Scouting ants as the cognitive elite of the ant-hill

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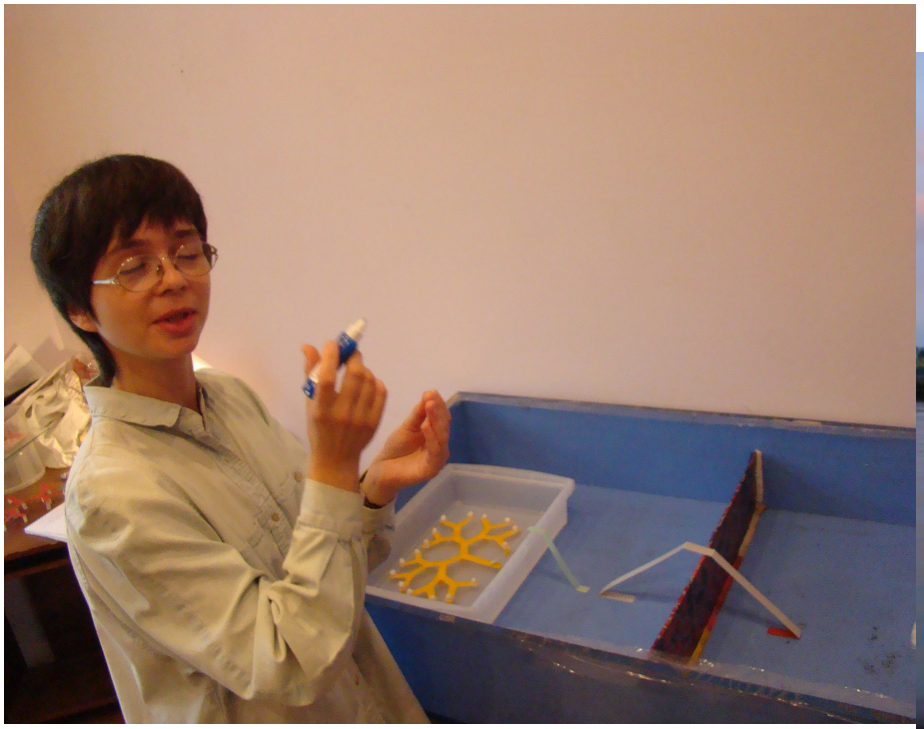

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Cognitive specialization in animal communities
is based on the ability of some individuals to learn faster within specific domains.

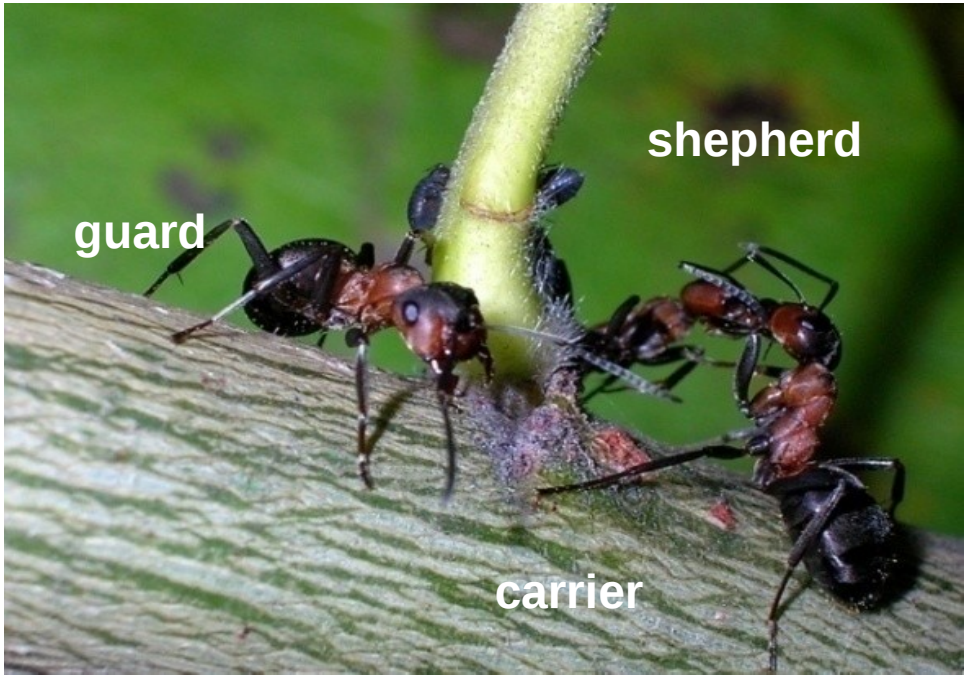
Red wood ants (Formica rufa group) – the smartest ants in the World. Zh.Reznikova, B.Ryabko, 2011. *Numerical competence in animals, with an insight from ants*. Behaviour, 148, 405-434

The main task groups in out-nest workers in red wood ants (Dobrzańska, 1958)

