Brigham Young University Science Bulletin, Biological Series

Volume 15 | Number 2 Article 1

8-1971

A list of arthropods of medical importance which occur in Utah with a review of arthropod-borne diseases endemic in the state

Vernon J. Tipton
Department of Zoology, Brigham Young University, Provo, Utah

Robert C. Saunders
Department of Zoology, Brigham Young University, Provo, Utah

Brigham Young University
Science Bulletin

A LIST OF ARTHROPODS OF MEDICAL IMPORTANCE WHICH OCCUR IN UTAH WITH A REVIEW OF ARTHROPOD-BORNE DISEASES ENDEMIC IN THE STATE

by

Vernon J. Tipton
and
Robert C. Saunders

BIOLOGICAL SERIES — VOLUME XV, NUMBER 2
AUGUST 1971

BRIGHAM YOUNG UNIVERSITY SCIENCE BULLETIN

BIOLOGICAL SERIES

The Brigham Young University Science Bulletin, Biological Series, publishes acceptable papers, particularly large manuscripts, on all phases of biology.

Separate numbers and back volumes can be purchased from Publication Sales, Brigham Young University, Provo, Utah. All remittances should be made payable to Brigham Young University.

Orders and materials for library exchange should be directed to the Division of Gifts and Exchange, Brigham Young University Library, Provo, Utah 84601.

Brigham Young University
Science Bulletin

A LIST OF ARTHROPODS OF MEDICAL IMPORTANCE WHICH OCCUR IN UTAH WITH A REVIEW OF ARTHROPOD-BORNE DISEASES ENDEMIC IN THE STATE

by

Vernon J. Tipton
and
Robert C. Saunders

BIOLOGICAL SERIES — VOLUME XV, NUMBER 2
AUGUST 1971

TABLE OF CONTENTS

A LIST OF ARTHROPODS OF MEDICAL IMPORTANCE WHICH OCCUR IN UTAH WITH A REVIEW OF ARTHROPOD-BORNE DISEASES ENDEMIC IN THE STATE

by

Vernon J. Tipton and Robert C. Saunders*

INTRODUCTION

The information contained in this paper has been assembled for the express purpose of demonstrating lacunae in current knowledge of health problems associated with arthropods in Utah. Obviously it is not definitive, nor is it intended to be, but rather it should serve as a base for future research investigations. It will be modified as additional information becomes available.

Not all of the arthropods in this list are of proven medical importance—in fact many of them are of doubtful importance—but they are included in the list because they are close relatives of species which are of medical significance in other areas and their potential for affecting the health of man has not yet been fully investigated.

Some difficulties are inherent in a review of the history of arthropod-borne diseases, particularly in rural areas. Records are incomplete and their accuracy is suspect. Some arthropod-borne diseases are not included on the standard state report form and thus in many instances are not reported. In rural areas, where many arthropod-borne diseases occur, people may not seek medical care because of tradition or because no care is available. Diagnostic techniques are slow to reach rural areas and receive broad acceptance. Unless the index of suspicion is high, physicians are prone to ignore diagnostic tests necessary for specific discrimination. However, the history of tularemia in Utah provides ample evidence that rural medicine does not necessarily mean archaic methods and techniques. Dr. Richard A. Pearse, a Brigham City physician, published a clinical description of tularemia in humans which is considered to be the first account in the English language (Jellison, 1971). Many of the early epidemiological investigations of tularemia were conducted in the rural community of Delta and were prompted by the astute observations of local physicians.

Colorado Tick Fever:

The work of Becker (1926, 1930) demonstrated that Colorado tick fever (CTF) is a disease entity distinct from Rocky Mountain spotted fever (RMSF) but it was not until 1940 that Topping, Cullyford, and Davis (1940) provided the first detailed clinical description of CTF. Consequently, accurate data on the incidence of CTF prior to 1940 are not available. Records of cases of CTF in Utah from 1940 to 1959 maintained by the Rocky Mountain Laboratory in Hamilton, Montana, are probably the most reliable but may be incomplete because information is based on CTF virus isolated from the blood of Utah residents at Hamilton and undoubtedly there were patients who were hospitalized elsewhere or not at all. Prior to 1960 the accuracy of records of CTF is in question because diagnostic techniques for the arboviruses were in their infancy. Comparatively simple but reliable tests are available but physicians may not utilize them either because of inconvenience or they may not be aware that the CTF virus persists for approximately 90 days after onset. Because of their epidemiological and clinical similarities CTF has been confused with RMSF. In children CTF may cause encephalitis-like symptoms and even death (Eklund, Kennedy, and Casey, 1961) but probably there are few inapparent infections in a population. It is possible that many mild cases have escaped detection and have not been reported. According to Pratt and Rice (1969) there were only 96 cases of CTF reported in Utah during the period from 1956 to 1969 compared with 1,717 cases in Colorado during the same period. However, the low incidence of CTF in Utah may not be a

*Department of Zoology, Brigham Young University, Provo, Utah

true measure of its significance. There is no immunization available and treatment consists of supportive care.

Dermacentor andersoni Stiles is considered to be the most important vector in the epidemiological pattern involving man. However, CTF virus has been isolated from ticks of several other species indicating that they may play an important role in the cycle in nature. Ecological studies aimed at determining epidemiological patterns in nature and particularly the identity of reservoir animals are needed.

THE ENCEPHALITIDES:

Cases of western encephalitis (WE) and perhaps other encephalitides have probably occurred in humans and horses in Utah prior to the outbreak of 1933. However, the etiology and epidemiology of the encephalitides had not yet been elucidated, and one can only speculate about the prevalence of arthropod-borne viral agents in horses and humans prior to that date. In the Register of Deaths at the Salt Lake City Health Department, Bureau of Vital Statistics, brain fever was listed as the cause of death in several instances during the 1847-1865 period. It is possible that at least some of these deaths were due to infections with arboviruses.

The 1933 episode described by Madsen (1934) occurred in two waves, both of which began in the West Point area of Weber County. The first wave began about July, reached a peak about 10 August, and had almost completely subsided by 1 September. Madsen estimated that 1,139 sick horses were involved in the first wave, of which 43.9 percent died. The second wave, which began the middle of September and subsided about 1 November, involved 2,819 horses, of which about 53.2 percent died. The main focus of infection was in Salt Lake, Davis, Box Elder, Cache, and Weber counties in Utah and Franklin County in Idaho, but there were isolated cases in Rich, Summit, Morgan, Utah, and Tooele counties. An outbreak among humans occurred twenty-five years later (in 1958) in the same general locality in northern Utah and represents the largest number of cases reported in Utah for a single year (Jenkins and Donath, 1959). Serological studies revealed a high number of inapparent infections. Thomas and Smith (1959) conducted a survey on infection rates in mosquitoes, birds, and mammals and found that the highest infection rates in chickens and mosquitoes occurred in the geographical center of the human outbreak. In connection with the 1958 outbreak, Rees et al. (1959) concluded:

> (1) There was in Utah in 1958 a recognized outbreak of Western Equine Encephalitis in man; (2) It was accompanied by a tremendous increase in the numbers of *C. tarsalis* mosquitoes; (3) *Culex tarsalis* mosquitoes were avidly feeding on man in considerable numbers during this period; and (4) Some *C. tarsalis* mosquitoes were harboring the Western equine strain of encephalitis virus.

Local physicians reported an extensive outbreak of human encephalitis of unconfirmed etiology in Box Elder County in 1936. In Weber County in 1956 there was a serologically confirmed case of St. Louis encephalitis and in 1957 a fatal case of SLE plus two cases of WE, one of which was fatal. There were 525 cases of equine encephalitis from 1955 to 1969, including 244 cases in the outbreak of 1958. There is no evidence of arbovirus activity in Weber County from 1933 to 1955. During recent years along the Wasatch front there have been occasional cases of a disease, difficult to diagnose but typical of western encephalitis. Physicians do not routinely submit acute and convalescent sera necessary for definitive diagnostic tests. Some additional information is needed on feeding preferences of mosquitoes and the role of passerine birds in the epidemiology of WE in areas where there have been active foci in the past. The fate of arboviruses during periods between epidemics is a perennial problem requiring investigation.

Other arboviruses which have been isolated in Utah include Hart Park-like isolates from *Culex tarsalis*, California encephalitis group isolates from *Anopheles freeborni*, *Culiseta inornata*, *Aedes dorsalis*, *A. nigromaculis*, *Culex erythrothorax*, *Psorophora signipennis*, and *Culex tarsalis* and Cache Valley isolates from *Culiseta inornata* and *Anopheles freeborni* (Holden and Hess, 1959; Crane et al., 1970; and Elbel et al., 1971).

ROCKY MOUNTAIN SPOTTED FEVER:

Beck (1955) reviewed the history of Rocky Mountain spotted fever (RMSF) in Utah. It is not certain when RMSF first occurred in the state, but probably the disease was prevalent among early settlers. Beck (loc cit.) reproduced a newspaper article, published in 1941, in which Dr. William M. McKay, acting commissioner of health for the state of Utah during that period, speculates that Brigham Young was afflicted with RSMF at the time he entered Salt Lake Valley. Some support for this view is supplied by Byington (in Beck, 1955) who believed that "mountain fever" was the same as RMSF. In the Register of Deaths at the Salt Lake City Health Department, Bureau of Vital Statistics,

several deaths are recorded for which the cause is listed as "mountain fever." Although there is insufficient evidence to establish a definitive relationship between the two, the season during which the deaths occurred is consistent with the epidemiology of RMSF. We do not overlook the possibility that "mountain fever" could be Colorado tick fever which also occurs in Utah under similar circumstances. The deaths for which "mountain fever" was listed as the cause occurred as follows: two in July and one in August of 1849; one in June and five in July of 1850; two in early November of 1854; and one in late May and two in September of 1855. In at least one instance the cause of death was given as "intermittent mountain fever." In the majority of cases the victims were adult males.

Dermacentor andersoni Stiles is considered to be the most important vector involved in human cases of RMSF in Utah although there may be other species important in the perpetuation of the disease in nature. Beck (1955) and Coffee (1953) gave data on seasonal and altitudinal distribution as well as life cycles of tick vectors of RMSF.

Jellison (1945) considers the cottontail rabbit, *Sylvilagus nuttalli* Bachman to be an important component of the RMSF biocenose. It is a vagile animal with a fairly high degree of ecological tolerance. Studies of the population dynamics of the ectoparasites of the cottontail rabbit may suggest ecological patterns which help to perpetuate the disease in nature.

From 1915 through 1969 the Utah State Department of Health, Bureau of Vital Statistics, recorded 496 cases of RMSF in Utah among both residents and nonresidents. Cases occurred most frequently during the months of June, July, and August, although others were reported as early as April and as late as November. Among arthropod-borne diseases with endemic foci in Utah, RMSF is second only to tularemia in total number of cases reported in the state.

Plague:

The recorded history of plague in Utah is not dramatic, but nonetheless, plague represents a disease of great potential significance because of the widespread distribution of capable vectors and reservoirs in the state and the increasing number of fishermen and campers who invade the plague biocenose each year. There have been only two confirmed human cases (in 1936 and 1966) and one doubtful case (in 1939) reported in the state.

According to Allred (1952) and Beck (1955), capable vectors of plague are indigenous to every county in the state, and there are 41 proven reservoirs of plague in Utah, of which 36 are species of rodents. Stark lists 43 species of fleas which are classified as "capable (natural)" or "potential (experimental)" vectors. *Xenopsylla cheopis* (Rothschild), the most important vector of plague on a worldwide basis, has not been collected in large numbers in Utah. *Diamanus montanus* (Baker) has been considered the most significant vector of plague in Utah, but Parker (1971) obtained *Pasteurella pestis* isolates repeatedly from *Malaraeus sinomus* (Jordan), *Opisodasys keeni* (Baker), *Monopsyllus eumolpi* (Rothschild), and *Epitedia stanfordi* Traub. The number of isolates was highest from specimens of *M. sinomus* and *O. keeni* associated with species of *Peromyscus*. Parker believes that plague is not limited to squirrel-flea complexes or to particular vegetative associations and topographic patterns. It is evident that vector efficiency varies considerably and is influenced by several environmental factors. Thus, there may be several species of rodent fleas with the potential to function effectively as vectors of plague as environmental conditions change and meet the requirements for transmission by a particular vector species. A study extending over several years relating population fluctuations of fleas on ground squirrels, on wood rats, and in their nests to environmental changes may be helpful in understanding vector and reservoir capabilities.

Tularemia:

Tularemia is a zoonotic disease which has probably been present in the wild fauna of Utah for hundreds of years. Thus it is tempting to speculate about its importance among the pioneers during the last half of the nineteenth century. A large segment of the male population in pioneer Utah was engaged in agricultural pursuits, particularly clearing of land, which suggests an invasion of an ecosystem in which transmission of tularemia was likely of common occurrence. Before the advent of white settlers, Indians may have been victims of tularemia inasmuch as rabbits, proven reservoirs of tularemia, probably constituted a significant part of their diet.

However, recorded history of tularemia in Utah begins about 1908 as indicated by Francis (1925):

> There has existed in Utah, at least since 1908, a human disease known locally as deer-fly fever. What I believe to be the first clinical reference to human cases of tularemia is contained in a paper read before the Utah State Medical Association, Salt Lake City, October

> 3, 1910, by R. A. Pearse, Brigham City, Utah. Dr. Pearse refers to six cases, which occurred in the month of August, caused by the bite of a fly, on the exposed parts of the body (neck, ear, cheek, wrist, ankle, and hand). After an incubation period of from two to five days . . . In 1919 and 1920, I studied seven cases of deer-fly fever near Fillmore, Millard County, Utah, and found them positive for tularemia, clinically, culturally, and serologically. The cases occurred in June, July and August during the seasonal prevalence of the fly *Chrysops discalis*. The sites of the fly bites were the neck, temple, ear, and posterior surface of the lower third of the thigh. In all cases, suppuration occurred in the glands draining the bitten area. All patients had fever; one died on the twenty-sixth day of illness. I heard of perhaps two dozen other cases in the general community in which I worked. From seventeen jackrabbits, sick or dead, in the community I isolated *Bacterium tularense*, thus establishing the great reservoir of infection.

In an earlier publication, Francis (1922) gives a more specific location of tularemia foci in Utah.

> So far as known there have been but two foci of infection in Utah. The focus here reported is in Millard County, 5 miles (8 kilometers) west of Holden, 5 miles northwest of Fillmore, 25 miles (40 kilometers) southeast of Delta, and 120 miles (193 kilometers) south of Salt Lake City. The other focus has received clinical confirmation and is located near Brigham, a town 20 miles (32 kilometers) north of Ogden in Box Elder County. Both foci have probably existed for at least fifteen years.

Although tularemia does not usually occur in epidemic form, Hillman and Morgan (1937) reported an outbreak of 26 cases among a group of 170 enrollees of a Civilian Conservation Corps camp "located on the treeless plains north of Great Salt Lake." They suggested that the epidemiological evidence available pointed to deer flies as the vectors and jackrabbits as the reservoirs. The cases were diagnosed between 11 and 30 July 1935. There was a noticeable increase in the population of deer flies the week before the onset of the first case. Several men in the camp experienced multiple bites, and lesions on tularemia victims were on uncovered portions of the body. Jackrabbits were numerous; many were dead and several were lethargic.

Locomotive Springs, the site of the Civilian Conservation Corps camp, is in the general area of Tremonton where Pearse had seen cases in 1908 and 1910.

Russian workers have proposed subspecific designations for the causative agents of tularemia which have been accepted by most North American workers. *Francisella tularensis tularensis* of North America is usually associated with rabbits and arthropods while the more cosmopolitan form, *Francisella tularensis palearctica* appears to be transmitted independent of arthropods and has been isolated from aquatic or semiaquatic rodents. An organism isolated from a water sample collected in Utah was given the name *Francisella novicida* (Larson, Wicht, and Jellison, 1955). All three forms have been found in Utah. *Francisella tularensis tularensis* is the principal cause of human tularemia but *Francisella tularensis palearctica*, isolated from muskrats, should be mentioned because of its importance in Utah.

According to the records of the Utah State Department of Public Health, Bureau of Vital Statistics, there have been 986 cases of tularemia in the state during the 45-year period from 1925 through 1969. Approximately three-fourths of these cases occurred during the twenty-year period from 1935 to 1954.

Chrysops discalis has been shown to be an efficient experimental vector of tularemia; it has been known to bite man (Jellison, 1950). For these reasons it has been suspected of being the most important deer fly vector of tularemia in Utah. However, Cox (1965) found *C. discalis* to be less abundant than *C. fulvaster* and *C. aestuans* in study areas near Utah Lake. Moreover, he isolated *F. tularensis* from three of 73 pools of deer flies. Two isolates were obtained from two pools of *C. fulvaster* and one isolate from one pool of *C. aestuans*.

There is a particular need for investigation of seasonal and geographic distribution of species of *Chrysops* and the animals on which they feed, the duration of infection in reservoirs and vector species, and serological surveys of human populations in areas where there are high density populations of deer flies.

Malaria:

Most cases of malaria which have occurred in the state were contracted elsewhere, but Marshall and Rees (1948), in their excellent review of malaria in Utah, have provided substantial evidence that local transmission has taken place, particularly in southern Utah. They point out that most of the early Utah settlers came from the Mississippi Valley where malaria was prevalent. Contact with the outside world was maintained through continuing immigration, returning missionaries, and settlers passing through on their way to California or Oregon. Perhaps the only case of malaria in Utah sufficiently well documented to be consid-

ered autochthonous is cited by them as follows: "In April, 1947, a *vivax* infection was reported in a two-year-old child of that area who had never been out of the state." The "area" referred to is southern Utah. *Anopheles freeborni* Aitken is widespread throughout the state and *Anopheles franciscanus* McKracken is widespread throughout the southern half of the state (Nielsen, 1968). Both are considered to be efficient vectors of malaria, especially the former.

In the Register of Deaths at the Salt Lake City Health Department, Bureau of Vital Statistics, there are several entries in which "malignant fever" and "bilious fever" are listed as the cause of death. Early physicians made the distinction among "fever," "mountain fever," "malignant fever," "bilious fever," and "typhoid fever," and although it would be inaccurate to associate malignant fever or bilious fever with malaria, there is a possibility that a persistent fever occurring during the summer months could be malaria.

In a five-year period from 1943 through 1947, 723 cases of malaria were reported in Utah and reflect the impact of returning servicemen on the incidence of disease within the state. There was another less dramatic rise in the incidence of malaria in Utah, associated with the Korean War, during the period from 1951 to 1955 when 75 cases were reported. Nevertheless, with an adequate reservoir of infection, capable vectors, and a susceptible resident population, malaria has not become established in Utah. Rapid diagnosis and treatment of servicemen, improved mosquito control, and an informed public are the principal factors which mitigate the importance of malaria in Utah. The feeding habits of the mosquito vectors in a rural setting may be another factor of some importance. Cattle and horses are the preferred sources of blood meals for some *Anopheles* species.

Miscellaneous:

Relapsing fever is virtually unknown in Utah, although it has been reported on several occasions from surrounding states. Davis (1939) reported a single case which occurred near Salt Lake City in 1928. Both *Ornithodoros parkeri* and *O. turicata*, proven vectors of relapsing fever, occur in the state although their distribution is not completely known.

Coxiella burnetti, the causative agent of Q fever, has been isolated from rodents (*Dipodomys ordii*, *D. microps*, and *Peromyscus maniculatus*) and a tick (*Dermacentor parumapterus*) in the Great Salt Lake Desert in Utah. *C. burnetti* antibodies were demonstrated serologically in *Lepus californicus*, *Onychomys leucogaster*, and *Eutamias minimus* (Stoenner et al., 1959). There is no record of Q fever in

Cases of Selected Arthropod-Borne Diseases in Utah 1915-1969

Year	CTF	WE	Malaria	RMSF	Tularemia
1915				35	
1916				34	
1917				15	
1918				5	
1919				10	
1920				9	
1921				8	
1922				18	
1923				15	
1924				10	
1925		2		6	1
1926				5	4
1927				7	1
1928			1	10	1
1929				11	0
1930				13	4
1931				10	2
1932				22	4
1933				5	6
1934			1	12	6
1935			3	14	37
1936				8	5
1937			2	12	41
1938			10	19	73
1939		2	1	24	44
1940	2	2	5	15	55
1941		5	0	13	45
1942		0	5	8	48
1943		12	313	12	34
1944		5	157	10	23
1945		2	112	9	28
1946		4	93	5	29
1947		6	48	5	36
1948		2	2	4	45
1949	1°	3	2	14	35
1950		5	0	7	40
1951	1°	2	23	18	30
1952	1°	8	38	9	20
1953	1°	6	7	9	40
1954	2°	6	4	4	22
1955	3°	2	3	7	29
1956	3	1°°	0	3	21
1957	4	3°°	1	9	30
1958	0	47	0	0	17
1959	4	38	2	1	10
1960	4	23	0	3	19
1961	2	6	0	1	17
1962	8	8	0	0	16
1963	12	12	0	0	3
1964	12	1	0	1	24
1965	11	0	1	0	10
1966	4	1	3	0	3
1967	11	0	3	0	7
1968	5	0	1	0	5
1969	16	0	3	2	16

°Represents isolations from patients hospitalized at Rocky Mountain Laboratory, Hamilton, Montana.

