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ECTOPARASITES OF AFRICAN MAMMALS.(U)  
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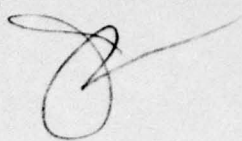
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ECTOPARASITES OF AFRICAN MAMMALS  
FINAL SCIENTIFIC REPORT

ADA 033941

C. Selby Herrin

and

Vernon J. Tipton

November 1976

Supported by

U. S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND  
Washington, D. C. 20314

Contract No. DADA17-73-C-3042

Center for Health and Environmental Studies  
Brigham Young University  
Provo, Utah 84602

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| 13. ABSTRACT<br>The study of ectoparasites of African mammals was an integral part of the contract on "potential vectors and reservoirs of diseases in overseas areas." The collection consisted of ectoparasites from approximately 100,000 African small mammals and represents probably more than 500 species of which many are yet undescribed. The study was undertaken because (1) epidemiological studies of arthropod-borne diseases require a sound taxonomic base., (2) a study of ectoparasites may provide information concerning interactions among animal reservoirs of disease, and (3) an understanding of ecological parameters for ectoparasites and their hosts may enhance understanding of epidemiological patterns. Of the four major groups dealt with, considerably more work was done with the mesostigmatid mites and the fleas than with the ticks and the trombiculid mites. All the fleas were mounted and many identified. A paper on the fleas of Morocco was published in the Journal of the Egyptian Public Health Association. Almost all mesostigmatid mites from northwest Africa were mounted and identified at least to genus, however, only about half of those collected in southern Africa were mounted. A major paper dealing with the mite genus <u>Laelaps</u> in Africa has been published in the Great Basin Naturalist. Another paper is currently being prepared for publication by a graduate student dealing with half of the trombiculid mites have been mounted on slides, but almost none have been identified. Very little work has been done with the ticks. The tick collection is being prepared for shipment to another scientist who will assume responsibility for the identification work of this group. Thus, this project was terminated with considerable work yet to be done with this enormous collection of ectoparasites. |  |                                                                                                                                                                                        |                      |

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|-----------------------------------|--------|----|--------|----|--------|----|
|                                   | ROLE   | WT | ROLE   | WT | ROLE   | WT |
| African                           |        |    |        |    |        |    |
| Arthropod Parasites               |        |    |        |    |        |    |
| Arthropod-borne Diseases          |        |    |        |    |        |    |
| Chiggers                          |        |    |        |    |        |    |
| Ecological Distribution           |        |    |        |    |        |    |
| Ectoparasites                     |        |    |        |    |        |    |
| Epidemiological Studies           |        |    |        |    |        |    |
| Ethiopian Region                  |        |    |        |    |        |    |
| Fleas                             |        |    |        |    |        |    |
| Geographical Distribution         |        |    |        |    |        |    |
| <u>Haemolaelaps</u>               |        |    |        |    |        |    |
| Host-parasite Relationships       |        |    |        |    |        |    |
| Ixodoidea                         |        |    |        |    |        |    |
| <u>Laelaps</u>                    |        |    |        |    |        |    |
| Mammals                           |        |    |        |    |        |    |
| Mesostigmatid Mites               |        |    |        |    |        |    |
| Morocco                           |        |    |        |    |        |    |
| Numerical Taxonomy                |        |    |        |    |        |    |
| Reservoirs                        |        |    |        |    |        |    |
| Selgem Database Management System |        |    |        |    |        |    |
| Taxonomic Revision                |        |    |        |    |        |    |
| Ticks                             |        |    |        |    |        |    |
| Trombiculid Mites                 |        |    |        |    |        |    |
| Vectors                           |        |    |        |    |        |    |