guards

aphid milkers

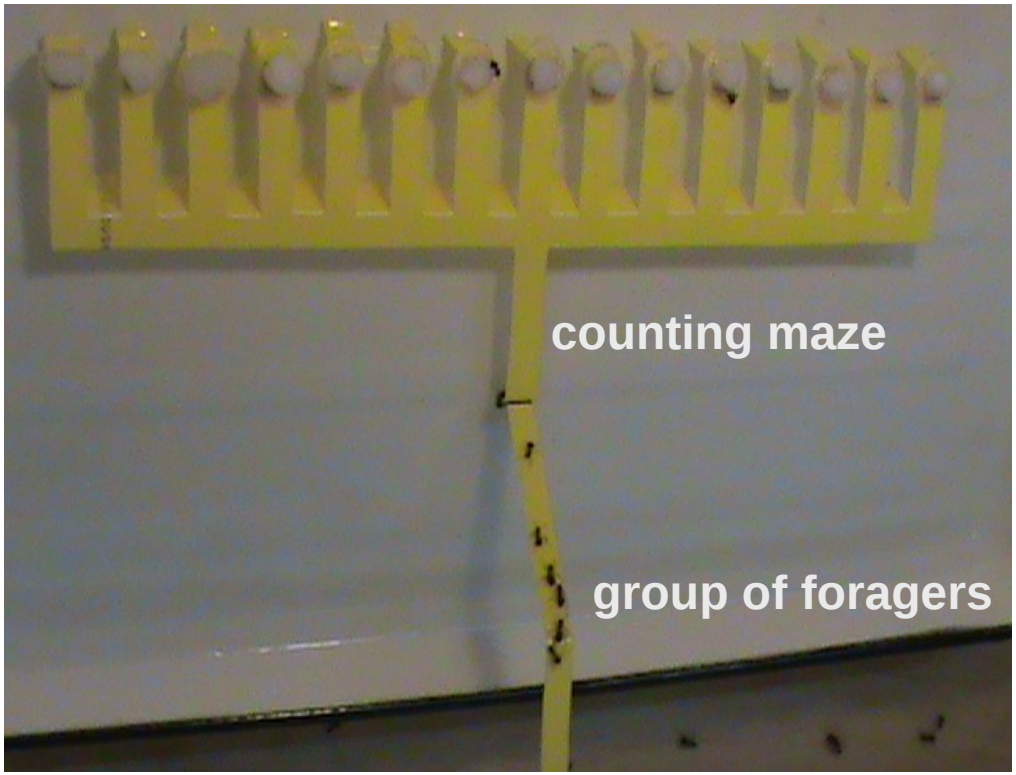
hunters

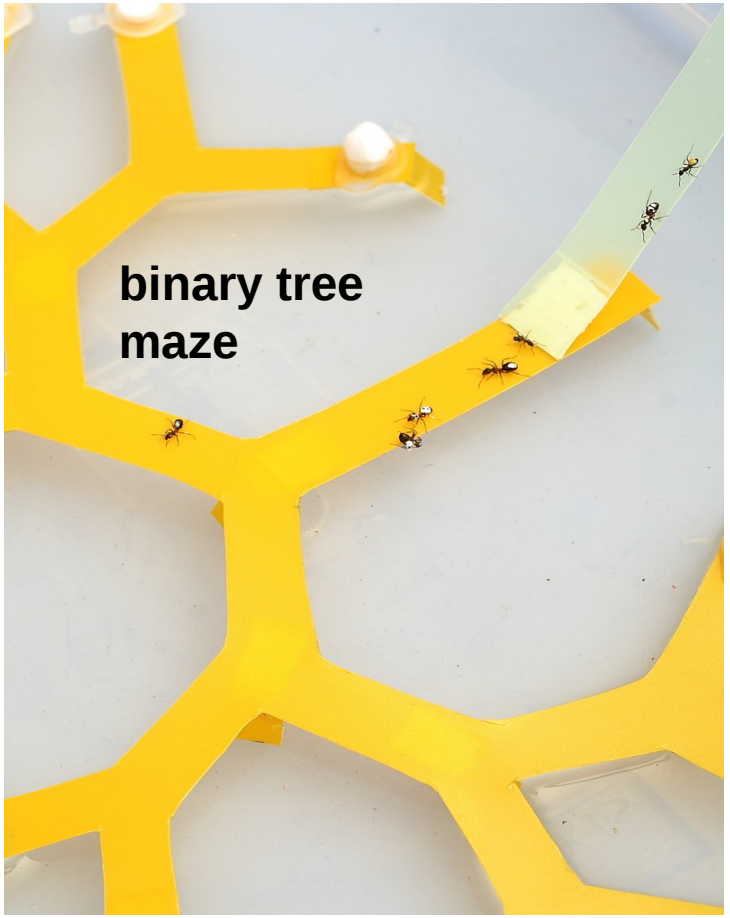


Professional specialization among aphid milkers (constant subgroups, Reznikova,Novgorodova, 1998; Reznikova, 2012; Novgorodova, 2015):

scouts
shepherds
guards
carriers

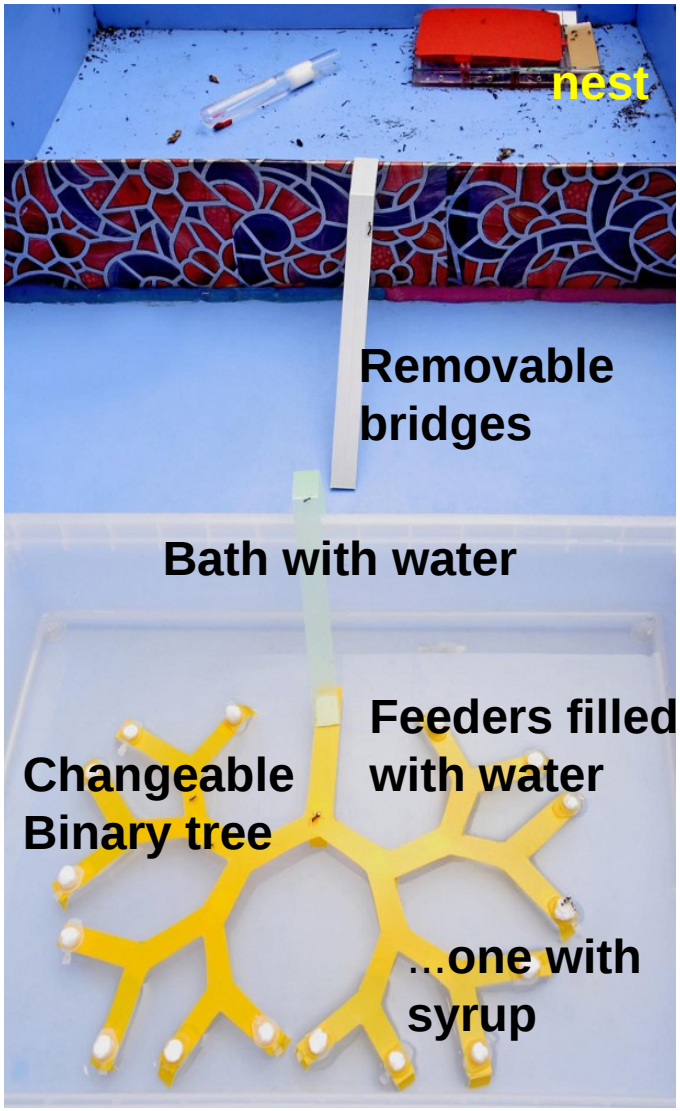
What makes an ant a scout is still enigmatic





Scouting ants are able to memorise and pass to foragers the exact information about the sequence of turns towards a goal as well as about the number of objects (Reznikova, Ryabko, 1994, *Mem. Zool*.; Reznikova, Ryabko, 2011, *Behaviour*; Reznikova, 2008, *Myrmecological News*)

Scouts and members of their foraging groups were identified using the binary-tree set-up (available at: ***www.reznikova.net***)



We considered an ant ***scout*** if she:
(1) found the feeder first
(2) memorized its location without the possibility to use the odour track
(3) having collected the syrup returned to the nest immediately and directly
(4) entered into antennal contacts with other ants
(5) made repeated trips between the nest and the binary tree

We considered ants ***foragers*** if they:
(1) visited the feeder after their contacts with a scout without the possibility to use the odour track
(2) Did not repeat their trips and were not apt to contact with others

Control group: randomly selected active ants not mobilized by scouts

To obtain the “psychological profile” of the **scout** in comparison with members of the other task groups we selected them as follows :

Scouts and their “foragers” - revealed with the use of the binary tree set - up

Aphid milkers – those members of the basic laboratory colony which attended to the aphids on an aspen branch placed on the arena

Guards - those members of the basic laboratory colony which were on duty on the lid of the laboratory nest and reacted aggressively when approached with a needle

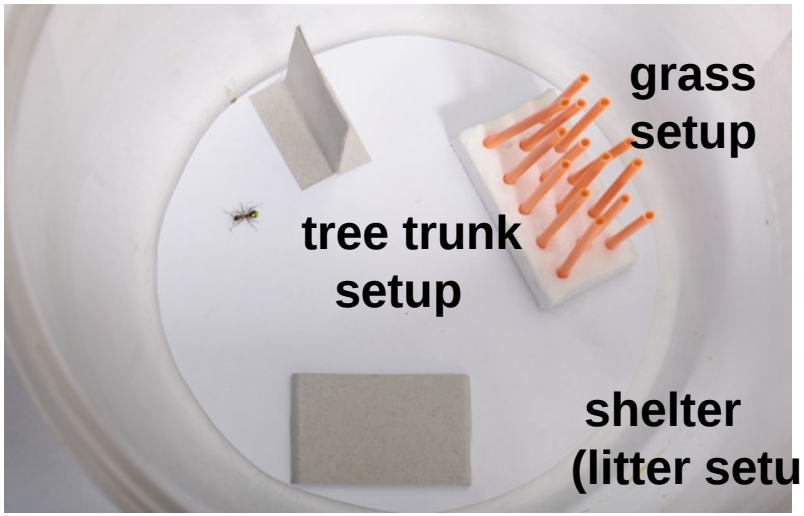
Hunters - those members of the basic laboratory colony which caught prey and transported it to the nest.

