Chunky reproduces better?

Small rodent fertility and fitness in commercial orchards

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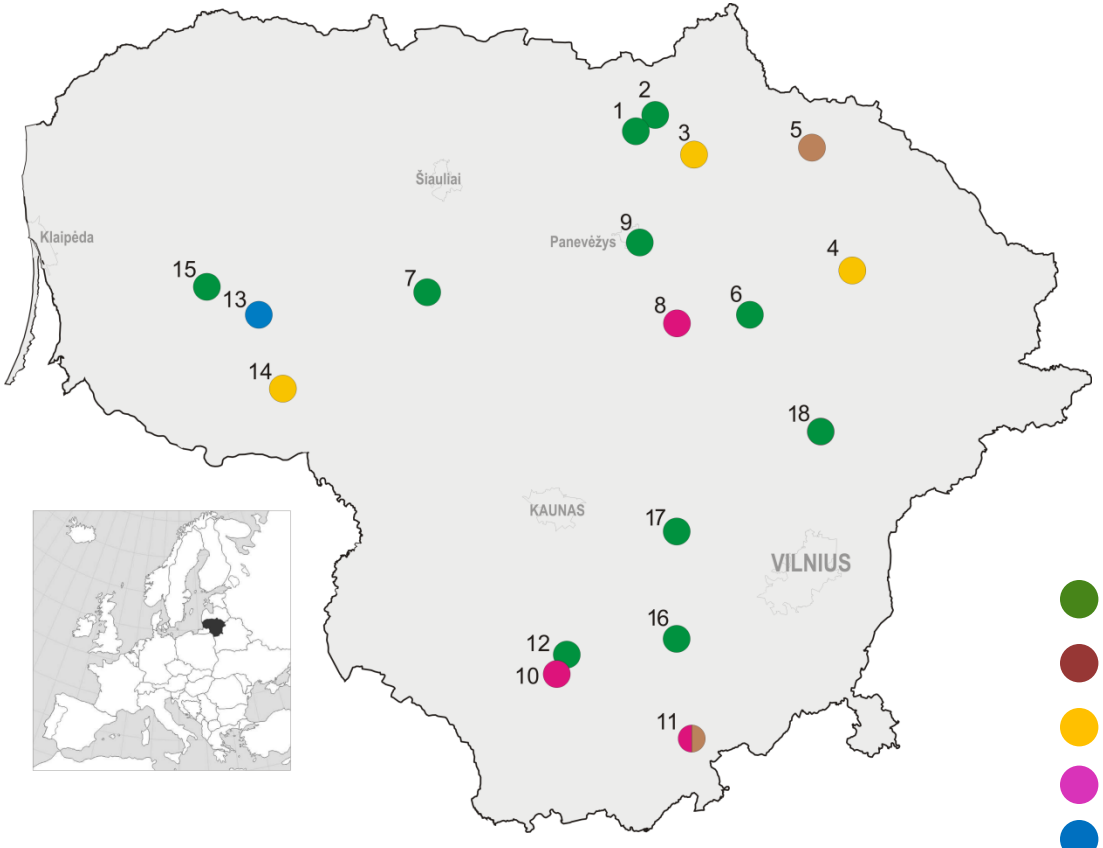
Study sites



Lithuania:
65,300 km^2
52.26% territory is agricultural
33% arable land
27% semi-natural vegetation
42.8 inhabitants/km^2 in 2020
75 mammal species

25,980 ha commercial orchards
9851 ha berry plantations
99,215 tons of production

- apple orchards
- plum orchards
- currant plantations
- raspberry plantations
- highbush blueberry plantation

Study sites:

Characteristics of habitats

Crops	N	Crop age [1]			Intensity [2]			Control habitat [3]		
		O	MD	Y	H	M	L	MM	NM	FE
Apple	11	9	1	1	6	2	3	8	2	1
Plum	2		1	1		1	1	1	1	
Currant	3		3			1	2	3		
Raspberry	3		2	1	1	1	1	1	1	1
Highbush blueberry	1		1		1			1		

[1] Age of the orchard: O—old, MD—medium, Y—young. [2] Intensity of agricultural practices on site: L—low, M—medium, H—high. [3] Control habitat: MM—mowed meadow, NM—non-mowed meadow, FE—forest edge

Intensity of agricultural practices on site:

high

medium

low

Material and methods

- Snap trapping, summer and autumn 2018–2020
- Trapping effort 25,503 trap days
- Body condition index, based on body mass and body length
- Dissection

