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Active Projects in the United States and Canada Dealing with Grasshopper Research

H.C. Severin

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Entomology
Pamphlet No. 3

January, 1942

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ACTIVE PROJECTS IN THE UNITED STATES AND CANADA
DEALING WITH GRASSHOPPER RESEARCH

by

H. C. Severin

Entomologist

**THIS BOOK DOES
NOT CIRCULATE**

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Agriculture Experiment Station
SOUTH DAKOTA STATE COLLEGE
Brookings, S. Dak.

Active Projects in the United States and Canada Dealing with Grasshopper Research

By H. C. Severin, Station Entomologist
South Dakota Agricultural Experiment Station, Brookings, South Dakota

The sixteenth annual meetings of the Rocky Mountain Conference of Entomologists were held at Cameron Pass, Colorado, August 17 to August 21, 1941. Some time was devoted during these meetings to a discussion of the research work that is being done at present with grasshoppers. It was felt by those participating in the discussions that it would be highly desirable if certain data were available concerning grasshopper research projects that are being actively investigated at the present time in the United States and in Canada. The author of this paper was asked to assume the responsibility of formulating an appropriate and adequate questionnaire and to send a copy of this questionnaire to all individuals that are doing research work with grasshoppers. A questionnaire was accordingly prepared by the writer and a copy was sent to all individuals from whom it was believed desirable information might be obtained. A copy of this questionnaire follows:

Brookings, S. Dak.
September 8, 1941

Dear Sir:

At the recent meetings of the Rocky Mountain Conference of Entomologists held in Colorado, I was asked to collect and tabulate data dealing with grasshopper research projects that are being investigated in the United States of North America and Canada. We are interested in all projects dealing with any and all phases of study concerned with grasshoppers. We do not want a discussion of any project but only the title of the project and a few other facts concerning it. Economic and non-economic projects should be listed. Projects dealing with biological enemies, both plant and animal, should be reported. Ecological studies of grasshoppers, including any and all aspects including a study of plants resistant to grasshopper attack should likewise be listed. If a project is subdivided, please state titles of subdivisions.

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Kindly report on your projects as follows:

Name title of project.

Name titles of subdivisions of project if any.

At the end of each title, place the name of the individual having charge of the project or a subdivision of the project.

Name the state or area where the investigations are being carried out.

Name the cooperating agencies.

IMPORTANT: Kindly furnish the writer with the names and addresses of any other person or organization that is doing research work with grasshoppers in your state. There are a considerable number of such individuals not connected with State Experiment Stations or with the U. S. Bureau of Entomology.

As soon as the replies to this request have been received, the writer will tabulate the data and a copy of the entire report will be mailed to all individuals who have cooperated with him. If your experiment station or institution does not do any investigational work with grasshoppers, please write me to that effect.

If the efforts of the writer materialize satisfactorily, and a satisfactory report can be written, then it will be possible to take the first steps in better coordinating our research work which is concerned with grasshoppers (if such coordination is possible or desirable). It will also make it possible to bring together research workers for the purpose of discussing methods and technique employed in their projects. It may be responsible for avoiding too much duplication of work. It is the hope of the writer that other advantages may accrue from the report.

Very truly yours,

H. C. Severin, Head
Dept. of Entomology-Zoology

Approximately seventy-five copies of the questionnaire were mailed to as many different individuals. A copy of the questionnaire was sent to at least one individual connected with each of the State Agricultural Experiment Stations in the United States, a copy was sent to representatives of the United States Bureau of Entomology and Plant Quarantine, a copy was sent to individuals having charge of Entomological research work in the provinces of Canada and to representatives of the Division of Entomology of the Dominion of Canada. The author of this paper wishes to acknowledge the aid given him by all individuals who cooperated by filling out and returning the questionnaires sent them. It would not be practical to list the names of the cooperators, but to all of them he is grateful.