Control groups: mixed (“average”) out-nest workers.

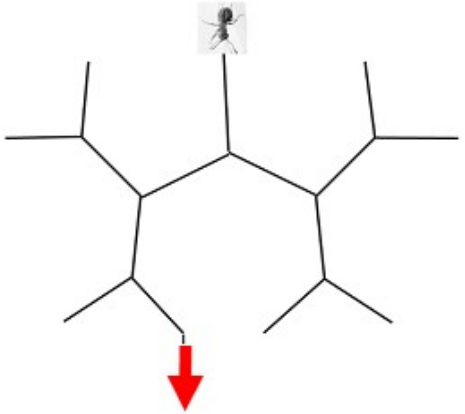
All ants were individually marked with colour paint.

To reveal distinctive features of scouts in comparison with members of other task groups we designed the first ***battery of behavioural tests***

(1) ***Exploratory activity***: the artificial piece of world

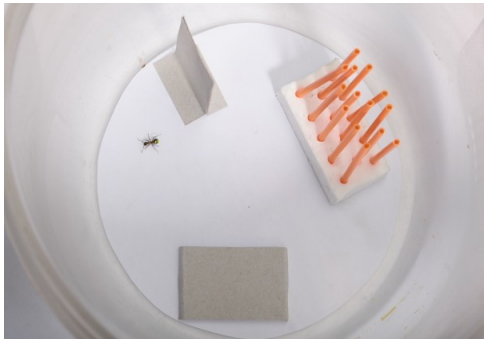


(2) ***Aggressiveness***: dyadic interactions with a ground beetle during 10 min (Reznikova, Dorosheva, 2013, Evolutionary Psychology)

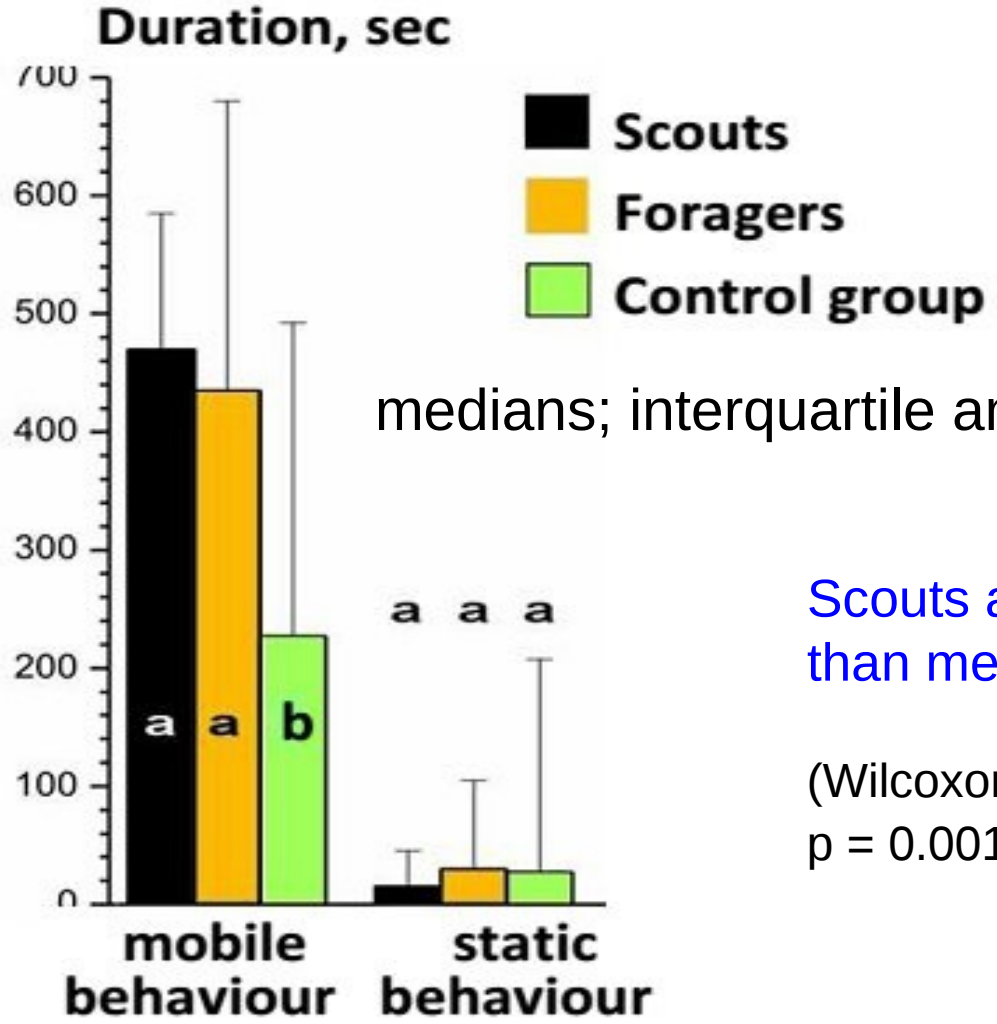


(3) ***Cognition:*** The ability to memorize the path to the nest

Difference between duration of mobile and static behaviours on the surface of the arena in different groups of ants