°°One case of SLE.

humans in Utah, but this may be due to faulty diagnosis or reporting, inasmuch as human cases have occurred in surrounding states.

Mohr (1951), in his paper on the distribution of murine typhus and plague in the United States, gives no records of murine typhus for the state of Utah. The flea index of *Xenopsylla cheopis* on *Rattus* sp. apparently has never been very high in Utah, and probably accounts for the absence of the disease in the state.

Armstrong (1922) reported an epidemic of typhus on the San Juan Indian Reservation during the last half of 1920 and the first half of 1921 in which there were 63 cases of typhus with 27 deaths among approximately 7,000 Indians. The San Juan Indian Reservation is 5,884 square miles in the four-corners area of New Mexico, Arizona, and Utah.

One case of dengue was reported in 1942, but it was probably contracted outside the state.

One doubtful case of rickettsialpox has been reported from Utah (Pratt and Rice, 1969).

In Utah the incidence of bites and stings of arthropods and the number of cases of dermatitis caused by urticating and vesicating insects is unknown. Scattered cases of arachnidism have been reported, including at least one death from the sting of a hymenopterous insect. *Latrodectus hesperus* Chamberlin and Ivie and several species of Hymenoptera are the most important venomous arthropods in the state.

Tick paralysis, caused by the bite of female ticks, *Dermacentor andersoni* Stiles, occurs most frequently in an area comprising the northern part of Idaho and adjacent portions of Washington and Montana. Isolated cases have been reported in other sections of the Rocky Mountains where *Dermacentor andersoni* occurs (Philip, 1969). Insofar as we are aware there have been no cases of tick paralysis reported in Utah, but the possibility of its occurrence should not be overlooked.

ACKNOWLEDGMENTS

We are indebted to many people who have contributed time and effort to minimize the number of errors in the list of arthropods and who have made suggestions concerning the review of arthropod-borne diseases in Utah. In particular we are grateful to Dr. Karl V. Krombain, chairman, Department of Entomology, National Museum of Natural History, Smithsonian Institution and his associates at the National Museum and the Systematic Entomology Laboratory, United States Department of Agriculture: Dr. Ralph E. Crabhill, Jr., Dr. K. C. Emerson, Dr. Douglas C. Ferguson, Dr. William D. Field, Dr. Richard C. Froeschner, Dr. Ashley B. Gurney, Dr. Jon L. Herring, Dr. Arnold S. Menke, Dr. C. F. W. Muesebeck, Dr. Curtis W. Sabrosky, Dr. Reese I. Sailer, Dr. D. R. Smith, Dr. Robert Traub, and Dr. Willis W. Wirth. Others who have reviewed the manuscript and have made helpful suggestions are Dr. Don M. Rees, Dr. Lewis T. Nielsen, Dr. Robert Winget, and Mr. Bruce Knudson, Department of Biology, University of Utah; Dr. Wilford J. Hanson and Dr. George F. Knowlton, Utah State University; Dr. James M. Brennan, Dr. William L. Jellison, and Mr. Glen M. Kohls, Rocky Mountain Laboratory, Hamilton, Montana; Dr. Robert E. Elbel, Deseret Test Center, Dugway, Utah; Dr. Dale D. Parker, Research Entomologist, EcoDynamics, Salt Lake City, Utah; Dr. Willis J. Gertsch, Portal, Arizona; Dr. Harold E. Stark, Center for Disease Control, Fort Collins, Colorado; Dr. Phyllis T. Johnson, Costa Mesa, California; Dr. Dorald M. Allred, Dr. Ferron L. Andersen, Dr. Gerald L. Hayward, Dr. Vasco M. Tanner, and Dr. Stephen L. Wood, Department of Zoology, Brigham Young University, Provo, Utah; Dr. Donald N. Wright, Department of Microbiology, Brigham Young University, Provo, Utah; Dr. Maurice T. James, Dr. William Turner, and Mr. Craig R. Baird, Washington State University, Pullman, Washington; Dr. Deane P. Furman, University of California, Berkeley, California; Dr. Kenneth J. Capelle, Bear River Research Station, Brigham City, Utah; Dr. Harry Hoogstraal, U. S. Naval Medical Research Unit No. 3, Cairo, Egypt; Dr. Bobbie V. Peterson, Entomology Research Institute, Ottawa, Ontario, Canada. We are also indebted to Dennis I. Anderson and Lynden P. Baum for their assistance with accumulation of the scientific names for the list and to Phyllis Madden for typing the manuscript.

LIST OF ARTHROPODS

ARACHNIDA

I. Acarina: Ixodides

A. Argasidae

1. *Argas*
   - *A. cooleyi* Kohls and Hoogstraal, 1960
   - *A. gigantcus* Kohls and Clifford, 1968
   - *A. sanchezi* Dugès, 1887

2. *Ornithodoros*
   - *O. concanensis* Cooley and Kohls, 1941
   - *O. eremicus* Cooley and Kohls, 1941
   - *O. kelleyi* Cooley and Kohls, 1941
   - *O. parkeri* (Cooley, 1936)
   - *O. sparnus* Kohls and Clifford, 1963
   - *O. talaje* (Guérin-Mèneville, 1849)
   - *O. turicata* (Dugès, 1876)

3. *Otobius*
   - *O. megnini* (Dugès, 1884)
   - *O. lagophilus* Cooley and Kohls, 1940

B. *Ixodidae*

1. *Dermacentor*
   - *D. albipictus* (Packard, 1869)
   - *D. andersoni* Stiles, 1908
   - *D. hunteri* Bishopp, 1912
   - *D. parumapertus* Neumann, 1901

2. *Haemaphysalis*
   - *H. leporispalustris* (Packard, 1869)

3. *Ixodes*
   - *I. angustus* Neumann, 1899
   - *I. jellisoni* Cooley and Kohls, 1938
   - *I. kingi* Bishopp, 1911
   - *I. marmotae* Cooley and Kohls, 1938
   - *I. muris* Bishopp and Smith, 1937
   - *I. ochotonae* Gregson, 1941
   - *I. pacificus* Cooley and Kohls, 1943
   - *I. sculptus* Neumann, 1904
   - *I. soricis* Gregson, 1942
   - *I. spinipalpis* Hadwen and Nuttall, 1916
   - *I. texanus* Banks, 1908
   - *I. woodi* Bishopp, 1911

4. *Rhipicephalus*
   - *R. sanguineus* (Latreille, 1806)

I'. Acarina: Mesostigmata

A. *Dermanyssidae*

1. *Dermanyssus*
   - *D. gallinae* (De Geer, 1778)

2. *Hirstionyssus*
   - *H. bisetosus* Allred, 1957
   - *H. cynomys* (Radford, 1941)
   - *H. eutamiae* Allred and Beck, 1966
   - *H. femuralis* Allred, 1957
   - *H. hilli* (Jameson, 1950)
   - *H. incomptus* (Eads and Hightower, 1952)
   - *H. isabellinus* (Oudemans, 1913)
   - *H. latiscutatus* (de Meillon and Lavoipierre, 1944)
   - *H. longichelae* Allred and Beck, 1966
   - *H. neotomae* (Eads and Hightower, 1951)
   - *H. occidentalis* (Ewing, 1923)
   - *H. paraffinis* Herrin, 1970
   - *H. perognathi* Herrin, 1970
   - *H. staffordi* Strandtmann and Hunt, 1951
   - *H. talpae* Zemskaya, 1955
   - *H. thomomys* Allred and Beck, 1966
   - *H. torus* Allred and Beck, 1966
   - *H. triacanthus* (Jameson, 1950)
   - *H. utahensis* Allred and Beck, 1966

3. *Liponyssoides*
   - *L. becki* (Allred, 1957)
   - *L. sanguineus* (Hirst, 1914)

4. *Myonyssus*
   - *M. montanus* Furman and Tipton, 1955

B. Haemogamasidae

1. *Brevisterna*
   - *B. montanus* (Ewing, 1922)
   - *B. utahensis* (Ewing, 1922)

2. *Eulaelaps*
   - *E. stabularis* (Koch, 1836)

3. *Haemogamasus*
   - *H. alaskensis* Ewing, 1925
   - *H. barberi* (Ewing, 1925)
   - *H. nidiformis* Bregetova, 1955
   - *H. occidentalis* (Keegan, 1951)
   - *H. pontiger* (Berlese, 1903)

4. *Ischyropoda*
   - *I. armatus* Keegan, 1951
   - *I. furmani* Keegan, 1951

C. Halaraehnidae

1. *Zumptiella*
   - *Z. bakeri* (Furman, 1954)

D. Laelapidae

1. *Androlaelaps*
   - *A. circularis* (Ewing, 1933)
   - *A. crowei* Jameson, 1947
   - *A. debilis* Jameson, 1950
   - *A. fenilis* (Megnin, 1876)
   - *A. geomys* Strandtmann, 1949
   - *A. glasgowi* (Ewing, 1925)
   - *A. hollisteri* (Ewing, 1925)
   - *A. leviculus* Eads, 1951

2. *Hypoaspis*
   - *H. gurabensis* (Fox, 1946)
   - *H. lubrica* Oudemans and Voigts, 1904

3. *Laelaps*
   - *L. incilis* Allred and Beck, 1966
   - *L. kochi* Oudemans, 1936
   - *L. multispinosus* Banks, 1909
   - *L. nuttalli* Hirst, 1915

E. Macronyssidae

1. *Chrioptonyssus*
   - *C. robustipes* (Ewing, 1925)

2. *Ornithonyssus*
   - *O. aridus* Furman and Radovsky, 1963
   - *O. bacoti* (Hirst, 1913)
   - *O. silviarum* (Canestrini and Fanzago, 1877)

3. *Steatonyssus*
   - *S. antrozoi* Radovsky and Furman, 1963

F. Rhinonyssidae

1. *Paranconyssus*
   - *P. icteridius* Strandtmann and Furman, 1956

G. Spinturnicidae
1. *Paraspinturnix*
P. globosus Rudnick, 1960
2. *Spinturnix*
S. orri Rudnick, 1960

I''. Acarina: Oribatei
Garabodidae
Passalozetes
P. lincaris Higgins and Woolley, 1962

I'''. Acarina: Trombidiformes
A. Trombiculidae
1. *Acomatacarus*
A. arizonensis Ewing, 1942
2. *Chatia*
C. ochotona (Radford, 1942)
C. setosa Brennan, 1946
3. *Cheladonta*
C. crossi Lipovsky, Crossley, and Loomis, 1955
4. *Euschoengastia*
E. cordiremus Brennan, 1948
E. cricetícola Brennan, 1948
E. cynomyicola Crossley and Lipovsky, 1954
E. decipiens Gould, 1956
E. fasolla Brennan and Beck, 1955
E. furmani Gould, 1956
E. hoffmanae Gould, 1956
E. lanceolata Brennan and Beck, 1955
E. lanei Brennan and Beck, 1955
E. luteodema Brennan, 1948
E. obesa Brennan and Beck, 1955
E. oregonensis (Ewing, 1929)
E. pomerantzi Brennan and Jones, 1954
E. radfordi Brennan and Jones, 1954
E. rotunda Brennan and Beck, 1955
E. sciuricola (Ewing, 1925)
E. soricinus Gould, 1956
5. *Euschoengastoides*
E. lacerta (Brennan, 1948)
E. hoplai (Loomis, 1954)
E. utahensis (Brennan and Beck, 1955)
6. *Eutrombicula*
E. belkini (Gould, 1950)
7. *Hexidionis*
H. allredi (Brennan and Beck, 1955)
H. doremi (Brennan and Beck, 1955)
8. *Hyponeocula*
H. arenicola (Loomis, 1954)
H. montanensis (Brennan, 1946)
9. *Gahrliepia*
G. americana (Ewing, 1942)
10. *Leeuwenhoekia*
L. americana (Ewing, 1942)
11. *Leptotrombidium*
L. myotis (Ewing, 1929)
L. panamensis (Ewing, 1925)
L. potosina (Hoffman, 1950)
12. *Miyatrombicula*
M. esocnis (Sasa and Ogata, 1953)
M. sargenti (Brennan, 1952
13. *Neoschoengastia*
N. americana (Hirst, 1921)
14. *Neotrombicula*
N. californica (Ewing, 1942)
N. harperi (Ewing, 1928)
N. jewetti (Brennan and Wharton, 1950)
N. microti (Ewing, 1928)
N. subsignata (Brennan and Wharton, 1950)
15. *Odontacarus*
O. hirsutus (Ewing, 1931)
O. linsdalei (Brennan and Jones, 1954)
O. micheneri Greenberg, 1952
16. *Trombicula*
T. bakeri Ewing, 1946
T. kardosi Loomis, 1954
T. univari Brennan, 1965
17. *Whartonia*
W. perplexa (Brennan, 1947)

B. Myobiidae
Radfordia
R. bachai Howell and Elzinga, 1962
R. lemina (Koch, 1841)
R. subuliger Ewing, 1938

II. Araneida
A. *Loxoscelidae*
Loxosceles
L. unicolor Keyserling, 1887

B. Theridiidae
Latrodectus
L. hesperus Chamberlin and Ivie, 1935

III. Scorpionida
A. Buthidae
Centruroides
C. sculpturatus Ewing, 1928

B. Vejovidae
1. *Anuroctonus*
A. phaiodactylus (Wood, 1863)
2. *Hadrurus*
H. arizonensis Ewing, 1928
H. spadix, Stahnke, 1940
3. *Vejovis*
V. becki Gertsch and Allred, 1965
V. boreus (Girard, 1845)
V. concusus Stahnke, 1940
V. utahensis Williams, 1968
V. wapatkiensis Stahnke, 1940

INSECTA

I. Anoplura
A. Haematopinidae
Haematopinus
H. asini (Linnaeus, 1758)
H. eurysternus (Nitzsch, 1818)
H. suis (Linnaeus, 1758)

B. Hoplopleuridae
1. *Enderleinellus*
E. marmotae Ferris, 1919
E. osborni Kellogg and Ferris, 1915
E. paralongiceps Kim, 1966
E. suturalis (Osborn, 1891)
E. tamiasciuri Kim, 1966

2. *Fahrenholzia*
   F. pinnata Kellogg and Ferris, 1915
   F. reducta Ferris, 1922
3. *Haemodipsus*
   H. lyriocephalus (Burmeister, 1839)
   H. setoni Ewing, 1924
   H. ventricosus (Denny, 1842)
4. *Hoplopleura*
   H. acanthopus (Burmeister, 1839)
   H. arboricola Kellogg and Ferris, 1915
   H. captiosa Johnson, 1960
   H. difficilis Kim, 1965
   H. erratica (Osborn, 1896)
   H. ferrisi Cook and Beer, 1959
   H. hesperomydis (Osborn, 1891)
   H. onychomydis Cook and Beer, 1959
   H. pacifica Ewing, 1924
   H. reithrodontomydis Ferris, 1951
   H. sciuricola Ferris, 1921
   H. trispinosa Kellogg and Ferris, 1915
5. *Neohaematopinus*
   N. citellinus Ferris, 1942
   N. inornatus (Kellogg and Ferris, 1915)
   N. laeviusculus (Grube, 1851)
   N. marmotae Ferris, 1923
   N. neotomae Ferris, 1942
   N. pacificus Kellogg and Ferris, 1915
   N. sciuri Jancke, 1931
   N. sciuropteri (Osborn, 1891)
   N. semifasciatus Ferris, 1916
   N. spilosomae Pratt and Stojanovich, 1961
6. *Polyplax*
   P. alaskensis Ewing, 1927
   P. auricularis Kellogg and Ferris, 1915
   P. borealis Ferris, 1933
   P. serrata (Burmeister, 1839)
   P. spinulosa (Burmeister, 1839)

C. Linognathidae
1. *Linognathus*
   L. africanus Kellogg and Paine, 1911
   L. pedalis (Osborn, 1896)
   L. setosus (von Olfers, 1816)
   L. stenopsis (Burmeister, 1838)
   L. vituli (Linnaeus, 1758)
2. *Solenoptes*
   S. binipilosus (Fahrenholz, 1916)
   S. capillatus Enderlein, 1904
   S. ferrisi (Fahrenholz, 1916)

D. Pediculidae
1. *Microphthirus*
   M. uncinatus (Ferris, 1916)
2. *Pediculus*
   P. humanus Linnaeus, 1758
3. *Pthirus*
   P. pubis (Linnaeus, 1758)

II. Orthoptera

A. Blattidae
1. *Arenivaga*
   A. erratica Rehn, 1907
2. *Blatta*
   B. orientalis (Linnaeus, 1758)
3. *Blatella*
   B. germanica (Linnaeus, 1767)
4. *Panchlora*
   P. nivea (Linnaeus, 1758)
5. *Periplaneta*
   P. americana (Linnaeus, 1758)
   P. australiasiae (Fabricius, 1775)
6. *Suppella*
   S. longipalpa (Fabricius, 1798)

III. *Coleoptera*

A. Leptinidae
1. *Leptinillus*
   L. validus (Horn, 1872)
2. *Platypsyllus*
   P. castoris Ritsema, 1869

B. Meloidae
1. *Epicauta*
   E. fabricii (LeConte, 1853)
   E. ferruginea (Say, 1823)
   E. normalis Werner, 1945
   E. puncticollis (Mannerheim, 1843)
2. *Lytta*
   L. cyanipennis (LeConte, 1851)
3. *Nemognatha*
   N. lurida LeConte, 1853
   N. lutea LeConte, 1853

IV. Diptera

A. Calliphoridae
1. *Aldrichina*
   A. grahami (Aldrich, 1930)
2. *Bufolucilia*
   B. silvarum (Meigen, 1826)
3. *Calliphora*
   C. coloradensis Hough, 1899
   C. livida Hall, 1948
   C. terraenovae Macquart, 1851
   C. vicina Robineau-Desvoidy, 1830
   C. vomitoria (Linnaeus, 1758)
4. *Cochliomyia*
   C. hominivorax (Coquerel, 1858)
   C. macellaria (Fabricius, 1775)
5. *Cynomyopsis*
   C. cadaverina (Robineau-Desvoidy, 1830)
6. *Eucalliphora*
   E. lilaea (Walker, 1849)
7. *Lucilia*
   L. illustris (Meigen, 1826)
8. *Phaenicia*
   P. sericata (Meigen, 1826)
9. *Phormia*
   P. regina (Meigen, 1826)
10. *Pollenia*
    P. rudis (Fabricius, 1794)
11. *Protocalliphora*
    P. aenea Shannon and Dobroscky, 1924
    P. asiovora Shannon and Dobroscky, 1924
    P. cuprina (Hall, 1948)
    P. hesperia Shannon and Dobroscky, 1924
    P. hirudo Shannon and Dobroscky, 1924
    P. hirundo Shannon and Dobroscky, 1924
    P. metallica (Townsend, 1919)
    P. sialia Shannon and Dobroscky, 1924

12. *Protophormia*
P. terraenovae (Robineau-Desvoidy, 1830)

B. Ceratopogonidae

1. *Culicoides*
C. baueri Hoffman, 1925
C. cochisensis Wirth and Blanton, 1967
C. cockerellii (Coquillett, 1901)
C. crepuscularis Malloch, 1915
C. freeborni Wirth and Blanton, 1969
C. haematopotus Malloch, 1915
C. hieroglyphicus Malloch, 1915
C. montanus Wirth and Blanton, 1969
C. obsoletus (Meigen, 1818)
C. palmerae James, 1945
C. stellifer (Coquillett, 1901)
C. usingeri Wirth, 1952
C. utahensis Fox, 1946
C. variipennis variipennis (Coquillett, 1901)

2. *Leptoconops*
L. kerteszi Hieffer, 1908

C. Chloropidae

Hippelates
H. microcentrus Coquillett, 1904
H. montanus Sabrosky, 1941
H. pallipes (Loew, 1865)
H. particeps (Becker, 1912)
H. pusio Loew, 1872

D. Culicidae

1. *Aedes*
A. atropalpus (Coquillett, 1902)
A. campestris Dyar and Knab, 1907
A. cataphylla Dyar, 1916
A. cinereus Meigen, 1818
A. communis (De Geer, 1776)
A. dorsalis (Meigen, 1830)
A. excrucians (Walker, 1856)
A. fitchii (Felt and Young, 1904)
A. flavescens (Muller, 1764)
A. hexodontus Dyar, 1916
A. impiger (Walker, 1848)
A. implicatus Vockeroth, 1954
A. increpitus Dyar, 1916
A. intrudens Dyar, 1919
A. melanimon Dyar, 1924
A. nielseni O'Meare and Craig, 1970
A. nigromaculis (Ludlow, 1907)
A. niphadopsis Dyar and Knab, 1918
A. pullatus (Coquillett, 1904)
A. schizopinax Dyar, 1929
A. sierrensis (Ludlow, 1905)
A. spencerii idahoensis (Theobald, 1901)
A. sticticus (Meigen, 1838)
A. trivittatus (Coquillett, 1902)
A. varipalpus (Coquillett, 1902)
A. ventrovittis Dyar, 1916
A. vexans (Meigen, 1830)

