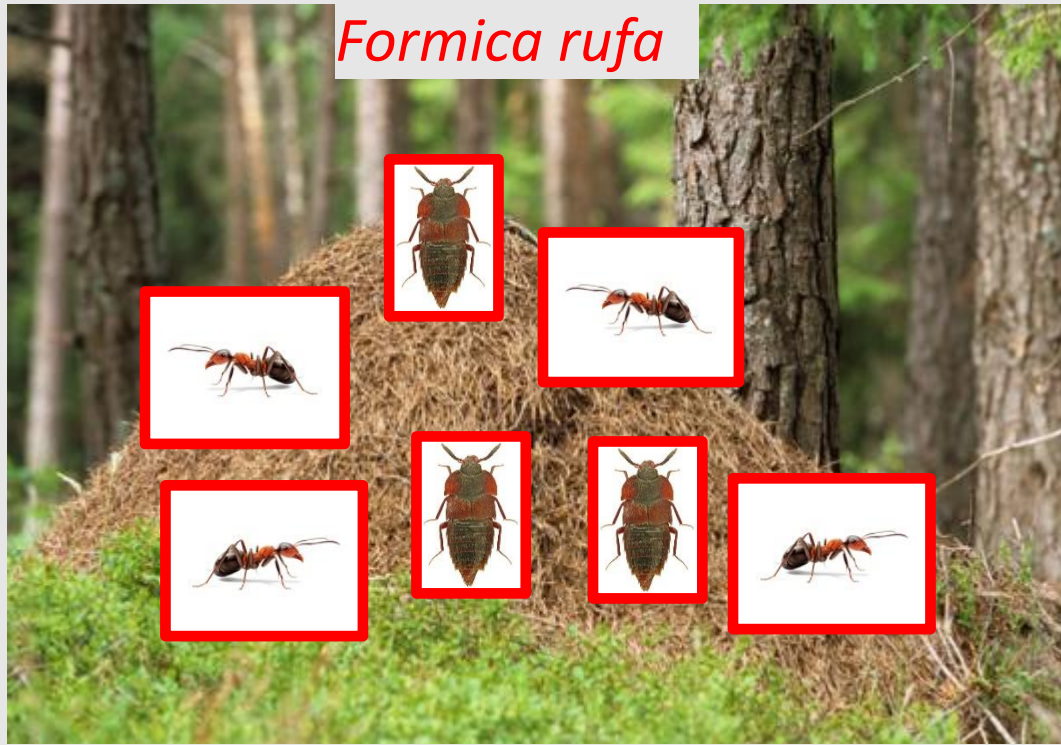


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