FOREST FLEAS: HOW FOREST TYPE AFFECTS ECTOPARASITES OF MICE

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WHY STUDY ECTOPARASITES

- Provides key information for potential disease outbreaks
- Can allow us to determine the host specificity of ectoparasites
- Several wildlife diseases can jump to livestock and humans
  - Brucellosis, Bobcat Fever, Lyme Disease

MEET THE MICE

P. MANICULATUS GRACILIS

Deer Mice

Common

Forest Specialist

Photo via Sebastian Benedetto

P. LEUCOPUS NOVEBORACENSIS

White-Footed Mice

Uncommon

Generalist

Photo via Phil Meyers

BACKGROUND LITERATURE

- Madison, Hill, and Gleason 1984 found that home range depended on sex and breeding season.
- They also found *P. leucopus* to be inhabiting squirrel nests.
- Are *Peromyscus* picking up generalist species based on nesting habits?

TABLE 1.—Nest preference and communal nesting of five male (M) and four female (F) *Peromyscus leucopus* during radiotracking. The subscript numbers identify the different mice of each sex. Thirteen nests (A-M), their types and their height aboveground are shown. Daily minimum temperatures are also shown

	Min.	Nest locations and height aboveground (m)												
	temp.	Squirrel nest					Tree					Ground		
Date	C	A(10+)	B(10+)	C(10+)	D(10+)	E(10+)	F(5)	G(3)	H(3)	I(2)	J(2)	K	L	M
10/5	1		M_1F_3				M_4	M_5						
10/7	4	F_1	M_1M_2				M_4F_2	M_5						
10/8	3						M_4F_2							
10/9	1	M_4F_1	$M_{1,}M_2$					M_5	F_4					M_3F_3
10/13	3	M_4	$M_{1,2}F_{1,3}$				F_2	M_5	F_4					M_3
10/14	2	$M_{1,2,4}F_1$					F_2	M_5	F_4					M_3F_3
10/16	5	M_4F_1	M_2F_3		M_3		F_2	M_5	F_4					
10/19	6		M_2				F_2	M_5	F_4			$M_{1,3}$		
10/20	13	F_1		M_3				M_5	F_4	M_2		M_1		
10/22	18						M_5	F_4	M_2		M_1F_2			
10/23	6	F_1				M_3		M_5	F_4	M_2		M_1		
10/25	-1							F_4	M_2	M_3	M_1F_1			
10/26	-2								F_4	M_2	M_3	M_1F_1		
10/27	-1									M_2	M_3	M_1F_1	F_4	
10/28	1								F_4	M_2	M_3	M_1F_1		
10/29	3											M_1F_1		
10/30	-1									M_2	M_3	M_1F_1		
10/31	-2										M_3	$M_1F_{1,2}$		
11/1	5											M_1F_1		
11/2	6											M_1F_1		
11/3	1									M_2	M_3	M_1		
11/5	-1		M_2									M_1		M_1

BACKGROUND LITERATURE

- Smith and Speller 1970
- Found that *P. maniculatus gracilis* and *P. leucopus noveboracensis* tend to occupy different forest types
- This was due to variations in microclimate
- Does habitat partitioning lead to differences in ectoparasite communities?

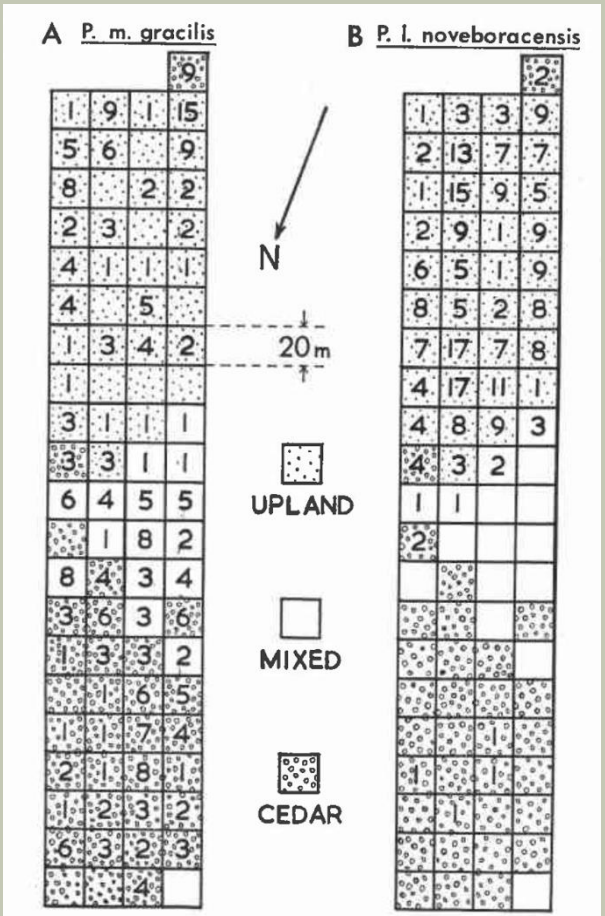

FIG. 1. Distribution of the three forest associations on Manning's Wood plot and of the captures of (A) *P. m. gracilis* and (B) *P. l. noveboracensis*. The number of captures in the trap at the center of each 20 × 20 m (0.04 ha) trapping station is shown.

BACKGROUND LITERATURE

- Krasnov 2008 researched ectoparasites in the South African rodent *Rhabdomys pumilio*
- Theorized that the larger *R. pumilio* males would have more ectoparasites
- Is size a factor among *Peromyscus*?

HYPOTHESES

- How does habitat partitioning in *Peromyscus maniculatus gracilis* and *Peromyscus leucopus noveboracensis* contribute to ectoparasite communities found within the two species?