2. *Anopheles*
A. earlei Vargas, 1943
A. franciscanus McCracken, 1904
A. freeborni Aitken, 1939

3. *Coquillettidia* (=*Mansonia*)
C. perturbans (Walker, 1856)

4. *Culex*
C. apicalis Adams, 1903
C. erythrothorax Dyar, 1907
C. pipiens pipiens Linnaeus, 1758
C. pipiens quinquefasciatus Say, 1823
C. restuans (Theobald, 1901)
C. tarsalis Coquillett, 1896
C. territans Walker, 1856
C. thriambus Dyar, 1921

5. *Culiseta*
C. impatiens (Walker, 1848)
C. incidens Thompson, 1868
C. inornata Williston, 1893
C. morsitans dyari Coquillett, 1902
C. silvestris minnesotae Barr, 1957

6. *Orthopodomyia*
O. signifera (Coquillett, 1896)

7. *Psorophora*
P. signipennis (Coquillett, 1896)

E. Cuterebridae

Cuterebra
C. angustifrons Dalmat, 1942
C. approximata Walker, 1866
C. grisea Coquillett, 1904
C. jellisoni Curran, 1942
C. lepusculi Townsend, 1897
C. polita Coquillett, 1898
C. princeps (Austen, 1895)
C. ruficrus (Austen, 1933)
C. tenebrosa Coquillett, 1898

F. Gasterophilidae

Gasterophilus
G. haemorrhoidalis (Linnaeus, 1785)
G. intestinalis (De Geer, 1776)
G. nasalis (Linnaeus, 1758)

G. Hippoboscidae

1. *Icosta*
I. americana (Leach, 1817)
I. hirsuta (Ferris, 1927)
I. nigra (Perty, 1833)

2. *Lipoptena*
L. depressa (Say, 1823)

3. *Melophagus*
M. ovinus (Linnaeus, 1785)

4. *Myophthiria*
M. fimbriata (Waterhouse, 1887)

5. *Neolipoptena*
N. ferrisi (Bequaert, 1935)

6. *Olfersia*
O. sordida Bigot, 1885

7. *Ornithomya*
O. anchineuria Speiser, 1905

8. *Ornithoica*
O. vicina (Walker, 1849)

H. Muscidae

1. *Fannia*
F. canicularis (Linnaeus, 1761)
F. scalaris (Fabricius, 1794)

2. *Haematobia*
H. irritans Linnaeus, 1785

3. *Musca*
M. autumnalis De Geer, 1776
M. domestica (Linnaeus, 1758)

4. *Muscina*
   M. assimilis (Fallén, 1823)
   M. stabulans (Fallén, 1817)
5. *Stomoxys*
   S. calcitrans (Linnaeus, 1758)

I. *Nycteribiidae*
Basilia
   B. antrozoi (Townsend, 1893)
   B. corynorhini (Ferris, 1916)
   B. forcipata Ferris, 1924

J. Oestridae
1. *Cephenemyia*
   C. jellisoni Townsend, 1941
   C. pratti Hunter, 1916
2. *Hypoderma*
   H. bovis (Linnaeus, 1758)
   H. lineatum (Villers, 1789)
3. *Oestrus*
   O. ovis Linnaeus, 1758

K. Piophilidae
Piophila
   P. casei (Linnaeus, 1758)

L. Psychodidae
1. *Lutzomyia*
   L. aquilonia (Fairchild and Harwood, 1961)
   L. californica (Fairchild and Hertig, 1957)
   L. oppidana (Dampf, 1944)
   L. stewarti (Mangabeira and Galindo, 1944)
   L. vexator (Coquillett, 1907)
2. *Psychoda*
   P. alternata Say, 1824

M. Rhagionidae
Symphoromyia
   S. atripes Bigot, 1887
   S. fulvipes Bigot, 1887
   S. hirta Johnson, 1897
   S. inquisitor Aldrich, 1915
   S. johnsoni Coquillett, 1894
   S. pachyceras Williston, 1886

N. Sarcophagidae
1. *Ravinia*
   R. aeerba (Walker, 1849)
   R. derelicta (Walker, 1852)
   R. errabunda (Wulp, 1895)
   R. latisetosa Parker, 1914
   R. lherminieri (Robineau-Desvoidy, 1830)
   R. planifrons (Aldrich, 1916)
   R. pusiola (Wulp, 1895)
2. *Sarcophaga*
   S. argyrostoma (Robineau-Desvoidy, 1830)
   S. bishoppi Aldrich, 1916
   S. bullata Parker, 1916
   S. cooleyi Parker, 1914
   S. haemorrhoidalis (Fallén, 1817)
   S. perspicax, Aldrich, 1916
   S. sarraceniodes Aldrich, 1916
   S. shermani Parker, 1923
   S. sinuata Meigen, 1826
   S. utilis Aldrich, 1915
3. *Wohlfahrtia*
   W. vigil opaca Coquillett, 1897

O. Simuliidae
1. *Cnephia*
   C. jeanae DeFoliart and Peterson, 1960
   C. mutata (Malloch, 1914)
   C. villosa DeFoliart and Peterson, 1960
2. *Prosimulium*
   P. davisi Peterson and DeFoliart, 1960
   P. exigens Dyar and Shannon, 1927
   P. flaviantennum (Stains and Knowlton, 1940)
   P. fulvum (Coquillett, 1902)
   P. longilobum Peterson and DeFoliart, 1960
   P. onychodactylum Dyar and Shannon, 1927
   P. shewelli Peterson and DeFoliart, 1960
   P. travisi Stone, 1952
   P. uinta Peterson and DeFoliart, 1960
   P. unicum (Twinn, 1938)
3. *Simulium*
   S. arcticum Malloch, 1914
   S. argus Williston, 1893
   S. aureum Fries, 1824
   S. bicorne Dorogostajskij, Rubtzov, and Vlasenko, 1935
   S. bivittatum Malloch, 1914
   S. canadense Hearle, 1932
   S. canonicola (Dyar and Shannon, 1927)
   S. corbis Twinn, 1936
   S. decorum Walker, 1848
   S. defoliarti Stone and Peterson, 1958
   S. griseum Coquillett, 1898
   S. hunteri Malloch, 1914
   S. jacumbae Dyar and Shannon, 1927
   S. latipes (Meigen, 1804)
   S. mediovittatum Knab, 1915
   S. meridionale Riley, 1887
   S. nigricoxum Stone, 1952
   S. petersoni Stone and DeFoliart, 1959
   S. piperi Dyar and Shannon, 1927
   S. pugetense (Dyar and Shannon, 1927)
   S. rugglesi Nicholson and Mickel, 1950
   S. trivittatum Malloch, 1914
   S. tuberosum (Lundstrom, 1911)
   S. venator Dyar and Shannon, 1927
   S. venustum Say, 1823
   S. virgatum Coquillett, 1902
   S. vittatum Zetterstedt, 1838
   S. wyomingense Stone and DeFoliart, 1959
4. *Twinnia*
   T. nova (Dyar and Shannon, 1927)

P. Streblidae
Trichobius
   T. corynorhini Cockerell, 1910
   T. major Coquillett, 1899

Q. Syrphidae
Eristalis
   E. dimidiatas Wiedemann, 1830
   E. tenax (Linnaeus, 1758)

R. Tabanidae
1. *Atylotus*
   A. incisuralis var. *utahensis* Rowe and Knowlton, 1935
2. *Chrysops*
   C. aestuans Wulp, 1867
   C. callidus Osten Sacken, 1875

C. carbonarius Walker, 1848
C. coquilletti Hine, 1904
C. discalis Williston, 1880
C. excitans Walker, 1850
C. frigidus Osten Sacken, 1877
C. fulvaster Osten Sacken, 1877
C. furcatus Walker, 1848
C. indus Osten Sacken, 1875
C. mitis Osten Sacken, 1875
C. niger Macquart, 1838
C. noctifer noctifer Osten Sacken, 1877
C. noctifer pertinax Williston, 1887
C. pachycerus Williston, 1887
C. sackenii Hine, 1903
C. wileyae Philip, 1955

3. *Haematopota*
H. americana Osten Sacken, 1875

4. *Hybomitra*
H. epistates (Osten Sacken, 1878)
H. frontalis (Walker, 1848)
H. opaca (Coquillett, 1904)
H. rhombica (Osten Sacken, 1876)
H. rhombica var. *osburni* (Hine, 1904)
H. rupestris (McDonnough, 1921)
H. sequax (Williston, 1887)
H. sonomensis var. *phaenops* (Osten Sacken, 1877)
H. tetrica var. *hirtula* (Bigot, 1892)

5. *Pilimas*
P. californicus (Bigot, 1892)

6. *Silvius*
S. quadrivittatus (Say, 1823)

7. *Stenotabanus*
S. flavidus (Hine, 1904)
S. guttatulus (Townsend, 1893)

8. *Tabanus*
T. aegrotus Osten Sacken, 1877
T. atratus Fabricius, 1775
T. dorsifer Walker, 1860
T. gilanus Townsend, 1897
T. laticeps Hine, 1904
T. lincola Fabricius, 1794
T. productus Hine, 1904
T. pumilus Macquart, 1838
T. punctifer Osten Sacken, 1876
T. stonei Philip, 1941

V. Hemiptera

A. Cimicidae

1. *Cimex*
C. lectularius Linnaeus, 1758
C. pilosellus (Horvath, 1910)

2. *Oeciacus*
O. vicarius Horvath, 1912

B. Reduviidae

1. *Reduvius*
R. personatus (Linnaeus, 1758)
R. vanduzeei Wygodzinsky and Usinger, 1964

2. *Triatoma*
T. protracta (Uhler, 1894)

VI. Hymenoptera

A. Apidae

1. *Apis*
A. mellifera Linnaeus, 1758

2. *Bombus*
B. appositus Cresson, 1878
B. bifarius Cresson, 1878
B. centralis Cresson, 1864
B. edwardsii Cresson, 1878
B. flavifrons Cresson, 1863
B. griscocollis (De Geer, 1773)
B. hunti Greene, 1860
B. morrisoni Cresson, 1878
B. nevadensis nevadensis Cresson, 1874
B. occidentalis occidentalis Greene, 1858
B. rufocinctus Cresson, 1863

B. Formicidae

1. *Pogonomyrmex*
P. barbatus barbatus (F. Smith, 1856)
P. californicus (Buckley, 1867)
P. imberbiculus W.M. Wheeler, 1902
P. occidentalis (Cresson, 1865)
P. rugosus Emery, 1895

2. *Crematogaster*
C. mormonum Emery, 1895
C. vermiculata Emery, 1895

3. *Solenopsis*
S. molesta molesta (Say, 1836)
S. molesta validiuscula Emery, 1895
S. salina W.M. Wheeler, 1908
S. xyloni McCook, 1879

C. Mutillidae

1. *Chyphotes*
C. epedaphus Buzicky, 1941
C. similis Baker, 1905

2. *Dasymutilla*
D. californica (Radoszkowski, 1861)
D. canco (Blake, 1879)
D. fulvohirta (Cresson, 1865)
D. gloriosa (Saussure, 1867)
D. klugii (Gary, 1872)
D. monticola (Cresson, 1865)
D. phaon phaon (Fox, 1899)
D. phaon var. *fimbrialis* Mickel, 1928
D. scitula Mickel, 1928
D. ursula (Cresson, 1875)
D. vesta vesta Cresson, 1865

3. *Dilophotopsis*
D. concolor concolor (Cresson, 1865)

4. *Odontophotopsis*
O. crebus (Melander, 1903)
O. inconspicua (Blake, 1886)
O. melicausa (Blake, 1871)
O. venusta (Blake, 1886)

5. *Pseudomethoca*
P. contumax (Cresson, 1865)
P. contumeliosa Mickel, 1935
P. manca Mickel, 1924
P. propinqua (Cresson, 1865)
P. toumeyi (Fox, 1894)

6. *Sphaeropthalma*
S. abdominalis (Blaker, 1886)
S. ceres (Fox, 1899)
S. dirce (Fox, 1899)
S. marpesia (Blake, 1879)
S. unicolo (Cresson, 1865)

7. *Timulla*
T. grotei (Blake, 1871)

8. *Typhoctes*
   T. peculiaris (Cresson, 1875)

D. Pompilidae

Pepsis
   P. angustimarginata Viereck, 1908
   P. mildei Stol, 1857
   P. pallidolimbata pallidolimbata Lucas, 1895
   P. thisbe Lucas, 1895

E. Sphecidae

1. *Astata*
   A. bicolor Say, 1823
   A. nevadica Cresson, 1881
   A. nubecula Cresson, 1865
   A. occidentalis Cresson, 1881

2. *Bembix*
   B. americana comata Parker, 1917
   B. americana spinolae Lepeletier, 1845
   B. amoena Handlirsch, 1893
   B. occidentalis W.J. Fox, 1893
   B. rugosa Parker, 1917

3. *Cerceris*
   C. conifrons Mickel, 1916
   C. convergens Viereck and Cockerell, 1904
   C. finitima Cresson, 1865
   C. nigrescens Smith, 1856

4. *Clypeadon*
   C. laticinctus (Cresson, 1865)

5. *Didineis*
   D. nodosa Fox, 1894

6. *Mimesa*
   M. cressonii Packard, 1867

7. *Philanthus*
   P. gibbosus (Fabricius, 1775)

8. *Prionyx*
   P. atratus (Lepeletier, 1845)
   P. parkeri Bohart and Menke, 1963

F. Vespidae

1. *Ancistrocerus*
   A. antilope antilope (Panzer, 1798)
   A. catskill albophaleratus (Saussure, 1855)
   A. catskill catskill (Saussure, 1853)
   A. lineaticentris fulvicarpus Cameron, 1908
   A. neocallosus neocallosus Bequaert, 1943
   A. spilogaster Cameron, 1905
   A. tigris tigris (Saussure, 1857)
   A. tuberculiceps sutterianus (Saussure, 1875)
   A. tuberculiceps tuberculiceps (Saussure, 1853)

2. *Enodynerus*
   E. annulatus annulatus (Say, 1824)
   E. annulatus sulphureus (Saussure, 1858)
   E. auranus (Cameron, 1906)
   E. boscii boscii (Lepeletier, 1841)
   E. exoglyphus albovittatus (R. Bohart, 1939)
   E. exoglyphus exoglyphus (R. Bohart, 1939)
   E. foraminatus aequalus (Cameron, 1906)
   E. fusus fusus (Cresson, 1872)
   E. hidalgo hidalgo (Saussure, 1857)
   E. martini (R. Bohart, 1942)
   E. pratensis pratensis (Saussure, 1870)
   E. russatus (R. Bohart, 1942)

3. *Eumenes*
   E. bollii bollii Cresson, 1872
   E. iturbide pedalis Fox, 1894
   E. sculleni R. Bohart, 1950
   E. verticalis tricinctus Isely, 1917

4. *Leptochilus*
   L. erubescens (R. Bohart, 1940)
   L. republicanus (Dalla Torre, 1889)
   L. rubicundulus (R. Bohart, 1940)
   L. rufinodus (Cresson, 1868)

5. *Mischocyttarus*
   M. flavitarsis flavitarsis (Saussure, 1854)
   M. flavitarsis idahoensis Bequaert, 1933

6. *Odynerus*
   O. cinnabarinus R. Bohart, 1939
   O. margaretellus Rohwer, 1915

7. *Polistes*
   P. canadensis var. *kaibabensis* Hayward, 1932
   P. flavus Cresson, 1868
   P. fuscatus centralis Hayward, 1933
   P. fuscatus utahensis Hayward, 1933

8. *Pseudomasaris*
   P. edwardsii (Cresson, 1872)
   P. zonalis (Cresson, 1864)

9. *Pterocheilus*
   P. laticeps Cresson, 1872
   P. micheneri R. Bohart, 1940
   P. pedicellatus R. Bohart, 1940
   P. provancheri (Huard, 1895)

10. *Stenodynerus*
   S. apache R. Bohart, 1949
   S. blandoides blandoides R. Bohart, 1943
   S. blandus blandus (Saussure, 1870)
   S. cochisensis (Viereck, 1908)
   S. minimoferus R. Bohart, 1949
   S. noticeps noticeps R. Bohart, 1948
   S. percampanulatus (Viereck, 1906)
   S. toltecus (Saussure, 1857)
   S. valliceps R. Bohart, 1948

11. *Symmorphus*
   S. meridionalis (Viereck, 1903)

12. *Vespula*
   V. artica Rohwer, 1916
   V. arenaria (Fabricius, 1775)
   V. atropilosa (Sladen, 1918)
   V. austriaca (Panzer, 1799)
   V. consobrina (Saussure, 1864)
   V. maculata (Linnaeus, 1763)
   V. norvegicoides Sladen, 1918
   V. pennsylvanica (Saussure, 1857)
   V. vulgaris (Linnaeus, 1758)

VII. Lepidoptera

A. Arctiidae

1. *Arachnis*
   A. picta Packard, 1864

2. *Arctia*
   A. caja utahensis (Henry Edwards, 1886)

3. *Apantesis*
   A. nevadensis (Grote and Robinson, 1866)
   A. ornata (Packard, 1864)
   A. parthenice (Kirby, 1837)
   A. proxima (Guerin-Meneville, 1844)

A. williamsi tooele Barnes and McDunnough, 1910
A. williamsi form *determinata* (Neumoegen, 1881)

4. *Diacrisia*
D. vagans (Boisduval, 1852)
D. virginica (Fabricius, 1798)

5. *Ectypia*
E. clio jessica (Barnes, 1900)

6. *Estigmene*
E. oregonsis (Stretch, 1873)

7. *Halysidota*
H. argentata subalpina French, 1890
H. maculata agassizi Packard, 1864
H. osluri Rothschild, 1909
H. tesellaris (J. E. Smith and Abbot, 1797)

8. *Hemihyalea*
H. labecula (Grote, 1881)

9. *Holomelina*
H. fragilis (Strecker, 1878)

10. *Isia*
I. isabella (J. E. Smith and Abbott, 1797)

11. *Leptarctia*
L. californiae form *decia* (Boisduval, 1869)

12. *Nemeophila*
N. plantaginis (Linnaeus, 1758)

B. Lasiocampidae

1. *Malacosoma*
M. americanum (Fabricius, 1793)
M. californicum fragile (Stretch, 1881)
M. disstria Hubner, 1822

2. *Phyllodesma*
P. americana (Harris, 1841)

3. *Tolype*
T. glenwoodi Barnes, 1900

C. Lymantridae

Dasychira
D. vagans grisca (Barnes and McDunnough, 1913)

D. Nymphalidae

1. *Aglsis*
A. milberti Godart, 1819

2. *Argynnis*
A. leto Behr, 1862
A. nokomis Edwards, 1862

3. *Basilarchia*
B. lorquini Boisduval, 1852

4. *Nymphalis*
N. antiopa (Linnaeus, 1758)

5. *Vanessa*
V. atalanta Linnaeus, 1758
V. cardui Linnaeus, 1758
V. carye Hubner, 1806

E. Saturniidae

1. *Automeris*
A. io (Fabricius, 1775)

2. *Coloradia*
C. pandora Blake, 1863

3. *Hemileuca*
H. eleganterina (Boisduval, 1852)
H. hera hera (Harris, 1841)
H. nevadensis Stretch, 1872
H. oliviae Cockerell, 1898

4. *Platysamia*
P. euryalus (Boisduval, 1855)
P. gloveri Strecker, 1872

VIII. Mallophaga

A. Gyropidae

Gliricola
G. porcelli (Schank, 1781)
G. ovalis Burmeister, 1838

B. Laemobothriidae

Laemobothrion
L. atrum (Nitzsch, 1818)
L. glutinans Nitzsch, 1861
L. maximum (Scopoli, 1763)
L. simile Kellogg, 1896
L. tinnunculi (Linnaeus, 1758)
L. vulturis (J. C. Fabricius, 1775)

C. Menoponidae

1. *Actornithophilus*
A. lacustris Clay, 1962
A. limarius Clay, 1962
A. luminosae (Kellogg, 1908)
A. mexicanus Emerson, 1953
A. ochraceus (Nitzsch, 1818)
A. paludosus Clay, 1962
A. patellatus (Piaget, 1890)
A. piceus lari (Packard, 1870)
A. piceus piceus (Denny, 1842)
A. stictus (Kellogg & Paine, 1911)
A. totani (Schrank, 1803)
A. umbrinus (Burmeister, 1838)
A. uniseriatum (Piaget, 1880)

2. *Amyrsidea*
A. megalosoma (Overgaard, 1943)
A. perdicis (Denny, 1842)