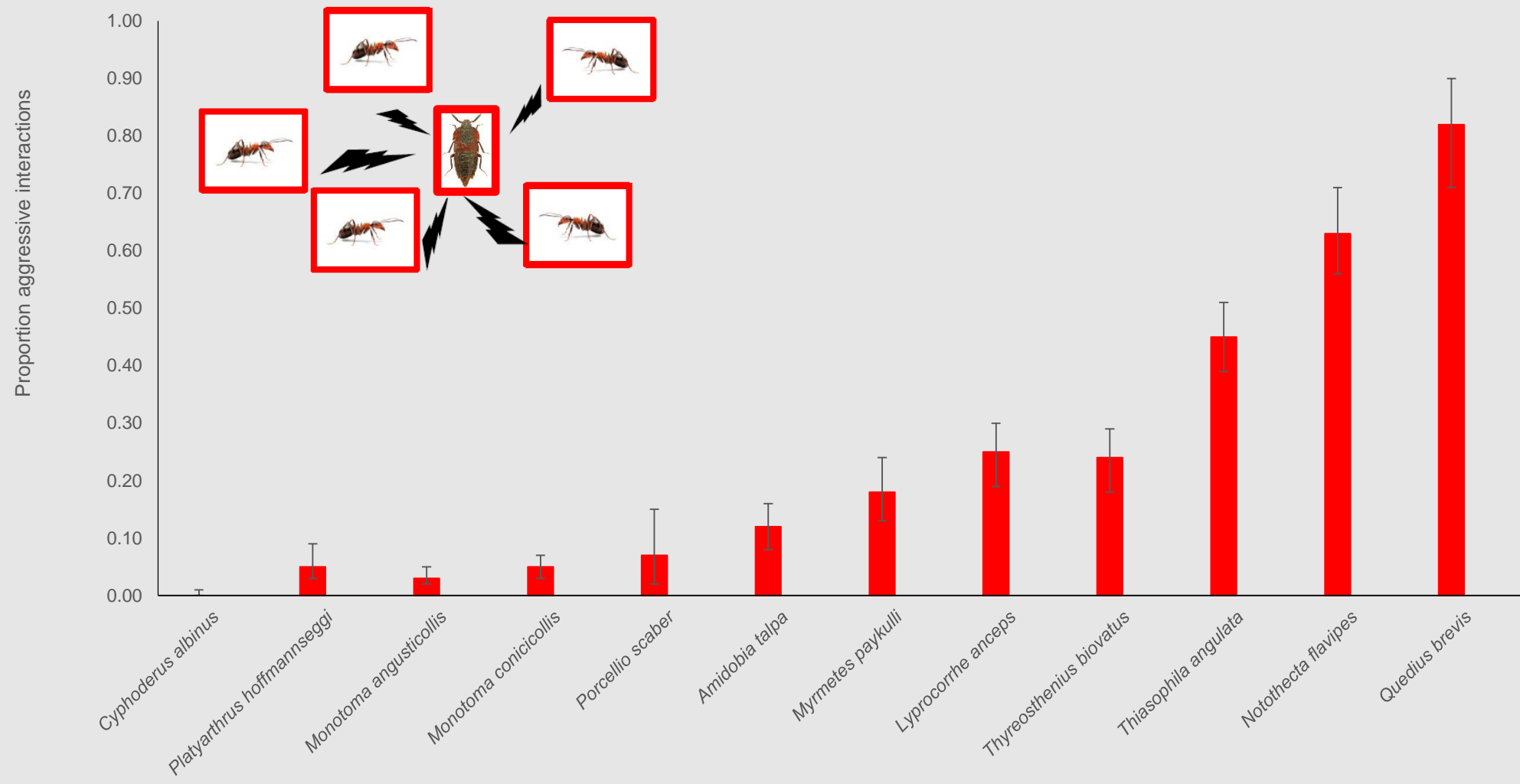
# D) CHEMICAL ADAPTATION: BEHAVIOUR EXPERIMENTS