Test 1: 11 scouts, 36 foragers, 20 members of the control group, **2011-2012**



medians; interquartile amplitude

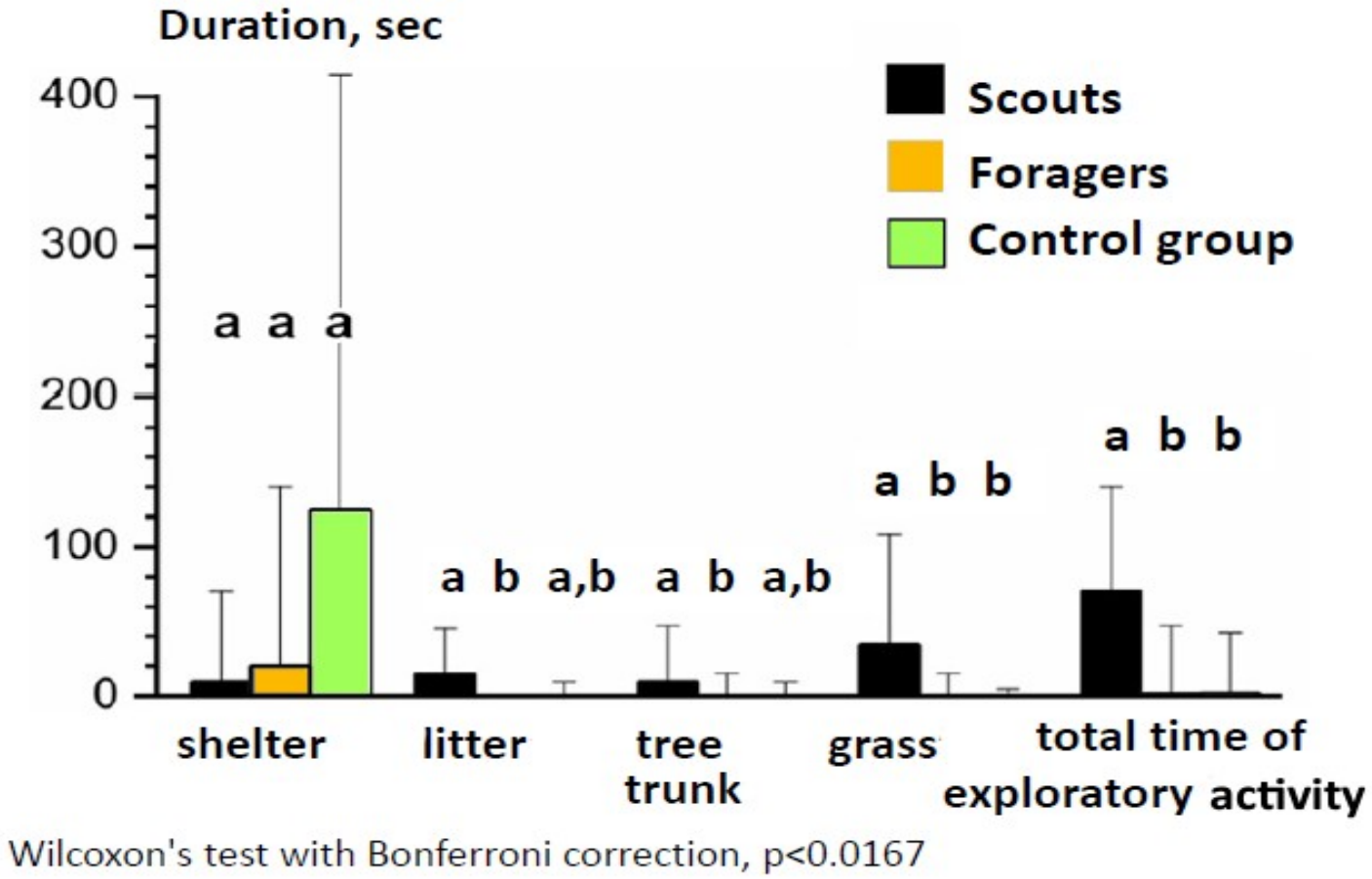
Scouts and foragers are more mobile than members of the control group

(Wilcoxon's test with Bonferroni correction; p = 0.001 and 0.010, correspondingly).

Different letters: values differ significantly;
The same letters: values do not differ

Duration of time spent by ants on different elements of artificial world (medians; interquartile amplitude)

Test 1

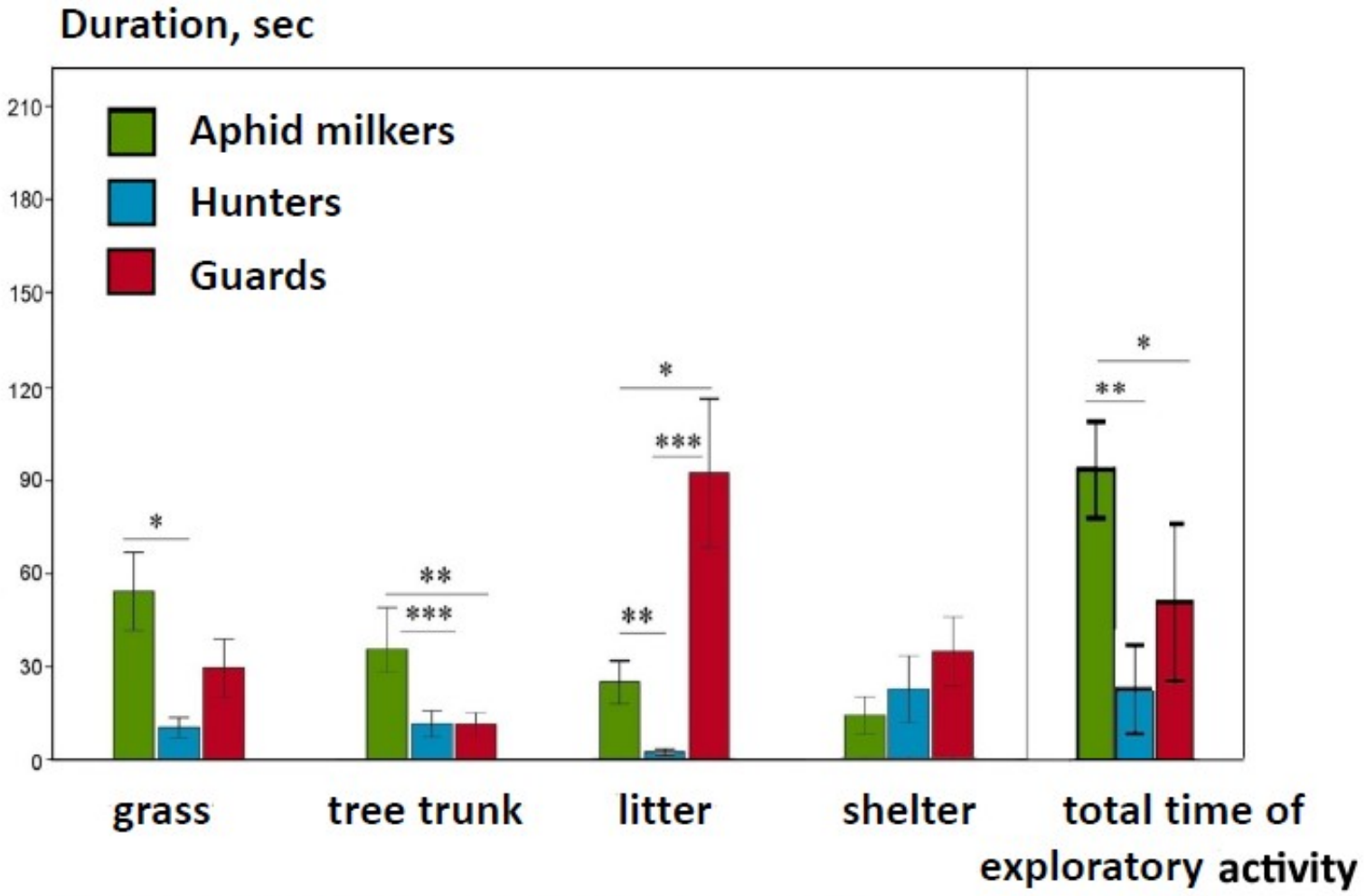


2011-2012

The total duration of time spent on all elements in sum is more in scouts than in foragers and in the control group (p=0.002; p= 0.01, correspondingly).
Scouts prefer grass setup, and they are not apt to hide under the shelter