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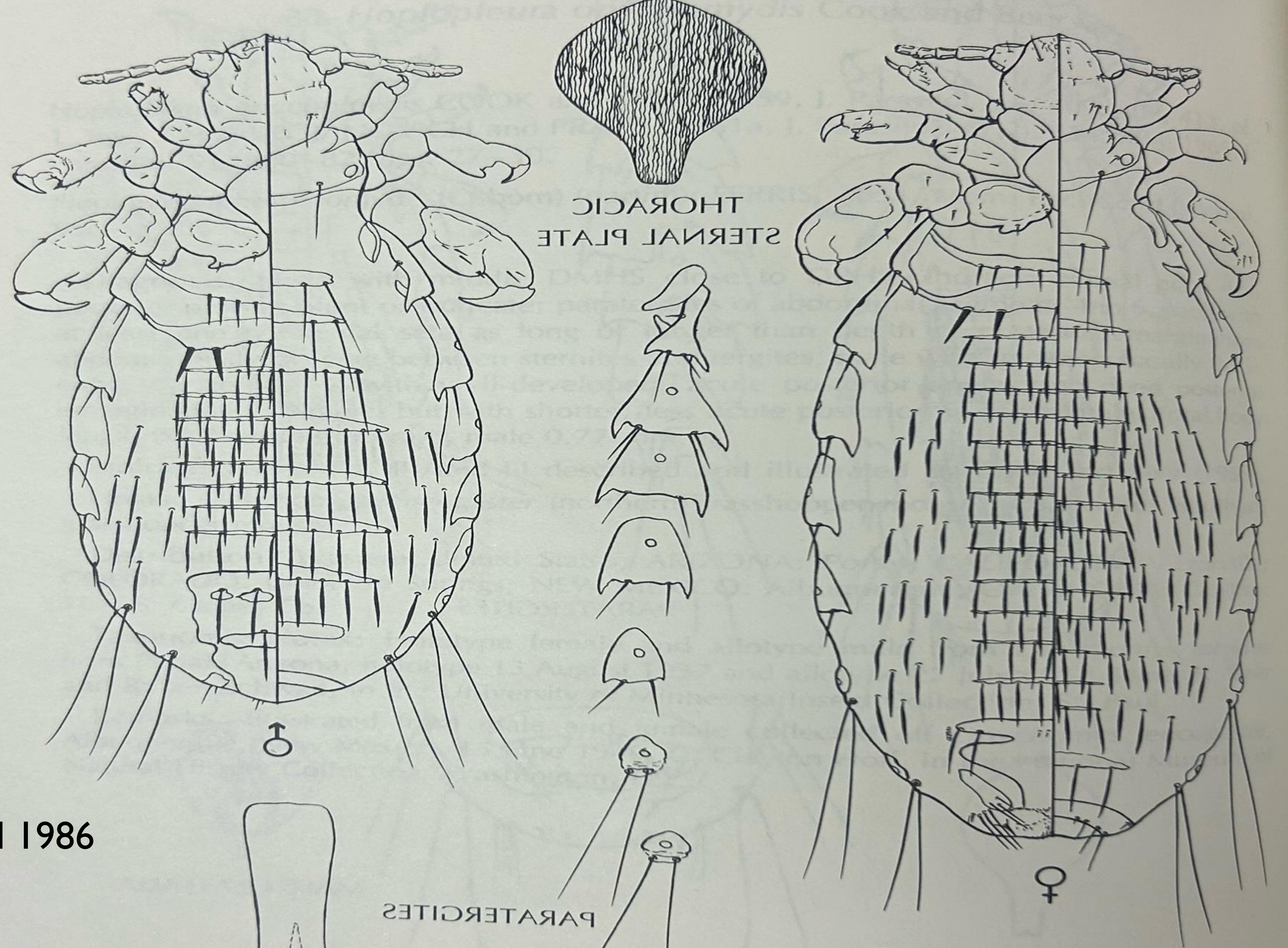
- How does flea abundance vary in *P. maniculatus* based on body condition, habitat, and litter depth?

FIELD WORK

- 8 grids with 24 Sherman traps
- 4 grids in coniferous forest and 4 grids in deciduous
- Trapped, tagged, and combed mice for 3 days on each grid
- Identified ectoparasites retrieved from each individual

ECTOPARASITES

- Lice, Ticks, Mites, and Fleas
- Majority of ectoparasites found were adult fleas
- Some ticks were found but they are typically found in higher frequencies in the spring
- Only 1 mite and 1 louse were found



Kim et al 1986

A, 10, 11B; FERRIS, 1921,
1951, Mem. Pac. Coast
-5: 410, figs. 10, 21, 27;

terior process; first sternal
ae more widely spaced at
teral lobes short, pointed
7 tergites bearing setae;
nd arms of pseudopenis

Cook and Beer (1959).