3. *Ardeiphilus*
A. floridae Tuff, 1965

4. *Austromenopon*
A. aegialitidis (Durrant, 1906)
A. atrofulvum (Piaget, 1880)
A. durisetosum (Blagoveshtchensky, 1948)
A. himantopi Timmermann, 1954
A. limosae Timmermann, 1954
A. micrandum (Nitzsch, 1866)
A. sachtlebeni Timmermann, 1954
A. spenceri Timmermann, 1956
A. squatarolae Timmermann, 1954
A. transversum (Denny, 1842)

5. *Bonomiella*
B. columbae Emerson, 1957

6. *Ciconiphilus*
C. butoridiphagus Carriker, 1964
C. cygni Price & Beer, 1965
C. decimfasciatus (Boisduval & Lacordaire, 1835)
C. pectiniventris (Harrison, 1916)

7. *Colpocephalum*
C. brachysomum Kellogg & Chapman, 1902

C. flavescens (de Haan, 1829)
C. fregili Denny, 1842
C. impressum Rudow, 1866
C. kelloggi Osborn, 1902
C. leptopygos Nitzsch, 1874
C. nanum Piaget, 1890
C. napiforme Rudow, 1869
C. pectinatum Osborn, 1902
C. tausi (Ansari, 1951)
C. turbinatum Denny, 1842
C. unciferum Kellogg, 1896
C. zerafae Ansari, 1955

8. *Comatomenopon*
C. thulae Tuff, 1967

9. *Cuculiphilus*
C. alternatus (Osborn, 1902)

10. *Dennyus*
D. bruneri (Carriker, 1903)
D. spinigcr Ewing, 1930

11. *Eureum*
E. spenceri Emerson & Pratt, 1956

12. *Hohorsticlla*
H. frontalis Carriker, 1949

13. *Holomenopopn*
H. clypeilargum Eichler, 1943
H. leucoxanthum (Burmeister, 1838)
H. setigerum (Blagoveshtchensky, 1948)
H. transvaalense (Bedford, 1920)

14. *Kurodaia*
K. acadicae Price & Beer, 1963
K. flammei Price & Beer, 1963
K. fulvovasciata (Piaget, 1880)
K. haliaeti (Denny, 1842)
K. magna Emerson, 1960
K. painei (McGregor, 1912)
K. subpachygaster (Piaget, 1880)

15. *Machaerilaemus*
M. amercanus (Ewing, 1930)
M. clayae (Balat, 1966)
M. malleus (Burmeister, 1838)
M. melospizae Emerson, 1954

16. *Menacanthus*
M. alaskensis (Kellogg & Chapman, 1902)
M. annulatus (Giebel, 1874)
M. chrysophaeus (Kellogg, 1896)
M. distinctus (Kellogg & Chapman, 1899)
M. eurysternum (Burmeister, 1838)
M. expansus (Osborn, 1896)
M. gonophacus (Burmeister, 1838)
M. mutabilis Blagoveshtchensky, 1940
M. perforatus (Piaget, 1880)
M. persignatus (Kellogg & Chapman, 1899)
M. picicola (Packard, 1873)
M. robustus (Kellogg, 1896)
M. stramineus (Nitzsch, 1818)

17. *Menopon*
M. pallens Clay, 1949

18. *Myrsidea*
M. anaspila (Nitzsch, 1866)
M. conspica (Kellogg & Chapman, 1902)
M. culcullaris (Nitzsch, 1818)
M. dissimilis (Kellogg, 1896)
M. emersoni Clay, 1966
M. incerta (Kellogg, 1896)
M. interrupta (Osborn, 1896)
M. latifrons (Carriker, 1910)
M. melanorum (Kellogg, 1896)
M. palloris (Carriker, 1903)
M. picae (Linnaeus, 1758)
M. quadrifasciata (Piaget, 1880)
M. quadrimaculata (Carriker, 1902)
M. ridulosa (Kellogg & Chapman, 1899)
M. rustica (Giebel, 1874)

19. *Nosopon*
N. lucidum (Rudow 1869)

20. *Piagetiella*
P. peralis (Leidy, 1878)

21. *Plegadiphilus*
P. plegadis (Dubinin, 1938)

22. *Pseudomenopon*
P. insolens (Kellogg, 1896)
P. par (Kellogg, 1896)
P. pilosum (Scopoli, 1763)
P. quadrii Eichler, 1952

23. *Triniton*
T. anserinum (J. C. Fabricius, 1805)
T. querquedulae (Linnaeus, 1758)

D. Philopteridae

1. *Acidoproctus*
A. maximus Piaget, 1878

2. *Anaticola*
A. crassicornis cornicephalus (Zavaleta, 1946)
A. crassicornis crassicornis (Scopoli, 1763)
A. crassicornis dafilensis Carriker, 1956
A. crassicornis depuratus (Nitzsch, 1866)
A. crassicornis hopkinsi Eichler, 1954
A. crassicornis mergiserrati (De Geer, 1778)

3. *Anatoecus*
A. cygni emersoni Keler, 1960
A. dentatus affinis Keler, 1960
A. dentatus dentatus (Scopoli, 1763)
A. dentatus ferrugineus (Giebel, 1874)
A. icterodes bipunctatus (Giebel, 1874)
A. icterodes boschadis Keler, 1960
A. icterodes icterodes (Nitzsch, 1818)
A. icterodes marcui Keler, 1960
A. icterodes simmillimus Keler, 1960
A. icterodes tendeiroi Keler, 1960

4. *Aquanirmus*
A. amercanus (Kellogg & Chapman, 1899)

5. *Ardeicola*
A. botauri (Osborn, 1896)
A. cruscula Carriker, 1960
A. expallida Blagoveschtchensky, 1940
A. florida nigra Tuff, 1967
A. goisagi Uchida, 1953
A. rhaphidus (Nitzsch, 1866)

6. *Bruclia*
B. angustifrons (Carriker, 1902)
B. argula (Burmeister, 1838)
B. audax (Kellogg, 1899)
B. biocellata (Piaget, 1880)
B. brachythorax (Giebel, 1874)
B. cedrorum (Piaget, 1880)
B. deficiens (Piaget, 1885)
B. domestica (Kellogg & Chapman, 1899)
B. ductilis (Kellogg & Chapman, 1899)
B. iliaci brevicolor Ansari, 1956
B. interposita (Kellogg, 1899)
B. limbata (Burmeister, 1838)
B. longa (Kellogg, 1896)

B. longifrons Carriker, 1956
B. nebulosa (Burmeister, 1838)
B. ornatissima (Giebel, 1874)
B. peninsularis (Kellogg, 1899)
B. rotundata (Osborn, 1896)
B. straminea (Denny, 1842)
B. subtilis (Nitzsch, 1874)
B. tenuis (Burmeister, 1838)
B. xanthocephali (Osborn, 1896)
B. zeropunctata antiqua Ansari, 1956
B. zeropunctata zeropunctata Ansari, 1957

7. *Carduiceps*
C. cingulatus cingulatus (Denny, 1842)
C. cingulatus clayae Timmermann, 1954
C. zonarius (Nitzsch, 1866)

8. *Chelopistes*
C. meleagridis (Linnaeus, 1758)

9. *Cirrophthirus*
C. testudinarius (Children, 1836)

10. *Colinicola*
C. docophoroides (Piaget, 1880)

11. *Columbicola*
C. baculoides Paine, 1912
C. macrourae (Wilson, 1941)

12. *Craspedorrhynchus*
C. americanus Emerson, 1960
C. aquilinus (Denny, 1842)
C. dilatatus (Rudow, 1869)
C. haematopus (Scopoli, 1763)
C. hirsutus Carriker, 1956
C. subhaematopus Emerson, 1960

13. *Cuclogaster*
C. heterogrammicus (Nitzsch, 1866)

14. *Cuculicola*
C. splendidus (Kellogg, 1899)

15. *Cuculoecus*
C. coccygi (Osborn, 1895)

16. *Cummingsiella*
C. ambigua (Burmeister, 1838)
C. longirostricola (Wilson, 1937)

17. *Degeeriella*
D. discocephalus aquilarum Eichler, 1943
D. fulva (Giebel, 1874)
D. fusca (Denny, 1842)
D. nisus nisus (Giebel, 1866)
D. nisus vagans (Giebel, 1874)
D. regalis (Giebel, 1866)
D. rufa carruthi Emerson, 1953
D. rufa rufa (Burmeister, 1838)

18. *Falcolipeurus*
F. marginalis Osborn, 1902
F. suturalis (Rudow, 1869)

19. *Fulicoffula*
F. americana Emerson, 1960
F. comstocki (Kellogg & Paine, 1911)
F. distincta Emerson, 1960
F. longipila (Kellogg, 1896)

20. *Goniocotes*
G. chrysocephalus Giebel, 1874
G. microthorax (Stephans, 1829)

21. *Goniodes*
G. bonasus Emerson, 1948
G. centrocerci Simon, 1938
G. colchici Denny, 1842
G. dispar Burmeister, 1838
G. merriamanus Packard, 1873
G. nebraskensis Carriker, 1945
G. stefani Clay & Hopkins, 1955
G. submamillatus Emerson, 1950

22. *Ibidoecus*
I. bisignatus (Nitzsch, 1866)

23. *Incidifrons*
I. monachus (Kellogg & Paine, 1911)
I. transpositus (Kellogg, 1896)

24. *Lagopoecus*
L. colchicus Emerson, 1949
L. gambeli Emerson, 1949
L. gibsoni Hopkins, 1947
L. obscurus Emerson, 1948
L. perplexus (Kellogg & Chapman, 1899)
L. umbellus Emerson, 1950

25. *Lipeurus*
L. maculosus Clay, 1938

26. *Lunaceps*
L. holophaeus cabenisi Timmermann, 1954
L. limosella clayae Timmermann, 1954
L. numenii (Denny, 1842)

27. *Mulcticola*
M. macrocephalus (Kellogg, 1896)

28. *Ornithobius*
O. goniopleurus Denny, 1842
O. waterstoni reconditus Timmermann, 1962

29. *Oxylipeurus*
O. corpulentus Clay, 1938
O. ellipticus (Keler, 1958)
O. mesopelios colchicus Clay, 1938
O. polytrapezius (Burmeister, 1838)

30. *Pectinopygus*
P. farallonii (Kellogg, 1896)
P. tordoffi, Elbel & Emerson, 1956

31. *Perenirmus*
P. arcticus Cariker, 1958
P. auritus (Scopoli, 1763)
P. gulosus (Nitzsch, 1866)
P. jungens (Kellogg, 1896)
P. mirinotatus (Kellogg & Chapman, 1899)
P. quadripustulatus (Kellogg & Mann, 1912)

32. *Philopterus*
P. agelaii (Osborn, 1896)
P. americanus (Kellogg, 1899)
P. citrinellae curvirostrae (Sehrank, 1776)
P. corvi (Linnaeus, 1758)
P. excisus domesticus (Kellogg, 1896)
P. excisus major (Kellogg, 1896)
P. excisus microsomaticus Tandan, 1955
P. fringillae (Scopoli, 1772)
P. garrulae (Piaget, 1880)
P. hanzaki Balat, 1955
P. mirus (Kellogg & Chapman, 1899)
P. ocellatus osborni Edwards, 1952
P. phillipi Emerson, 1953
P. picae (Denny, 1842)
P. rufus (Kellogg, 1899)
P. ruttcri (Kellogg, 1899)

33. *Physconelloides*
P. spenceri Emerson & Ward, 1958
P. wisemani Emerson, 1960
P. zenaidurae (McGregor, 1917)

34. *Picicola*
P. foedus (Kellogg & Chapman, 1899)
P. orpheus (Osborn, 1896)
P. snodgrassi (Kellogg, 1896)

35. *Quadraceps*
Q. alcyonae (Carriker, 1959)
Q. assimilis major (Kellogg, 1899)
Q. carrikeri Hopkins & Timmermann, 1954
Q. connexus (Kellogg & Mann, 1912)
Q. charadrii hospes (Nitzsch, 1866)
Q. falcigerus (Peters, 1931)
Q. fimbriatus (Giebel, 1866)
Q. griseus (Rudow, 1869)
Q. hemichrous (Nitzsch, 1866)
Q. hiaticulae hoephilus (Kellogg, 1896)
Q nigrolimbatus (Mjöberg, 1910)
Q. phaeonotus (Nitzsch, 1866)
Q. punctatus sublingulatus Timmerman, 1952
Q. ravus (Kellogg, 1899)
Q. semifissus mexicanus Carriker, 1944
Q. similis (Giebel, 1866)
Q. zephyra (Timmermann, 1954)

36. *Rallicola*
R. advenus (Kellogg, 1896)
R. kelloggi Emerson, 1957
R. mystax (Giebel, 1874)
R. ortygometrae subporzanae Emerson, 1957

37. *Rhynonirmus*
R. scolopacis (Denny, 1842)

38. *Rotundiceps*
R. cordatus (Osborn, 1896)

39. *Saemundssonia*
S. conica conica (Denny, 1842)
S. conica naumanni (Giebel, 1874)
S. kratochvili Balat, 1950
S. lari congener (Giebel, 1874)
S. lobaticeps (Giebel, 1874)
S. parvigenitalis Ward, 1955
S. platygaster nitzschi (Giebel, 1866)
S. platygaster platygaster (Denny, 1842)
S. scolopacisphaeopodis (Schrank, 1803)
S. tricolor Carriker, 1956
S. tringae (O. Fabricius, 1780)

40. *Strigiphilus*
S. acutifrons Emerson, 1961
S. aitkeni Clay, 1966
S. barbatus (Osborn, 1902)
S. cursor (Burmeister, 1838)
S. oculatus (Rudow, 1870)
S. otus Emerson, 1955
S. speotyti (Osborn, 1896)

41. *Sturnidoecus*
S. simplex (Kellogg, 1896)
S. sturni (Schrank, 1776)

E. Ricinidae

1. *Ricinus*
R. angulatus (Kellogg, 1896)
R. arcuatus (Kellogg & Mann, 1912)
R. bombycillae (Denny, 1842)
R. diffusus (Kellogg, 1896)
R. inexpectatus Balat, 1966
R. japonicus (Uchida, 1915)
R. medius Uchida, 1926
R. merulae (Durrant, 1906)
R. microcephalus (Kellogg, 1896)
R. picturatus (Carriker, 1902)
R. subhastatus (Durrant, 1906)
R. sucinaceus (Kellogg, 1896)
R. serratus (Durrant, 1906)

2. *Trochiloecetes*
T. lineatus (Osborn, 1896)
T. prominens (Kellogg & Chapman, 1899)
T. ochoterenai (Zavaleta, 1943)

F. Trichodectidae

1. *Bovicola*
B. bovis (Linnaeus, 1758)
B. caprae (Gurlt, 1843)
B. crassipes (Rudow, 1866)
B. equi (Denny, 1842)
B. limbatus (Gervais, 1844)
B. ovis (Schrank, 1781)

2. *Eutrichophilus*
E. setosus (Giebel, 1861)

3. *Felicola*
F. subrostrata (Burmeister, 1838)

4. *Geomydoecus*
G. californicus (Chapman, 1897)

5. *Neotrichodectes*
N. osborni Keler, 1944

IX. Siphonaptera

A. Amphipsyllidae
Amphisylla
A. sibirica washingtoni Hubbard, 1954

B. Ceratophyllidae

1. *Amphalius*
A. necopinus (Jordan, 1925)

2. *Ceratophyllus*
C. affinis neglectus Smit, 1958
C. celsus celsus Jordan, 1926
C. garei Rothschild, 1902
C. niger C. Fox, 1908
C. petrochelidoni Wagner, 1936

3. *Dactylopsylla*
D. (*Foxella*) *ignota apachina* (C. Fox, 1941)
D. (*Foxella*) *ignota arizonensis* (Hubbard, 1947)
D. (*Foxella*) *ignota comis* Jordan, 1929
D. (*Foxella*) *ignota ignota* Baker, 1895
D. (*Foxella*) *ignota recula* (Jordan and Rothschild, 1915)
D. (*Foxella*) *ignota utahensis* (Wagner, 1931)
D. (*Foxelloides*) *minidoka* Prince and Stark, 1951
D. (*Spicata*) *rara* I. Fox, 1940

4. *Diamanus*
D. montanus (Baker, 1895)

5. *Malaraeus*
M. bitterrootensis (Dunn, 1923)
M. euphorbi (Rothschild, 1905)
M. sinomus (Jordan, 1925)
M. telchinum (Rothschild, 1905)
M. confintelis Prince, 1959

6. *Megabothris*
M. abantis (Rothschild, 1905)

7. *Monopsyllus*
M. ciliatus kincaidi Hubbard, 1947

M. cyrturus (Jordan, 1929)
M. eumolpi americanus Hubbard, 1950
M. eumolpi eumolpi (Rothschild, 1905)
M. exilis (Jordan, 1937)
M. vison (Baker, 1904)
M. wagneri (Baker, 1904)

8. *Nosopsyllus*
N. fasciatus (Bosc d'Antic, 1801)

9. *Opisocrostis*
O. hirsutus (Baker, 1895)
O. labis (Jordan and Rothschild, 1922)
O. tuberculatus cynomuris Jellison, 1939
O. tuberculatus tuberculatus (Baker, 1904)

10. *Opisodasys*
O. keeni keeni (Baker, 1896)
O. pseudarctomys (Baker, 1904)

11. *Orchopeas*
O. caedens caedens (Jordan, 1925)
O. howardii (Baker, 1895)
O. leucopus (Baker, 1904)
O. neotomae Auguston, 1943
O. nepos (Rothschild, 1905)
O. sexdentatus agilis (Rothschild, 1905)
O. sexdentatus nevadensis (Jordan, 1929)

12. *Oropsylla*
O. idahoensis (Baker, 1904)

13. *Thrassis*
T. acamantis medius Stark, 1970
T. acamantis utahensis (Wagner, 1936)
T. aridis campestris Prince, 1944
T. aridis hoffmani (Hubbard, 1949)
T. arizonensis (Baker, 1898)
T. bacchi bacchi (Rothschild, 1905)
T. bacchi caducus (Jordan, 1930)
T. bacchi consimilis Stark, 1957
T. bacchi gladiolis (Jordan, 1925)
T. francisi barnesi (Stark, 1970)
T. francisi francisi (C. Fox, 1927)
T. pandorae pandorae Jellison, 1937
T. stanfordi (Wagner, 1936)

C. *Hystrichopsyllidae*

1. *Anomiopsyllus*
A. amphibolus Wagner, 1936
A. nudatus (Baker, 1898)

2. *Atyphloceras*
A. echis echis Jordan and Rothschild, 1915
A. multidentatus multidentatus (C. Fox, 1909)

3. *Callistopsyllus*
C. terinus (Rothschild, 1905)

4. *Catallagia*
C. decipiens Rothschild, 1915
C. newcyi Holland and Loshbaugh, 1958

5. *Carteretta*
C. carteri clavata Good, 1942

6. *Conorhinopsylla*
C. standfordi Stewart, 1930

7. *Corrodopsylla*
C. curvata curvata (Rothschild, 1915)
C. curvata obtusata (Wagner, 1929)

8. *Ctenophthalmus*
C. pseudagyrtes pseudagyrtes (Baker, 1904)

9. *Delotelis*
D. telogoni Rothschild, 1905

10. *Epitedia*
E. scapani (Wagner, 1936)
E. stanfordi Traub, 1944
E. testor (Rothschild, 1915)
E. wenmanni wenmanni (Rothschild, 1904)

11. *Hystrichopsylla*
H. dippiei truncata Holland, 1957
H. linsdalei Holland, 1957

12. *Jordanopsylla*
J. allredi Traub and Tipton, 1951

13. *Megarthroglossus*
M. becki Tipton and Allred, 1951
M. divisus divisus (Baker, 1898)
M. procus Jordan and Rothschild, 1915
M. smiti Mendez, 1956

14. *Meringis*
M. dipodomys Kohls, 1938
M. hubbardi Kohls, 1938
M. jamesoni Hubbard, 1943
M. jewetti Hubbard, 1940
M. parkeri (Jordan, 1937)

15. *Nearctopsylla*
N. brooksi (Rothschild, 1904)
N. hyrtaci (Rothschild, 1904)

16. *Neopsylla*
N. inopina Rothschild, 1915

17. *Phalacropsylla*
P. allos Wagner, 1936

18. *Rhadinopsylla*
R. heiseri (McCoy, 1911)
R. sectilis goodi (Hubbard, 1941)
R. sectilis sectilis (Jordan and Rothschild, 1923)
R. fraterna (Baker, 1895)

19. *Stenistomera*
S. alpina (Baker, 1895)
S. hubbardi Egoscue, 1968
S. macrodactyla (Good, 1942)

D. Ischnopsyllidae

1. *Myodopsylla*
M. gentilis (Jordan and Rothschild, 1921)

2. *Sternopsylla*
S. distincta texana (C. Fox, 1914)

E. Leptosyllidae

1. *Ctenophyllus*
C. armatus terribilis (Rothschild, 1903)

2. *Odontopsyllus*
O. dentatus (Baker, 1904)

3. *Ornithophaga*
O. nearctica Holland and Loshbaugh, 1958

4. *Peromyscopsylla*
P. hamifer vigens (Jordan, 1937)
P. hesperomys adelpha (Rothschild, 1915)
P. hesperomys ravalliensis (Dunn, 1923)
P. selenis (Rothschild, 1906)

F. Pulicidae

1. *Cediopsylla*
C. inaequalis inaequalis (Baker, 1895)
C. interrupta Jordan, 1925

2. *Ctenocephalides*
   C. felis felis (Bouche, 1835)
3. *Echidnophaga*
   E. gallinacea (Westwood, 1875)
4. *Hoplopsyllus*
   H. (Euhoplopsyllus) glacialis affinis (Baker, 1895)
   H. (Hoplopsyllus) anomalus (Baker, 1904)
5. *Pulex*
   P. irritans Linnaeus, 1758
6. *Xenopsylla*
   X. cheopis (Rothschild, 1903)

G. Vermipsyllidae
   Chaetopsylla
   C. stewarti Johnson, 1955

BIBLIOGRAPHY

ACARINA

Allred, D. M. 1954a. Mites found on mice of the genus *Peromyscus* in Utah. Unpub. dissertation, Univ. of Utah, Salt Lake City, Utah. 163 p. + maps, graphs, and illustrations.

