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Influence of Host Size on Louse Densities on Eastern Chipmunks (*Tamias striatus*)

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It seems plausible that ectoparasite infestation densities might be influenced by host size. As part of a general survey of the ectoparasites and other arthropods associated with the eastern chipmunk, *Tamias striatus,* in a 5-ha suburban deciduous plot about 11 km southwest of Nashville, Davidson Co., Tennessee, louse densities of infested chipmunks were correlated with host length and weight for the period October 1977 through November 1978. Louse-free chipmunks were therefore disregarded for these analyses.

Chipmunks were live-trapped and anesthetized (with ether) before lice were collected by meticulous visual pelage searches aided by a low-power zoom lens attached to a binocular microscope. Hosts were measured (in centimeters) from nose tip to tail base and weighed (in grams). Processed chipmunks were tagged for individual recognition and released at their capture site following full recovery from anesthesia; to avoid data bias, host individuals were not included in the analyses more than once.

All lice collected were identified as the common eastern chipmunk associate, *Hoplopleura erratica* (Anoplura: Hoplopleuridae). Table I shows that length versus weight of chipmunk individuals showed highly significant positive correlation so that either of these 2 variables could feasibly be used alternatively for correlation testing against louse numbers. Both length and weight did indeed show very significant negative correlation with louse densities although the higher value of the correlation coefficient obtained using the variable, chipmunk length, shows that this represents a slightly better correlation (Table I). Hosts were not segregated with respect to sex for these data because a larger survey in the same area showed no significant difference between the number of lice on infested male versus female chipmunks; a greater proportion of male chipmunks was actually infested with lice, however (n = 381 chipmunks) (Durden, 1983, Journal of the Tennessee Academy of Science **58:** 16–20).

The equation for the line describing the number of lice (y) predictably parasitizing an infested chipmunk of length, x_1, is:

$$y = -0.32x_1 + 67.7.$$

The equation for the line correlating the number of lice (y) predictably on an infested host of weight, x_2, is:

$$y = -0.42x_2 + 58.2.$$

Both of these equations, derived from present data, describe louse numbers on infested chipmunks as a linear regression of host size.

To assess any influence of host age on louse infestation densities, the 51 louse-infested chipmunks were segregated according to approximate host age. This treatment revealed that adult hosts (n = 27 chipmunks) were infested by a mean of 7.1 lice, whereas subadults (n = 11) supported a mean of 18.5 lice and juveniles (n = 13) a mean of 43.3 lice—these differences are highly significant ($\chi^2 = 29.8$, $P < 0.001$).

These data clearly show that increase in length or weight of an eastern chipmunk infested with lice is statistically accompanied by a reduction in the louse density and that this reduction is linear. This negative correlation might not be expected because increase in host size would appear to provide more louse habitat. In fact, this

TABLE I. *Correlation of length, weight, and louse infestation densities for individual eastern chipmunks.**

Correlation	n (hosts)	r	P	Mean center
Chipmunk length (x_1) vs. weight (x_2)	143	+0.79	<0.001	154.5 cm, 98.0 g
Chipmunk length vs. no. of lice (y)	51	−0.60	<0.001	153.2 cm, 18.8 lice
Chipmunk weight vs. no. of lice	51	−0.55	<0.001	93.9 g, 18.8 lice

* Total no. of lice collected = 959.

negative relationship is contrary to some other published reports describing host size and louse densities. Cook and Beer (1958, Ecology **39:** 645–659) and Phillips (1966, Journal of Medical Entomology **3:** 150–155) have documented positive correlations between variables (host length versus louse numbers) on male meadow voles (*Microtus pennsylvanicus*) in Minnesota and on small mammals in Taiwan, respectively. However, Beer and Cook (1968, Journal of Medical Entomology **5:** 85–90) have recorded larger louse populations on deer mice (*Peromyscus maniculatus*) of extreme sizes (i.e., their smallest and largest size classes) in Minnesota, and Holdenreid et al. (1951, Ecological Monographs **21:** 1–18) stated that young California ground squirrels (*Spermophilus beecheyi*), recently emerged from the maternal burrow, supported most lice.

Present trends probably reflect a better louse resistance in larger chipmunk individuals. Larger chipmunks represent older individuals and this resistance could be achieved behaviorally, morphologically, or immunologically, with time. Behavioral responses suggest a lowered efficiency of self-grooming in the less experienced, younger chipmunks; morphological parameters such as fur and skin modification with age should also be considered. Immunological competence could be attained gradually with time or acquired through previous exposure to louse antigens or to cross-reactive antigens from other hematophagous arthropods (e.g., den Hollander and Allen, 1986, Journal of Medical Entomology **23:** 44–50). Mohr and Stumpf (1964, Journal of Medical Entomology **1:** 73–77) recorded significantly more ticks on young meadow vole (*M. californicus*) hosts, a phenomenon which they attributed to the less adept self-grooming abilities of these individuals; it is tempting to propose a similar efficiency modification of self-grooming with age model to account for the present correlations.

It should be noted that, in this study, young chipmunks were trapped after they had emerged from their natal burrows at about 6 wk of age (Durden, 1983, Journal of Zoology, London **201:** 117–123; Durden, 1984, Journal of the Tennessee Academy of Science **59:** 28–30). Louse infestations of young chipmunks must therefore have been acquired from maternal females and multiplied to fairly high densities by the time these young animals first ventured above ground when they were trapped for analyses. Louse numbers on younger chipmunks confined to natal burrows may not have reached equilibrium and therefore might not conform to the significant negative correlations described here.

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