oile; GEORGIA: Brooks
RTH CAROLINA: Dur-
tonio; VIRGINIA: Lee

Sigmodon hispidus,
tomology, University

female, Grady Co.,
tural History Collec-

ECTOPARASITES

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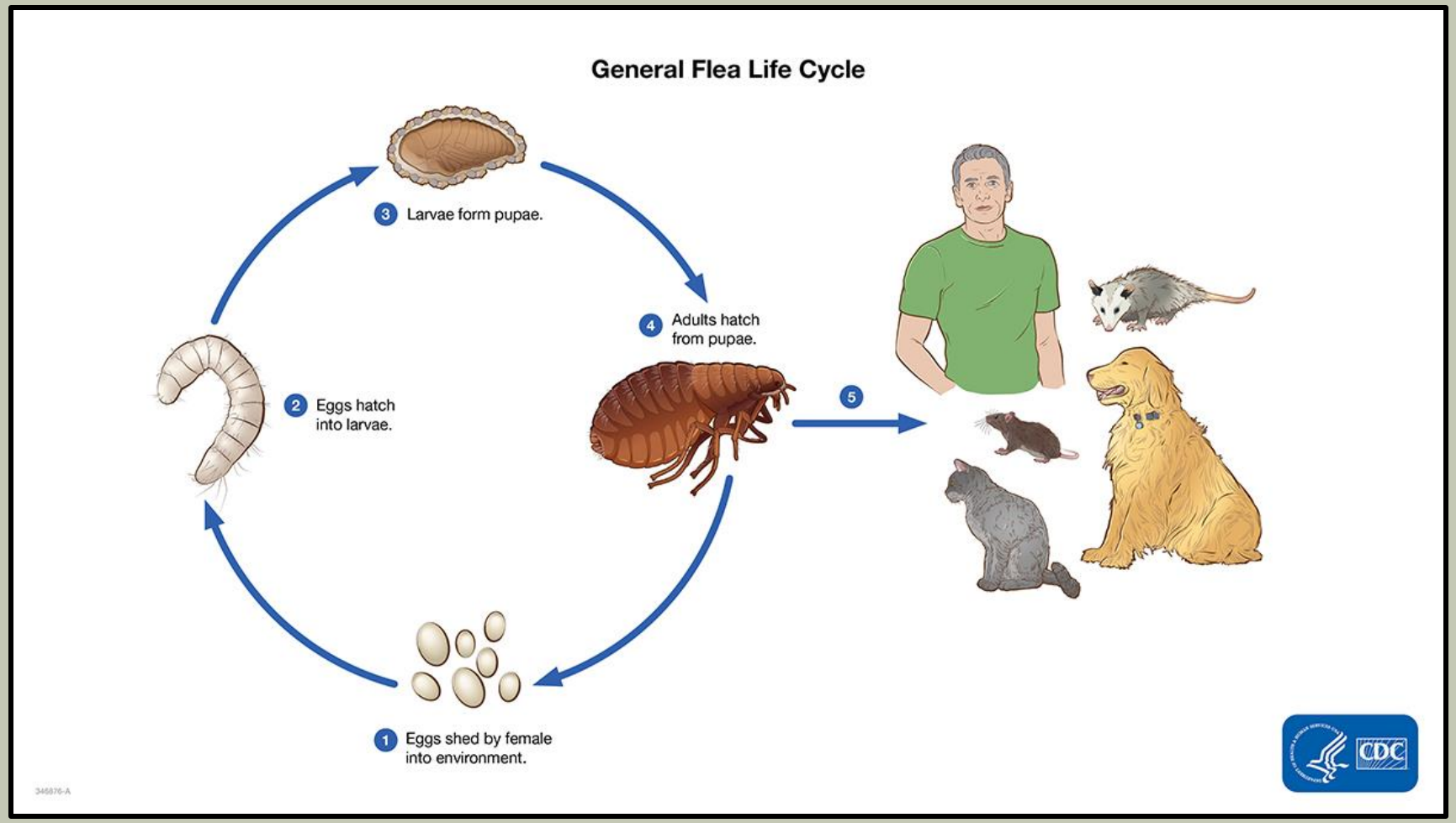
LIFE HISTORY OF FLEAS

- Eggs laid on host or in leaf litter
- Larva lives in leaf litter
- Pupa develops in leaf litter
- Adults must find a host to feed
- Without host they must find high humidity and cool temperatures to survive

LIFE HISTORY OF FLEAS

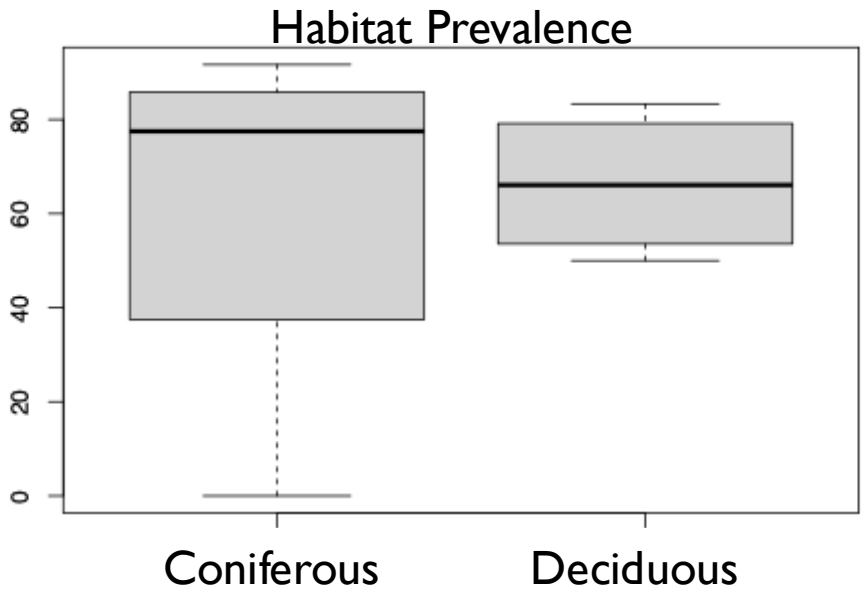


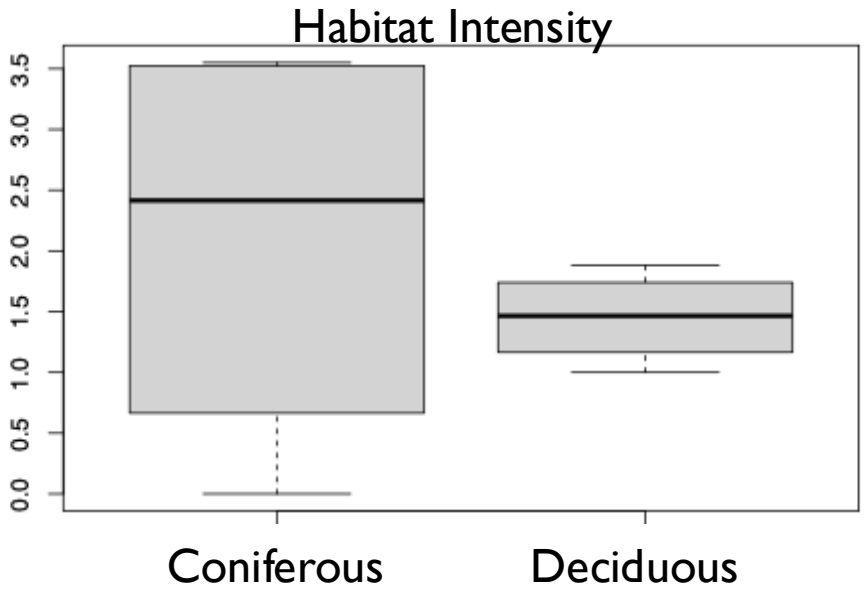
RESULTS

HABITAT VS PREVALENCE AND INTENSITY

- Prevalence – number of individuals infected out of the total number of individuals
- Intensity – average number of fleas per infected mouse

- Prevalence between Coniferous and Deciduous t = -0.21139, df = 3.8075, p-value = 0.8434
- Intensity between Coniferous and Deciduous t = 0.7225, df = 3.2802, p-value = 0.5181