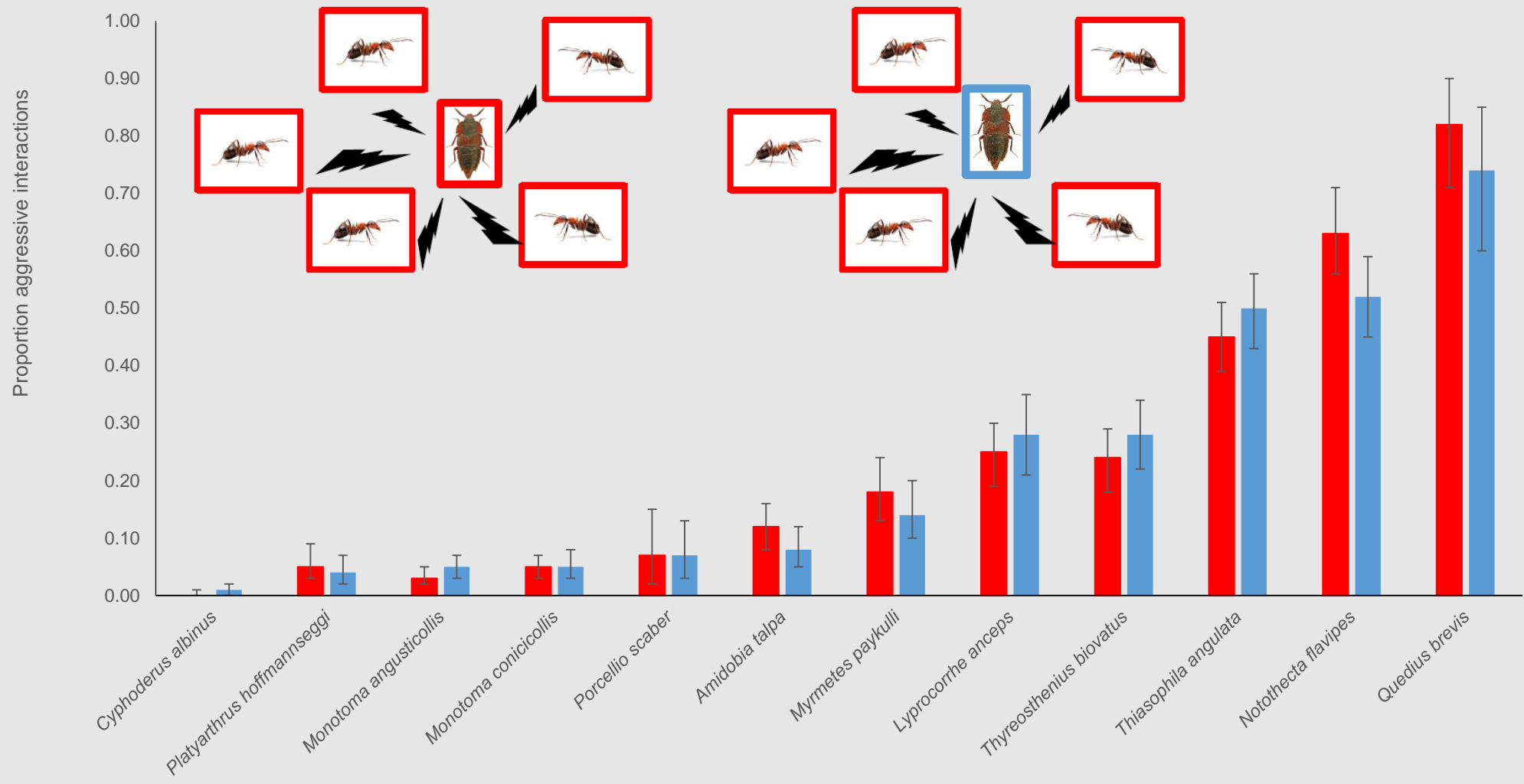
40 *Formica rufa* workers of same polydomous colony

first 20-30 interactions scored (ignoring, opening mandibles, biting, acid spraying, chasing)