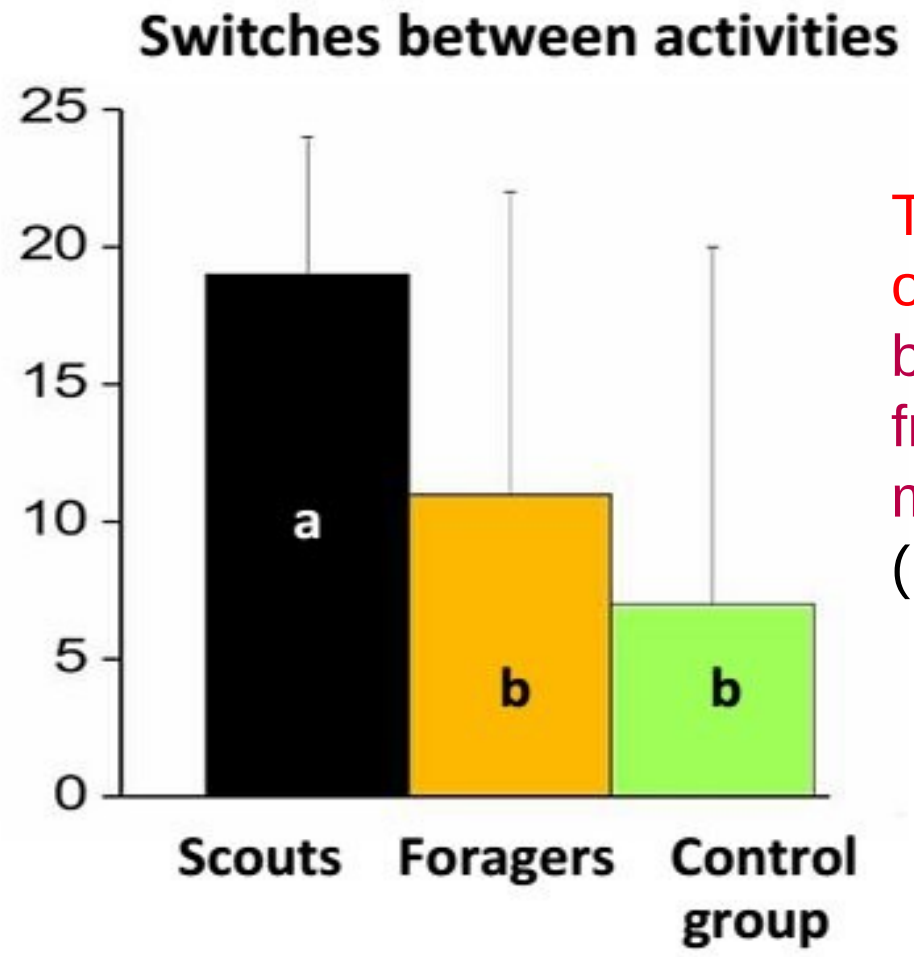
By the type of exploratory activity scouts are most close to aphid milkers

medians; interquartile amplitude **Test 1**



Wilcoxon's test with Bonferroni correction, p<0.0167

Scouts as a group behave more uniformly than others: all scouts investigate all elements of the artificial world, whereas only half of both foragers and members of the control group display any interest at all.
They hide under the shelter or simply stay put.



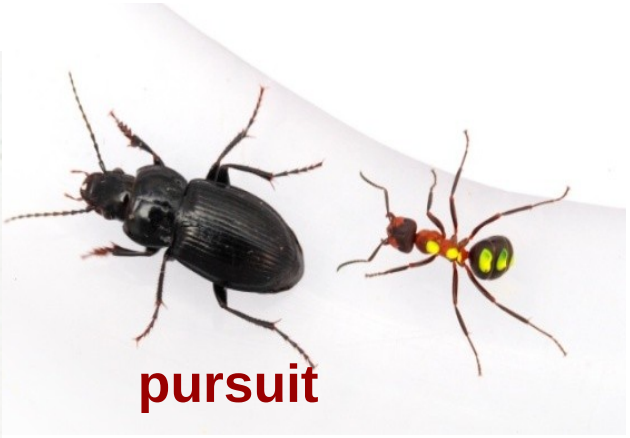
(in sum during 10 min)

Test 1

The most characteristic feature of the scouts: they switch between activities more frequently than foragers and members of the control group
($p < 0.05$; Student's criterion)

Test 2: aggressiveness.

Behavioural reactions of ants towards their Dear Enemy (a ground beetle of the genus Pterostichus)



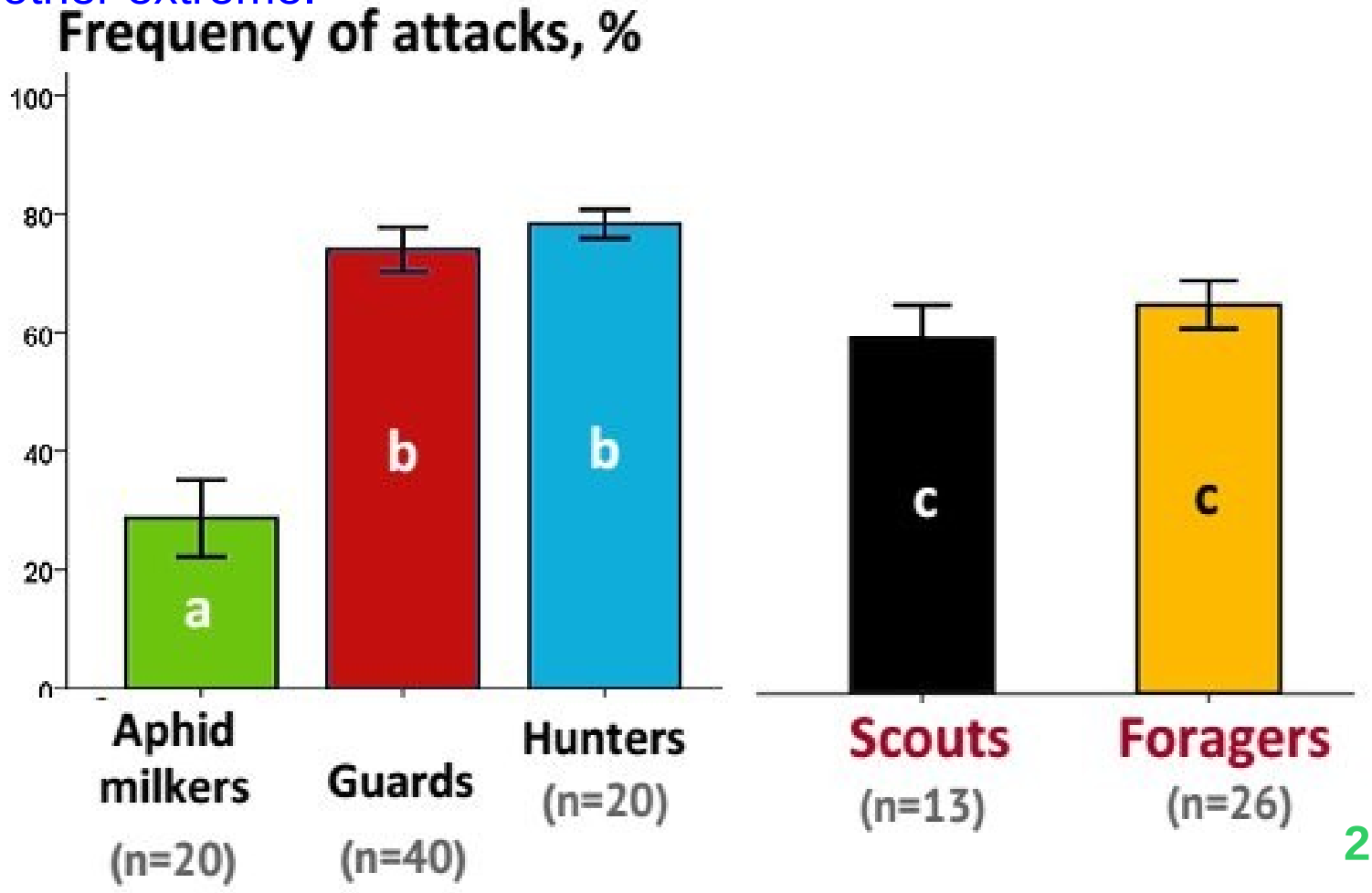
Beware of beetles!