The remainder of this article will be devoted to the task of listing the reported title of each project dealing with grasshopper research work, the subdivision of each project, if any, the name of the individual or individuals having charge of the project or subdivision of the project, and the name of the state, province, or area where the investigations are being carried on. The plan of listing the projects will be as follows:

- a. by the United States Bureau of Entomology and Plant Quarantine
- b. by States in alphabetical order
- c. by Dominion of Canada, Division of Entomology
- d. by Provinces of Canada

States that had no grasshopper research project to report are not listed in this paper. Since all but six of the State Experiment Stations in the United States were heard from by the writer, and since all but one of these six states usually are not troubled by grasshoppers, it may be assumed by the reader, that the States not listed are not doing any work with grasshoppers, at least not any work that may be regarded as strictly economic in nature.

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Entomology and Plant Quarantine
Division of Cereal and Forest Insect Investigation

C. M. Packard, In Charge; J. R. Parker, Coordinator

Stations: Bozeman, Montana; Sacramento, California; and Tempe, Arizona.

A. General Research. Headquarters: Bozeman, Montana.

1. Periodic inspections. Migration.
Areas: Montana, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Colorado, New Mexico--J. R. Parker and Assistants.
2. Permanent and semi-permanent survey area studies, development and analysis of survey methods.--Project Leader R. L. Shotwell.

B. Range Species.

1. Summary of project 1936-41.
2. Surveys to determine distribution, abundance and habits of different species.
3. Observations at permanent stations.
4. Location of hold-over areas and prediction of outbreaks.
5. Natural and artificial control.
6. Insectary studies of life-histories and food preferences. In cooperation with Wyoming Agricultural Experiment Station.

Areas: Same as "A."

Project leader: F. A. Morton.

C. Intensive Study Areas.

1. Northern Great Plains--Project leader: E. G. Davis, Bozeman, Montana.
2. Southern Great Plains--Project leader: J. R. Horton, Wichita, Kansas.
3. California--Project leader: C. C. Wilson, Sacramento, California.

4. Arizona--Project leader: V. L. Wildermuth, Tempe, Arizona.

Field Work:

- (1) egg survival survey
- (2) nymph survey
- (3) adult survey
- (4) fall egg survey
- (5) habitats and food plants

Areas: Montana, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Colorado, New Mexico, Utah, Arizona, California, Nevada.

D. Parasites, Predators and Diseases.

Project leaders: F. D. Butcher, C. C. Wilson (California and Nevada).
V. L. Wildermuth (Arizona)

1. Laboratory
 - (a) study of literature
 - (b) feeding habits of predators
2. Field
 - (a) abundance records
 - (b) habits
 - (c) collection and rearing

Areas: Same as "C."

E. Control, Artificial.

Project leaders: E. J. Hinman, C. C. Wilson.

1. Kinds and amounts of poisons used in baits.
2. Laboratory tests.
3. Field tests.

Areas: Same as "C."

ARIZONA

Title of project: Range grasshoppers of Arizona.

Leader: Charles Vorhies, University of Arizona, Tucson, Arizona.

State: Arizona.

ARKANSAS

Title of project: Control of grasshoppers.

Leader: Dwight Isely, Agricultural Experiment Station, Fayetteville, Arkansas.

State: Arkansas.

CALIFORNIA

Title of project: No official project, but observations are made on life histories, the effect of environment on grasshoppers, geographical distribution of various species, climographical distribution of various species and control.

Leader of project: Stewart Lockwood, Department of Agriculture, Sacramento, California.

State: California.

FLORIDA

Title of project: Control of lubberly locust. Project includes life history studies, ecology, distribution, preferred foods and preferred places of oviposition of the lubberly locust.

Leaders of project: J. R. Watson and H. E. Bralley, Florida Experiment Station, Gainesville, Florida.

State: Florida (north and central portions of state; Hamasassa to Clay Counties).

ILLINOIS

Title of project: Grasshoppers of abundance and their control.

Leaders: W. P. Flint and staff, State Natural History Survey Division and Illinois Agricultural Experiment Station, Urbana, Illinois.

State: Illinois.

Subdivisions of above project:

- A. Title: Surveys of relative abundance of grasshoppers in Illinois.

Leaders: H. B. Petty and other staff members, State Natural History Survey Division of Illinois and Illinois Agricultural Experiment Station, Urbana, Illinois.

State: Illinois.