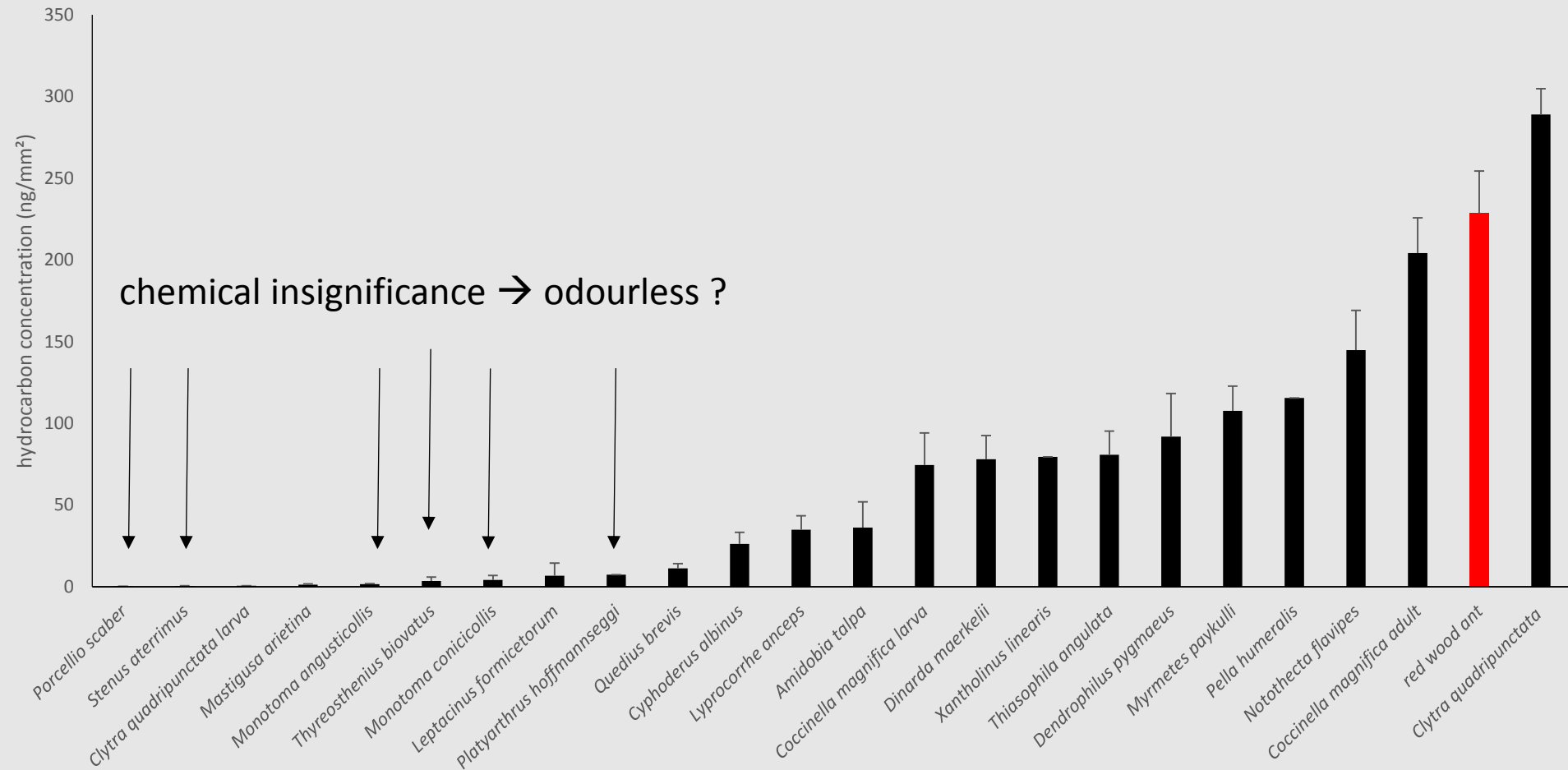
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