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MAMMALIAN ECTOPARASITE CONSORTISM AT THE NATIONAL REACTOR TESTING STATION[1]

Dorald M. Allred[2]

Studies of ectoparasites of vertebrates at the National Reactor Testing Station in Idaho were conducted between June 1966 and September 1967. The host relationships, ecological and geographical distribution, seasonal occurrence and other biotic relationships of each of four major groups—ticks, fleas, mites, and lice—have been published (Allred 1968a, 1968b, 1970). The first article of that series discusses the physical characteristics of the station, study areas and procedures, and lists the vertebrates examined. This paper presents the interspecific and intergroup relationships between the eight most common species of these four major groups of ectoparasites found on the mammals.

The degree of compatibility between different species of ectoparasites is based on a negative correlation factor determined by the following formula:

$$\frac{\text{expected rate minus the actual rate}}{\text{expected rate}} = \text{negative correlation factor,}$$

where the expected rate equals the sum of the actual rates of infestation of the respective, individual groups. For example, only fleas were found on 14.9% and only lice on 0.7% of the kangaroo rats. Fleas and lice together were found on only 1.5% of the rats. Applying the above formula, fleas and lice together are expected to occur on 15.6% of the kangaroo rats. The difference between the actual (1.5%) and the expected (15.6%) is 14.1% which, when divided by 15.6% (the expected rate of infestation), yields a negative correlation factor of 90.4. The higher the correlation factor, the greater the competition between species, or the greater the significance of other factors of environmental resistance opposing their occurrence together.

Ectoparasite-Mammal Relationships

Fleas were found on mammals of more species than were other ectoparasites, whereas lice were found on the fewest (Table 1). On infested mammals, fleas were the most common ectoparasites on 15 species, ticks the most common on four, mites on one, and lice with fleas and mites with fleas were equally common on one species of host.

Fleas were found on mammals of all species except one, lice on all except six, mites on all except five, and ticks on all except four.

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Table 1. Percentages of mammals infested with ectoparasites.

Mammal			%[2] of infested mammals[3] possessing:			
Species	No. examined	No. infested[1]	Fleas	Lice	Mites	Ticks
Canis latrans	6	5	100	0	0	0
Dipodomys ordii	808	743	72	15	46	65
Eutamias minimus	398	247	68	43	19	32
Lepus californicus	125	88	64	5	13	67
Lynx rufus	8	7	100	0	0	14
Marmota flaviventris	6	5	100	80	40	40
Microtus montanus	25	17	71	35	53	24
Mus musculus	1	1	100	0	0	0
Mustela frenata	4	4	50	0	0	100
Neotoma cinerea	14	14	100	13	33	47
Onychomys leucogaster	63	63	87	6	84	70
Perognathus parvus	474	318	38	8	29	68
Peromyscus maniculatus	1866	1629	82	30	37	40
Plecotus townsendii	78	43	0	0	100	0
Reithrodontomys megalotis	39	18	72	11	11	22
Sorex merriami	9	1	100	0	100	0
Spermophilus townsendii	60	43	65	65	28	40
Sylvilagus idahoensis	13	11	82	9	9	27
Sylvilagus nuttallii	28	23	83	4	28	39
Taxidea taxus	5	3	33	67	0	100
Thomomys talpoides	8	8	88	13	63	13
Vulpes fulva	4	3	100	0	0	0
Total species infested		22	21	15	16	17

[1]With any of the 4 kinds of ectoparasites listed.
[2]Nearest whole percent.
[3]Those infested with any kind of ectoparasite.

Ectoparasite Compatibility on Common Mammals

Relative degrees of ectoparasite and host compatibility are shown in Table 2. Fleas on kangaroo rats, chipmunks and deer mice, lice on kangaroo rats and pocket mice, mites on chipmunks, and ticks on deer mice and pocket mice apparently were the least compatible combinations.

Intergroup compatibility of ectoparasites is shown in Table 3. On kangaroo rats the most compatible ectoparasites were fleas with ticks; on chipmunks, lice with ticks; on pocket mice, mites with ticks; and on deer mice, fleas with mites. Greatest incompatibility on these hosts occurred between fleas, lice and ticks on kangaroo rats, mites and ticks on chipmunks, and lice, mites, and ticks on pocket mice and deer mice.

Compatibility between the common species of ectoparasites is shown in Table 4. Chigger mites of *Euschoengastia decipiens* were the least compatible with any other single species, whereas lice of

Table 2. Ectoparasite group isolation on commonly-collected mammals of four species.

Host	%[1] of mammals[2] infested only with:			
	Fleas	Lice	Mites	Ticks
Dipodomys ordii	15	1	5	12
Eutamias minimus	32	12	4	8
Perognathus parvus	16	3	7	37
Peromyscus maniculatus	24	3	3	6

[1]Nearest whole percent.
[2]Of those infested with some kind of ectoparasite.

Table 3. Association relationships between groups of ectoparasites on commonly-collected mammals of four species.