- B. Title: The influence of certain crops on grasshopper abundance.

Leaders: W. P. Flint, J. H. Bigger, and other staff members, State Natural History Survey Division and Illinois Agricultural Experiment Station, Urbana, Illinois.

State: Illinois.

- C. Title: Studies of active control measures of grasshoppers.

Leaders: J. H. Bigger and other staff members, State Natural History Survey Division of Illinois, Urbana, Illinois.

State: Illinois.

- D. Title: Studies of the relative preference of Melanoplus differentialis (Thomas) to strains of corn and the development of this species of grasshopper on such strains of corn.

Leaders: W. P. Flint and staff members, State Natural History Survey Division of Illinois and Illinois Agricultural Experiment Station, Urbana, Illinois.

State: Illinois.

IOWA

Title of project: Biology, ecology and control of grass-feeding grasshoppers in Iowa (non-migratory species of grasshoppers of economic importance).

Leaders: C. J. Drake and George Decker, State College, Ames, Iowa.

State: Iowa.

Title of project: Emergency insect investigation.

Leaders: C. J. Drake and O. E. Tauber, State College, Ames, Iowa.

State: Iowa.

KANSAS

Title of project: The effects of different systems of management of grasslands and conservation areas upon grasshopper populations.

Leaders: D. A. Wilbur and R. F. Fritz, Agricultural Experiment Station, Manhattan, Kansas.

State: Kansas.

Subdivisions of project:

1. Effects of strip-cropping and other dryland farming practices on grasshopper abundance and injury in Greeley, Finney, Seward, and Thomas Counties.

2. Relationship between soil conservation practices in the Eastern Kansas counties of Labette, Allen, Anderson, and Franklin, on grasshopper abundance.
3. Survey of grasshopper populations in selected types of grasslands representative of the Flint Hills section of Kansas. Collections have been made weekly throughout the growing season for the past eight years.
4. Laboratory tests of foods and feeding habits of the thistle hopper, Aeoloplus turnbulli bruneri Caudell and the migratory hopper, Melanoplus mexicanus (Sauss.).
5. Study of ecology and behavior of grasshoppers in a selected permanent area near Garden City, Kansas.

Title of project: Annual summary of the insects of Kansas.

Leaders: R. C. Smith and E. G. Kelly, Agricultural Experiment Station and Extension Division respectively, Manhattan, Kansas.

State: Kansas.

Title of project: Insects attacking alfalfa in Kansas.

Leader: R. C. Smith, Agricultural Experiment Station, Manhattan, Kansas.

Subdivisions of project:

1. Life history of the gordius worm.
2. Seasonal history of the grasshopper species occurring in alfalfa.
3. Life history of the wing mite.
4. Testing of baits and other grasshopper control methods in alfalfa.

Title of project: Effect of environmental factors on the life history, coloration and fecundity of the two-striped and the differential grasshopper.

Leader: Charles H. Bratt, Kansas State College, Manhattan, Kansas.

State: Kansas.

Title of project: Resistance of crop plants to grasshopper attacks.

Leaders: R. H. Painter and R. W. Jugenheimer, Agricultural Experiment Station, Manhattan, Kansas.

State: Kansas.

Title of project: Bombyliid predators of grasshopper eggs. Biology and taxonomy of adults and immature stages.

Leader: R. H. Painter, Agricultural Experiment Station, Manhattan, Kansas.

State: Kansas.

MINNESOTA

Title of project: A study of the factors affecting grasshopper populations.

Leaders: A. G. Ruggles, University of Minnesota, University Farm, St. Paul, Minnesota, and J. R. Parker, Bozeman, Montana.

State: Minnesota.

MISSOURI

Title of project: An investigation of the cereal and forage insects of Missouri.

Leaders of project: L. Haseman and H. E. Brown, Agricultural Experiment Station, Columbia, Missouri.

State: Missouri with field stations at Columbia, Chillicothe, Monroe City, Sedalia, Bolivar, and Cape Girardeau.