All these reactions are considered attacks

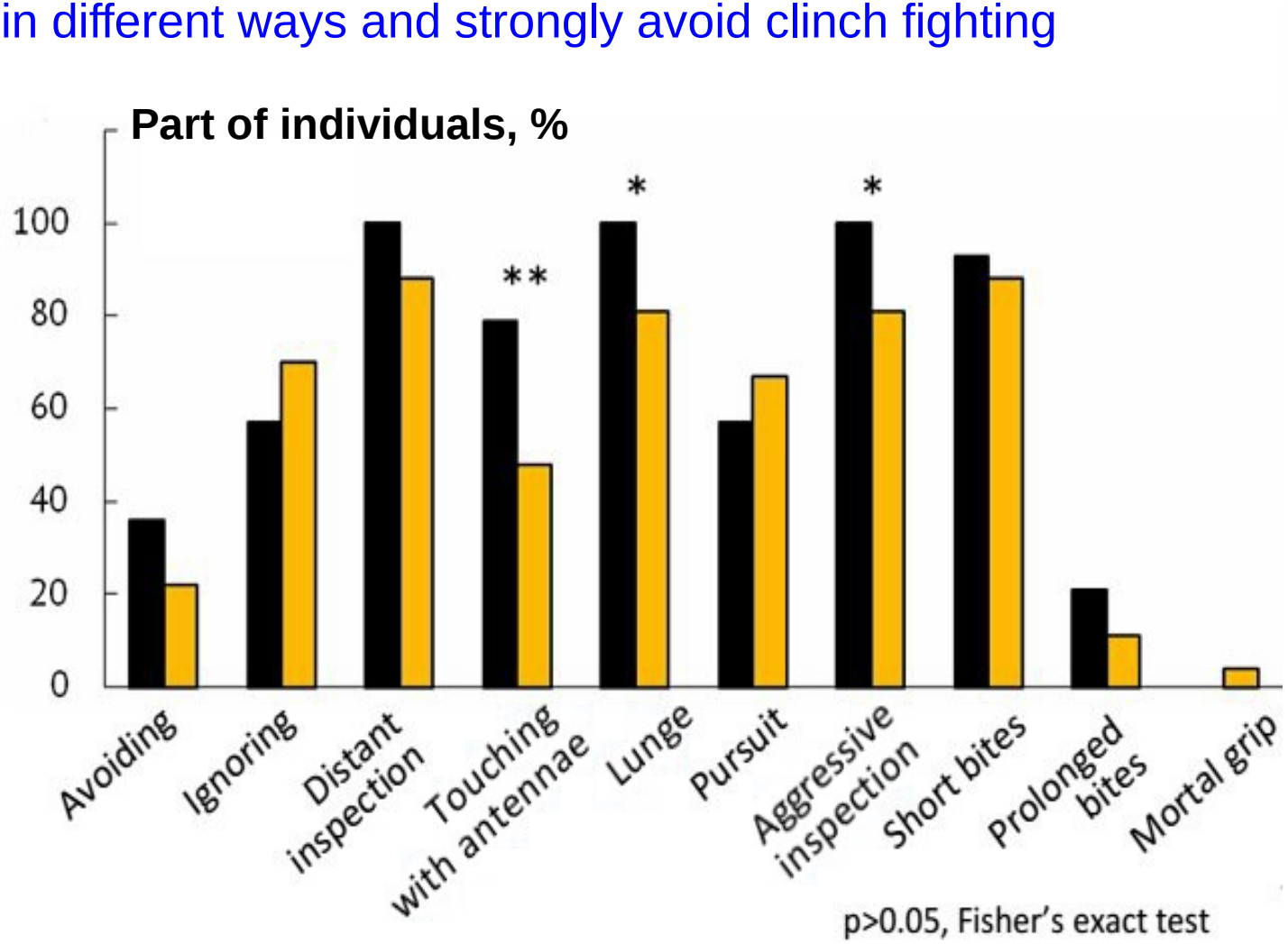
Test 2

Scouts are not timid.

By the level of aggressiveness scouts and foragers are between aggressive guards and hunters on the one extreme and peaceful aphid milkers on the other extreme.