## ABSTRACT

The study of ectoparasites of African mammals was an integral part of the contract on "potential vectors and reservoirs of diseases in overseas areas." The collection consisted of ectoparasites from approximately 100,000 African small mammals and represents probably more than 500 species of which many are yet undescribed. The study was undertaken because (1) epidemiological studies of arthropod-borne diseases require a sound taxonomic base, (2) a study of ectoparasites may provide information concerning interactions among animal reservoirs of disease, and (3) an understanding of ecological parameters for ectoparasites and their hosts may enhance understanding of epidemiological patterns. Of the four major groups dealt with, considerably more work was done with the mesostigmatid mites and the fleas than with the ticks and the trombiculid mites. All the fleas were mounted and many identified. A paper on the fleas of Morocco was published in the Journal of the Egyptian Public Health Association. Almost all mesostigmatid mites from northwest Africa were mounted and identified at least to genus, however, only about half of those collected in southern Africa were mounted. A major paper dealing with the mite genus Laelaps in Africa has been published in the Great Basin Naturalist. Another paper is currently being prepared for publication by a graduate student dealing with the genus Haemolaelaps in northwest Africa south of the Sahara. Approximately half of the trombiculid mites have been mounted on slides, but almost none have been identified. Very little work has been done with the ticks. The tick collection is being prepared for shipment to another scientist who will assume responsibility for the identification work of this group. Thus, this project was terminated with considerable work yet to be done with this enormous collection of ectoparasites.

## I. Introduction

The major objectives of this project were to (1) determine parameters related to the geographical and ecological distribution of ectoparasites of Africa, (2) provide a reference collection of identified ectoparasites with well documented associated data available to workers with interest in epidemiology and the ectoparasite fauna of Africa, (3) enter the data into a computer data base system (SELGEM system for information management) so that it would be readily available to those working with a specific disease biocenose involving African ectoparasites, and (4) provide data, illustrations and keys through publication of scientific papers which may be used by epidemiologists and entomologists to identify ectoparasites found on mammals of Africa.

The project on ectoparasites of African mammals was restricted to four major groups of arthropod parasites: (1) mesostigmatid mites, (2) trombiculid mites, (3) ticks and (4) fleas. All other arthropod parasites (lice and other miscellaneous insects) in the collections were returned to the Smithsonian Institution for distribution to other specialists for study. The largest group of specimens was the mesostigmatid mites, thus a greater percentage of effort was devoted to this group. Each of these four major groups are treated separately in the report following the discussion of the background of the project.

## II. Background

A contract between the U. S. Army Medical Research and Development Command and the Smithsonian Institution for a study of African mammals and their ectoparasites was initiated in April of 1965. The Smithsonian Institution negotiated a subcontract with Brigham Young University for the study of ectoparasites of African mammals in September of 1970. Thus the study of ectoparasites of African mammals was an integral part of the contract on "Potential Vectors and Reservoirs of Diseases in Overseas Areas." Following discussions with the Chief, Entomology Research Branch, USAMRDC, it was decided that a proposal for the study of Ectoparasites of African Mammals should be submitted to USAMRDC rather than the Smithsonian Institution. This arrangement allowed direct monitoring of the project and provided for effective dialogue between the Chief of the Entomology Research Branch and the principal investigator.

Direct support for the study was preferred over a subcontract awarded to BYU by the Smithsonian Institution because it reduced indirect costs. Under the previous arrangement, overhead costs were paid to both the Smithsonian Institution and BYU. Those who initiated the original contract did not fully anticipate the volume of work which would be generated by the collection of ectoparasites from approximately 100,000 mammals, nor was consideration given to the expertise necessary for a study of exotic ectoparasites. The mammal work progressed according to schedule, but the ectoparasites accumulated in vast numbers. As the magnitude of the task became more and more apparent, it was decided to request direct support to allow acceleration

of the ectoparasite portion of the work.

The ectoparasites collected from the approximately 100,000 African mammals constitute the largest single collection of ectoparasites made in any geographical or political subdivision of the world. There are probably more than 500 species of ectoparasites in this collection, many of which are yet undescribed. The African continent is noted for the number and variety of endemic arthropod-borne diseases. There were several practical reasons for studying the ectoparasites of African mammals. Epidemiological studies of arthropod-borne diseases require a sound taxonomic base, and a study of ectoparasites provides information concerning interactions among animal reservoirs of disease. An understanding of ecological parameters for ectoparasites and their hosts may enhance understanding of epidemiological patterns.