Allred, D. M. 1954b. Mites as intermediate hosts of tapeworms. Proc. Utah Acad. Sci., Arts and Letters 31:44-51.

Allred, D. M. 1954c. Observations on the stylosome (feeding tube) of some Utah chiggers. Proc. Utah Acad. Sci., Arts and Letters 32:61-63.

Allred, D. M. 1954d. Mites found on mice of the genus *Peromyscus* in Utah. I. General infestation. Great Basin Nat. 16:23-31.

Allred, D. M. 1957a. Notes on the life history and bionomics of the wood rat mite, *Brevisterna utahensis* (Acarina). Trans. Amer. Micro. Soc. 76:72-78.

Allred, D. M. 1957b. Mites found on mice of the genus *Peromyscus* in Utah. II. Family Haemogamasidae. Proc. Entomol. Soc. Wash. 59(1):31-39.

Allred, D. M. 1957c. Mites found on mice of the genus *Peromyscus* in Utah. III. Family Dermanyssidae. Amer. Midland Nat. 57:450-460.

Allred, D. M. 1957d. Mites found on mice of the genus *Peromyscus* in Utah. V. Trombiculidae and miscellaneous families. Great Basin Nat. 17:95-102.

Allred, D. M. 1957e. The male, deutonymph, and protonymph of the mite *Eubrachylaelaps circularis* (Ewing) (Acarina: Laelaptidae) with notes on morphological variations. Ann. Entomol. Soc. Amer. 50:206-209.

Allred, D. M. 1957f. A new species of mite, *Hirstionyssus bisetosus*, from the nests of the desert wood rat, *Neotoma lepida lepida* Thomas. Proc. Entomol. Soc. Wash. 59:83-89.

Allred, D. M. 1957g. Setal variations on mites of the species *Brevisterna utahensis* (Ewing) (Acarina). Proc. Utah Acad. Sci., Arts and Letters 34: 51-54.

Allred, D. M. 1958. Mites found on mice of the genus *Peromyscus* in Utah. IV. Families Laelaptidae and Phytoseiidae. Pan-Pacific Entomol. 34: 17-32.

Allred, D. M. 1961. Parasitic mites on marmots in Utah. J. Parasitol. 47:124.

Allred, D. M. 1965. Clarification of the type data for *Ischyropoda furmani* Keegan. J. Parasitol. 51: 604.

Allred, D. M. 1966. Unusual records of mites in Utah. Great Basin Nat. 26:34.

Allred, D. M., and D E. Beck. 1953a. Mite fauna of wood rat nests in Utah. Proc. Utah Acad. Sci., Arts and Letters 30:53-56.

Allred, D. M., and D E. Beck. 1953b. A new species of *Acomatacarus* (Acarina, Trombiculidae) from Utah. Great Basin Nat. 13(3-4):87-90.

Allred, D. M., and D E. Beck. 1966. Mites of Utah mammals. Brigham Young Univ. Sci. Bull., Biol. Series 8(1):1-123.

Allred, D. M., and N. J. Marchett. 1957. Experimental feeding of the mite, *Brevisterna utahensis* (Acarina: Haemogamasidae). J. Parasitol. 43:51-54.

Allred, D. M., and E. J. Roscoe. 1956. Life history of the tick *Dermacentor parumapertus* in Utah. J. Parasitol. 42:516-522.

Allred, D. M., and E. J. Roscoe. 1957. Parasitic mites in desert wood rat nests, with notes on free living forms. Trans. Amer. Micro. Soc. 76:389-403.

Allred, D. M., D E. Beck, and L. D. White. 1960. Ticks of the genus *Ixodes* in Utah. Brigham Young Univ. Sci. Bull., Biol. Series 1(4):1-42.

Ash, D. B. 1963. A seasonal study of mites on deer mice (*Peromyscus maniculatus*) in a chaparral community. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 33 p.

Bacha, W. J., Jr. 1957. The life history of *Otobius lagophilus*. J. Parasitol. 43:560-565.

Beck, D E. 1955. Some unusual distributional records of ticks in Utah. J. Parasitol. 41:198-201.

Beck, D E., and D. M. Allred. 1955. Seasonal study of the tick *Ornithodoros hermsi*, found in the nest of the desert wood rat, *Neotoma lepida lepida* in Utah. Proc. Utah Acad. Sci., Arts and Letters (1954-1955), 32:131-135.

Bishopp, F. C. 1911. The distribution of the Rocky Mountain spotted fever tick. U. S. Dept. Agr. Bur. Ent. Circ. 136. 4 p.

Bishopp, F. C., and H. L. Trembly. 1945. Distribution and hosts of certain North American ticks. J. Parasitol. 31(1):1-54.

Brennan, J. M., and D E. Beck. 1955. The chiggers of Utah (Acarina: Trombiculidae). Great Basin Nat. 15(1-4):1-21.

Brinton, E. P. 1965. Identification of the adults, nymphs, and larvae of ticks of the genus *Dermacentor* Koch (Ixodidae) in the western United States. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 63 p.

Brinton, E. P., and D E. Beck. 1963a. Hard-bodied ticks of the western United States. Brigham Young Univ. Sci. Bull. Biol. Series 2(3) part 1:1-28.

Brinton, E. P., and D E. Beck. 1963b. Hard-bodied ticks of the western United States. Brigham Young Univ. Sci. Bull., Biol. Series 2(3) parts 2 and 3:1-21.

Brinton, E. P., and G. M. Kohls. 1963. New distributional and host data for the tick *Dermacentor hunteri* Bishopp. Great Basin Nat. 23:166.

BRINTON, E. P., D E. BECK, AND D. M. ALLRED. 1965. Identification of the adults, nymphs, and larvae of the genus *Dermacentor* Koch (Ixodidae) in the western United States. Brigham Young Univ. Sci. Bull., Biol. Series 5(4):1-44.

BROWN, J. H. 1945. The rabbit tick, *Haemaphysalis leporis-palustris* Packard, as an ectoparasite of man. Can. Entomol. 77:176.

COOLEY, R. A. 1938. The genera *Dermacentor* and *Octocentor* (Ixodidae) in the United States with studies in variation. Nat. Inst. Health Bull. 171. 89 p.

COOLEY, R. A. 1945. The genera *Boophilus, Rhipicephalis,* and *Haemaphysalis* (Ixodidae) of the New World. Nat. Inst. Health Bull. 187. 54 p.

COOLEY, R. A., and G. M. KOHLS. 1944. The Argasidae of North America, Central America, and Cuba. Amer. Mid. Nat. Mono. 1. 151 p.

COOLEY, R. A., AND G. M. KOHLS. 1945. The genus *Ixodes* in North America. Nat. Inst. Health Bull. 184. 246 p.

DAVIS, G. E. 1939. *Ornithodoros parkerii* Distribution and host data: spontaneous infection with relapsing fever spirochetes. Public Health Rpts. 54:345-349.

DESPAIN, W. J. 1968. Elevational occurrence of the ticks *Dermacentor andersoni* and *Dermacentor parumapertus* in Utah County, Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 36 p.

EDMUNDS, L. R. 1951. A checklist of the ticks of Utah. Pan-Pacific Entomol. 27:23-26.

ELZINGA, R. J., AND D. M. REES. 1964. Ability of immature ticks of *Ixodes kingi* and *Dermacentor parumapertus* to survive low temperatures. Proc. Utah Acad. Sci., Arts and Letters 41:213-216.

FREMLING, C., AND A. GASTFRIEND. 1955. Seasonal abundance of the tick *Dermacentor parumapertus.* Ecology 36:162-163.

FURMAN, D. P., AND V. J. TIPTON. 1955. The genus *Myonyssus* Tiraboschi (Acarina: Dermanyssidae) including a new species from pika. J. Parasitol. 41:179-184.

BASTFRIEND, A. 1955. New host records for immature stages of the tick *Dermacentor parumapertus.* J. Parasitol. 41:63-65.

HERRIN, C. S. 1970. A systematic revision of the genus *Hirstionyssus* (Acari: Mesostigmata) of the Nearctic region. J. Med. Entomol. 7:391-437.

HERRIN, C. S., AND D E. BECK. 1965. Observations on the biology, anatomy, and morphology of *Otobius lagophilus* Cooley and Kohls. Brigham Young Univ. Sci. Bull., Biol. Series 6(2):1-19.

HIGGANS, H. G., AND T. A. WOOLEY. 1962. A new species of *Passolozetes* from Utah with notes on the genus (Acarina: Oribatidei). Great Basin Nat. 22:93-96.

HOOKER, W. A. 1909. Geographical distribution of American ticks. J. Econ. Entomol. 2:403-428.

HOWELL, J. F., D. M. ALLRED, AND D E. BECK. 1957 Seasonal population fluctuations of mites in desert wood rat nests in central Utah. Ecology 38:82-88.

HOWELL, J. F., AND R. J. ELZINGA. 1962. A new *Radfordia* (Acarina: Myobiidae) from the kangaroo rat and a key to the known species. Ann. Entomol. Soc. Amer. 55:547-555.

JOHNSON, E. D. 1966. Ticks of the Dugway Proving Grounds and vicinity and their host associations. Proc. Utah Acad. Sci., Arts and Letters 43:49-66.

JORGENSEN, C. D. 1957a. Oviposition habits of the tick *Dermacentor parumapertus* Neumann and factors influencing egg development. Great Basin Nat. 17:42-51.

JORGENSEN, C. D. 1957b. The Ord kangaroo rat and its physical resistance to the tick *Dermacentor parumapertus* Neumann. Proc. Utah Acad. Sci., Arts and Letters 34:183-184 (Abstract).

KEEGAN, H. L. 1953. Collections of parasitic mites from Utah. Great Basin Nat. 13:35-42.

KOHLS, G. M. 1952. A record of the occurrence of the tick *Ixodes muris* Bishopp and Smith on muskrats in Utah. Great Basin Nat. 12:65-66.

KOHLS, G. M., AND C. M. CLIFFORD. 1963. *Ornithodoros sparnus* n. sp., a parasite of wood rats, *Neotoma* spp. and deer mice, *Peromyscus* spp. in Utah and Arizona (Acarina: Argasidae). J. Parasitol. 49:857-861.

KOHLS, G. M., AND C. M. CLIFFORD. 1968. The subgenus *Persicargas* (Ixodoidea, Argasidae, *Argas*). 6. *A. (P.) giganteus,* n. sp., from wild birds in western United States and Sonora, Mexico. Ann. Entomol. Soc. Amer. 61:1113-1116.

KOHLS, G. M., AND H. HOOGSTRAAL. 1960. Observations on the subgenus *Argas* (Ixodoidea, Argasidae, *Argas*). 2. *A. cooleyi,* new species, from western North American birds. Ann. Entomol. Soc. Amer. 53:625-631.

KOHLS, G. M., AND R. R. PARKER. 1948. Occurrence of the brown dog tick in the western states. J. Econ. Entomol. 41:102.

KOHLS, G. M., H. HOOGSTRAAL, C. M. CLIFFORD, AND M. N. KAISER. 1970. The subgenus *Persicargas* (Ixodoidea, Argasidae, *Argas*). 9. Redescription and new world records of *Argas (P.) persicus* (Oken), and resurrection, redescription, and records of *A. (P.) radiatus* Railliet, *A. (P.) sanchezi* Duges, and *A. (P.) miniatus* Koch, new world ticks misidentified as *A. (P.) persicus.* Ann. Entomol. Soc. Amer. 63:590-606.

MERINO, J. M. 1967. Ticks of the genus *Haemaphysalis* in the western U. S. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 116 p.

PARKER, R. R., C. B. PHILIP, G. E. DAVIS, AND R. A. COOLEY. 1937. Ticks of the United States in relation to disease in man. J. Econ. Entomol. 30: 51-69.

RADOVSKY, F. J. 1967. The Macronyssidae and Laelapidae (Acarina: Mesostigmata) parasitic on bats. Univ. Calif., Pub. Entomol. 46:1-288. 48 pls.

ROBERTSON, R. G. 1961. A morphological study of some larval ticks of the genus *Dermacentor* with emphasis on structures of possible taxonomic importance. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 30 p.

ROSASCO, M. E. 1957. Seasonal abundance of the tick, *Dermacentor parumapertus,* on black-tailed jackrabbit, with notes on other ectoparasites. J. Mammal. 38:485-490.

TALLEY, G. M. 1957. The incidence of nasal mites in over-wintering red-wing blackbirds in the vicinity of Utah Lake, Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 13 p.

WHITE, L. D. 1959. Identification of larval ticks of the genus *Ixodes* known to occur in Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 64 p.

ANOPLURA

BELL, I. L. 1950. A study of sucking lice (Anoplura) on rodents in Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 55 p.

Emerson, K. C. 1970. Personal communication.
Ignoffo, C. M. 1956. Notes on louse-host associations of the Great Salt Lake Desert with keys to the lice. Great Basin Nat. 16(1-4):9-17.
Ignoffo, C. M. 1957. New records of mammal-lice associations. Entomol. News 68:162.
Johnson, P. T. 1971. Personal communication.

ARANEIDA

Chamberlin, R. V. 1928. Notes on spiders from the La Sal Mountains of Utah. Can. Entomol. 60: 93-95.
Chamberlin, R. V., and W. Ivie. 1933. Spiders of the Raft River Mountains of Utah. Bull. Univ. Utah 23(4):1-53.
Chamberlin, R. V., and W. Ivie. 1935. The black widow spider and its varieties in the United States. Bull. Univ. Utah Biol. Ser. 3(1):1-29.
Gertsch, W. J. 1958. The spider genus *Loxosceles* in North America, Central America, and the West Indies. Amer. Mus. Nov. 1977:1-46.
Gertsch, W. J. 1970. Personal communication.
Lafferty, K. M. 1949. A preliminary study of the spiders of Red Butte Canyon. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 152 p.
Levi, H. W. 1959. The spider genus *Latrodectus* (Araneae: Thaeridiidae). Trans. Amer. Micro. Soc. 78:7-43.
Levi, H. W., and A. Spielman. 1964. The biology and control of the South American brown spider, *Loxosceles laeta* (Nicolet), in a North American focus. Amer. J. Trop. Med. Hyg. 13:132-136.

COLEOPTERA

Arnet, R. H., Jr. 1960. The beetles of the United States. Cath. Univ. Press, Washington, D. C. 1112 p.
Gould, D. J., and R. S. Beal, Jr. 1952. New records of *Leptinus testaceus* from North America. Pan-Pacific Entomol. 28:193.
Parks, J. J., and J. W. Barnes. 1955. Notes on the family Leptinidae including a new record of *Leptinillus validus* (Horn) in North America (Coleoptera). Ann. Entomol. Soc. Amer. 48:417-421.
Selander, R. B. 1951. The blister beetles (Meloidae) of Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 140 p.
Selander, R. B. 1970. Personal communication.
Werner, F. G., and R. L. Edwards. 1948. *Leptinus americanus* Lec. taken on a shrew (Coleoptera-Leptinidae), Psyche 55 (2):51-54.
Werner, F. G., W. R. Enns, and F. H. Parker. 1966. The Meloidae of Arizona. Univ. of Arizona Agr. Expt. Sta. Tech. Bull. 175. 96 p.
Wood, D. M. 1965. Studies on the beetles *Leptinillus validus* (Horn) and *Platypsyllus castoris* Ritsema from beaver. Proc. Entomol. Soc. Ontario 95:33-63.

DIPTERA

Aldrich, J. M. 1905. A catalogue of North American Diptera. Smithsonian Misc. Collection 46:195-209.
Arnell, J. H. 1968. The taxonomy, distribution, and biology of the *Aedes varipalpis* mosquito complex in Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 73 p.
Arnell, J. H., and L. T. Nielsen. 1967. Notes on the distribution and biology of tree hole mosquitoes in Utah. Proc. Utah Mosq. Abate. Assoc. 20:28-29.
Arnold, F. D. 1966. An evaluation of the housefly problem in the major populated counties in Utah. Unpub. Ph.D. dissertation, Univ. of Utah, Salt Lake City, Utah. 81 p.
Baird, C. R. 1970. Laboratory studies of two species of jackrabbit bot flies. Unpub. master's thesis, Utah State Univ., Logan, Utah. 40 p.
Baird, C. R., and K. J. Capelle. 1969. Successful laboratory mating of two species of jackrabbit bot flies. J. Med. Entomol. 6:196.
Beadle, L. D. 1955. Man-biting habits of *Culex* tarsalis and associated mosquitoes in northern Utah. Proc. Utah Mosq. Abate. Assoc. 8:3.
Beadle, L. D. 1959. Field observations on the biting habits of *Culex tarsalis* at Mitchell, Nebraska, and Logan, Utah. Amer. J. Trop. Med. Hyg. 8:134-140.
Beck, D E. 1960. Mosquito survey of central Utah Valley, Utah. Proc. Utah Mosq. Abate. Assoc. 13: 18-23.
Beck, D E. 1961. Central Utah County, Utah, mosquito survey studies. Mosq. News 21:6-11.
Bennett, G. F., and C. W. Sabrosky. 1962. The Nearctic species of the genus *Cephenemyia* (Diptera, Oestridae). Can. Zool. 40:431-448.
Bequaert, J. C. 1954-1957. The Hippoboscidae or louse-flies (Diptera) of mammals and birds. Part II. Taxonomy, evolution and revision of American genera and species. Entomol. Amer. 24-26:1-611.
Bullock, H. R. 1952. Culicoid gnats of Salt Lake County. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 69 p.
Capelle, K. J. 1968. Seasonal incidence and species composition of blowflies at Bear River, Utah, 1963-1965. Paper presented at Entomol. Soc. Amer. Meetings, Dallas, Texas, Dec. 2, 1968. Unpublished.
Capelle, K. J. 1970. Studies on the life history and development of *Cuterebra polita* (Diptera: Cuterbridae) in four species of rodents. J. Med. Entomol. 7:320-327.
Capelle, K. J. 1970. Personal communication.
Carpenter, M. J. 1965. A study of ovarian cycles and longevity in univoltine and multivoltine species of Rocky Mountain *Aedes* mosquitoes. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 53 p.
Collett, G. C., and D. M. Rees. 1957. A comparison of mosquito collections made with portable (CO_2) bait traps and New Jersey type light traps. Proc. Utah Mosq. Abate. Assoc. 10:6-7.
Collett, G. C., and D. M. Rees. 1959. Mosquito abatement programs in Utah in 1958. Proc. 46th Ann. Meeting New Jersey Mosq. Exterm. Assoc. p. 61-63.
Collett, G. C., and D. M. Rees. 1961. Recent changes in *Aedes nigromaculis* (Ludlow) populations in the Salt Lake City Mosquito Abatement District. Proc. and Papers 29th Ann. Conf. Calif. Mosq. Control Assoc. p. 115.
Defoliart, G. R., and B. V. Peterson. 1960. New North American Simuliidae of the genus *Cnephia* Enderlein (Diptera), Ann. Entomol. Soc. Amer. 53:213-219.
Elbel, R. E., G. T. Crane, L. E. Stipe, G. B. Van Nosdol, and K. L. Smart. 1969. Mosquitoes and arboviruses from Callo, Utah, for the years 1966 and 1967 (Abstract). Proc. Utah Mosq. Abate. Assoc. 22:39.

GRAHAM, C. L. 1962. *Cuterbra* of Utah and neighboring states. Unpub. master's thesis, Utah State Univ., Logan, Utah. 35 p.

GRAHAM, C. L. 1964. Biological studies of three species of *Cutebra* from northern Utah. Unpub. Ph.D. dissertation, Utah State Univ., Logan, Utah. 82 p.