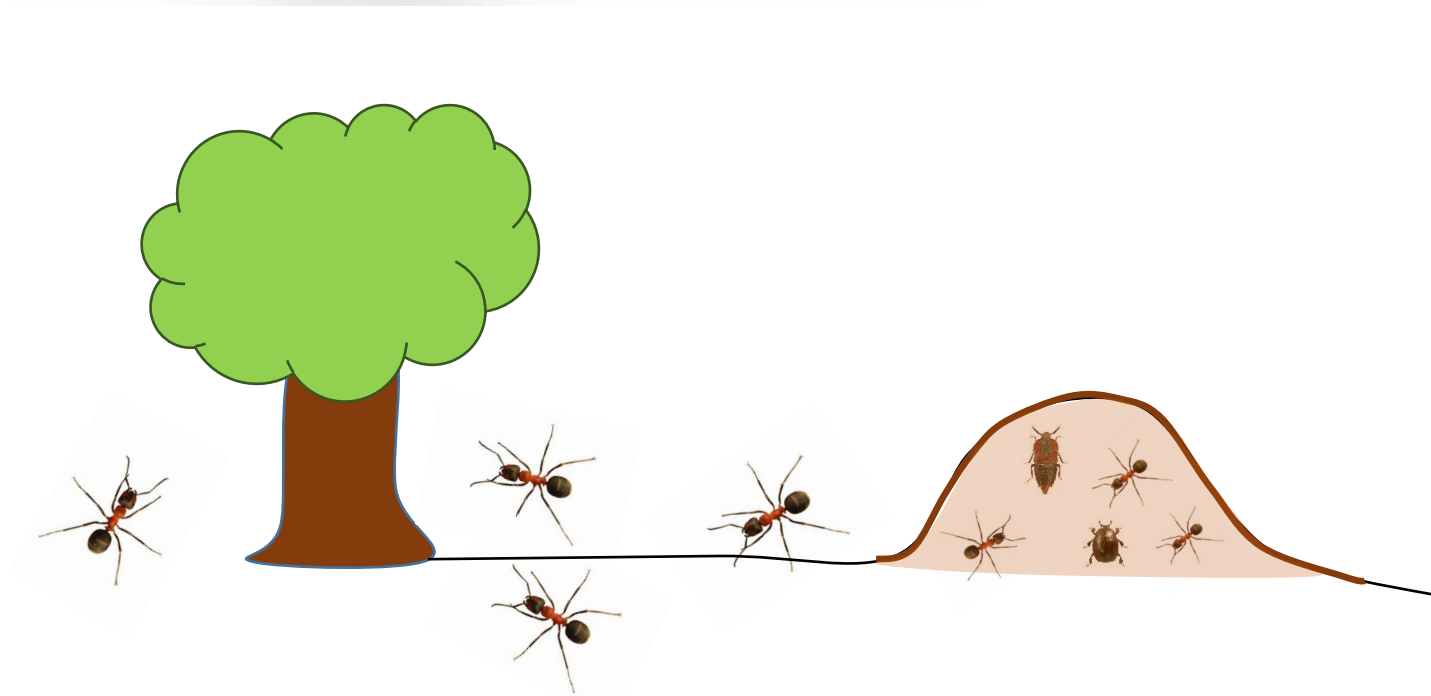
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