### III. Methods, Materials and Accomplishments

During the nearly six years duration of the project, the major emphasis was in the preparation of the ectoparasites for study; that is, sorting them into major taxonomic groups, shipment of Anoplura, Mallophaga, Streblidae and Nycteribiidae to appropriate entomologists, mounting of specimens on microscope slides, labeling and general identification.

The most critical need throughout the duration of the project was in obtaining host and locality data from the Smithsonian Institution Mammal Division. Selective mounting and identification of mesostigmatid mites and chiggers, and the determination of ecological parameters related to the geographical and ecological distribution of ectoparasites of Africa were dependent upon obtaining this information. Arrangements were made to obtain a magnetic tape copy of the Smithsonian Institution's African Mammal Project (AMP) data that had been entered into this master file. The Smithsonian Institution's SELGEM system for information management was installed at the Brigham Young University computer center. However, the AMP master file was not received and adapted to our computer system in sufficient time before the termination of the project to be useful. This master file was not complete, and thus it was necessary to obtain collection data from the Smithsonian Institution Mammal Division by other less efficient means. Some such data were obtained in the form of typed lists, however, these lists were incomplete as well.

Very little of the ectoparasite collections were prepared for museum storage. Some slides of fleas and mesostigmatid mites were labeled with identification labels, but none were labeled with collections data labels. This preparation of specimens for museum storage could not be completed without host identifications and the necessary collection data. The objective of entering the ectoparasite data into the African Mammal Project master file could not be achieved without identifications having been completed and the mammal data being entered into the master file first. Because of the slow progress which was made in the entering of mammal collection data into the master file, this objective could not be achieved prior to

the termination of the project. Thus, funding was terminated with considerable work yet to be done with this collection of ectoparasites.

#### A. Mesostigmatid Mites

The objective of this phase of the study was to investigate the systematics of mesostigmatid mites parasitic on small mammals of the Ethiopian region, including taxonomic revisions of certain genera, and host-parasite relationships of all groups. The specific aims in accomplishing this objective were to (1) make a systematic revision of the genus Laelaps of the Ethiopian region, based on numerical taxonomic analyses and host-parasite associations; (2) make a numerical taxonomic analysis of the genus Haemolaelaps of the Ethiopian region; (3) prepare identification keys to all mesostigmatid mite groups occurring on African small mammals; (4) prepare complete descriptions of all new species of African mesostigmatid mites for publication; and (5) investigate the host-parasite and ecological relationships of all parasitic mesostigmatid mites of Africa.

Almost all mesostigmatid mites from northwest Africa have been mounted and identified at least to genus, however, only about half of those collected in southern Africa have even been mounted. A major paper dealing with the mite genus Laelaps in Africa has been published in the Great Basin Naturalist (Herrin and Tipton, 1976, <sup>1</sup>). Reprints of this publication will be ready for distribution within the month. Another paper is currently being prepared for publication by a graduate student dealing with the genus Haemolaelaps in northwest Africa south of the Sahara. This paper should be submitted for publication within the next few months.

Preliminary identification keys to the families and genera of mesostigmatid mites of African small mammals were prepared but are not ready for publication. These keys to families and genera will have to be further refined, and keys to species of all genera prepared before of any such keys can be submitted for publication. Descriptions of new species of African Laelaps and Haemolaelaps mites have been prepared for publication. Illustrations of several other new species have been made, but no other descriptions have been prepared for publication. Approximately 12 new species, other than the Laelaps and Haemolaelaps, have been found among the African ectoparasite material.

Studies dealing with host-parasite and ecological relationships of all parasitic mesostigmatid mites of Africa could not be undertaken until after the identifications had been completed and the collection data (host, locality, ecological, etc.)

<sup>1</sup> Herrin, C. Selby and Vernon J. Tipton. 1976. A Systematic Revision of the Genus Laelaps s. str. (Acari: Mesostigmata) of the Ethiopian Region. Great Basin Naturalist 36 (2): 113-205, June 1976.

assembled. This could only be done after the mammal collection data and ectoparasite data had been entered into the AMP master file of the SELGEM computer system. This phase of the study was not even begun prior to the termination of the project.