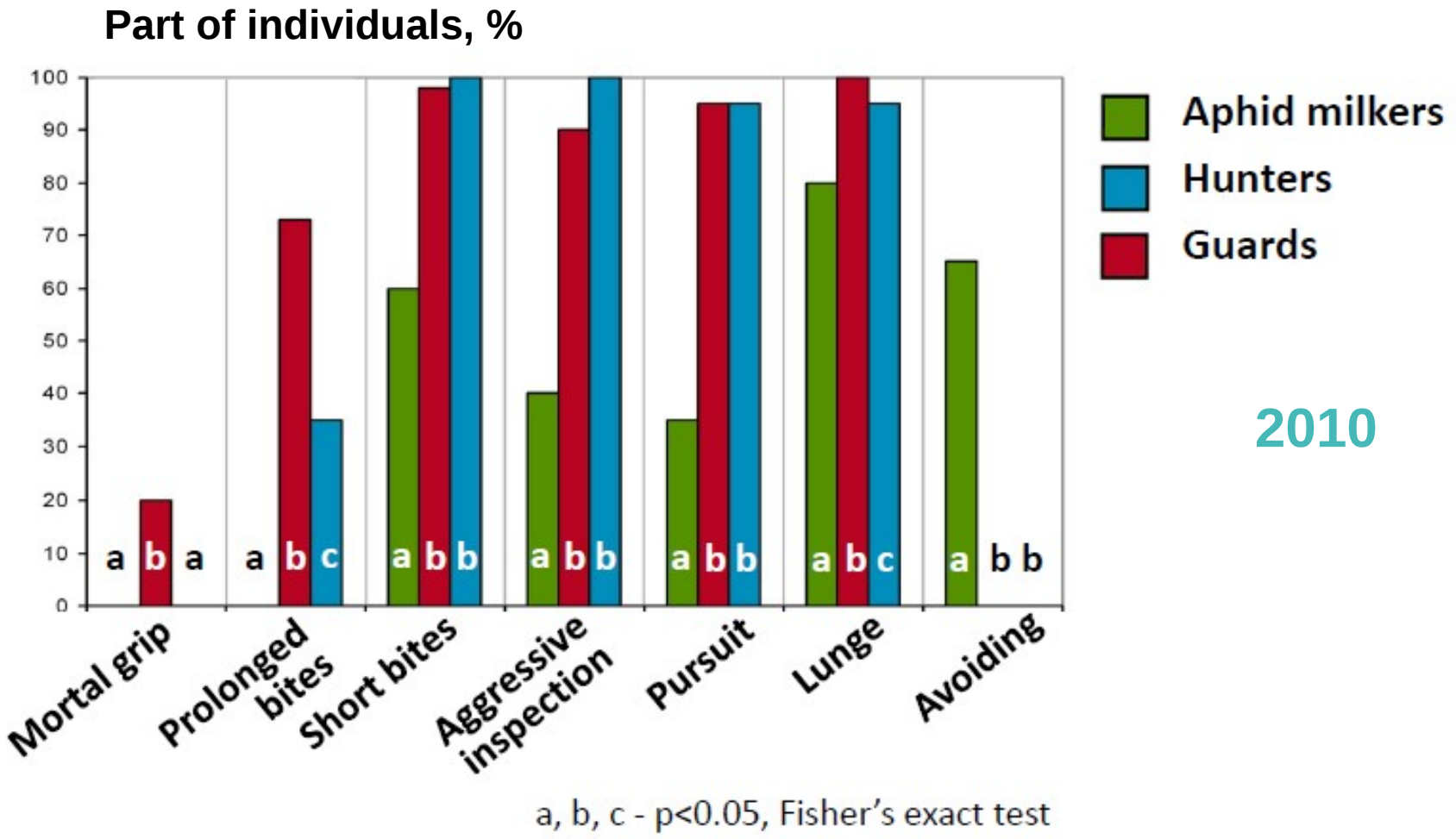
Specifics of aggressive behaviour in scouts: they inspect the enemy in different ways and strongly avoid clinch fighting



Test 2

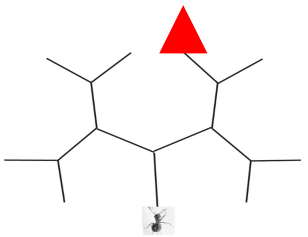
2011-2012

In comparison with members of other task groups scouts share more features of aggressive behaviour with aphid milkers than with guards and hunters

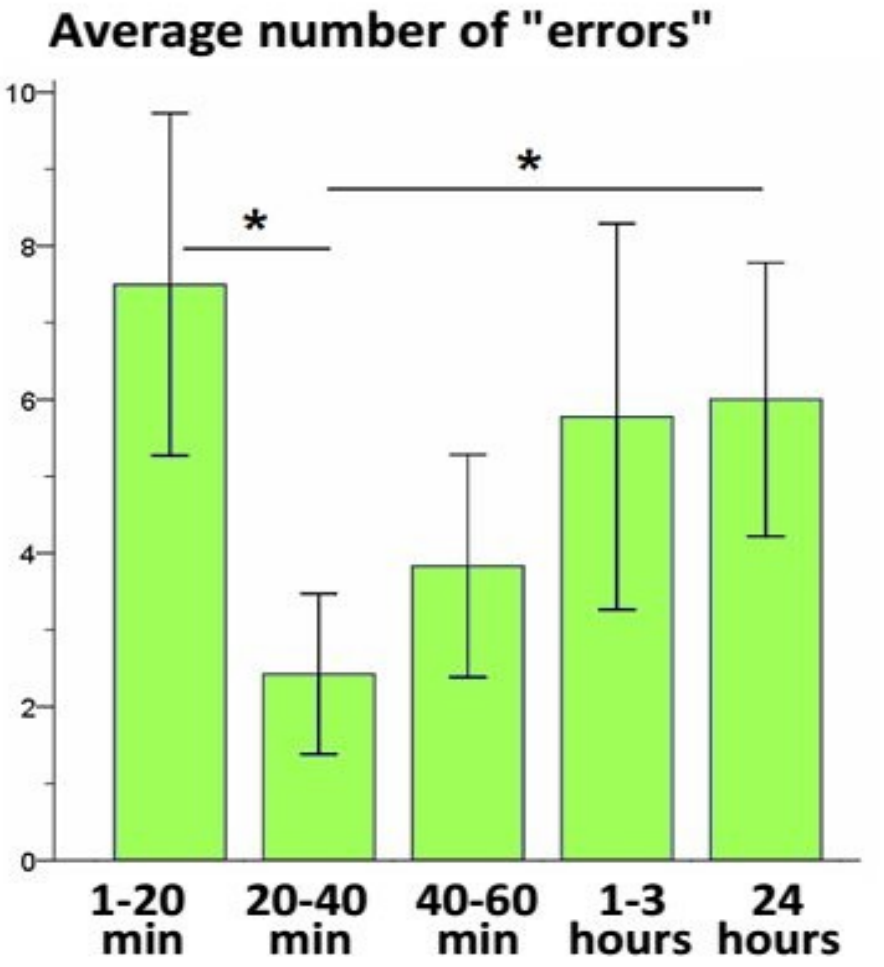


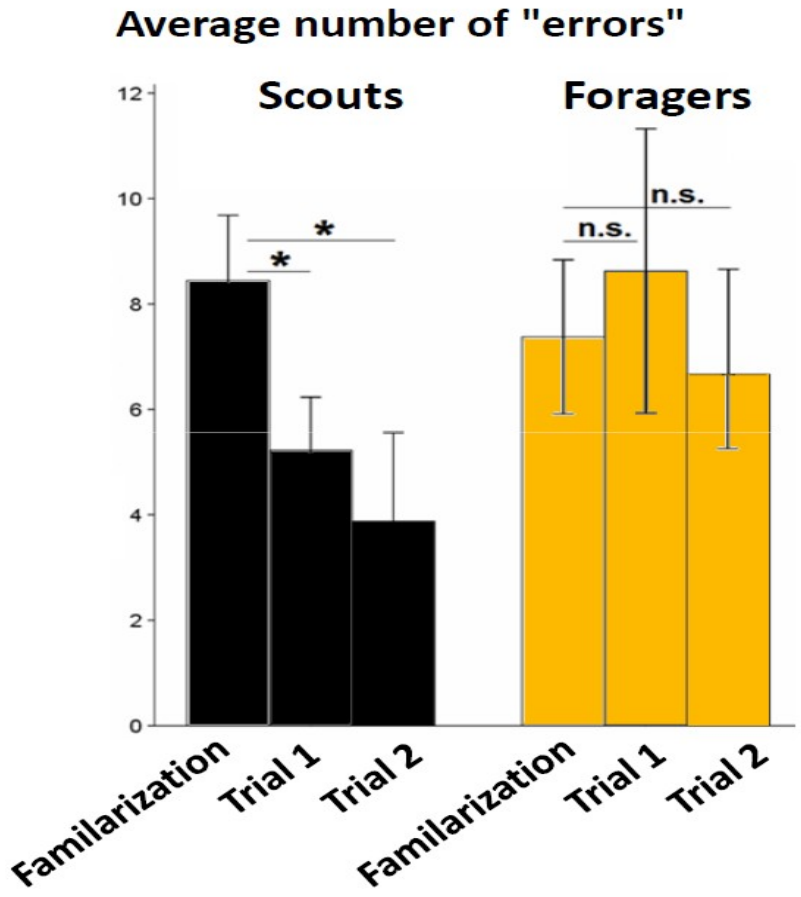
Knowledge is power... for scouts

Test 3: 9 scouts, 8 foragers, 20 control ants.