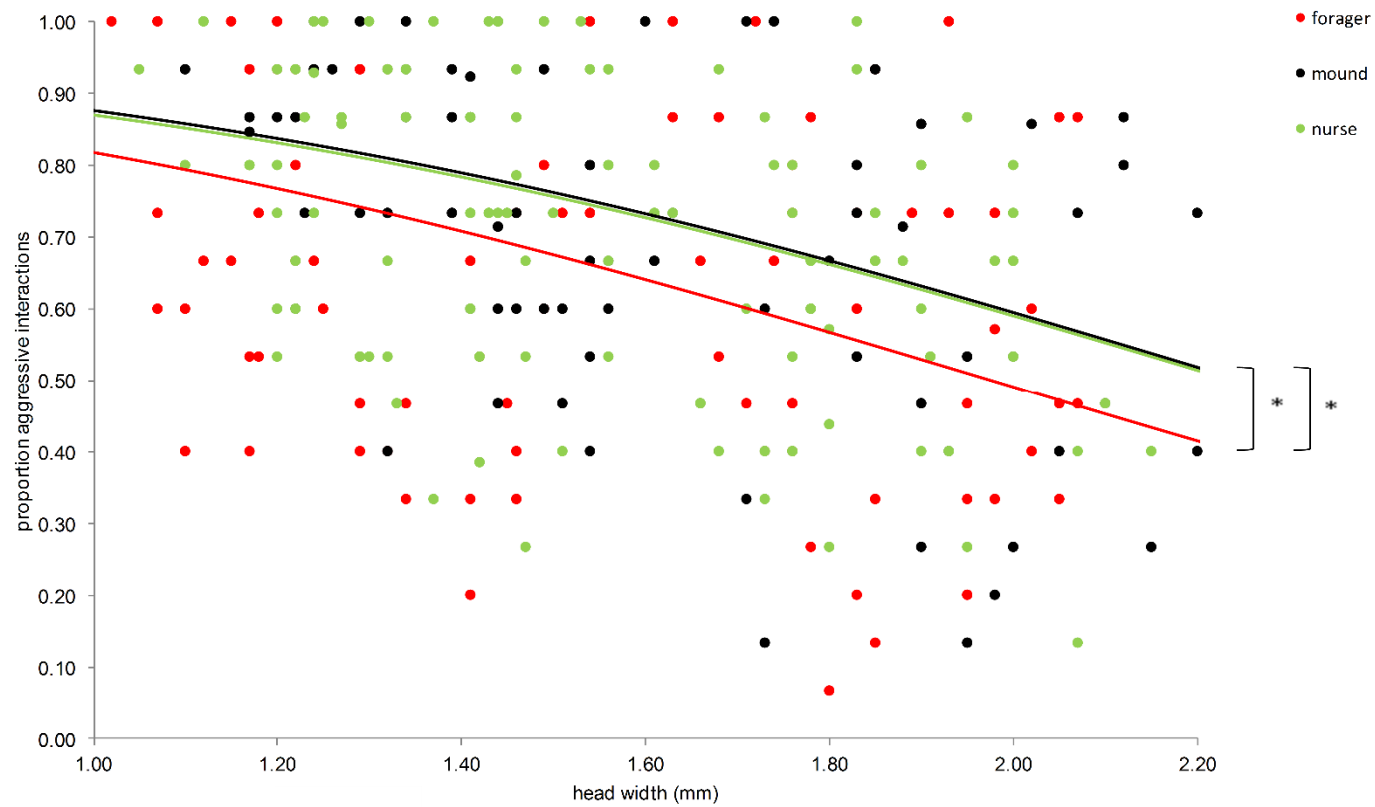
# D) CHEMICAL ADAPTATION: CUTICULAR HYDROCARBON CONCENTRATION