- Reproduction parameters:
  (1) number of embryos
  (2) number of placental scars
  (3) number of *corpora lutea*

- Reproduction failure:
  difference between (1) or (2) and (3)

Results

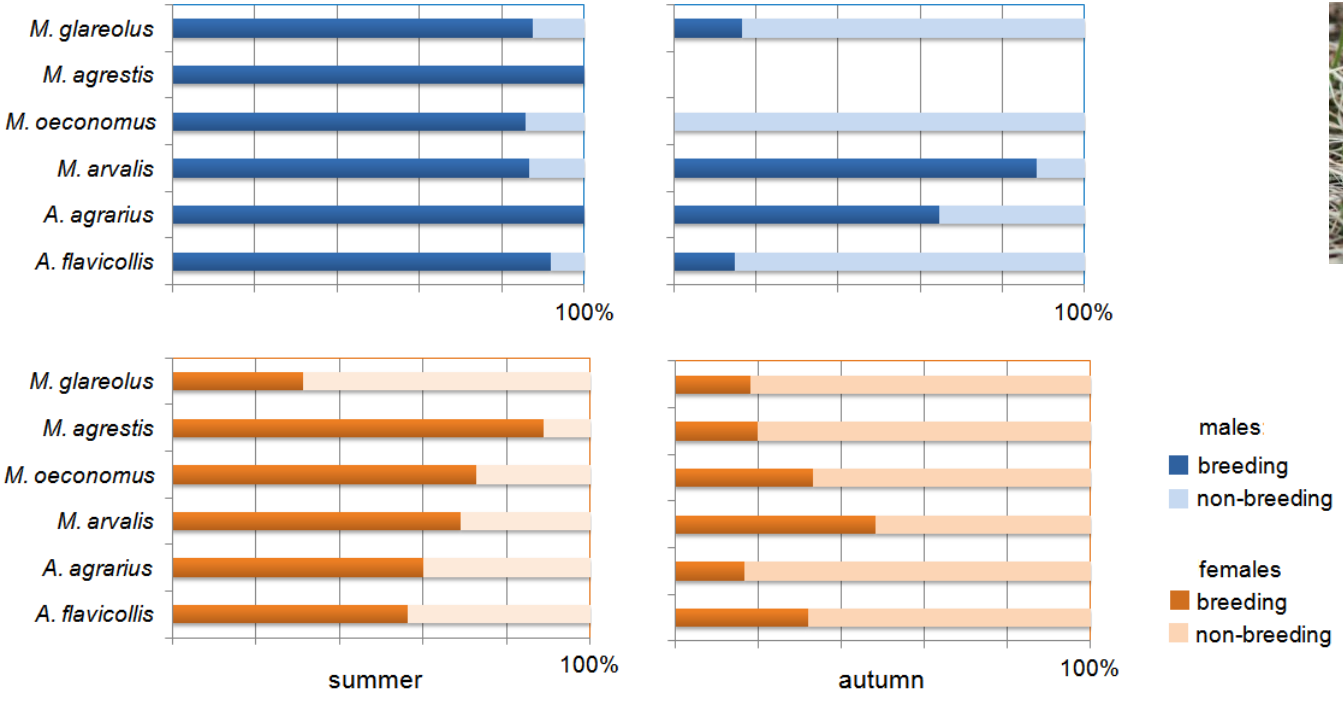
1450 individuals of 11 small mammal species

Species	Trapped			BCI	OLS	PLS	BF%
	Total	Ad♂♂	Ad ♀♀				
Apodemus flavicollis	374	99	60	3.40 ^{A}	5.33	5.91	12.2
Apodemus agrarius	346	38	29	3.38 ^{A}	6.21	6.35	21.4
Microtus arvalis	436	41	132	3.25 ^{B}	5.08 ^{A}	5.55 ^{B}	29.1
Microtus oeconomus	42	8	17	3.01 ^{B}	5.81	6.31	43.8
Microtus agrestis	31	7	14	3.29 ^{B}	5.00	5.55	14.3
Myodes glareolus	164	22	27	3.24 ^{B}	5.58	5.85	29.2
Mus musculus	5						
Micromys minutus	12						
Arvicola terrestris	1						
Sorex araneus	27						
Sorex minutus	12	3.9% of all individuals, not analysed further					

BCI – body condition index of adult animals
OLS – observed litter size, PLS – potential litter size
BF% - percent of breeding failures from number of pregnancies
^{AB} $p < 0.01$, ^{ab} $p < 0.05$