Members of the control group (5 subgroups)





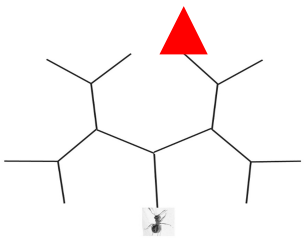
Student's criterion; 0.05< p <0.15

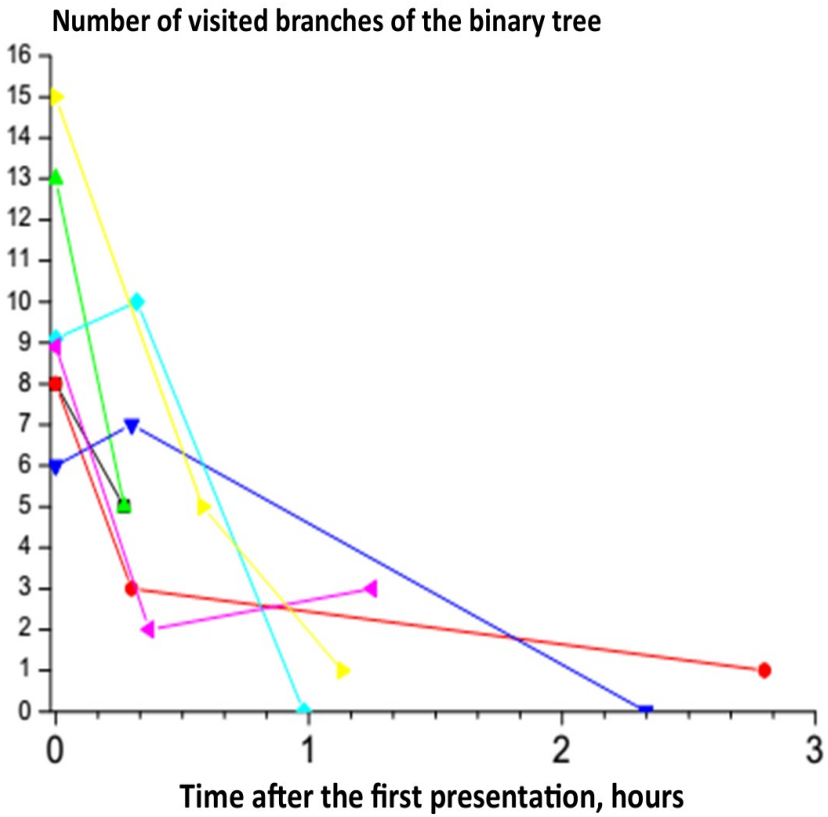
Trial 1 after 10-20 min.
trial 2 after 1-3 hours

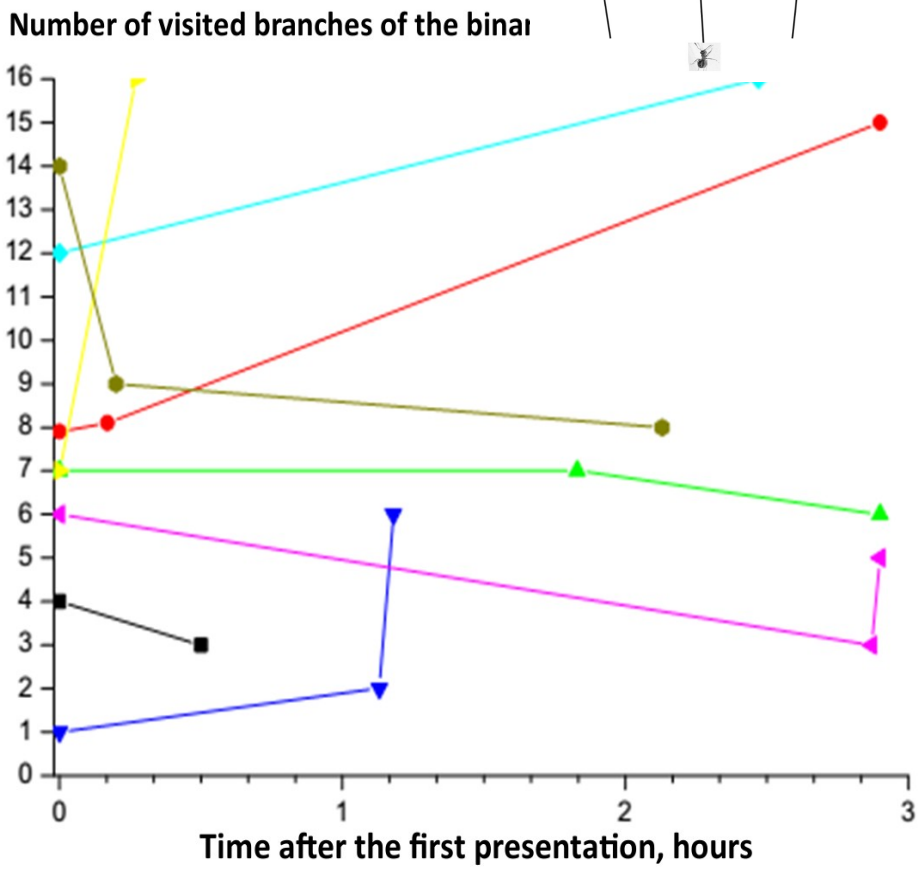
Individual curves of learning: Scouts

foragers

Test 3







Conclusion

1. Scouts are explorative. Both scouts and members of their foraging groups are more exploratory than “average” out-nest workers, and scouts are more explorative than foragers.
Scouts share features of exploratory activity with aphid milkers: they display a higher interest to artificial grass and tree trunks.
The most characteristic features of scouts are high frequency of switching between activities and faithful interest to the variety of stimuli (ADHD?:))

2. Scouts are brave. Aggressiveness in scouts and foragers is more than in aphid milkers but less than in guards.
In contrast to guards, both scouts and foragers strongly avoid aggressive actions which may be of danger to themselves, and they never attack the enemy directly.

3. Scouts are smart. Scouts form spatial memory faster and keep the information longer and better than foragers.

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