GRAHAM, J. E. 1950. A preliminary study of the gnats or midges of the tribe Tendipedini in northern Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 48 p.

GRAHAM, J. E. 1957. The need for a professional basis for pest control work in Utah. Proc. Utah Acad. Sci., Arts and Letters 34:31-33.

GRAHAM, J. E., AND D. M. REES. 1955. Granular insecticide carriers used in Utah in Mosquito abatement operations. Proc. and Papers 23rd Ann. Conf. Calif. Mosq. Control Assoc. p. 106-108.

GRAHAM, J. E., AND D. M. REES. 1956. Progress report on the field testing in Utah of some organic phosphorus insecticides for mosquito control. Proc. Utah Mosq. Abate. Assoc. 9:23-25.

GRAHAM, J. E., AND D. M. REES. 1958. Chemical control of mosquitoes in Utah. Proc. and Papers 26th Ann. Conf. Calif. Mosq. Control Assoc. p. 16-19.

GRAHAM, J. E., D. M. REES, AND G. F. EDMUNDS. 1953. A season of mosquito control with heptachlor. Proc. and Papers 22nd Ann. Conf. Calif. Mosq. Control Assoc. p. 21.

GRAHAM, J. E., D. M. REES, AND L. T. NIELSEN. 1958. Trends in mosquito populations in Salt Lake County. Mosq. News 18:98-100.

GRAHAM, J. E., AND I. E. BRADLEY. 1962a. The effects of species on density of mosquito larval populations in Salt Lake County Utah. Mosq. News 22:239-247.

GRAHAM, J. E. AND I. E. BRADLEY. 1962b. An evaluation of some techniques used to measure mosquito populations. Utah Acad. Sci., Arts and Letters 39:77-83.

GRUNDMANN, A. W. 1949. Mosquitoes as pests and vectors of disease in Utah. Proc. Utah Mosq. Abate. Assoc. 2:58-63.

GRUNDMANN, A. W., AND J. M. BUTLER. 1953. Dipterous larvae infesting the intestinal tract of the coyote, *Canis latrans* Say 1823. J. Kansas Entomol. Soc. 26:129-131.

GRUNDMANN, A. W., AND J. R. CROOK. 1959. Endoparasites of rodents found in Glen Canyon. Univ. Utah Anthropol. Papers No. 40:105-106.

HARMSTRON, F. C., AND A. D. HESS. 1964. Mosquitoes as actual and potential vectors of disease as now known for Utah. Proc. Utah Mosq. Abate. Assoc. 17:25-27.

HOPLA, C. E. 1947. A taxonomic study of the adult mosquitoes of Utah County, with notes on the biology and distribution of the more common species. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 97 p.

IGNOFFO, C. M. 1961. Biology of *Cuterebra jellisoni* on *Lepus californicus deserticola*. Ann. Entomol. Soc. Amer. 54:509-512.

JAMES, M. T. 1948. The flies that cause myiasis in man. U. S. Dept. Agr. Publ. 631. 175 p. (1947).

JORLING, B. 1938. A revision of the genus *Trichobius* Diptera, Acalypterae, Streblidae). Parasitology 30:358-587.

JONES, D. T. 1941-1943. Utah house flies. Proc. Utah Acad. Sci., Arts and Letters 18-20:105-108.

KNOWLTON, G. F. 1931. Notes on Utah Diptera. Can. Entomol. 63:152-157.

KNOWLTON, G. F. 1936. Some Utah flesh flies. Proc. Utah Acad. Sci., Arts and Letters 13:237-239.

KNOWLTON, G. F., AND L. E. FRONK. 1950. Some blood-sucking Diptera of Utah. Utah Agr. Expt. Sta. Mimeo. Ser. 369.

KNOWLTON, G. F., AND F. C. HARMSTON. 1937. Utah Diptera. Proc. Utah Acad. Sci., Arts and Letters 14:141-149.

KNOWLTON, G. F., AND D. E. MADSEN. 1935a. The sheep "tick." Utah Agr. Expt. Sta. Leaflet 67.

KNOWLTON, G. F., AND D. E. MADSEN. 1935b. Mosquitoes annoy sheep. J. Econ. Entomol. 28:934-935.

KNOWLTON, G. F., AND D. R. MADDOCK. 1944. Snipe flies in Utah. J. Econ. Entomol. 37:119.

KNOWLTON, G. F., AND J. A. ROWE. 1934. New blood-sucking flies from Utah (Simuliidae, Diptera). Ann. Entomol. Soc. Amer. 27:580-584.

KNOWLTON, G. F., AND T. O. THATCHER. 1934. Utah horseflies. Proc. Utah Acad. Sci., Arts and Letters 11:291-294.

KNOWLTON, G. F., F. C. HARMISTON, AND D. E. HARDING. 1938. Blood-sucking Utah Diptera. Proc. Utah Acad. Sci., Arts and Letters, 15:103-105.

KNOWLTON, G. F., F. C. HARMISTON, AND G. S. STAINS. 1939. Insects of Utah, Diptera. Utah Agr. Expt. Sta. Mono. Ser. 200 (Tech) part 5. 22 p.

KNOWLTON, G. F., M. J. JANES, AND W. L. THOMAS. 1933. Some Utah Diptera. Proc. Utah Acad. Sci., Arts and Letters 10:155-157.

KNUDSEN, A. B., AND D. M. REES. 1967. The emergence of *Chrysops discalis* Williston on the shore of the Great Salt Lake, Utah. Proc. Utah Mosq. Abate. Assoc. 20:29-33.

LEWIS, W. 1949. The taxonomy and notes on bionomics and control of the Tabanidae of Salt Lake County, Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 81 p.

LINAM, J. H. 1961. A mosquito survey of Skull Valley, Tooele County, Utah. Proc. Utah Mosq. Abate. Assoc. 14:26-27.

LINAM, J. H., AND L. T. NIELSEN. 1962. Notes on the taxonomic separation of adult females of *Culex pipiens* L. and *Culex quinquefasciatus* Say. Mosq. News 22:290-293.

LINAM, J. H., AND L. T. NIELSEN. 1963a. Utah mosquitoes—their published history. Proc. Utah Mosq. Abate. Assoc. 16:16-23.

LINAM, J. H., AND L. T. NIELSEN. 1963b. Notes on the identification of some western *Culex* larvae. Proc. 50th Ann. Meeting New Jersey Mosq. Exterm. Assoc. p. 411-415.

LINAM, J. H., AND L. T. NIELSEN. 1964. Utah mosquitoes—their published history. Supplement 1. Proc. Utah Mosq. Abate. Assoc. 17:22-23.

LINAM, J. H., AND L. T. NIELSEN. 1966. Notes on the distribution, ecology, and overwintering habits of *Culex pipiens* Adams in Utah. Proc. Entomol. Soc. Wash. 68(2):136-138.

MARLOR, R. L., AND D. M. REES. 1957. The influence of climatological factors on the biting activities of the mosquito *Aedes dorsalis* (Meigen). Proc. Utah Mosq. Abate. Assoc. 10:19-22.

MUKHERJEE, A. B. 1964. A comparative study of the karyotypes of four genera and nineteen species of mosquitoes present in Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 52 p.

Neilsen, L. T. 1957. Notes on the flight ranges of Rocky Mountain mosquitoes of the genus *Aedes*. Proc. Utah Acad. Sci., Arts and Letters 34:27-29.

Nielsen, L. T. 1958. Control of snow mosquitoes in the mountains of Utah. Proc. Utah Mosq. Abate. Assoc. 11:33-34.

Nielsen, L. T. 1959a. The mosquitoes of Utah—a revised list. Mosq. News 19:45-47.

Nielsen, L. T. 1959b. Seasonal distribution and longevity of Rocky Mountain snow mosquitoes of the genus *Aedes*. Proc. Utah Acad. Sci., Arts and Letters 36:83-87.

Neilsen L. T. 1962. The Utah Mosquito Abatement Association—a brief history of mosquito control in Utah. Proc. Utah Mosq. Abate. Assoc. 15: 12-15.

Nielsen, L. T. 1968. A current list of mosquitoes known to occur in Utah with report of new records. Proc. Utah Mosq. Abate. Assoc. 21:34-37.

Nielsen, L. T., and J. H. Linam. 1963. New distributional records of the mosquitoes of Utah. Proc. Utah Acad. Sci., Arts and Letters 40:193-196.

Nielsen, L. T., and J. H. Linam. 1964. Additional distribution records for Utah mosquitoes with notes on biology. Proc. Utah Mosq. Abate. Assoc. 17:29-31.

Nielsen, L. T., and J. H. Linam. 1966. Utah mosquitoes—their published history: Supplement II. Proc. Utah Mosq. Abate. Assoc. 19:21-23.

Nielsen, L. T., and D. M. Rees. 1961. An identification guide to the mosquitoes of Utah. Bull. Univ. Utah Biol. Series 12(3):1-58.

Nielsen, L. T., J. H. Arnell, and J. H. Linam. 1967. A report on the distribution and biology of treehole mosquitoes in the western United States. Proc. 35th Ann. Conf. Calif. Mosq. Cont. Assoc., Inc., and Amer. Mosq. Cont. Assoc. p. 72-76.

Nielsen, L. T., J. H. Linam, and D. M. Rees. 1963. New distributional records for mosquitoes in the Rocky Mountain States. Proc. 50th Ann. Meeting New Jersey Mosq. Extern. Assoc. p. 424-428.

Nielsen, L. T., J. H. Linam, J. H. Arnell, and T. J. Zavortink. 1968. Distributional and biological notes on the treehole mosquitoes of the western United States. Mosq. News 28:361-365.

Ogden, L. J., and J. W. Kilpatrick. 1958. Control of *Fannia canicularis* (L.) in Utah dairy barns. J. Econ. Ent. 51:611-612.

Peterson, B. V. 1953. The black flies (Diptera: Simuliidae) in the canyons in the vicinity of Salt Lake City with notes on their biology. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 67 p.

Peterson, B. V. 1955. A preliminary list of the black flies (Diptera: Simuliidae) of Utah. Proc. Utah Acad. Sci., Arts and Letters 32:113-115.

Peterson, B. V. 1956. Observations on the biology of Utah black flies (Diptera: Simuliidae). Can. Entomol. 88:496-507.

Peterson, B. V. 1958a. The taxonomy and biology of Utah species of black flies (Diptera: Simuliidae). Unpub. Ph.D. dissertation, Univ. of Utah, Salt Lake City, Utah. 336 p.

Peterson, B. V. 1958b. A redescription of the female and first description of the male, pupa, and larva of *Prosimulium flaviantennus* (S. and K.) with notes on the biology and distribution. Can. Entomol. 90:469-473.

Peterson, B. V. 1959a. New distributional and host records for bat flies and a key to the North American species of *Basilia* Ribeiro (Diptera: Nycteribiidae). Proc. Entomol. Soc. Ontario 90:30-37.

Peterson, B. V. 1959b. Three new black fly records from Utah (Diptera: Simuliidae). Proc. Entomol. Soc. Wash. 61:21.

Peterson, B. V. 1959c. Notes on the biology of some species of Utah black flies (Diptera: Simuliidae). Mosq. News 19:86-90.

Peterson, B. V. 1959d. Observations on mating, feeding, and oviposition of some Utah species of black flies (Diptera: Simuliidae). Can. Entomol. 91:147-155.

Peterson, B. V. 1960a. Notes on some natural enemies of Utah black flies (Diptera: Simuliidae). Can. Entomol. 92:266-274.

Peterson, B. V. 1960b. The Simuliidae (Diptera) of Utah, Part I. Keys, original citations, types and distribution. Great Basin Nat. 20:81-104.

Peterson, B. V. 1970a. The *Prosimulium* of Canada and Alaska (Diptera: Simuliidae). Mem. Entomol. Soc. Can. No. 69:1-216.

Peterson, B. V. 1970b. The identities of three closely related western species of *Prosimulium* (Diptera: Simuliidae). Can. Entomol. 102:118-128.

Peterson, B. V., and G. R. Defoliart. 1960. Four new species of *Prosimulium* (Diptera: Simuliidae) from western United States. Can. Entomol. 92: 85-102.

Rees, D. M. 1934a. Mosquito records from Utah. Pan-Pacific Entomol. 10:161-165.

Rees, D. M. 1934b. Notes on mosquito fish in Utah, *Gambusia affinis* (Baird and Girard). Copeia 1934 (4):157-159.

Rees, D. M. 1935. Observations on a mosquito flight in Salt Lake City. Bull. Univ. Utah 25(5), Biol. Series 2(6):106.

Rees, D. M. 1939a. Origin of mosquito producing waters in the vicinity of Salt Lake City, Utah. Bull. Univ. Utah 29(5), Biol. Series 3(9):1-13.

Rees, D. M. 1939b. Progress in mosquito control in the vicinity of Salt Lake City. Proc. 26th Ann. Meeting New Jersey Mosq. Extern. Assoc. 155-160.

Rees, D. M. 1942a. The mosquitoes of Utah. Bull. Univ. Utah Biol. Series 33(7):1-99.

Rees, D. M. 1942b. Supplementary list of mosquitoes from Utah. Pan-Pacific Entomol. 18:77-82.

Rees D. M. 1944. A new mosquito record from Utah (Diptera: Culicidae). Pan-Pacific Entomol. 20:19.

Rees, D. M. 1945a. The utilization of fish by a mosquito abatement district; their effectiveness and limitation. Proc. 32nd Ann. Meeting New Jersey Mosq. Extern. Assoc. p. 211-216.

Rees, D. M. 1945b. Supplemental notes on mosquito fish in Utah, *Gambusia affinis* (Baird and Girard). Copeia 1945(4):236.

Rees, D. M. 1949. Advances in mosquito work in Utah in 1948. Proc. 36th Ann. Meeting New Jersey Mosq. Extern. Assoc. p. 58-59.

Rees, D. M. 1952. The effectiveness of mosquito control in Salt Lake City, Utah, as determined by light trap collections. Proc. 39th Ann. Meeting New Jersey Mosq. Extern. Assoc. p. 105-109.

Rees, D. M. 1954. The *Aedes nigromaculis* mosquito situation in Utah. Proc. Utah Mosq. Abate. Assoc. 7:23-24.

Rees, D. M. 1955. Recent advances in mosquito control in the Rocky Mountain region. Proc. and Papers 23rd Ann. Conf. Calif. Mosq. Control Assoc. and 11th Ann. Meeting Amer. Mosq. Control Assoc. p. 6-9.

REES, D. M. 1957. Cooperative measures applied in mosquito abatement in Utah during 1956. Proc. and Papers 25th Ann. Conf. Calif. Mosq. Control Assoc. p. 15-17.

REES, D. M. 1958. Report on the results of control methods applied to biting gnats in the vicinity of Salt Lake City, Utah, (Diptera: Ceratopogonidae). Proc. 10th Intern. Congr. Entomol. 3:741-744.

REES, D. M. 1964. Mosquitoes—importance in Utah. Utah Water News 12(3):14.

REES, D. M., AND F. D. ARNOLD. 1953. An outbreak of blowflies in Salt Lake County in 1962. Proc. Utah Acad. Sci., Arts and Letters 30:60-62.

REES, D. M., AND H. R. BULLOCK. 1954. Culicoid gnats of Salt Lake County, Utah (Diptera: Ceratopogonidae (=Heleidae)). Proc. Utah Acad. Sci., Arts and Letters 31:42-43.

REES, D. M., AND G. C. COLLETT. 1954. The biology of *Aedes niphadopsis* Dyar and Knab (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 56:207-214.

REES, D. M., AND G. C. COLLETT. 1955. An air-propelled boat used in mosquito abatement work in Utah. Mosq. News 15:193-195.

REES, D. M., AND G. C. COLLETT. 1956. Mosquito abatement activities in Utah during 1955. Proc. and Papers 24th Ann. Conf. Calif. Mosq. Control Assoc. p. 6-8.

REES, D. M., AND G. C. COLLETT. 1959. Factors influencing the encephalitis outbreak in Utah in 1958. Proc. and Papers 27th Ann. Conf. Calif. Mosq. Control Assoc. p. 88-97.

REES, D. M., AND J. E. GRAHAM. 1953. 1952 field tests of heptachlor for mosquito control. Proc. and Papers 21st Ann. Conf. Calif. Mosq. Control Assoc. p. 4-6.

REES, D. M., AND F. C. HARMSTON. 1946. Observations on the habits of *Anopheles freeborni* in northern Utah and southern Idaho (Diptera: Culicidae). Mosq. News 6:73-75.

REES, D. M., AND L. T. NIELSEN. 1947. On the biology and control of *Aedes dorsalis* (Meig.) in Utah. Proc. 34th Ann. Meeting New Jersey Mosq. Exterm. Assoc. p. 160-165.

REES, D. M., AND L. T. NIELSEN. 1951. Four new mosquito records from Utah. Pan-Pacific Entomol. 27:11-12.

REES, D. M., AND L. T. NIELSEN. 1955. Additional mosquito records from Utah. Pan-Pacific Entomol. 31:31-33.

REES, D. M., AND K. ONISHI. 1951. Morphology of the terminalia and internal reproductive organs, and copulation in the mosquito, *Culiseta inornata* (Williston) (Diptera: Culicidae). Proc. Entomol. Soc. Wash. 53:233-246.

REES, D. M., AND B. V. PETERSON. 1953. The black flies (Diptera: Simuliidae) in the canyons near Salt Lake City, Utah. Proc. Utah Acad. Sci., Arts and Letters 30:57-59.

REES, D. M., AND J. V. SMITH. 1950. Effective control methods used on biting gnats in Utah during 1949 (Diptera: Ceratopogonidae). Mosq. News 10:9-15.

REES D. M., AND J. V. SMITH. 1952. Control of biting gnats in North Salt Lake City, Utah, (Diptera: Heleidae). Mosq. News 12:49-52.

REES, D. M., G. C. COLLETT, AND R. N. WINGET. 1969. The *Leptoconops* problem in Utah. Proc. Utah Mosq. Abate. Assoc. 22:16-18.

REES, D. M., G. F. EDMUNDS, AND L. T. NIELSEN. 1953. Additional uses of granular larvicides in mosquito abatement. Proc. and Papers 22nd Ann. Conf. Calif. Mosq. Control Assoc. p. 20-21.

RICHARDS, C. S., L. T. NIELSEN, AND D. M. REES. 1956. Mosquito records from the Great Basin and the drainage of the lower Colorado River. Mosq. News 16:10-17.

RICHENS, V. B. 1965. Larvae of bot flies in the northern pocket gopher. J. Mammal. 46:689-690.

ROWE, J. A. 1953. Mosquitoes and health. Proc. Utah Mosq. Abate. Assoc. 6:12-14 (Mimeo).

ROWE, J. A., AND G. F. KNOWLTON. 1935. The genus *Tabanus* in Utah. Can. Entomol. 67:238-244.

ROWE, J. A., AND G. F. KNOWLTON. 1936. Pangoniinae of Utah (Tabanidae: Diptera). Ohio J. Sci. 36:253-259.

SABROSKY, C. W. 1941. The *Hippelates* flies or eye gnats: Preliminary notes. Can. Entomol. 73:23-27.

SEDMAN, Y. S. 1952. The Syrphidae of Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 174 p.

SMITH, J. V. 1950. A study of the control of the gnat, *Leptoconops kerteszi* var. *americanus* Carter in North Salt Lake City, Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 51 p.

STAINS, G. S., AND G. F. KNOWLTON. 1940. Three new western Simuliidae (Diptera). Ann. Entomol. Soc. Amer. 33:77-80.

STAINS, G. S., AND G. F. KNOWLTON. 1943. A taxonomic and distributional study of the Simuliidae of the western United States. Ann. Entomol. Soc. Amer. 36:259-280.

STONE, A., AND B. V. PETERSON. 1958. *Simulium defoliarti*, a new black fly from the western United States (Diptera: Simuliidae). Bull. Brooklyn Entomol. Soc. 53:1-6.

STONE, A., C. W. SABROSKY, W. W. WIRTH, R. H. FOOTE, AND J. R. COULSON. 1965. A catalog of the Diptera of America north of Mexico. U. S. Dept. Agr. Handbook 276. 1696 p.

TAYLOR, S. K. 1959. Bionomics of *Culex tarsalis* Coquillett in Utah County. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 36 p.

TRENT, D. W. 1960. Observations on the hibernation of *Culex tarsalis* Coquillett in Utah Valley. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 30 p.

TWINN, C. R. 1938. Blackflies from Utah and Idaho, with descriptions of new species (Simuliidae, Diptera). Can. Entomol. 70:48-55.

WIRTH, W. W., AND F. S. BLANTON. 1967. The North American *Culicoides* of the *guttipennis* group (Diptera: Ceratopogonidae). Florida Entomol. 50:207-243.

WIRTH, W. W., AND F. S. BLANTON. 1969a. North American *Culicoides* of the *pulicaris* group (Diptera: Ceratopogonidae). Florida Entomol. 52: 207-243.