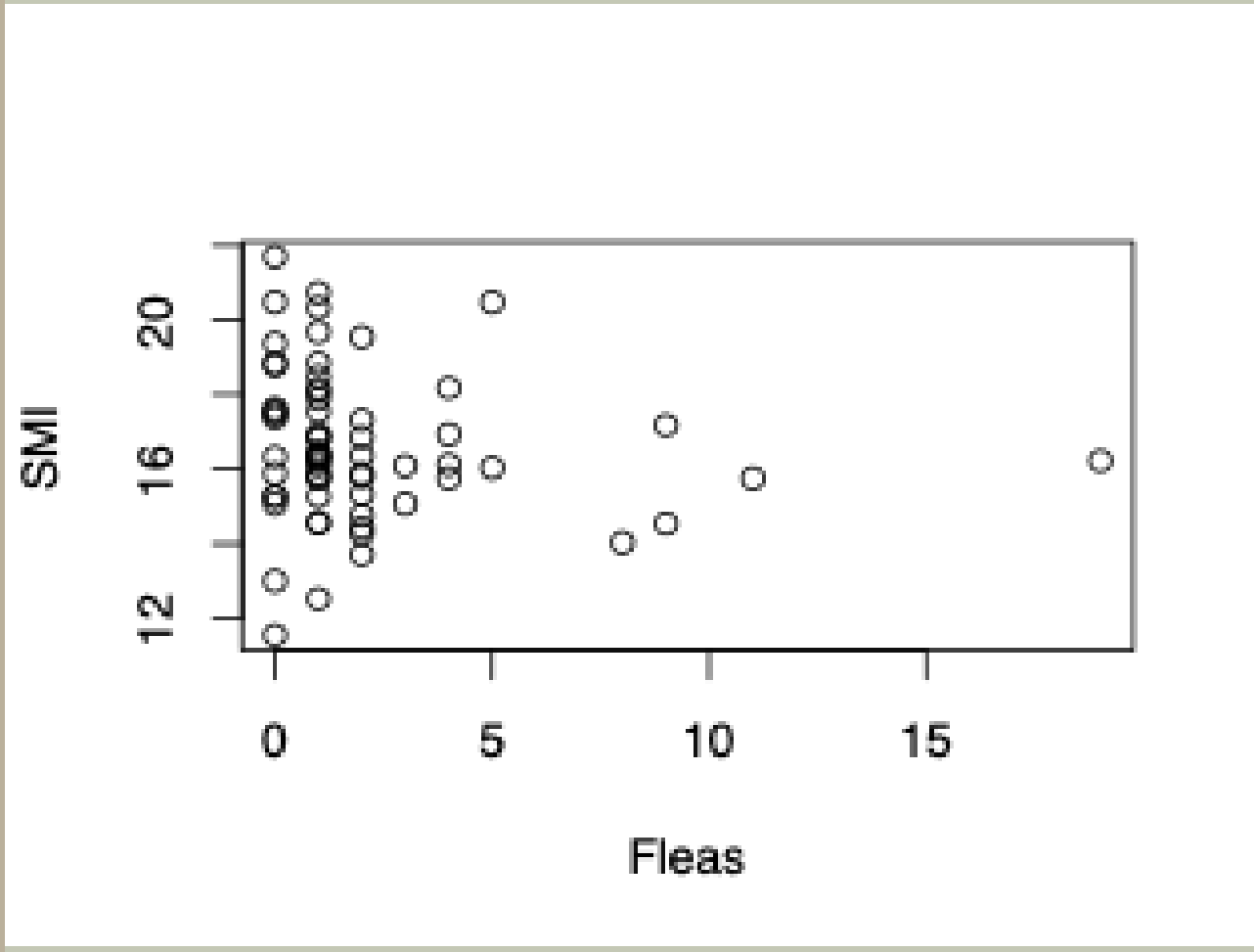


CONDITION

SMI is the weight corrected for effect of length

Body Condition in relation to fleas

Cor -0.1248341



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