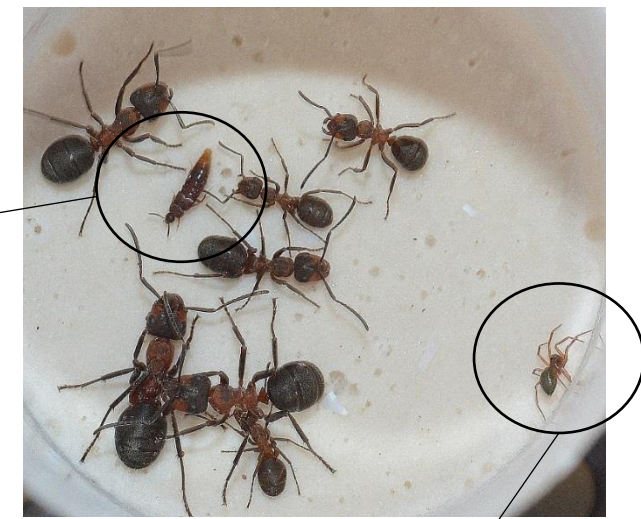
# E) ANT DEFENCE SPECIALIZATION



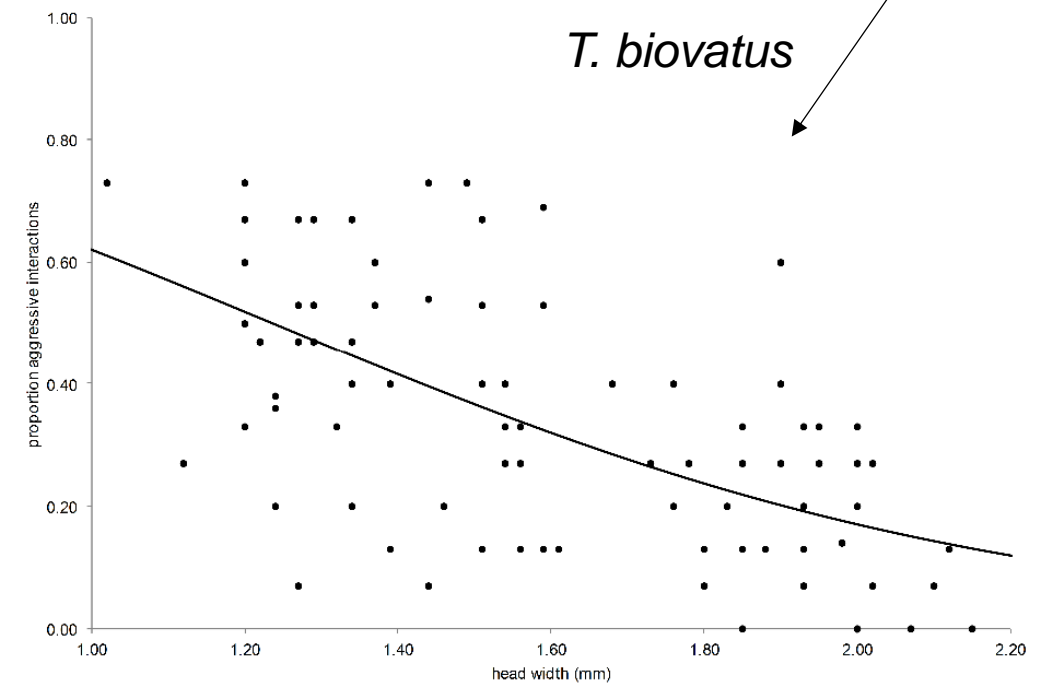
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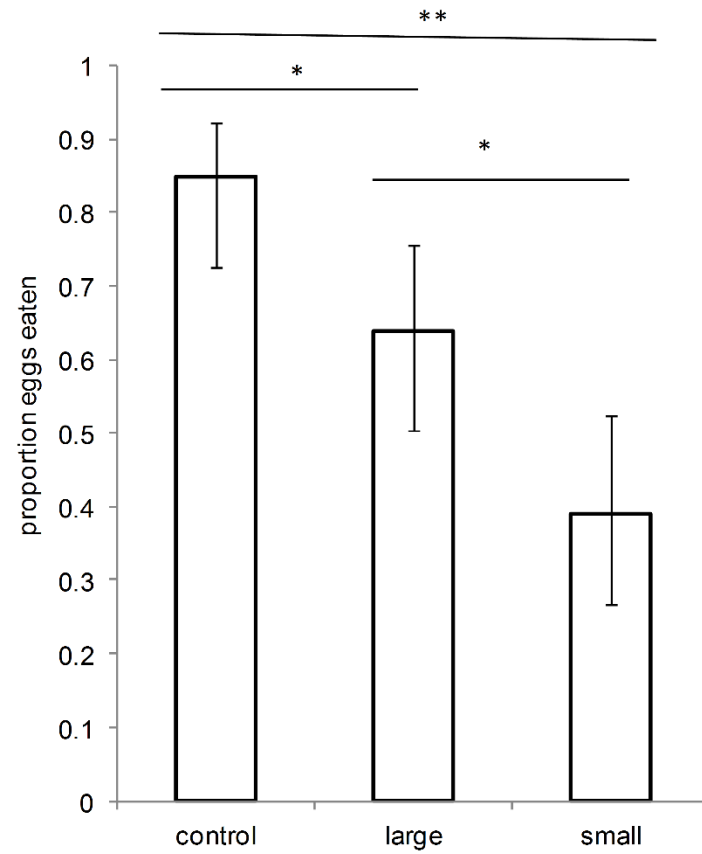
*T. angulata*



*T. biovatus*



# E) ANT DEFENCE SPECIALIZATION: EGG PROTECTION



*T. angulata*

# CONCLUSION

- **unspecialized** species succeed to live in wood ant nests
  - absence of chemical appeasement glands
  - absence of specialized behaviour
  - absence of chemical mimicry
- some live preferentially among the brood and ants do not adjust their aggression towards potential more harmful species.
  - But:
    - complex food web: other food sources and intraguild predation among brood predators
    - size-dependent defence of workers
    - other mechanisms: nest moving?
- biased focus on specialized myrmecophiles !!!

