# THE EFFECT OF RODENT HOST ABUNDANCE ON ECTOPARASITE ABUNDANCE AND DISTRIBUTION: DOES THEORY WORK EVERYWHERE?

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Spatial distribution of parasitic organisms is represented by a set of more or less uniform inhabited "islands" or patches (their host organisms), whereas the environment between these patches is absolutely unfavourable. Abundance of the hosts, thus, is an important factor affecting distribution and abundance of parasites. Classical epidemiological models predict that mean parasite abundance and prevalence increases in a curvilinear fashion to a plateau with increasing host abundance. We studied the effect of host abundance on parasite abundance and prevalence using data on the associations of fleas and their rodent hosts from the Negev desert and Central Europe (Slovakia). We tested also if a simple epidemiological model can reproduce the pattern of the abundance-prevalence relationship.
In both regions, a simple epidemiological model based on mean flea abundance and degree of aggregation, either corrected (Negev) or not (Slovakia) for host sample size, can predict the observed pattern of prevalence. In some cases, however, observed flea prevalence was higher than that predicted from the epidemiological model. The discrepancy of the observed prevalence from that predicted by the model can be explained by either a relatively low negative effect of flea parasitism on a host or strong resistance of a host to flea parasitism or both.
The results from the Negev desert for 2 flea-rodent associations indicated that flea abundance increased in either curvilinear fashion to an asymptote (for a flea with year-round activity, X*e*nop*sylla* d*i*pod*illi*), or linearly (for winter-active flea No*s*op*syll*u*s ira*nu*s t*h*e*odo*ri*) with increase of host density. The prevalence of infestation changed either unimodally (X. d*i*pod*illi*) or logarithmically (N. *i. t*h*e*odo*ri*) as host density increased. In addition, there was a positive relationship between the mean number of fleas per host and the percentage of hosts infested. However, simulations of the fraction of resident hosts demonstrated that this parameter influences the relationship between host density and flea burden only when residents comprise no more than 50% of all host individuals.
In contrast, the results from Slovakia (for 57 flea-host associations) demonstrated that the relationships between flea abundance or prevalence and host abundance were either negative (23 and 34 flea-host associations, respectively) or absent. Negative relationships between flea abundance and host abundance were always accompanied with negative relationships between flea prevalence and host abundance. The link between flea

abundance or prevalence and host abundance, evaluated as the coefficient of determination of the respective regressions, decreased with an increase in parameter b of Taylor's power law across flea-host associations. Mean crowding of fleas decreased with an increase of host abundance in eight flea-host associations. The absolute value of the slope in four of these associations was <1, suggesting that flea crowding decreased with an increase in host abundance to an asymptote. Mean crowding increased with an increase in flea abundance in 49 flea-host association. In 15 associations, the value of the slope was <1, suggesting that mean crowding of these fleas in these hosts approached an asymptote at high flea abundances.

Comparison of the results from Central Negev and Slovakia indicates that epidemiological models are not always universal and that relationship between abundances of host and parasite belonging to the same higher taxa can vary geographically Results of this study suggest that (a) different flea-host associations are governed by different regulating mechanisms; (b) different regulation mechanisms may act simultaneously within the same flea-host associations and (c) flea-induced host mortality can be inferred from the relationship between flea aggregation and flea abundance, whereas host-induced flea mortality can be inferred from the relationship between flea abundance and aggregation and host abundance.