WIRTH, W. W., AND F. S. BLANTON. 1969b. New species and records of *Culicoides* from western North America. (Diptera: Ceratopogonidae). Proc. Entomol. Soc. Wash. 71:556-567.

HEMIPTERA

KNOWLTON, G. F. 1955. Hemiptera of Utah—records. Utah Agr. Expt. Sta. Mimeo. Series 140.

KNOWLTON, G. F., AND E. J. TAYLOR. 1948. Some predaceous Hemiptera largely from Utah. Proc. Utah Acad. Sci., Arts and Letters 26:135.

Nielsen, G. L. 1955. A study of the families of Utah Hemiptera. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 46 p.

Ryckman, R. E. 1954. *Reduvius senilus* Van Duzee from the lodges of *Neotoma* in San Juan County, Utah. Bull. So. Calif. Acad. Sci. 53(2):88.

Usinger, R. L. 1944. The Triatominae of North and Central America and the West Indies and their public health significance. U. S. Public Health Ser. Public Health Bull. 283. 83 p.

Usinger, R. L. 1966. Monograph of the Cimicidae (Hemiptera-Heteroptera) Thomas Say Foundation Pub. 7. 585 p. + xi.

Wygodzinsky, P., and R. L. Usinger. 1964. The genus *Reduvius* Fabricius in western North America (Reduviidae; Hemiptera, Insecta). Amer. Mus. Nov. 2175:1-15.

HYMENOPTERA

Bohart, R. M. 1966. A review of *Aphilanthops* and related genera. Proc. Entomol. Soc. Wash. 68(2): 158-167.

Bohart, R. M., and A. S. Menke. 1963. A reclassification of the Sphecinae with a revision of the Nearctic species of the tribes Sceliphronini and Sphecini. Univ. Calif. Publ. Entomol. 30(2):91-182.

Buren, W. F. 1968. A review of the species of *Crematogaster*, sensu stricto, in North America (Hymenoptera: Formicidae). J. Georgia Entomol. Soc. 3:91-121.

Cole, A. C. 1942. The ants of Utah. Amer. Midland Nat. 28:358-388.

Cole, A. C. 1968. *Pogonomyrmex* harvester ants, a study of the genus in North America. Univ. Tennessee Press, Knoxville, Tennessee. 222 p.

Evans, H. E., and R. W. Matthews. 1968. North American *Bembix*, a revised key and suggested grouping. Ann. Entomol. Soc. Amer. 61:1284-1299.

Furguson, W. E. 1967. Male sphaerophthalmine mutillid wasps of the Nevada test site. Brigham Young Univ. Sci. Bull. Biol. Series 8(4):1-26.

Hayward, C. L. 1932. The paper wasps of Utah, including a description of a new variety of *Polistes canadensis* L. Proc. Utah Acad. Sci. 9:85-101.

Ingham, C. O. 1959. Ants of the Virgin River Basin, southwestern Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 140 p.

Kliewer, J. W. 1952. Biology and control of paper wasps of Salt Lake City and vicinity. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 36 p.

Knowlton, G. F. 1939. Utah Hymenoptera. Utah Agr. Expt. Sta. Mono. Series 200 (Tech.) part 4. 8 p.

Krombein, K. V. 1967. Hymenoptera of America north of Mexico: Synoptic Catalog. USDA Agr. Mono. 2. Supplement 2. 584 p.

Krombein, K. V., et al. 1958. Hymenoptera of America north of Mexico: Synoptic Catalog. USDA Agr. Mono. 2. Supplement 1. 305 p.

Miller, C. 1961. Taxonomy and distribution of Nearctic *Vespula*. Can. Entomol. Supplement 22. 52 p.

Muesebeck, C. F. W., K. V. Krombein, H. K. Townes, et al. 1951. Hymenoptera of America north of Mexico: Synoptic catalog. USDA Agr. Mono. 2. 1420 p.

Rees, D. M., and A. W. Grundman. 1940. A preliminary list of the ants of Utah. Univ. of Utah Bull. 31:1-11.

Rees, D. M., and J. W. Kliewer. 1953. Notes on the biology and control of wasps in Salt Lake City and vicinity. Proc. Utah Acad. Sci., Arts and Letters 30:114-115.

Schuster, R. M. 1958. A revision of the sphaeropthalmine Mutilidae of America north of Mexico II. Entomol. Amer. 37:1-30.

Scullen, H. 1965. Review of the genus *Cerceris* in America north of Mexico. Proc. U.S. Nat. Mus. 116:333-548.

Scullen, H. 1968. A revision of the genus *Eucerceris* Cresson. Bull. U. S. Nat. Mus. 268:1-97.

LEPIDOPTERA

Knowlton, G. F. 1939. Lepidoptera. Utah Agr. Expt. Sta. Mono. Series 200 (Tech.) part 2. 14 p.

Sugden, J. W. 1937. Notes on the migrational flights of *Vanessa cardui* in Utah. Pan-Pacific Entomol. 13:109-110.

MALLOPHAGA

Behle, William E. 1971. Checklist of the birds of Utah. Unpublished manuscript.

Elbel, R. E., and K. C. Emerson. 1956. A new mallophagan from the White Pelican. Entomol. News 67(7):173-176.

Emerson, K. C. 1950. The genus *Lagopoecus* (Philopteridae: Mallophaga) in North America. J. Kansas Entomol. Soc. 23(3):97-101.

Emerson, K. C. 1961. The genus *Panenirmus* (Mallophaga) found on North American woodpeckers. J. Kansas Entomol. Soc. 34(1):34-43.

Emerson, K. C. 1962. A tentative list of Mallophaga for North American birds (north of Mexico). Dugway Proving Ground: 1-217.

Emerson, K. C. 1964a. Checklist of the Mallophaga of North America (north of Mexico). Part I. Suborder Amblycera. Dugway, Utah, (Mimeo). 171 p.

Emerson, K. C. 1964b. Checklist of the Mallophaga of North America (north of Mexico). Part II. Suborder Amblycera. Dugway, Utah, (Mimeo). 104 p.

Emerson, K. C. 1968. The genera and species of the Mallophaga of North America (north of Mexico). Part I. Suborder Ischnocera. Mimeo. 194 p.

ORTHOPTERA

Barnum, A. H. 1952. The taxonomy of Utah Orthoptera with notes on distribution. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 236 p.

Barnum, A. H. 1954. The taxonomy of Utah Orthoptera. Great Basin Nat. 14:39-60.

Hansen, H. O. 1963. The cockroaches of Salt Lake County, Utah. Unpub. master's thesis, Univ. of Utah, Salt Lake City, Utah. 65 p.

Knowlton, G. F. 1935. Bed bugs and cockroaches. Utah Agr. Expt. Sta. Leaflet 68.

SCORPIONIDA

Gertsch, W. J., and D. M. Allred. 1965a. Scorpions of the Nevada test site. Brigham Young Univ. Sci. Bull., Biol. Series 6(4):1-15.

GERTSCH, W. J., AND D. M. ALLRED. 1965b. The scorpions of the *Vejovis boreus* group (subgenus *Paruroctonus*) in North America (Scorpionida, Vejovidae). Amer. Mus. Nov. 2278:1-54.

JOHNSON, J. D. 1968. Scorpions of Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 36 p.

WOOD, H. C. 1863. Description of a new species of scorpion in the Utah territory: *Centrurus phaeodactylus* Wood. Proc. Aca. Nat. Sci. Philadelphia 2:372.

SIPHONAPTERA

ALLRED, D. M. 1951. A preliminary study of the distribution of fleas in Utah known to be capable and potential vectors of plague. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 141 p.

AMOUREAUX, R. L. 1964. Taxonomic study of fleas of the genus *Foxella* (Wagner) in Utah (Siphonaptera: Dolichopsyllidae). Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 27 p.

BECK, D E., AND D. M. ALLRED. 1950-1951. Further distributional data on Utah Siphonaptera. Proc. Utah Acad. Sci., Arts and Letters 28:113 (Abstract).

EGOSCUE, H. J. 1966a. New and additional host-flea associations and distributional records of fleas from Utah. Great Basin Nat. 26:71-75.

EGOSCUE, H. J. 1966b. A new species of the genus *Stenistomera* (Siphonaptera: Hystichopsyllidae). Bull. So. Calif. Acad. Sci. 67(3):138-142.

EWING, H. E., AND I. FOX. 1943. The fleas of North America. Classification, identification, and geographical distribution of these injurious and disease-spreading insects. USDA Misc. Publ. 500. 142 p.

HOWELL, J. F. 1954. A study of the aspectional variation of Siphonaptera associated with the nests of the Thomas wood rat, *Neotoma lepida lepida* Thomas. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 38 p.

HOWELL, J. F. 1957. Fleas associated with nests of the desert wood rat. J. Parasitol. 43:566-573.

HUBBARD, C. A. 1947. The fleas of western North America. Iowa State College Press, Ames, Iowa. 533 p.

JOHNSON, P. T. 1961. A revision of the species of *Monopsyllus* Kolenati in North America. Agr. Res. Ser. Tech. Bull. 1227. 69 p.

JOHNSON, P. T. 1971. Personal communication.

PARKER, D. D. 1958. Seasonal occurrence of fleas on antelope ground squirrels in the Great Salt Lake Desert. J. Econ. Entomol. 51:32-36.

PARKER, D. D., AND J. F. HOWELL. 1959. Host-flea relationships in the Great Salt Lake Desert. J. Parasitol. 45(6):597-604.

SMIT, F. G. A. M. 1958. A new North American bird-flea. Proc. U. S. Nat. Mus. 108(3394):51-57.

STANFORD, J. S. 1931. A preliminary list of Utah Siphonaptera. Proc. Utah Acad. Sci. 8:153-154.

STANFORD, J. S. 1944. More Utah Siphonaptera. Proc. Utah Acad. Sci., Arts and Letters 19-20: 173-178.

STARK, H. E. 1958. The Siphonaptera of Utah. U. S. Dept. HEW Comm. Disease Center, Atlanta, Georgia. 239 p.

STARK, H. E. 1970. A revision of the flea genus *Thrassis* Jordan 1933 (Siphonaptera: Ceratophyllidae) with observations on ecology and relationship to plague. Univ. Calif. Pub. Entomol. 53:vii + 184 p.

TIPTON V. J. 1949. A preliminary study of the siphonapterous ectoparasites found on the mammals of the families Cricetidae and Muridae in Utah County. Unpub. master's thesis. Brigham Young Univ., Provo, Utah. 87 p.

TIPTON, V. J. 1950. New distributional records for Utah Siphonaptera. Great Basin Nat. 10:62-65.

TIPTON, V. J., AND D. M. ALLRED. 1952. New distributional records of Utah Siphonaptera with the description of a new species of *Megarthroglossus* Jordan and Rothschild 1915. Great Basin Nat. 11:105-114.

TRAUB, R., AND V. J. TIPTON. 1951. *Jordanopsylla allredi*:, a new genus and species of flea from Utah (Siphonaptera). J. Wash. Acad. Sci. 41:264-270.

COLORADO TICK FEVER

ANONYMOUS. 1970. Colorado tick fever. RML Circular 2. Rocky Mountain Laboratory, Hamilton, Montana. 1 p.

BECKER, F. E. 1930. Tick-borne infections in Colorado. II. A survey of the occurrence of infections transmitted by the wood tick. Colorado Med. 27: 87-95.

EKLUND, C. M., R. C. KENNEDY, AND MARY CASEY. 1961. Colorado tick fever. Rocky Mountain Med. J. 58(6):21-25.

EKLUND, C. M., G. M. KOHLS, AND J. M. BRENNAN. 1955. Distribution of Colorado tick fever and virus carrying ticks. J. Amer. Med. Assoc. 157: 335-337.

TOPPING, N. H., J. S. CULLYFORD, AND G. F. DAVIS. 1940. Colorado tick fever. Public Health Rpts. 55:2224-2237.

ENCEPHALITIS

BROOKMAN, B. 1955. The current status of encephalitis in the west. Proc. Utah Mosq. Abate. Assoc. 8:5.

CRANE, G. T., R. E. ELBEL, D. E. KLIMSTRA, AND K. L. SMART. 1969. Isolation of Hart Park-like and California encephalitis group from mosquitoes of Cedar and Utah valleys, Utah, in 1967 (Abstract). Proc. Utah. Mosq. Abate. Assoc. 22:39-40.

CRANE, G. T., R. E. ELBEL, AND K. L. SMART. 1970. Arbovirus isolations from mosquitoes collected in West Central Utah, 1969. Proc. Utah Mosq. Abate. Assoc. 23:21 (Abstract).

CRANE, G. T., R. E. ELBEL, AND K. L. SMART. 1970. Arbovirus isolations from mosquitoes collected in Central Utah in 1967. Amer. J. Trop. Med. Hyg. 19:540-543.

ELBEL, R. E., G. T. CRANE, L. E. STIPE, G. B. VAN NOSDOL, AND K. L. SMART. 1971. Arbovirus isolations from mosquitoes collected at Callao, Utah, 1966 and 1967. Mosq. News 31:61-68.

GEBHART, L. P., G. J. STANTON, AND S. DE ST. JEER. 1968. Ecology of western equine encephalitis virus in nature. Proc. Utah Mosq. Abate. Assoc. 21:13-15.

GRAHAM, J. E., AND G. C. COLLETT. 1964. Surveillance for western equine encephalitis in Utah. Mosq. News 24:149-153.

GRAHAM, J. E., I. E. BRADLEY, AND G. C. COLLETT. 1960. Some factors influencing larval populations

of *Culex tarsalis* and western equine encephalitis in Utah. Mosq. News 20:100-103.

Grundmann, A. W. 1950. Preliminary results of an investigation in Utah of mosquito borne encephalitis. Proc. Utah Mosq. Abate. Assoc. 3:43-45.

Grundmann, A. W. 1954. The encephalitis problem in Utah. Proc. Utah Mosq. Abate. Assoc. 7:19-21. (Mimeo).

Grundmann, A. W., and G. R. Leymaster. 1954. Equine encephalomyelitis in Utah, a survey of horses and man utilizing serum-neutralization tests. J. Amer. Med. Assoc. 124:40-42.

Hess, A. D., and R. O. Hayes. 1967. Seasonal dynamics of western encephalitis virus. Amer. J. Med. Sci. 253:333-348.

Hess, A. D., and P. Holden. 1957. The natural history of the arthropod-borne encephalitides in the U. S. Ann N. Y. Acad. Sci. 70:294-311.

Holden, P., and A. D. Hess. 1959. Cache Valley virus, a previously undescribed mosquito-borne agent. Science 130(3383):1187-1188.

Jenkins, A. A., and R. Donath. 1959. The 1958 encephalitis outbreak in northern Utah. 1. Human aspects. Mosq. News 19:221-222.

Knowlton, G. F. 1934. Insect transmission of equine encephalomyelitis studies. Utah Agr. Expt. Sta. Bull. 250:47 (Biennial Report).

Knowlton, G. F. 1936. Insect transmission of equine encephalomyelitis. Report of Twelfth Rocky Mt. Conf. of Entomologists, Pingree Park, Colorado. p. 9.

Knowlton, G. F., and J. A. Rowe. 1935. Handling mosquitoes on equine encephalomyelitis investigations. J. Econ. Entomol. 28:824-829.

Love, G. J., and D. B. Francy. 1963. Summary of activities of the encephalitis section during 1962. Proc. Utah Mosq. Abate. Assoc. 16:8-11.

Madsen, D. E. 1934. Equine encephalomyelitis. Proc. Utah Acad. Sci., Arts and Letters 11:95-99.

Madsen, D. E., and G. F. Knowlton. 1935. Mosquito transmission of equine encephalomyelitis. J. Amer. Vet. Med. Assoc. 86:662-666.

Madsen, D. E., G. F. Knowlton, and J. A. Rowe. 1936. Further studies on transmission of equine encephalitis by mosquitoes. J. Amer. Vet. Med. Assoc. 89:187-196.

Rees, D. M., and G. C. Collett. 1959. Factors influencing the encephalitis outbreak in Utah in 1958. Proc. and Papers 27th Ann. Conf. Calif. Mosq. Control Assoc. p. 88-97.

Rees, D. M., L. J. Ogden, G. C. Collett, and J. E. Graham. 1959. The 1958 encephalitis outbreak in northern Utah. 3. Mosquito populations in relation to the outbreak. Mosq. News 19:227-231.

Spendlove, G. A., J. A. Rowe, and C. F. Knowlton. 1953. Mosquitoes and encephalitis. Utah State Agr. Coll. Ext. Circ. 199:1-2.

Thomas, L. A., and J. V. Smith. 1959. The 1958 encephalitis outbreak in northern Utah. 2. Infection rates in birds, mammals and mosquitoes. Mosq. News 19:223-226.

MALARIA

Grundmann, A. W., R. G. Warneck, and H. D. Newson. 1952. Nonhuman malaria in mosquitoes and the English sparrow, *Passer domesticus* Linn. in the vicinity of Salt Lake City, Utah. Mosq. News 12:53-57.

Knowlton, G. F. 1948. Malariology, mosquito control, and aviation. The Sanitarian 10(5):185, 187, 189-190.

Marshall, H. L., and D. M. Rees. 1948. Malaria in Utah. Rocky Mt. Med. J. 45:469-472.

Rees, D. M., and H. D. Newson. 1950. Mosquitoes of Salt Lake County, Utah, infected with nonhuman malaria. Proc. Utah Acad. Sci., Arts and Letters 27:71 (Abstract).

PLAGUE

Allred, D. M. 1952. Plague important fleas and mammals in Utah and the western United States. Great Basin Nat. 12:67-75.

Anonymous. 1936. Human and rodent plague in California, Idaho, and Utah. Public Health Rpts. 51:1019.

Anonymous. 1936. Rodent plague in California and Utah. Public Health Rpts. 51:1138.

Anonymous. 1936. Plague infection discovered in fleas and lice taken from marmots in Montana and in a marmot from Utah. Public Health Rpts. 51: 1159-1160.

Anonymous. 1936. Rodent plague in Beaver County, Utah. Public Health Rpts. 51:1207.

Anonymous. 1936. Plague infection in California and Utah. Public Health Rpts. 51:1257.

Anonymous. 1936. Plague in prarie dogs in Garfield County, Utah. Public Health Rpts. 51:1287.

Anonymous. 1937. Plague infection in fleas in California, Nevada, and Utah. Public Health Rpts. 52:1184-1185.

Anonymous. 1937. Plague infection in Wasatch County, Utah, and Madison County, Michigan. Public Health Rpts. 52:1321.

Anonymous. 1938. Plague infection found in fleas from desert wood rats in Utah. Public Health Rpts. 53:1042.

Anonymous. 1938. Plague infection found in ground squirrel and fleas from ground squirrels in Utah. Public Health Rpts. 53:1318.

Anonymous. 1938. Plague infection in fleas from ground squirrels in Rich County, Utah. Public Health Rpts. 53:1436.

Anonymous. 1940. Bubonic plague in Utah. Public Health Rpts. 55:258.

Anonymous. 1948. Plague infection in Salt Lake County, Utah. Public Health Rpts. 63:1478.

Anonymous. 1949. Plague infection in Utah and Washington. Public Health Rpts. 64:496.

Anonymous. 1949. Plague infection in San Juan County, New Mexico, and Sevier County, Utah. Public Health Rpts. 64:810.

Beck, D E., 1955. Distributional studies of parasitic arthropods in Utah, determined as actual and potential vectors of Rocky Mountain spotted fever and plague, with notes on vector-host relationships. Brigham Young Univ. Sci. Bull. Biol. Series 1(1): 1-64.

Byington, L. B. 1940. Two epizootics of plague infections in wild rodents in the western United States in 1938. Public Health Rpts. 55:1496-1501.

Hampton, R. C. 1940. Plague in the United States. Public Health Rpts. 55:1143-1158.

Hampton B. C. 1945. Plague infection reported in the United States during 1944 and summary of human cases, 1900-1944. Public Health Rpts. 60: 1361-1365.

MARCHETTE, N. J. 1963. *Pasteurella pestis* of low virulence for mice and guinea pigs isolated from *Peromyscus* plague focus in Utah. Amer. J. Trop. Med. Hyg. 12:215-218.

MCCOY, G. W. 1911. Studies upon plague in ground squirrel. II. A plague-like disease of rodents. Public Health Bull. 43:53-71.

MOHR, C. O. 1951. Entomological background on the distribution of murine typhus and murine plague in the United States. Amer. J. Trop. Med. Hyg. 31:355-372.

MYKLEBUST, R. J., F. C. HARMSTON, AND D. R. MADDOCK. 1949. Sylvatic plague investigations in Utah. CDC Publ. Fed. Sec. Agency, Atlanta, Georgia (Mimeo).

PARKER, D. D. 1971. Personal communication.

UNIV. OF UTAH. 1963. Summary status report on *Pasteurella pestis*. 1952-1962. Ecol. and Epizool. Ser. 92. Ecol. and Epizool. Res. Dugway, Utah. 110 p.

WAYSON, N. E. 1947. Plague-field surveys in western United States during ten years (1936-1945). Public Health Rpts. 62:780-791.