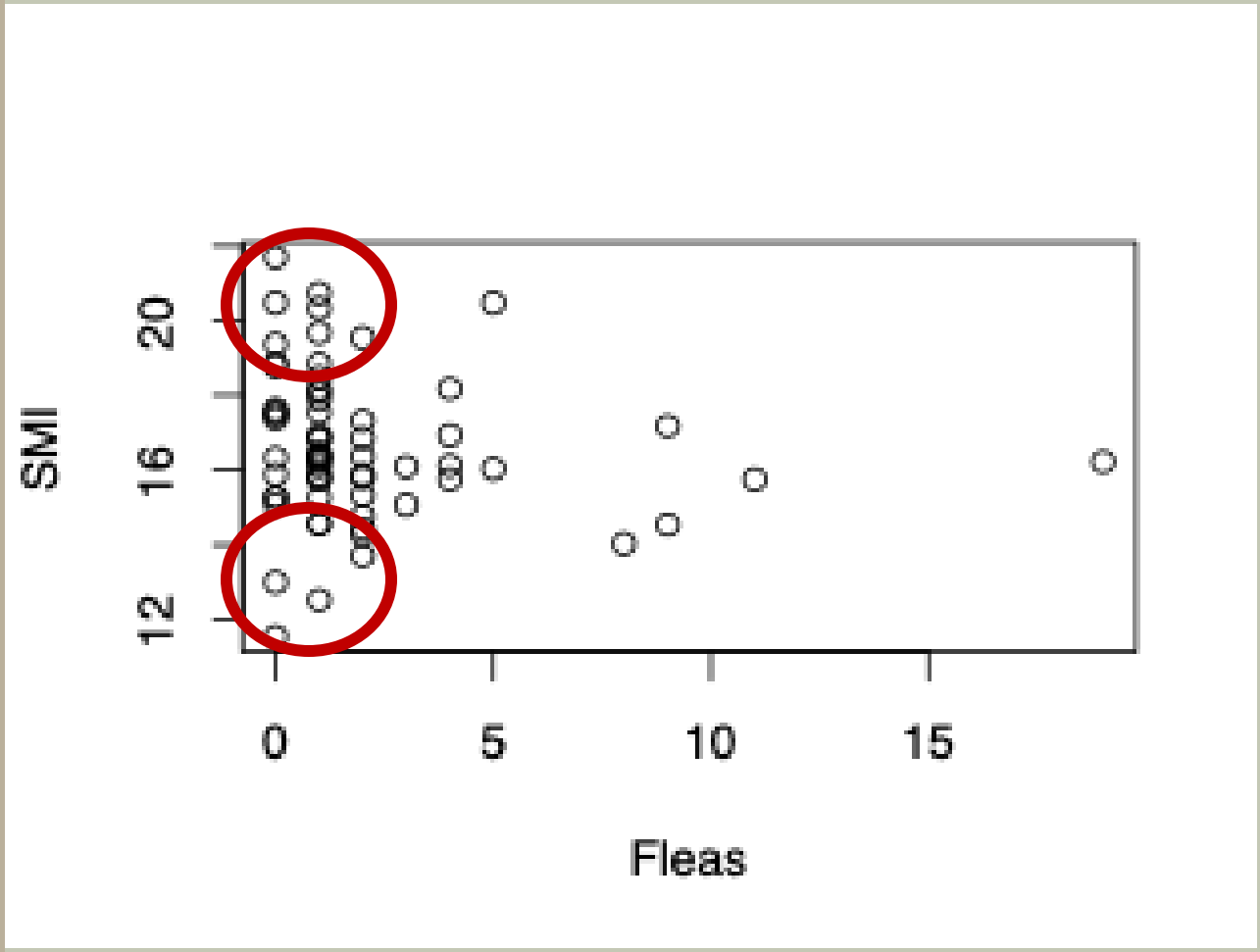
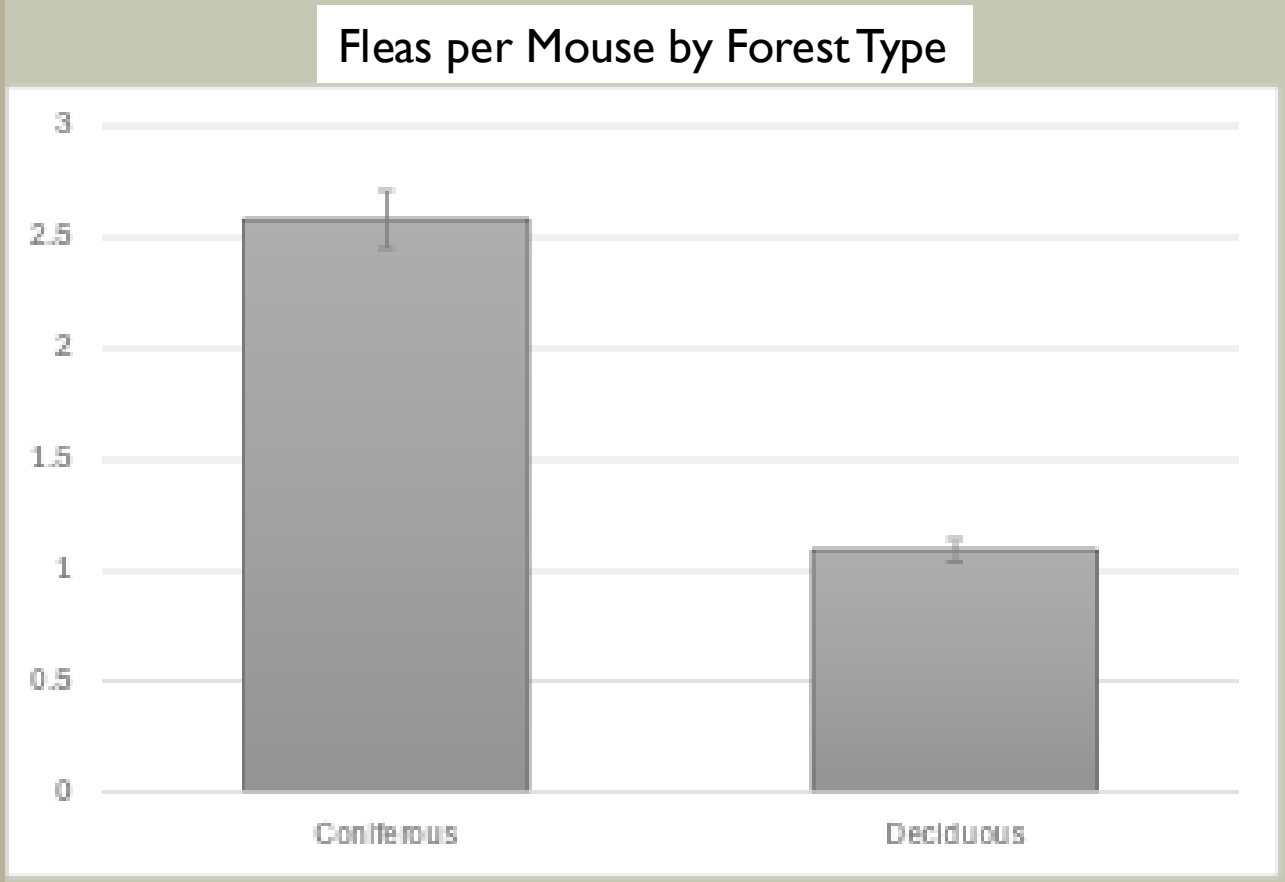


FLEAS PER MOUSE

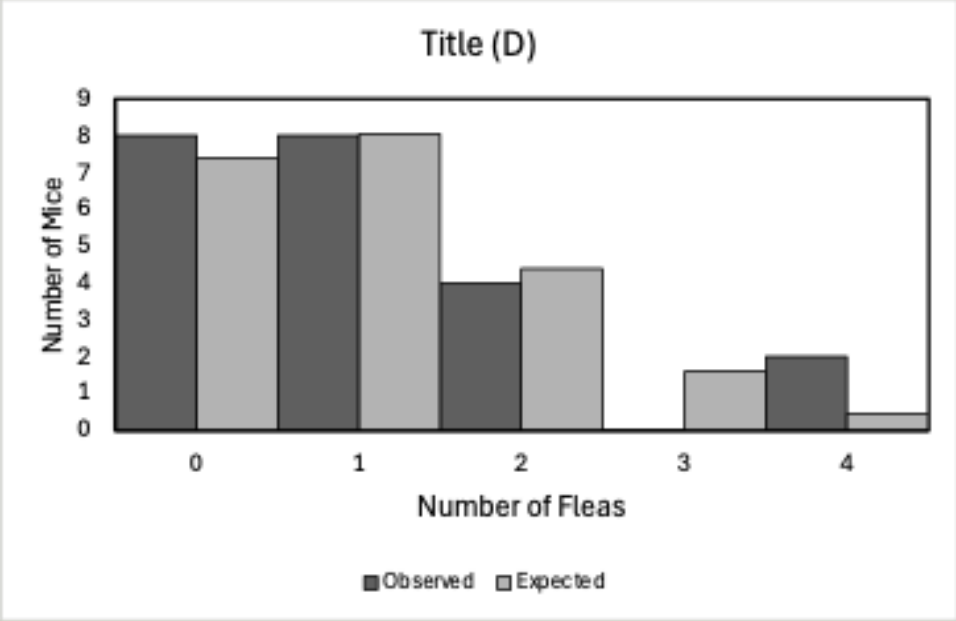
Difference in number of fleas per individual mouse