Ectoparasite association	Species and negative correlation factor[1]			
	D. ordii	*E. minimus*	*P. parvus*	*P. maniculatus*
Fleas-lice	90	78	97	72
Fleas-mites	54	90	80	54
Fleas-ticks	15	79	77	47
Lice-mites	86	80	90	68
Lice-ticks	89	77	95	84
Mites-ticks	63	100	69	83
Fleas-lice-mites	85	94	99	81
Fleas-lice-ticks	94	88	99	86
Fleas-mites-ticks	50	96	96	78
Lice-mites-ticks	89	97	100	93
Fleas-lice-mites-ticks	88	94	99	90

[1]Equals the expected rate of infestation (sum of the actual rates of infestation of the respective individual groups) minus the actual raee of infestation, divided by the expected rate of infestation. The higher the number the more negative the association.

Table 4. Association relationships between combinations of specific ectoparasites[1] on mammals.

Ectoparasite	Combination and negative correlation factor[2]	
	With 1 other ectoparasite	With 2 other ectoparasites
Fleas		
Meringes parkeri	81	197
Monopsyllus wagneri	50	111
Lice		
Polyplax auricularis	80	240
Mites		
Eubrachylaelaps debilis	59	102
Euschoengastia decipiens	102	181
Haemolaelaps glasgowi	39	64
Ticks		
Dermacentor andersoni	79	183
Ixodes kingi	62	136

[1]Only commonly-collected species.
[2]Equals the expected rate of infestation (sum of the actual rates of infestation of the respective individual groups) minus the actual rate of infestation, divided by the expected rate of infestation. The higher the number, the more negative the association.

Polyplax auricularis were the least compatible when more than one other species was involved. *Polyplax auricularis* was the least compatible of all species associations, and the mite *Haemolaelaps glasgowi* the most.

Species Consortism

Ticks of *Dermacentor andersoni* and fleas of *Meringes parkeri* were found alone on their hosts a greater percentage of the time than were other species (Table 5). Mites of *Eubrachylaelaps debilis* were associated with other ectoparasites more than any other species. The most frequent associations occurred between ticks of *Ixodes kingi* and fleas of *Meringes parkeri*. In fact, sufficiently low negative correlation factors occurred between these latter two species and between *Polyplax auricularis* and *Eubrachylaelaps debilis* in comparison to other combinations to suggest a positive interrelationship. However, when a third species is considered in these associations, the negative correlation factors increase considerably, except for the combinations of *Polyplax-Eubrachylaelaps-Monopsyllus wagneri*, and *Ixodes-Meringes-Haemolaelaps glasgowi* wherein the negative correlation factors were the lowest of any triple combinations.

In the nine combinations of four species, seven negative correlative values were over 99%, and two were 97% and 98%. Apparently when four groups are involved, too much competition is present to permit frequent infestations by so many different groups.

Table 5. Consortism between species of major groups of some common ectoparasites on mammals.

Parasite Association	%[1] times occurred: As only common[2] ectoparasite	%[1] times occurred: With ectoparasite indicated
Dermacentor andersoni	18	
Eubrachylaelaps debilis		2
Euschoengastia decipiens		1
Haemolaelaps glasgowi		5
Meringes parkeri		11
Monopsyllus wagneri		5
Polyplax auricularis		2
Eubrachylaelaps debilis	3	
Ixodes kingi		2
Meringes parkeri		1
Monopsyllus wagneri		7
Polyplax auricularis		6
Euschoengastia decipiens	14	
Ixodes kingi		2
Meringes parkeri		1
Monopsyllus wagneri		1
Polyplax auricularis		1
Haemolaelaps glasgowi	5	
Ixodes kingi		5
Meringes parkeri		6
Monopsyllus wagneri		8
Polyplax auricularis		3
Ixodes kingi	14	
Meringes pargeri		18
Monopsyllus wagneri		8
Polyplax auricularis		3
Meringes parkeri	18	
Polyplax auricularis		1
Monopsyllus wagneri	16	
Polyplax auricularis		8
Polyplax auricularis	6	

[1]Nearest whole percent. 1% indicated if less than 0.5%.
[2]Of the 8 listed in this table.

Conclusions

Negative consortism occurs between different groups of ectoparasites on the mammals at the NRTS. Only two of the 11 combinations on four common mammals (total of 44 groupings) had negative

correlation factors of less than 50. The lowest negative factor of any ectoparasite was for the mite *Haemolaelaps glasgowi* which is the most ubiquitous of all the species studied. The parasite with the highest factor was the louse *Polyplax auricularis* which belongs to the most host-specific group of the four categories of ectoparasites studied.

Of those ectoparasites which occurred as the only single group on their hosts, the fleas were predominant on three of the four common species of mammals, ticks on the other. Lice occurred alone most infrequently of the ectoparasite groups in all cases except one when they surpassed both the mites and ticks as single-occurring ectoparasites.

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