MONTANA

Title of project: The relationship of insect body fluid to the physical action of certain toxic materials. The purpose of this project is to study the body fluids, especially the digestive juices and the blood of the Mormon cricket, migratory locust and the two-striped locust, together with other economic locusts, to determine some of the normal physiological properties of these juices, the solubility of various toxic materials in these juices, the relationship between particle size and solubility, with the possibility of enlarging the project to the study of other economic insects.

Leader: J. H. Pepper, Agricultural Experiment Station, Bozeman, Montana.

State: Montana.

NEBRASKA

Title of project: Biology of the economically more important species of grasshoppers under Nebraska conditions.

Leader: H. Douglas Tate, Agricultural Experiment Station, Lincoln, Nebraska.

State: Nebraska.

NORTH DAKOTA

Title of project: An evaluation of tillage practices as a means of controlling grasshoppers.

Leaders: J. A. Munro and H. S. Telford, Agricultural Experiment Station, Fargo, North Dakota.

State: North Dakota.

Subdivisions of above project:

1. To determine the influence of both fall and spring tillage such as plowing, disking, duckfooting, harrowing, listing, packing

and other methods or combinations of such on the subsequent grasshopper population where there has been an infestation of eggs. In this work the importance of such factors as depth of tillage, soil types, moisture and weather conditions, time of season will be taken into consideration.

2. To determine the degree of control that can be achieved by various tillage practices as mentioned in "1" after the grasshoppers have been hatched but are still in their early nymphal stages.
3. To determine the dispersal capacity of the nymphal grasshoppers, first and second instars, especially over tilled (black) soil.
4. In conjunction with objective "3" to determine the starvation period of newly hatched 'hoppers.
5. To secure data on the effect of the various tillage practices on the predators of grasshoppers. To determine the mortality of predaceous forms such as blister beetles, beefly and carabid larvae, following various tillage operations.
6. To determine to what extent, if any, cultural practices influence the population of natural enemies of the grasshopper, such as birds and other insectivorous animals.
7. To secure data on the influence of soil conservation practices such as strip cropping and contour farming on egg deposition and their relationships to objectives mentioned in "3," "4," "5," and "6."
8. To determine to what extent egg deposition is favored by the presence of idle land, summerfallow, stubble, standing grain, cultivated crops and others.

OHIO

Title of project: A systematic study of the grasshoppers of Ohio.

Leader: E. S. Thomas, State Archaeological Museum, Columbus, Ohio.

State: Ohio.

OKLAHOMA

Title of project: A biological study of Schistocerca obscura (Fab.) in Oklahoma.

Leader: Graduate student under the direction of F. A. Fenton, State College, Stillwater, Oklahoma.

State: Oklahoma.

Title of project: (completed) Bait materials for grasshopper control.

Leader: F. E. Whitehead.

State: Oklahoma.

PENNSYLVANIA

Title of project: Taxonomic studies of Orthoptera, both North American and exotic. Also morphological and distributional studies of Orthoptera, also broad phylogenetic studies of the Orthoptera.

Leaders: James A. G. Rehn, Morgan Hebard, Radclyffe Roberts, and John W. H. Rehn, Academy of Natural Science of Philadelphia, Philadelphia, Pennsylvania.

Area: Studies of the Orthoptera of the World from the aspects mentioned above.

Title of project: Orthoptera of North America with special reference to the grasshoppers and roaches of Pennsylvania. This project is taxonomic in nature.

Leader: V. R. Haber, Agricultural Experiment Station, State College of Pennsylvania.

State: Pennsylvania.

SOUTH DAKOTA

Title of project: The grasshoppers of South Dakota and their control. The object of the project is to determine the most important economic species, to determine the range of each species, to determine the life history and seasonal cycle of each important species, to make thorough ecological studies of each such species and to work out control measures for the various species or groups of species.

Leader: H. C. Severin, Agricultural Experiment Station, Brookings, South Dakota.

State: South Dakota.

Title of project: A study of the blister beetles (Meloidae) of economic importance in South Dakota, the identification and distribution of each species, their life history, the feeding habits of the adults and larvae, and control of the adults.

Leader: N. P. Larson, Agricultural Experiment Station, Brookings, South Dakota.

State: South Dakota.

Title of project:

- A. Tillage and its effect upon grasshopper populations.
- B. Strip-farming and grasshopper populations.