Fleas are higher in coniferous forests

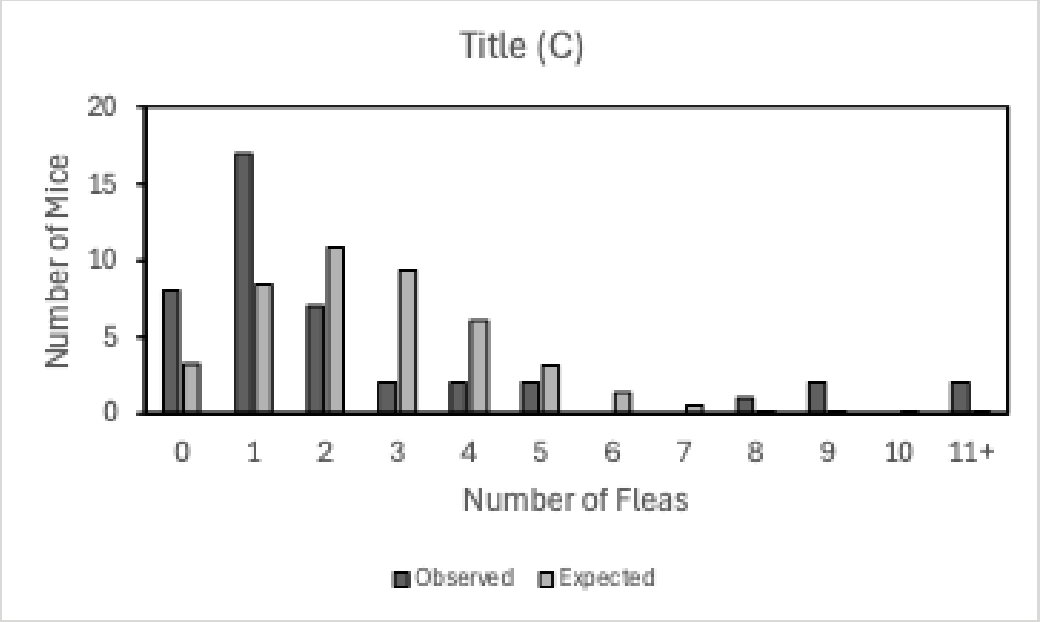
t = 2.4236, df = 56.296, p-value = 0.0186



DISTRIBUTION OF FLEAS ON HOSTS



- Observed vs expected is similar
  - Random distribution



- Observed vs expected is not similar
  - Clumped distribution

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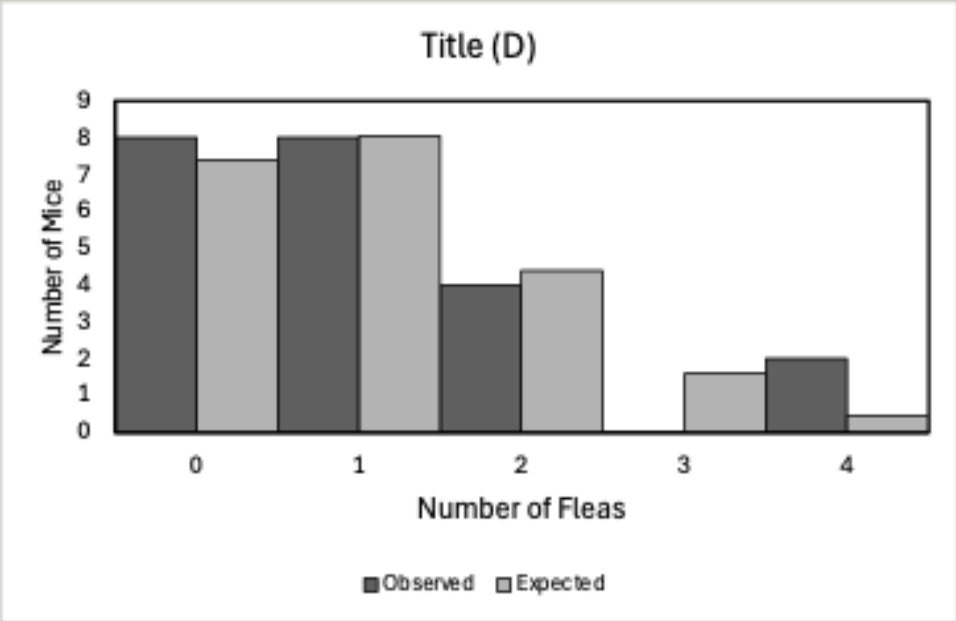