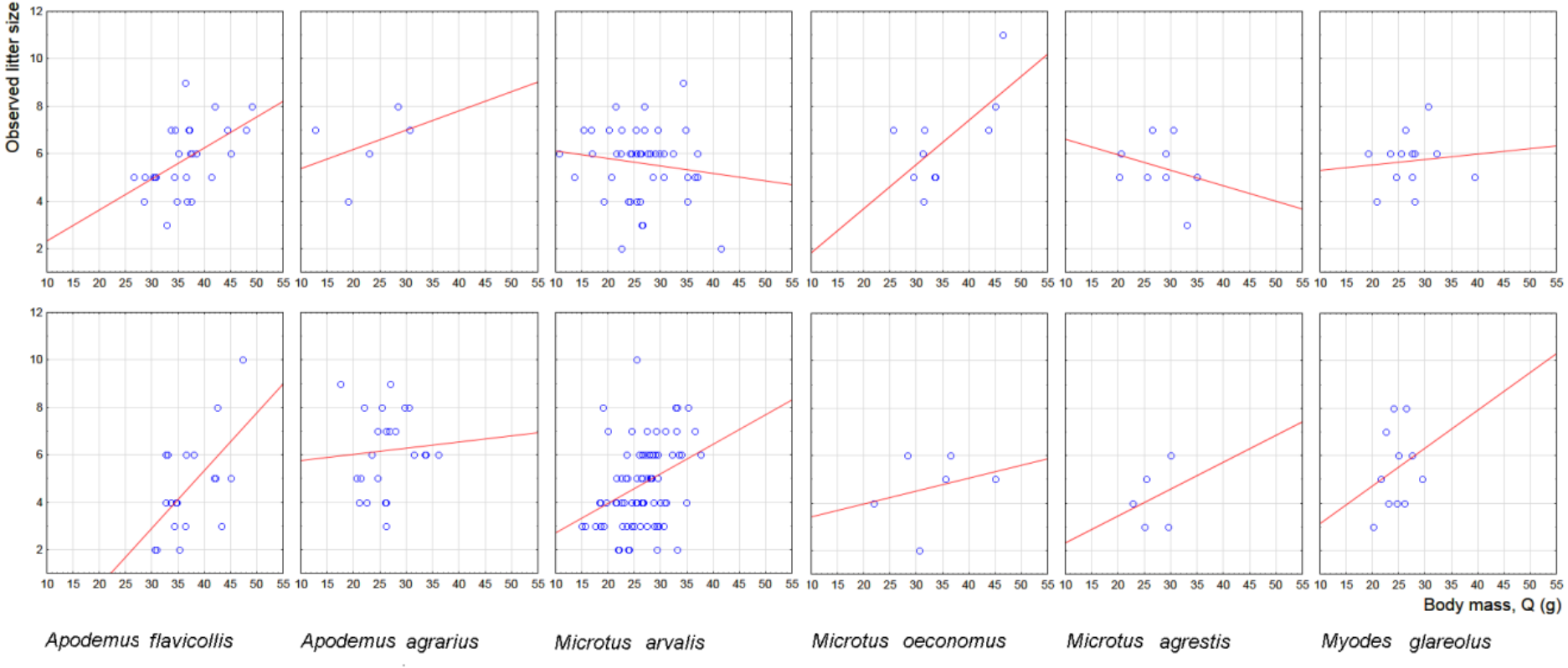
Results

Proportion of breeders in different seasons



Results

Relation of litter size to body mass in summer (top) and autumn (bottom)



Conclusions

- Commercial orchards sustain substantial rodent diversity and litter sizes equal to those in adjacent non-agriculture habitats (meadows and forests).
- In 6 most numerous rodent species potential litter sizes exceeded observed
- Breeding failures were observed, the most affected being *M. oeconomus*, *M. glareolus* and *M. arvalis*. The litter size in these three vole species was smaller in habitats with a higher intensity of agricultural practices.
- The litter size decreased towards winter in all rodents, most significantly in *M. arvalis* and *A. flavicollis*.
- In autumn, litter size and female body mass was positively correlated in all six rodent species.
- Knowledge of reproduction patterns may help in planning sustainable rodent control strategies in orchards and similar habitats.

Author Contributions:

Conceptualization, Li.B. and La.B.; methodology, Li.B.; formal analysis, L.iB.; resources, Li.B., La.B., and V.S.; investigation, V.S., Li.B., and La.B.; data curation, La.B. and V.S.; writing Li.B., La.B., and V.S.; project administration, Li.B.; funding acquisition, Li.B.

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