FACTORS INFLUENCING IMMATURE *Dermacentor variabilis* LOAD ON THE WHITE-FOOTED MOUSE (*Peromyscus leucopus*)

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ABSTRACT

The host-parasite relationship is an important and complex ecological interaction. Parasite load affects pathogen transfer and can influence host fitness. Mice were live trapped in three night trapping sessions conducted on two permanent grids every other month from June 2006 to December 2008. Grids were established in an old field and an early successional forest each with 104 sampling points. Data were analyzed with negative binomial regression. Gender and body size both had significant effects on tick load ($P = 0.012$ and $P = 0.029$, respectively), with males and larger hosts harboring more immature ticks. However, body size and gender were not significantly related with one another ($P = 0.234$). The data were also found to follow the 80/20 rule, in which less than 20% of the hosts harbor 80% of on-host immature *D. variabilis*.

OBJECTIVES

- To determine if parasitism by immature *Dermacentor variabilis* on *Peromyscus leucopus* follows the 80/20 rule.
- To determine if the number of on-host immature *D. variabilis* is associated with the gender, body size or habitat of its host (*P. leucopus*).

METHODS

- Conducted in two different habitats, an early successional forest and an old field habitat, approximately 300m apart in Adair County, Missouri.
- Live trapping was performed once every two months for over two years from June 2006 to December 2008 for 3-4 nights per session in both sites concurrently. There were a total of 11128 trap nights. Ticks were collected from host and identified to species and life stage.

STATISTICAL ANALYSIS

- The 80-20 rule was examined using a Lorenz curve, which displays the percentage of hosts as a function of percentage of ticks.
- Negative binomial regression was used to determine if there was a relationship between immature *D. variabilis* burden and habitat, host body mass or gender. First captures of *P. leucopus* were utilized in order to meet the independence assumption. Seven candidate models were run that included all possible combinations of the variables body size, gender, and habitat. Models were compared using Akaike's information criteria (AIC) and corrected AIC values.

RESULTS

Is *P. leucopus* the dominant host of immature *D. variabilis* in the study site?

- In both habitats, *P. leucopus* was found to harbor significantly more immature *D. variabilis* than any other host monitored.

TABLE 1: Total small mammal captures and mean immature *D. variabilis* load with standard error for hosts across two habitats. Provides evidence for a highly host specific relationship.

Species	Forest		Meadow	
	Individuals captured	Mean immature <i>D. variabilis</i> (SEM)	Individuals captured	Mean immature <i>D. variabilis</i> (SEM)
<i>Blarina sp</i>	4	0 ± 0.0	9	0 ± 0.0
<i>Microtus ochrogaster</i>	-	-	7	0.86 ± 0.71
<i>Peromyscus leucopus</i>	132	3.36 ± 0.75	40	5.25 ± 2.41
<i>Reithrodontomys megalotis</i>	2	0 ± 0.0	14	0.14 ± 0.0
<i>Cryptotis parva</i>	1	0 ± 0.0	13	0 ± 0.0
<i>Tamias striatus</i>	1	0 ± 0.0	3	0.67 ± 0.67
<i>Zapus hudsonius</i>	2	1.0 ± 1.0	1	0 ± 0.0

Is there differential parasitism within the host population?

- Parasitism was found to follow the 80/20 rule, graphically represented by the Lorenz curve below. The gini coefficient was 0.536. The gini coefficient is a measure of statistical dispersion between 0 and 1.

FIGURE 1: Lorenz curve depicting the percentage of hosts that harbor a given percentage of the on-host immature *D. variabilis*.

RESULTS

What factors influence differential parasitism within the host population?

- Model 4 had the lowest Akaike Information Criterion (AIC= 662.41) and Corrected AIC (AICc= 662.59) indicating that tick burden is associated with host body mass and gender. An independent sample T-test showed no significant association between *P. leucopus* gender and body mass ($P = 0.985$).
- Male *P. leucopus* were found to harbor twice as many immature *D. variabilis* as females (4.9 and 2.4 ticks, respectively).
- The number of immature *D. variabilis* was found to be positively correlated with host body mass.

TABLE 2: AIC and AICc values for the seven candidate models including variations of the three dependent variables of host body mass, gender, and habitat.

Model Number	Variables in Model	p-value	AIC	AICc
1	Body mass	<0.0001	665.74	665.83
2	Gender	0.001	669.86	669.95
3	Habitat	0.271	679.12	679.21
4	Body mass	0.003	662.41	662.59
	Gender	0.020		
5	Body mass	<0.0001	667.70	667.88
	Habitat	0.837		
6	Gender	0.002	671.56	671.74
	Habitat	0.583		
7	Body mass	0.003	664.22	664.52
	Gender	0.018		
	Habitat	0.666		

CONCLUSION

- The significance of body mass could relate to increased attachment area, increased energetic demands, or decreased grooming activity in larger individuals.
- The evident sex bias could be a result of differential behavior, resource use, or testosterone production in males.
- Host specificity must be examined as a two tiered concept. The first tier relates to the host preference of a tick between sympatric species while the second tier deals with the variation within a host population that causes differential tick burdens.

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