### B. Trombiculid Mites

The objectives were to conduct a systematic study of Ethiopian trombiculid mites, construct keys and make illustrations to facilitate their identification, and provide data relative to host-parasite relationships and other ecological parameters. The specific aims for accomplishing this objective were to (1) complete identification of the African chiggers; (2) construct keys and illustrate characters of taxonomic importance for major taxa; (3) describe new taxa and redescribe other taxa requiring such treatment; and, (4) compile and evaluate host-parasite data in terms of epidemiological significance.

Approximately 5,000 chiggers were mounted. However, all but about 300 specimens were from Morocco. Generic and specific determinations were made for about 1,300 of those mounted. Specific identifications were limited because of the lack of a reference collection of type material. Type specimens for about 80 species were located, but only 20 specimens were received. The material which was identified represents 13 genera or subgenera and some 22 species, including several undescribed species and at least three new genera or subgenera. Thus, evidence indicates considerable undescribed material in the Moroccan collection alone, and the same would be expected in other areas of Africa. There are still approximately 3,250 vials of chiggers yet to be mounted and most of the entire collection is left unidentified.

Progress in the preparation of identification keys, descriptions and illustration of characters was limited until more work could be done in assimilating a reference collection and in the identification of additional material. Thus, very little was accomplished in the description of new species or the preparation of keys and illustrations. Compilation and evaluation of host-parasite data could not be undertaken because of the lack of collection data and complete identifications of the material.

### C. Ticks

The objectives of this phase of the project were to identify ticks and make data on host-parasite relationships available to other workers engaged in studies of African Ixodoidea. The specific aims for accomplishing these objectives were to (1) identify all ticks in the Smithsonian-African collection, (2) attempt to make correlations between immature forms and adults, and (3) investigate the host-parasite and ecological relationships of African ticks.

Some progress was made in the preliminary identification of the ticks to genus. The tick collections, sorted by country, collector and collectors number, have been prepared for shipment to Dr. Carlton M. Clifford, National Institute of Allergy and Infectious Diseases, Rocky Mountain Laboratory, Hamilton, Montana 59840, who will assume responsibility for the identification of this collection, as well as any other studies which may be undertaken.

#### D. Fleas

The objectives of this part of the project were to conduct a systematic study of African fleas, compare the flea fauna of each political subdivision with the flea fauna of other political subdivisions and attempt to explain the differences on the basis of physical and biological parameters, and provide publications containing data on host-parasite relationships, distribution, and taxonomic keys and illustrations. The specific aims for accomplishing these objectives were to: (1) complete identification of the approximately 50,000 fleas in the Smithsonian-African collection; (2) publication of the paper on the fleas of Morocco; and (3) prepare publications containing descriptions of new taxa, taxonomic keys, illustrations, host-parasite and ecological relationships, and geographical distribution of all other political subdivisions of Africa.

All fleas have been processed and prepared for identification. Considerable work on the identification of this material was done in collaboration with Lt. Michael Hastriter and Dr. Robert Traub. This work has now ceased with the termination of the project. A paper dealing with the fleas of Morocco was published in the Journal of the Egyptian Public Health Association (Hastriter and Tipton, 1975,<sup>2</sup>). Reprints of this publication are ready for distribution.

Since a portion of the flea collection was sent to Dr. Robert Traub early in the history of the project, it is essential that this phase of the project be a cooperative venture between Dr. Traub and Lt. Michael Hastriter, or other workers, to avoid duplication of effort. Plans for joint authorship of papers on flea taxa to be described were formulated and Lt. Hastriter had identified about 30% of the fleas of Africa prior to the termination of the project. Consideration is being given to shipping the flea collection to Dr. Traub to await further work in the future.

<sup>2</sup>Hastriter, Michael W. and Vernon J. Tipton. 1975. Fleas (Siphonaptera) Associated With Small Mammals of Morocco. J. Egypt. Publ. Hlth Assoc. 50 (2): 79-169,

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