The object of the project is to determine the effect of different tillage practices upon egg-laying of grasshoppers, depth of burial of eggs, mechanical destruction of eggs and egg-pods, exposure of eggs to weather, birds, etc., hatching of eggs, and emergence of the newly hatched hoppers through the soil. Also to determine the effect of different tillage practices upon the principal biological enemies of grasshopper eggs.

Leader: G. B. Spawn, Agricultural Experiment Station, Brookings, South Dakota.

State: South Dakota.

UTAH

Title of project Grasshoppers and their allies with special reference to species which menace farm crops and range forage. (This project is primarily taxonomic and ecological in nature although it also includes life history studies).

Leaders: W. W. Henderson and staff, Agricultural Experiment Station, Logan, Utah.

State: Utah

VIRGINIA POLYTECHNIC INSTITUTE

Project: A study of the direct and indirect factors influencing the coloration of the grasshopper, Melanoplus bivittatus (Say).

Leader: James McD. Grayson.

State: Virginia.

WYOMING

Title of project. Control of Wyoming range grasshoppers.

Leader: C. H. Gilbert, Agricultural Experiment Station, Laramie, Wyoming.

State: Wyoming.

DOMINION OF CANADA
Department of Agriculture
Division of Entomology

H. G. Crawford, Chief, Field Crop Insect Investigation, Ottawa, Canada

Projects listed, areas indicated where projects are being investigated, and personnel in charge.

E. 10.01 GRASSHOPPERS

E. 10.01-1 Intensive ecological study of grasshoppers in a localized area--Brandon, Man., R. D. Bird, H. W. Moore, D. S. Smith.

E. 10.01-2 General grasshopper surveys throughout the province of Manitoba--Brandon, Man., R. D. Bird, R. H. Handford, H. W. Moore.

E. 10.01-3 Intensive grasshopper survey areas--Brandon, Man., R. H. Handford.

E. 10.01-4 Nymphal morphology of grasshoppers--Brandon, Man., T. H. Handford, S. Criddle.

E. 10.01-5 Grasshopper investigations--Saskatoon, Sask., K. M. King, L. C. Paul, H. Williamson, L. G. Putnam, P. C. Brown, W. B. Fox and survey assistants.

E. 10.01-6 Research in connection with grasshopper control--Lethbridge, Alta., R. M. White, P. J. G. Rock, R. H. Painter, C. L. Neilson.

E. 10.01-7 Systematic and economic study of the Orthoptera of British Columbia--Hamloops, B. C., E. R. Buckell, Prof. G. J. Spencer, I. J. Ward.

E. 10.01-8 Morphology of grasshopper eggs and egg pods--Brandon, Man., R. D. Bird, D. S. Smith.

List of grasshopper projects being conducted at or through the Dominion Entomological Laboratory at Brandon. Some of these projects are again listed in those enumerated under Dominion of Canada, Department of Agriculture, Division of Entomology.

CLASSIFIED LIST OF PROJECTS BRANDON LABORATORY

Revised November, 1941

A--Major projects

B--Secondary projects

C--Projects temporarily dropped

Class	Title
GRASSHOPPERS	
	Intensive ecological study of grasshoppers in localized areas. W. R. Allen
B	Arnaud study centre--W. R. Allen
A	Lyleton study centre--W. R. Allen
C	Grasshopper collecting points--W. R. Allen
A	General grasshopper surveys and economic forecast for the province of Manitoba--R. D. Bird, H. W. Moore, and R. H. Handford
C	Intensive grasshopper survey areas--R. H. Handford
B	Identification of nymphal grasshoppers--R. H. Handford
C	Morphology of grasshopper eggs and egg pods--D. S. Smith
A	Studies of ovarian development and oviposition of <u>Melanoplus mexicanus</u> --W. R. Allen

A The effect of weather on embryological development of grasshopper eggs in fall and spring--H. W. Moore

A The effect of weather on grasshopper nymphal development--
H. W. Moore

A The effect of weather on grasshopper abundance--H. W. Moore

B Studies of grasshopper outbreaks and fluctuations of the economic species--R. D. Bird

C Studies in control of grasshoppers by cultural methods--
R. H. Handford.