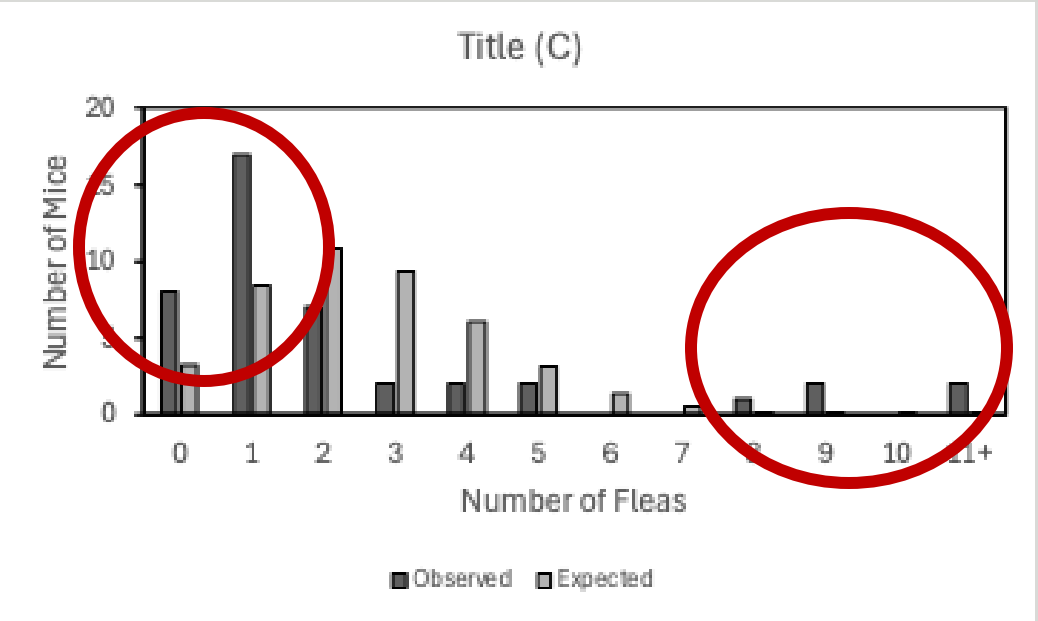

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- Observed vs expected is not similar
  - Clumped distribution

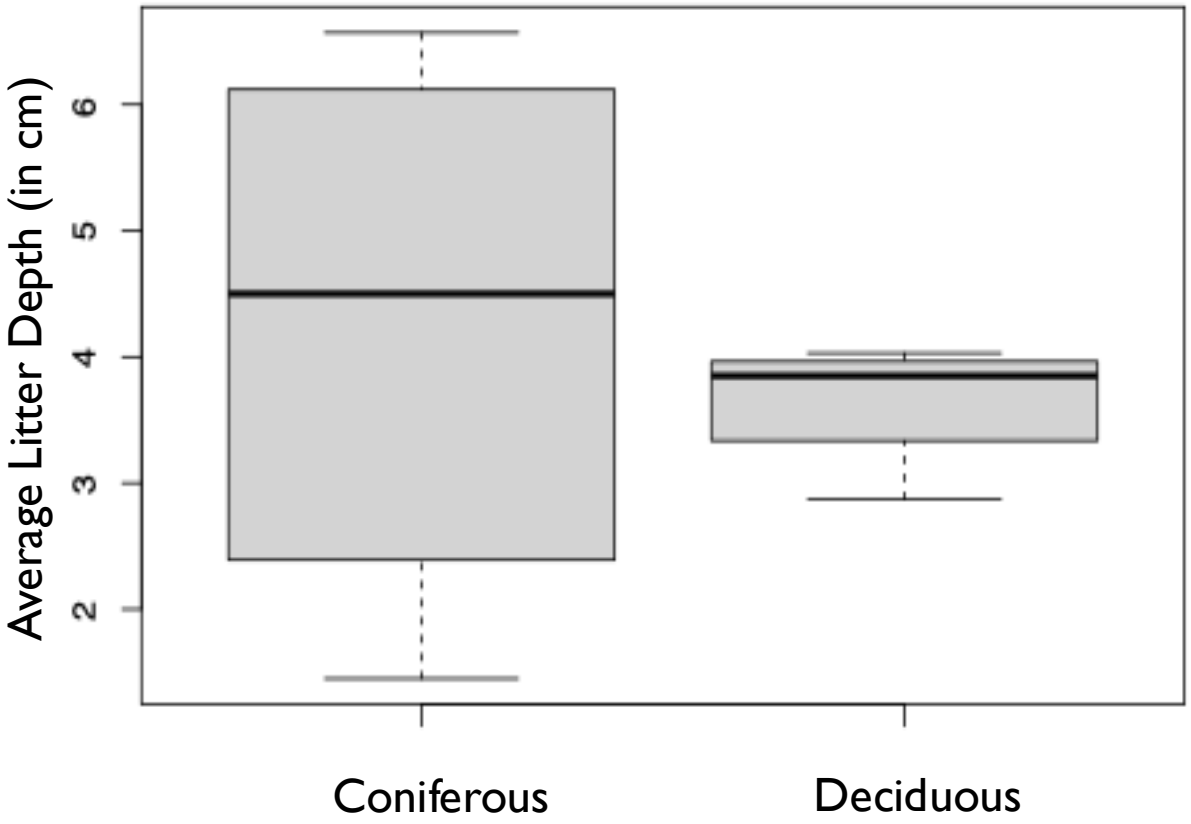
LEAF LITTER

- Important habitat for the growth and development of fleas
  - Where adults spend time between parasitizing hosts