ROCKY MOUNTAIN SPOTTED FEVER

BECK, D E. 1955. Distributional studies of parasitic arthropods in Utah, determined as actual and potential vectors of Rocky Mountain spotted fever and plague, with notes on vector host relationships. Brigham Young Univ. Sci. Bull. Biol. Series 1(1):1-64.

BECKER, F. E. 1926. Investigations on Rocky Mountain spotted fever in Colorado. J. Infect. Dis. 39: 81-88.

COFFEY, M. D. 1953. Some preliminary studies of Rocky Mountain spotted fever vectors in Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 84 p.

COFFEY, M. D. 1954. A study of some Rocky Mountain spotted fever vectors and their hosts in Utah. Great Basin Nat. 14:31-37.

HAMPTON, B. C., AND H. G. EUBANK. 1938. Rocky Mountain spotted fever. Public Health Rpts. 53: 984-990.

HERRIN, C. S. 1956. *Dermacentor andersoni* and Rocky Mountain spotted fever in national forest recreational sites of Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 51 p.

JELLISON, W. L. 1945. The geographical distribution of Rocky Mountain spotted fever and Nuttall's cottontail in the western United States. Public Health Rpts. 60:958-961.

LUNDGREN, D. L., B. D. THORPE, AND C. D. HASKELL. 1966. Infectious diseases in wild animals in Utah VI. Experimental infection of birds with *Rickettsia rickettsii*. J. Bact. 91:963-966.

PARKER, R. R., C. B. PHILIP, AND W. L. JELLISON. 1933. Rocky Mountain spotted fever. Potentialities of tick transmission in relation to geographical occurrence in the United States. Amer. J. Trop. Med. 13:341-379.

RUCKER, W. C. 1912. Rocky Mountain spotted fever. Public Health Rpts. 27:1465-1482.

RUMBEICH, A., R. E. DYER, AND L. F. BADGER. 1931. The typhus-roeky mountain spotted fever group. Public Health Rpts. 46:470-480.

TULAREMIA

ALLRED, D. M., G. N. STAGG, AND J. F. LAVENDER. 1956. Experimental transmission of *Pasteurella tularensis* by the tick, Dermacentor parumapertus. J. Infect. Dis. 99:143-145.

ANONYMOUS. 1927. Seasonal incidence and sources of infection of tularemia. Public Health Rpts. 42: 2948-2951.

ANONYMOUS. 1940. Tularemia (rabbit fever). Public Health Rpts. 55:667-670.

BARNES, W. C. 1928. Rabbit fever or tularemia. Sci. Monthly 27:463-469.

BURROUGHS, A. L., R. HOLDENRIED, D. S. LONGANECKER, AND K. F. MEYER. 1945. A field study of latent tularemia in rodents with a list of all known naturally infected vertebrates. J. Infect. Dis. 76:115-119.

BYFIELD, G. V., L. BRESLOW, R. R. CROSS, JR., AND N. J. HERSEY. 1945. Tick-borne tularemia. Report of 15 cases. J. Amer. Med. Assoc. 127:191-196.

CLEMENT, R. 1927. Tularemia: contamination and transmission by rabbits. Presse med. 35:1608-1610.

COX, K. B. 1964. Bibliography of Tularemia. Mimeo. 83 p.

COX, K. B. 1965a. Tularemia and deer flies in the environs of Utah Lake, Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 35 p.

COX, K. B. 1965b. Tularemia and deer flies in the environs of Utah Lake, Utah. Great Basin Nat. 25(1-2):13-29.

CRAWFORD, M. 1932. Tularemia from ingestion of insufficiently cooked rabbit. J. Amer. Med. Assoc. 99:1497-1498.

FRANCIS, E. 1919. Deer-fly fever, or Pahvant Valley plague. A disease of man of hitherto unknown etiology. Public Health Rpts. 34:2061-2062.

FRANCIS, E. 1921. Tularemia Francis 1921. I. The occurrence of tularemia in nature as a disease of man. Public Health Rpts. 36:1731-1738.

FRANCIS, E. 1922. Tularemia Francis 1921: A new disease of man. J. Amer. Med. Assoc. 78:1015-1018.

FRANCIS, E. 1925. Tularemia. J. Amer. Med. Assoc. 84:1243-1250.

FRANCIS, E. 1926. Tularemia. Hektoen Lecture. Proc. Inst. Med. Chicago. 6:27-37.

FRANCIS, E. 1928a. Symptoms, diagnosis and pathology of tularemia. J. Amer. Med. Assoc. 91:1155-1161.

FRANCIS, E. 1928b. History of Tularemia. DeLamar Lecture, Johns Hopkins Univ., Sch. Hyg. p. 94-115.

FRANCIS, E. 1928c. A summary of present knowledge of tularemia. Medicine 7:411-432.

FRANCIS, E. 1928d. Summary of present knowledge of tularemia. Harvey Lecture, Harvey Soc. N. Y. Series 1927-1928:25-48.

FRANCIS, E. 1929. Arthropods in the transmission of tularemia. Trans. Fourth Int. Cong. Entomol. 2:929-944.

FRANCIS, E. 1937. Sources of infection and seasonal incidence of tularemia in man. Public Health Rpts. 52:103-113.

FRANCIS, E., AND G. R. CALLENDER. 1927. Tularemia, the microscopic changes of the lesions in man. Arch. Path. Lab. Med. 3:577-607.

FRANCIS, E., ET AL. 1922. Tularemia Francis 1921: A new disease of man. USPHS Hyg. Lab. Bull. 130. 87 p.

FRANCIS, E., AND G. C. LAKE. 1921. Tularemia Francis 1921. III. Experimental transmission of tularemia in rabbits by the rabbit louse *Haemodip-*

sus ventricosus (Denny). Public Health Rpts. 36:1747-1753.

Francis, E., and G. C. Lake. 1922a. Tularemia Francis 1921. IV. Transmission of tularemia by the bedbug, *Cimex lectularius*. Public Health Rpts. 37:83-95.

Francis, E., and G. C. Lake. 1922b. Tularemia Francis 1921. V. Transmission of tularemia by the mouse louse *Polyplax serratus* (Burm.). Public Health Rpts. 37:96-101.

Francis, E., and B. Mayne. 1921. Tularemia Francis 1921. II. Experimental transmission of tularemia by flies of the species *Chrysops discalis*. Public Health Rpts. 36:1738-1746.

Francis, E., and D. Moore. 1926. Identity of Ohara's disease and tularemia. J. Amer. Med. Assoc. 86:1329-1332.

Gebhardt, L. P., and B. D. Thorpe. 1962. A review of tularemia. Univ. Utah Manuscript. 87 p.

Hillman, C. C., and M. T. Morgan. 1937. Tularemia: report of a fulminant epidemic transmitted by the deer fly. J. Amer. Med. Assoc. 108:538-540.

Jellison, W. L. 1950. Tularemia: Geographical distribution of "Deer-fly fever" and the biting fly, *Chrysops discalis* Williston. Public Health Rpts. 63:1321-1329.

Jellison, W. L. 1970. Tularemia in Montana. Montana Wildlife: 1-24.

Jellison, W. L. 1971. Personal communication.

Jellison, W. L., and G. M. Kohls. 1955. Tularemia in sheep and in sheep industry workers in western United States. Public Health Mono. 28. 17 p.

Jellison, W. L., G. M. Kohls, and C. B. Philip. 1951. Tularemia: muskrats as a source of human infection in Utah. Rocky Mt. Med. J. 48:594-597.

Jellison, W. L., and R. R. Parker. 1945. Rodents, rabbits, and tularemia in North America: Some zoological and epidemiological considerations. Amer. J. Trop. Med. 25:349-362.

Junkin, H. D. 1927. Two unusual cases of tularemia. Northwest Med. 26:415.

Knudsen, A. B., D. M. Rees, and G. C. Collett. 1968. Tularemia in Salt Lake County, Utah. Proc. Utah Mosq. Abate. Assoc. 21:15-16.

Larson, C. L., W. Wicht, and W. L. Jellison. 1955. A new organism resembling *P. tularensis* isolated from water. Public Health Rpts. 70:253-258.

Lundgren, D. L., N. J. Marchette, and P. S. Nichols. 1961. Certain immunological responses of wild rodents and laboratory animals following challenge with *Pasteurella tularensis*. Ecol. and Epizool. Series 60, June 30, 1961. Inst. Environ. Res. Univ. Utah.

Lundgren, D. L., N. J. Marchette, and K. L. Smart. 1957. Tularemia in the coyote, *Canis latrans lestes* Merriam. J. Infect. Dis. 101: 154-157.

Marchette, N. J., D. L. Lundgren, P. S. Nicholes, and E. D. Vest. 1961. Studies on infectious diseases in wild animals in Utah. 1. Susceptibility of wild animals to experimental tularemia. Zoonoses Res. 1:49-73.

McCoy, G. W., and C. W. Chapin. 1912. Further observations on a plague-like disease of rodents with a preliminary note on the causative agent, *Bacterium tularense*. J. Infect. Dis. 10:61-72.

Parker, D. D. 1957. Attempted transmission of *Pasteurella tularensis* by three species of fleas. J. Econ. Entomol. 50:724-726.

Parker, D. D., and D. E. Johnson. 1957. Experimental transmission of *Pasteurella tularensis* by the flea, *Orchopeas leucopus* (Baker). J. Infect. Dis. 101:69-72.

Parker, R. R., and E. Francis. 1926. Susceptibility of the coyote (*Canis lestes*) to tularemia. Public Health Rpts. 41:1407-1410.

Pearse, R. A. 1911. Insect bites. Northwest Medicine, N. S. 3:81.

Stagg, G., W. S. Tanner, and J. Lavender. 1959. Experimental infections of native animals with *Pasteurella tularensis*. J. Infect. Dis. 99:34-37.

Thorpe, B. D. 1962. Review of tularemia in arthropods and birds. Dept. Bact. Univ. Utah. Unpub. Manuscript 64 p.

Thorpe, B. D., R. W. Sidwell, D. E. Johnston, K. L. Smart, and D. D. Parker. 1965. Tularemia in the wildlife and livestock of the Great Salt Lake Desert Region, 1951 through 1964. Amer. J. Trop. Med. Hyg. 14:622-637.

Vest, E. D., and N. J. Marchette. 1958. Transmission of *Pasteurella tularensis* among desert rodents through infective carcasses. Science 128 (3320): 363-364.

Woodbury, A. M. 1955. Ecological studies of tularemia in Utah. *In* Symposium on ecology and disease transmission in native animals. U. S. Army Chemical Corps, Dugway, Utah. 112 p.

MISCELLANEOUS

Allred, D. M. 1956. Ticks and mites as potential vectors. *In* Symposium on ecology of disease transmission in native animals, p. 66-69. Special Publ. Ecol. Res., Univ. Utah and Army Chemical Corps, Dugway, Utah.

Anonymous. 1958. Morbidity: Utah 1958. Utah State Dept. Health, Bureau of Vital Statistics, Salt Lake City, Utah. 94 p.

Anonymous. 1968. Utah Vital Statistics, 1968. Annual Rpt. State of Utah, Dept. Soc. Services, Division of Health. Salt Lake City, Utah. 126 p.

Armstrong, C. 1922. Typhus fever on the San Juan Indian Reservation, 1920 and 1921. Public Health Rpts. 37:685-693.

Ashley, R. F. 1968. The distribution of overwintering arthropods in a sheep pasture in Utah County, Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 19 p.

Beck, D E. 1953. A study of some consortes found at a nesting site of the northern Cliff Swallow *Petrochelidon albifrons albifrons* (Rafinesque). Proc. Utah Acad. Sci., Arts and Letters 30:39-42.

Beck, D E., A. H. Barnum, and L. Moore. 1953. Arthropod consortes found in nests of *Neotoma cinerea acraia* (Ord.) and *Neotoma lepida lepida* Thomas. Proc. Utah Acad. Sci., Arts and Letters 30:43-52.

Berge, T. O., and E. H. Lennette. 1953. World distribution of Q fever: Human, animal, and arthropod infection. Amer. J. Hyg. 57:125-143.

Cott, E. H. 1956. Ecological observations on the insect fauna of the Great Salt Lake Desert and their epizootic implications. *In* Symposium on ecology of disease transmission in native animals. p. 69-73. Special publ. Ecol. Res., Univ. Utah and Army Chemical Corps, Dugway, Utah.

Cott, E. H., D. M. Allred, and E. J. Roscoe. 1956. The ectoparasite rearing program. *In* Symposium on ecology of disease transmission in native animals. p. 59-61. Special publ., Ecol. Res., Univ. Utah and Army Chemical Corps, Dugway, Utah.

DAVIDOFF, E. B. 1956. Ectoparasites of birds and mammals. *In* Symposium on ecology of disease transmission in native animals. p. 61-66. Special publ. Ecol. Res., Univ. Utah and Army Chemical Corps, Dugway, Utah.

DAVIS, G. E. 1939. *Ornithodoros parkeri*: Distribution and host data; spontaneous infection with relapsing fever spirochetes. Public Health Rpts. 54: 1345-1349.

DAVIS, G. E. 1940. Ticks and relapsing fever in the United States. Public Health Rpts. 55:2347-2351.

DAVIS, G. E. 1941. *Ornithodoros parkeri* and relapsing fever spirochetes in Utah. Public Health Rpts. 56:2464-2468.

ELZINGA, R. J., AND D. M. REES. 1964. Comparative rates of ectoparasite infestation on deer and harvest mice. Proc. Utah Acad. Sci., Arts and Letters 41: 217-220.

FELSENFELD, O. 1965. Borreliae, human relapsing fever, and parasite-vector relationships. Rac. Rev. 29:46-74.

HO, BENG CHAUN, AND D. M. REES. 1963. Ectoparasite-host associations in three areas in Utah and Wyoming. Proc. Utah Acad. Sci., Arts and Letters 40:115.

HORSFALL, F. L., AND I. TAMM (eds.). 1965. Viral and Rickettsial infections of man. Philadelphia, Lippincott. 1282 p.

HOWELL, J. F. 1960. Arthropod consortes of a kit fox den. Great Basin Nat. 20:71-77.

JAMES, M. T., AND R. F. HARWARD. 1969. Herm's Medical Entomology (sixth edition). MacMillan Co., New York, 484 p. + viii.

JELLISON, W. L. 1956. Rodent disease and parasites in Washington County, Utah, with particular reference to coccidioidomycosis. Proc. 11th Ann. Meeting INCDNCM, Salt Lake City, Utah. August 30, 31, and September 1, 1956. p. 96-104.

KNOWLTON, G. F. 1960. Insect conditions in Utah—1959 (Abstract). Proc. Utah Acad. Sci., Arts and Letters 37:151-152.

KNOWLTON, G. F. 1966. Entomology—observations. Proc. Utah Acad. Sci., Arts and Letters 43:158.

LUNDGREN, D. L., N. J. MARCHETTE, AND P. A. NICHOLES. 1961. Studies on the ecology and epizoology of the native fauna of the Great Salt Lake Desert. Ecol. and Epizool. Series 60. June 30, 1961. Inst. Environmental Res. Univ. Utah.

MATHESON, R. 1950. Medical Entomology. Comstock Publishing Associates, Ithaca, New York. 612 p.

MYKLEBUST, R. J. 1951. Some studies on the consortes of the Norway rat in Utah County, Utah. Unpub. master's thesis, Brigham Young Univ., Provo, Utah. 73 p.

PARRISH, H. M. 1959. Deaths from bites and stings of venomous animals and insects in the United States. Arch. Int. Med. 104:198-207.

PHILIP, C. B. 1969. Tick paralysis. RML Circ. 4. Rocky Mountain Laboratory, Hamilton, Montana. 2 p.

PRATT, H. D., AND P. L. RICE. 1969. Current status of some important arthropod-borne diseases in the United States. Dept. HEW. PHS 30 p.

REES, D. M., AND B. C. HO. 1961. Arthropods found in Flaming Gorge Reservoir Basin, 1959. Univ. Utah Anthropol. Papers No. 48:100-110, November 1960, pub. 1961.

ROBERTS, R. S. 1954. Mosquitoes and the disease synovitis (Staphylococcosis) in turkeys. Proc. Utah Mosq. Abate. Assoc. 7:17-19.

SIDWELL, R. W., D. L. LUNDGREN, J. B. BUSHMAN, AND B. D. THORPE. 1964. The occurrence of possible epizootic of Q fever in fauna of the Great Salt Lake Desert of Utah. Amer. J. Trop. Med. Hyg. 13:754-762.

SMART, J. 1948. A handbook for the identification of insects of medical importance. British Museum (Natural History). London. 295 p. + XIII pls.

STANFORD, J. S. 1934. Some ectoparasites of Utah birds and mammals. Proc. Utah Acad. Sci., Arts and Letters, 11:247.

STOENNER, H. G., R. HOLDENRIED, D. LACKMAN, AND J. S. OSBORN, JR. 1959. The occurrence of *Coxiella burnetii*, Brucella, and other pathogens among the fauna of the Great Salt Lake Desert in Utah. Amer. J. Trop. Med. Hyg. 8:590-596.

UNIV. OF UTAH. 1955a. Ecology of disease transmission in native animals. Ecol. Res. Dugway, Utah. 16 p.

UNIV. OF UTAH. 1955b. Symposium on ecology of disease transmission in native animals. Ecol. Res. Dugway, Utah. 112 p.

UNIV. OF UTAH. 1955-1956. A study of the ecology of infectious diseases in the native fauna. Ecol. Res. Dugway, Utah. 78 p.

UNIV. OF UTAH. 1957. A study of the ecology of infectious diseases in the native fauna of the Great Salt Lake Desert. Ecol. Res. Dugway, Utah. 49 p.

UNIV. OF UTAH. 1959a. Studies on the ecology and epizoology of the native fauna of the Great Salt Lake Desert. Ecol. and Epizool. Series 41. Ecol. and Epizool. Res. Group, Dugway, Utah. 63 p.

UNIV. OF UTAH. 1959b. Epizoological survey of certain endemic diseases in the southern part of the Great Salt Lake Desert. Ecol. and Epizool. Series 42. Ecol. and Epizool. Res. Group, Dugway, Utah. 18 p.

UNIV. OF UTAH. 1960. Studies on the ecology and epizoology of the native fauna of the Great Salt Lake Desert. Ecol. and Epizool. Series 44. Ecol. and Epizool. Res. Group Dugway, Utah. 67 p.

UNIV. OF UTAH. 1961. Studies on the ecology and epizoology of the native fauna of the Great Salt Lake Basin. Ecol. and Epizool. Series 63. Ecol. and Epizool. Res. Group, Dugway, Utah. 59 p.

UNIV. OF UTAH. 1962. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert. Ecol. and Epizool. Series 70. Ecol. and Epizool. Res. Group, Dugway, Utah. 103 p.

UNIV. OF UTAH. 1963. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert. Ecol. and Epizool. Series 100. Ecol. and Epizool. Res. Group, Dugway, Utah. 127 p. + 29 figs.

UNIV. OF UTAH. 1964. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert. Ecol. and Epizool. Series 108. Ecol. and Epizool. Res. Group, Dugway, Utah. 192 p.

UNIV. OF UTAH. 1965. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert, 1964. Ecol. and Epizool. Series 117. Ecol. and Epizool. Res. Group, Dugway, Utah. 180 p.

UNIV. OF UTAH. 1966. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert, 1965. Ecol. and Epizool. Series 123. Ecol. and Epizool. Res. Group, Dugway, Utah. 171 p.

UNIV. OF UTAH. 1967. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert, 1966. Ecol. and Epizool. Series 141.

Ecol. and Epizool. Res. Group, Dugway, Utah. 313 p.

Univ. of Utah. 1968. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert, 1967. Ecol. and Epizool. Series 144. Ecol. and Epizool. Res. Group, Dugway, Utah. 234 p.

Univ. of Utah. 1969. A study of the ecology and epizoology of the native fauna of the Great Salt Lake Desert, 1968. Ecol and Epizool. Series 145. Ecol. and Epizool. Res. Group, Dugway, Utah. 244 p.

Vest, E. D., et al. 1961. Studies on ecology of Q fever in native fauna in the Great Salt Lake Desert. Ecol. and Epizool. Series 66. Summary progress report. Inst. Environ. Biol. Res. Univ. Utah.

Vest, E. D., D. L. Lundgren, D. D. Parker, D. E. Johnston, E. L. Morse, J. B. Bushman, R. W. Sidwell, and B. D. Thorpe. 1965. Results of a five-year survey for certain enzootic disease in the fauna of western Utah. Amer. J. Trop. Med. Hyg. 14:124-135.

Woodbury, A. M. (ed.). 1956. Ecological check lists: The Great Salt Lake series. Ecological Res. Univ. Utah. 125 p. (Mimeo).

Woodbury, A. M. 1964. Disease dissemination among biotic communities of the Great Salt Lake Desert. Univ. Utah. Div. Biol. Sci. Misc. Papers 4. 282 p.