A Grasshopper bait investigations, including special studies on poisons, carriers and attractants and on the results obtained under a variety of meteorological and vegetational conditions, differences in effectiveness with different species, the period of effectiveness after application and on experimental methods --R. H. Handford with assistance from officers of the Brandon and Saskatoon laboratories.

C Scelio and other parasites of grasshopper eggs--D. S. Smith and
R. D. Bird

A Parasites of nymphal and adult grasshoppers--R. D. Bird in cooperation with C. W. Smith of Parasite Laboratory, Belleville, Ont.

B Studies of blister beetles predaceous on grasshopper eggs --W. R. Allen and R. D. Bird

A The biology of Systoechus vulgaris Lw. and its value as a grasshopper egg predator--W. R. Allen

B Studies of predators of grasshopper eggs, nymphs and adults other than blister beetles or bee-flies--R. D. Bird

Break-down of project E. 10.01-7

E. 10.01-7 Systematic and economic study of the Orthoptera of British Columbia: E. R. Buckell, G. J. Spencer, I. J. Ward--
Kamloops, B. C.

Subdivision A--Economic Study

Detailed research under this heading has been undertaken by all the above officers, but in recent years Prof. G. J. Spencer has mainly contributed to our knowledge of this complex study. This is particularly so in Section I to III.

Section I

Seasonal Studies

Species found in any area.

Surveys of species (on stations) and on special areas in British Columbia.

Estimates of population, methods employed.

Seasonal life history studies.

Cages. Hatching.

Behaviour, Tropisms. Physiology.

Rate of development.

Habitat studies.

Stations studies. Development of ovaries. Exhaustion.

Migrations, oscillations, tagging experiments.

Egg deposition. Development of ovaries. Exhaustion.

Egg counts. "Egging."

Mortality factors. Eggs.

Intermittency of species.

Vegetation. General range cover.

Vegetation. Plant species vs. grasshopper species present.

Effects of grasshoppers on vegetation damage.

Effects of overgrazing. Farming methods vs. grasshoppers.

Soil types. pH.

Soil & vegetation & grasshoppers. Irrigation. Poor farming.

Other insects' damage attributed to grasshoppers.

Section II

Natural control

Sarcophagidae.

Percent parasitism, sarcophagids, alia.

Meloidae.
Nemestrinidae.
Sphex complex.
Bombyliidae. Tachinidae.
Scelionidae.
Secondary parasites. Chalcids.
Predators. Insects. Bembecids; Mutilids.
Birds.
Mammals.
 Mammal interrelationship. Cuterebra.
Nematelminthes.
Mites.
Fungus.

Section III

Artificial control.

Poisons tried. Poison baits. Attractants.
Hygroscopic agents.
Proportions of mixtures.
 Experiments. Times, conditions, checks.
 Estimating per cent of kill.
 Kill vs. topography.
Repeated baitings on one area.
Early season vs. late season baiting.
The mechanics of spreading
Bait traps. Dusts. Harrowing.
Oil combinations. Oil sprays.
Radiometer studies.
Meteorological observations.
 Coordination.
 Comparisons with behaviour.
 Meteorological machines.
 Microclimate and effects on grasshoppers.
 (controlling factors).

Section IV

Extension and Surveys (Mainly undertaken by Buckell and Ward)

Formation of and technical advice to the permanent control zones established under the Provincial Grasshopper Control Act.
Annual examination of all areas in Province to "rate" and map infestation present.

Annual examination of all range lands in the Province to compare relationship between vegetation, grasshoppers present, weather conditions, and artificial control results. Construction of suitable mechanical bait spreaders for use under British Columbia conditions.

Subdivision B--Systematic Studies

A systematic study of the Orthoptera of British Columbia, and to some extent of North America, has been carried on for a number of years by E. R. Buckell.

This has resulted in:

Building up a collection of all species recorded from Canada. Life history notes on many species.

Maps showing:

- a. Distribution of B. C. species within the Province.
- b. Distribution of B. C. species within North America.
- c. Distribution of Canadian species within North America.