Proceedings of the Iowa Academy of Science

Volume 65 | Annual Issue Article 77

1958

Evaluation of Techniques for Recovering Ectoparasites

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Introduction

This study is an attempt to evaluate quantitatively and compare the effectiveness, selectivity and variation of the flotation technique as a method for recovering ectoparasites.

The recovery of ectoparasites from their host has taken on many forms in the past but few attempts have ever been made to compare the various techniques. The first, and probably the most common, method was undoubtedly searching through the pelt to uncover the parasites. The main limitations of searching are that it is tedious and rarely yields ectoparasites in sufficient quantities. Several variations of this basic technique of searching have been suggested by Waterston (1912, 1913).

The brushing technique, a somewhat more advanced design, has been used rather extensively on both birds and mammals. Brushing has the advantages of being easy to use, not requiring elaborate equipment and use without damage to the skin. Its main drawback is that brushing recovers only a portion of the ectoparasites and its use, at least in the past, has resulted in many erroneous records. Hopkins (1949) has suggested a modification of this technique to help reduce contamination and Dunn (1932) a modification to be used on living animals.

Another technique required the use of water plus a detergent. This method, called the flotation technique, has been used as a standard sampling procedure by Gering and Thomas (1953). Although this technique is laborious it has the advantage of collecting a high proportion of living ectoparasites with less probability of contamination.

A dependable method, termed the dissolution technique, has been described by Hopkins (1949). Briefly, dissolution consists of soaking animal skins in sodium hydroxide to remove the hair and ectoparasites; dissolving the hair in boiling sodium hydroxide; pouring the dissolved hair through a screen to collect the undissolved ectoparasites. This technique is time-saving, but more important it is the most effective means known to date to recover near-maximal

[1]This work was supported by Army Chemical Corps contract No. DA-18-064-CML-2639, with the University of Utah.

populations from animal skins. However, dissolution cannot be used when skins are to be saved or when living parasites are desired. A modification of Hopkin's technique, based upon dissolution of the total skin with caustic potash, has been devised by Cook (1954).

Methods and Materials

In order to realize the objectives set forth in the introduction the dissolution technique was used as the comparative-standard. The rodents used were the Ord kangaroo rat *Dipodomys ordii pallidus* (Durrant and Seltzer), and the white-footed deer mouse *Peromyscus maniculatus sonoriensis* (LeConte). These animals were live trapped in the southern arm of the Great Salt Lake Desert of northwestern Utah. Only animals which showed positive infestations were used for dissolution. Out of a total of approximately 30 animals that were examined by the flotation technique five deer mice and six kangaroo rats were selected for further scrutiny by the dissolution technique.[2] The collected ectoparasites were recorded as the number of mites, ticks, fleas, and lice (Anoplura) obtained from handling (ectoparasites found in the bag in which the animal was kept prior to flotation), flotation, and dissolution. All the ectoparasites recorded under the dissolution technique are those parasites which the flotation technique failed to collect.

Comparisons made in this study were based upon the assumption that the dissolution technique is responsible for maximum recovery of the ectoparasites.

Results and Discussion

No attempt was made to identify specifically the ectoparasites any further than mites, ticks, fleas and lice. The families of mites generally associated with the animals used in this study were: Dermanyssidae, Haemogamisidae, Laelaptidae, Listrophoridae, Phytoseiidae and Trombidiidae (Gering, 1953). Ticks of the family Ixodidae were either *Dermacentor parumapterus* Neum. or *Ixodes kingi* Bishopp. The sucking lice were *Fahrenholzia pinnata* K.&F. from the kangaroo rat and *Hoplopleura hesperomydis* (Osborn) associated with deer mice. The fleas are commonly represented by the genera *Monopsyllus, Malaraeus, Meringis, Orchopeas, Stenistomera* and *Thrassis* (Loshbaugh, 1953).

Totals of 2,937 ectoparasites were recovered from the Ord kangaroo rat and 784 ectoparasites collected from the deer mouse. The average number of ectoparasites within each group for both animals is presented in Table 1.

[2]Acknowledgment is made to Mr. William Bacha who directed and gave technical assistance on the flotation technique.

Table 1

Average Number of Each Ectoparasite Group Recovered from *D. ordii pallidus* and *P. maniculatus sonoriensis*

Host	Sample Size	Ectoparasites Mites	Ticks	Fleas	Lice	Total
D. o. pallidus	6	386.5	27.3	0.3	75.3	2937
P. m. sonoriensis	5	10.8	2.6	1.6	141.8	784

Mites on the kangaroo rat accounted for 78.9 percent of the total ectoparasites. In contrast only 6.8 percent of the ectoparasites on the deer mice were mites. Lice, which were the major group of ectoparasites on deer mice, were responsible for 90.4 percent of the total number. Ticks and fleas made up 5.6 percent and 0.1 percent of the total number recovered from the kangaroo rat and 1.6 percent and 1.0 percent of the ectoparasites recovered from the deer mice.

Comparisons between flotation and dissolution as methods for collecting ectoparasites from *D. ordii pallidus* and *P. maniculatus sonoriensis* are presented in Table 2. The values are listed as number, average and percent of the total ectoparasites which were recovered. Least significant difference at the 5 and 1 percent levels are also presented.