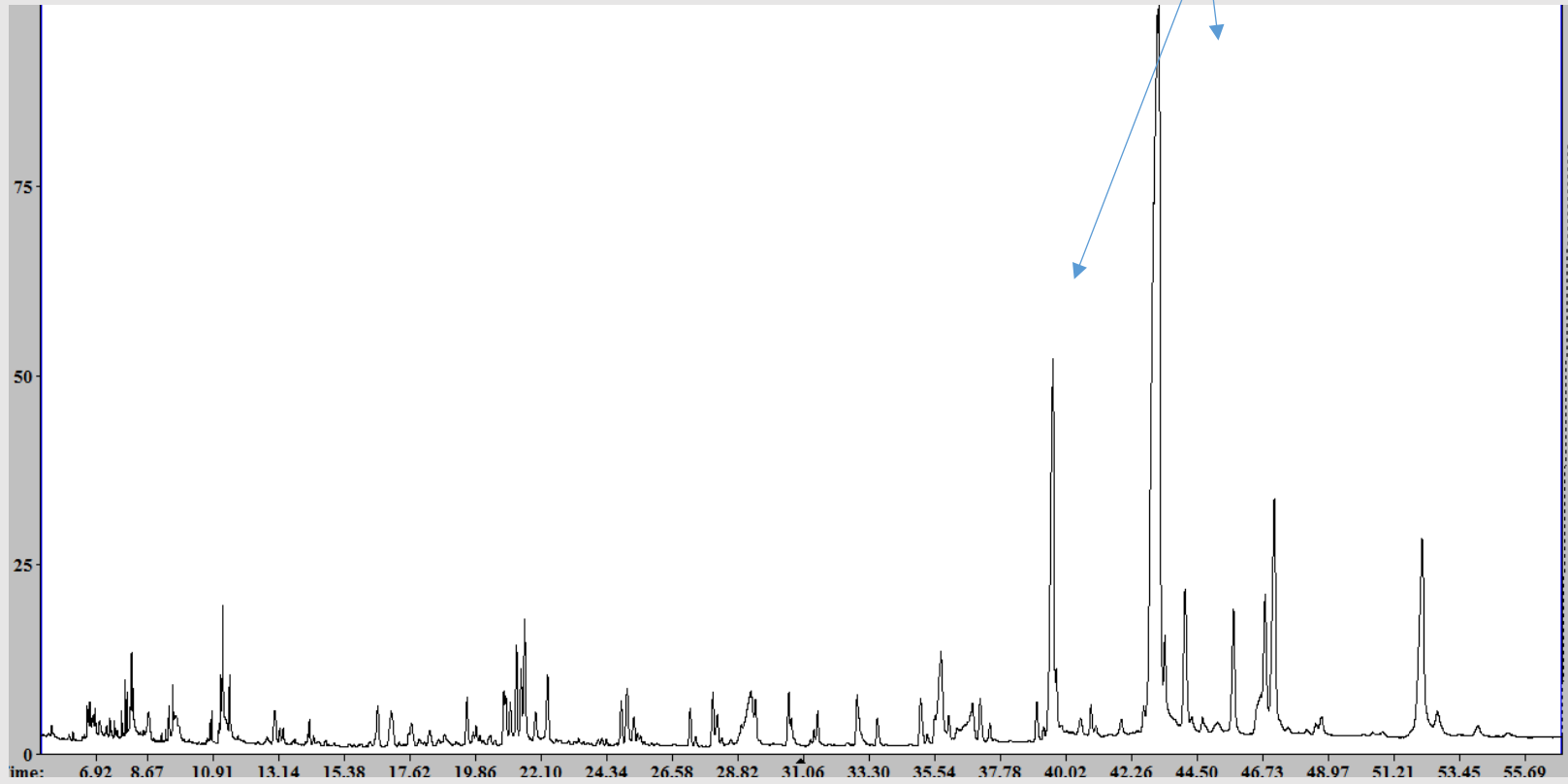


# ROOT APHIDS



# Hexane-methanol 5 min extraction

Triglycerides ?



# LOMECHUSA



larva with *Formica fusca* in summer



adult with *Myrmica* in winter

colony-specific chemical mimicry of beetle larvae

ants preferentially carry beetle larvae into safety compared to their own larvae