REINFECTIONS AT GRID LEVEL

Litter Depth does not differ between Coniferous and Deciduous grids

t = 0.50946, df = 3.3117, p-value = 0.6425

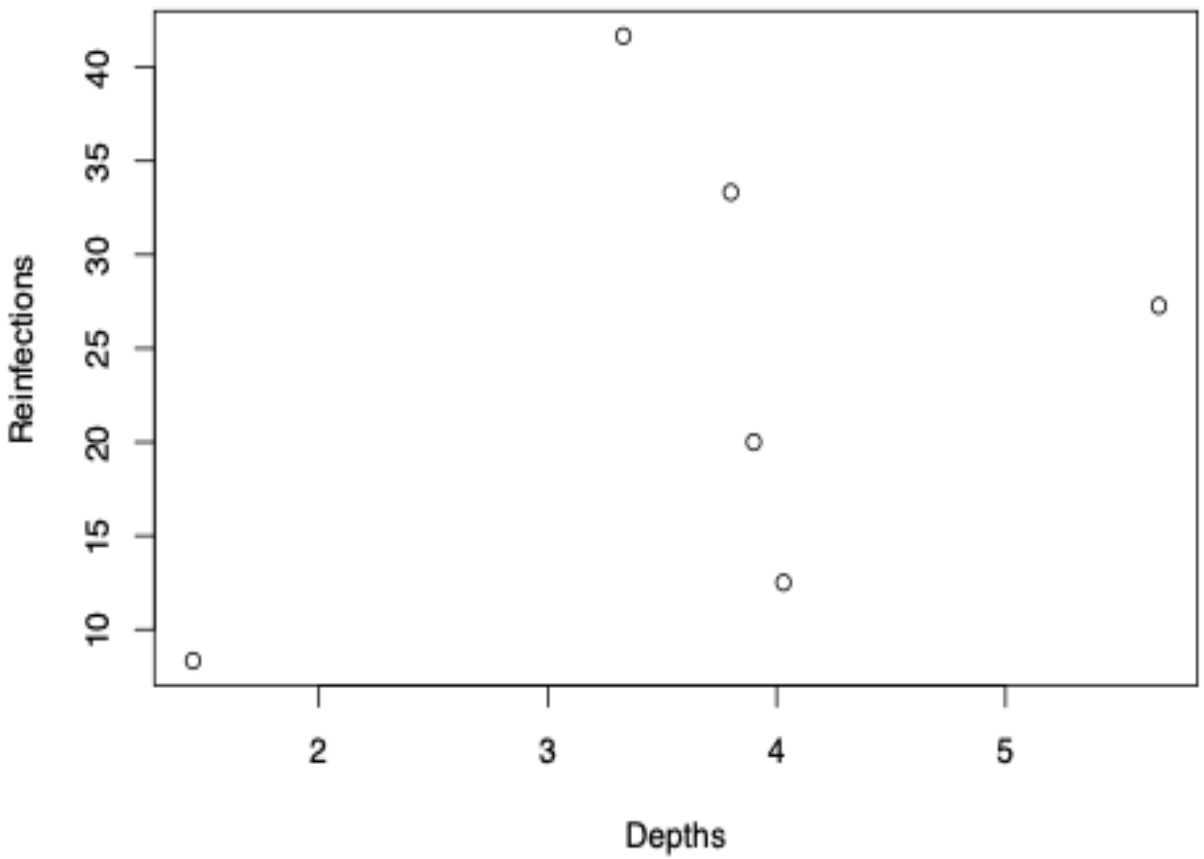


REINFECTIONS AT GRID LEVEL

Reinfections are not dependent on the depth of the leaf litter

cor(Depths,Reinfections)

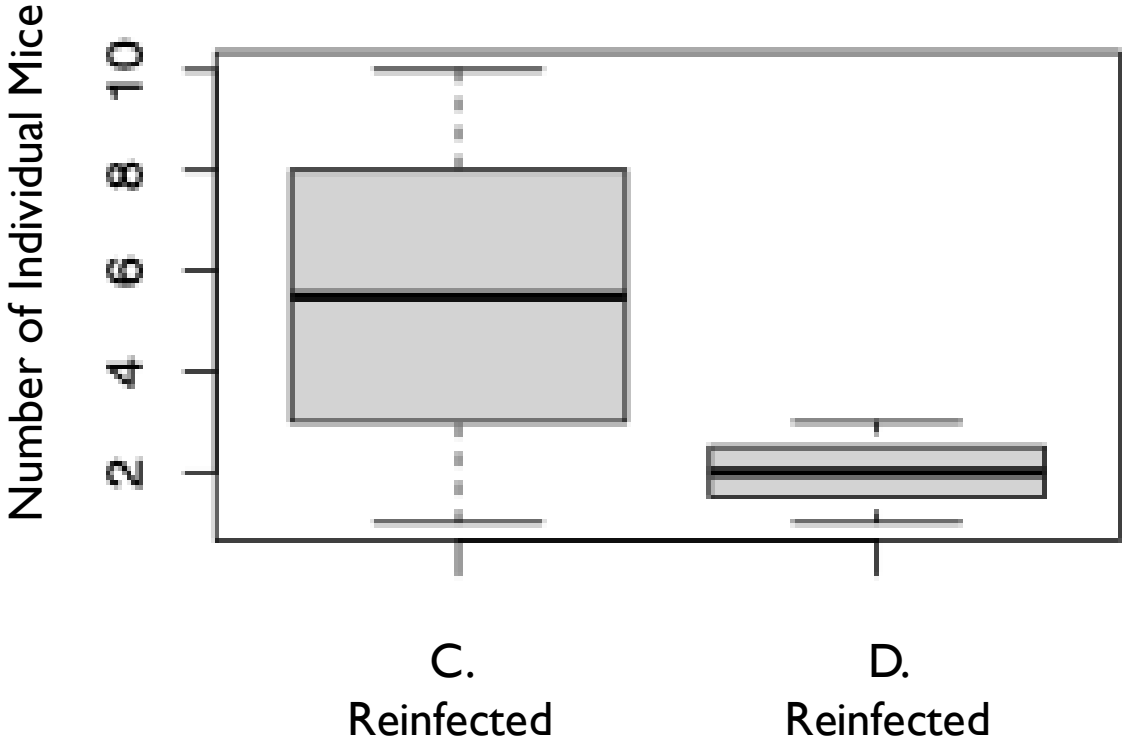
[1] 0.3655252



REINFECTIONS AT GRID LEVEL

Forest type does have an effect on the number of individuals reinfected

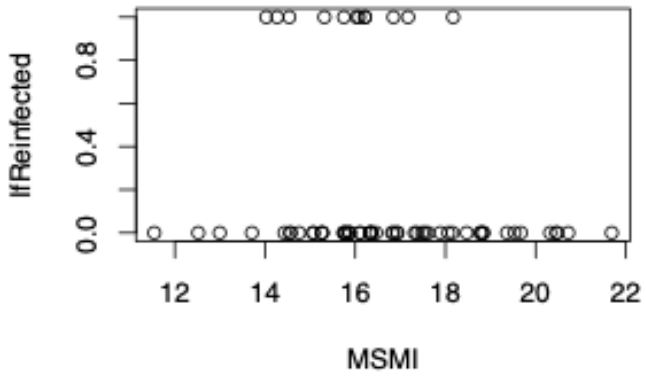
Reinfected: t = 3.1305, df = 10.492, p-value = 0.0101



REINFECTIONS AT INDIVIDUAL LEVEL

- Reinfection rate is not affected by individual body condition

	Estimate	z value	Pr(>|z|)
MSMI	-0.2448	-1.412	0.158



SUMMARY

- Habitat has no effect on prevalence or intensity of fleas at the population level
- Habitat has an effect on the number of fleas per individual mouse and number of mice that get reinfected
- This difference is not due to leaf litter depth
- Body size does not have an effect on the number of fleas

FUTURE RESEARCH

- What causes the differences in number of fleas per mouse by habitat type?
  - Humidity
  - Number of Hosts
- How might nesting habits of mice affect the species of ticks present?
  - Bird Ticks, Deer Ticks, Beaver Ticks, Squirrel Ticks
- Grooming behavior in mice

QUESTIONS?