Table 2

Comparisons Between the Flotation and Dissolution Technique as Methods for Recovering Ectoparasites

Technique	*D. o. pallidus* Number	Average	Percent	*P. m. sonoriensis* Number	Average	Percent
Handling	155	25.8	5.3	16	3.2	2.0
Flotation	920	153.3	31.0	129	25.8	16.4
Dissolution	1862	310.3	63.6	639	127.8	81.5
		L.S.D. 5%	14.8		5%	5.8
		1%	20.8		1%	8.3

The flotation method accounted for 31.0 percent of the ectoparasites which were recovered from *D. o. pallidus* and 16.4 percent of those extracted from *P. m. sonoriensis*. The dissolution method of itself claimed 63.6 percent of the ectoparasites from *D. o. pallidus* and 81.5 percent of those found on *P. m. sonoriensis*. If the flotation method had not been used first the dissolution technique would be responsible for 94.6 percent and 97.8 percent respectively. Thus the dissolution technique would be approximately three times more effective than the flotation technique in recovering ectoparasites from *Dipodomys* and about six times more effective when used on *Peromyscus*. This difference in recovery between animals is probably a manifestation of the predominant ectoparasite group that was associated with each species.

The ectoparasites from both deer mice and kangaroo rats were

analyzed together to determine if the flotation technique failed to recover a specific group. The percentage recovery for each group and the least significant difference within each technique are listed in Table 3.

Table 3

Percentage Recovery of Each Ectoparasite Group by the Flotation and Dissolution Technique.

Ectoparasite Group		Recovery Technique Flotation	Dissolution
Mites		33.4	60.2
Ticks		1.6	82.6
Lice		17.7	79.6
	L.S.D. 5%	18.2	24.0
	1%	33.2	44.0

The low percentage of ticks recovered by the flotation technique is apparently due to the tick habit of feeding-attachment. The few ticks that were collected were probably those not securely attached and/or those not feeding. The lice and mite habit of clinging to the animal fur may partially explain why more of these forms were not recovered by the flotation technique. The flotation technique is apparently more selective for mite recovery than for the recovery of lice. In addition the flotation technique should not be used when ticks are desired. The flea group was not included in this discussion because only ten fleas were collected, six of these by handling.

Variation within the flotation and dissolution technique was measured by the coefficient of variability statistic. The results of this analysis are presented in Table 4. The variation between individual samples of the flotation technique averaged 26.6 percent as compared to 14.6 percent for the dissolution technique.

Table 4

Coefficient of Variability and Standard Deviation of the Flotation and Dissolution Technique.

Host	Flotation S.D.	Flotation C.V.	Dissolution S.D.	Dissolution C.V.
D. ordii pallidus	10.3	25.4	9.2	15.9
P. maniculatus sonoriensis	4.7	27.8	10.9	13.4

S.D. standard deviation
C.V. coefficient of variability

Subjecting the skins to the flotation technique before dissolution obviously minimized the dissolution effect. The coefficient of the dissolution technique would be less than 10 percent if one were to assume that it would recover those ectoparasites obtained by flotation. Consequently the dissolution technique offers the most accurate and reliable numerical appraisal of the total population on a particular specimen.

Gering and Thomas (1953) have compared the effectiveness of the brushing technique and the flotation technique as methods for recovering ectoparasites. Since the flotation technique is a common denominator for both their study and this study, one can compare the effectiveness of all three techniques (brushing, flotation, dissolution) by projecting the data to account for ectoparasites that would have been recovered by the dissolution technique. This projected-calculation, after conversion to percent recovery based upon the dissolution technique, is presented in Table 5.

Table 5

Percent Recovery of Ectoparasites by Techniques of Brushing, Flotation and Dissolution.

Ectoparasite Group	Recovery Technique		
	Brushing	Flotation	Dissolution
Mites	11.9	38.8	49.2
Ticks	74.1	9.2	16.8
Fleas	61.5	17.7	20.8
Lice	12.9	33.3	53.8
Average	17.2	34.2	48.7

The one best method for collecting ectoparasites from animal skins would have to depend upon the desired objectives and the value of the pelt which is to be processed. On the basis of total ectoparasites recovered the dissolution technique is the better method. However, brushing of itself accounted for almost two-thirds of the flea population and three-fourths of the tick population. The high percentage of ticks recovered by brushing is not a true measure, since it included those ticks that were hand picked by Gering and Thomas (1953). The mites and lice within each technique were apparently recovered in equal amounts.

Summary

Comparisons are made on the flotation and dissolution techniques as methods for the recovery of ectoparasites from mammal skins. The mammals used were the Ord kangaroo rat, *Dipodomys ordii pallidus* (Durrant and Seltzer), and the white-footed deer mice *Peromyscus maniculatus sonoriensis* (Le Conte).

A total of 3,721 ectoparasites were recovered from 11 animals.

Lice were the major ectoparasite group on the deer mice while mites predominated on the kangaroo rat.

The dissolution technique is three and six times more effective than the flotation technique in recovering ectoparasites from kangaroo rats and deer mice.

There is an indication that the flotation technique is more selective in recovering mites than ticks and/or lice.

The dissolution technique apparently offers the one most accurate and reliable technique for obtaining ectoparasites from mammal skins.

The selection of a particular recovery-technique should consider: type of study to be conducted; desire for living ectoparasites; need for a particular ectoparasite group; value of skin; time.

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