UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION
Department of Entomology

Field Studies of the Beet Leafhopper

Eutettix tenellus Baker

By
Rowland W. Haegele

Bulletin No. 182 February, 1932

Published by the University of Idaho, Moscow, Idaho

Summary

Important breeding grounds of the beet leaf hopper, *Eutettix tenellus* Baker, are found in southwestern Idaho. These breeding grounds are west and northwest and some distance from the sugar beet producing districts in Twin Falls, Gooding, Jerome, Cassia, and Minidoka counties of southern Idaho. Important breeding areas are also found adjacent to these sugar beet districts. There is a similarity in the environment of the insect throughout southern and southwestern Idaho. These studies suggest the possible danger of the distant breeding grounds to the sugar beet industry of southern Idaho.

The spring host plants studied were *Norta altissima* L. (tumble mustard) and *Sophia parviflora* (Lam.) Standl. (flixweed or herb-sophia). The summer hosts were *Salsola pestifer* A. Nels. (Russian thistle), *Atriplex rosea* L. (redscale), and *Bassia hyssopifolia* (L.) Kuntze (seepweed).

Eutettix tenellus winters in the adult stage in the female form only, and on the waste and uncultivated desert areas These females oviposit in the spring host plants and the first generation develops on these plants. The first generation is completed in May or June, the second during July and August, and the third is either partially or wholly completed during the fall.

Beets are not necessary for the completion of the life cycle or seasonal life history of the insect because of the nature of the host plant sequence on the desert breeding grounds. The spring host plants were found to be of fundamental importance since they are the direct source and producers of the vast numbers of beet leaf hoppers that migrate into the beet fields every spring and which are responsible for a heavy loss to the sugar beet industry in southern Idaho. *Salsola pestifer* (Russian thistle) was found to be the most important summer host plant because of its wide distribution and abundance and because of the great numbers of the insects found to be breeding on it.

A migration of the new adults from the desert breeding grounds occurs every year at about the time of the completion of the first generation. From this migration there is a dispersal of the insects to the summer host plants in the desert, and into the beet fields throughout the irrigated districts lying east and southeast of the desert breeding areas. The western limit of the source of the migration is not known but it probably extends a considerable distance to the northwest of the beet fields of southern Idaho. There is a continuity of breeding grounds in that direction and the prevailing winds of that section are northwest. The migration occurs a few days earlier in the western than in the eastern part of the area studied.

These insects are found in greatest abundance in environments with a sparse host plant growth. The temperatures are found to be higher in such places.

The soil analysis of the host plant areas showed the soluble salts to be highest where *Bassia hyssopifolia* (seepweed) was common. Such soils were not favorable to the growth of the other host plants. The host plants showed a tendency to mature earlier and were more susceptible to drouth on the soils with the lower wilting coefficients.

The state survey for *Eutettix tenellus* from 1925 to 1929 showed no variation from year to year in the distribution of the insect or of its host plants. There is a noticeable variation from year to year in the populations of the insect in different parts of the state.

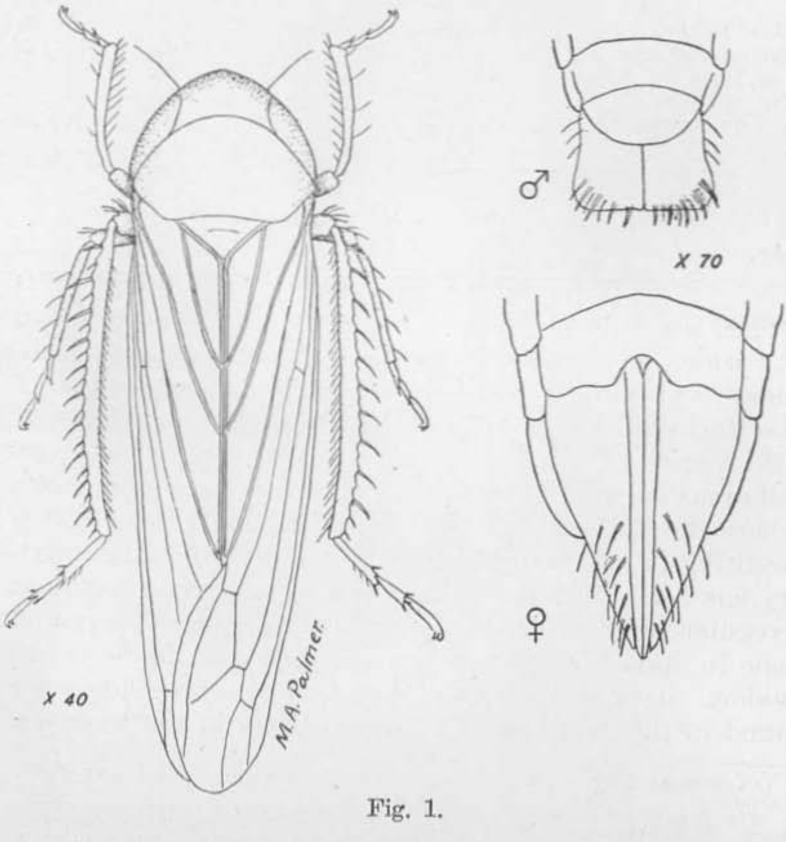

Fig. 1.

The adult of the beet leafhopper, *Eutettix tenellus* Baker.

Field Studies of The Beet Leafhopper
Eutettix tenellus Baker

By

Rowland W. Haegele*

CONTENTS

Introduction

THE beet leafhopper, *Eutettix tenellus* Baker, is an insect which has been responsible for enormous losses to the sugar beet industry in Idaho and other states west of the Rocky Mountains. This insect is a native of the semi-arid regions of the western states where most of the irrigated areas are subject to its invasion. There are a few areas where the damage has been so severe every year, (often resulting in a total loss of the beet crop), that the industry has been abandoned. Loss in many districts occurs at irregular intervals, with a heavy loss in some years and none in others. Also there are places where the beets are seldom if ever damaged. Areas of all three kinds are found in this state, such as the districts in southwestern

*Assistant Entomologist, University of Idaho Agricultural Experiment Station.

The author expresses his appreciation of Dr. Walter Carter who was in charge of the beet leafhopper investigations of the Bureau of Entomology from 1925 until his resignation in March, 1930, for his cooperation and support on this project and for suggestions offered. Also to Prof. Claude Wakeland, Entomologist of the University of Idaho Agricultural Experiment Station, for his constant interest and encouragement.

Dr. P. N. Annand was placed in charge of the beet leafhopper investigations of the Bureau of Entomology in March, 1930, and under his direction the University of Idaho Agricultural Experiment Station continued to cooperate with the Bureau in this work.

Idaho where beet production has not been successful, the south-central area with its periodic damage, and the eastern part of the state where there is rarely any loss.

Injury to beets is caused by a disease called curly-top. This disease is transmitted to sugar beets and garden beets by *E. tenellus* while feeding on the plant. The whole plant is affected. The leaf symptoms of the disease are first a clearing of the very small veins in the young leaves, a short time later a curling of the leaves inward at the edges, and then a roughening of the under surface caused by small nodules. As the disease developes, the leaves turn

Fig. 2.

Map showing location of the stations where data were gathered. The breeding grounds of *Eutettix tenellus* in southwestern Idaho as represented by the stations, are shown in relation to the areas in southern and eastern Idaho where sugar beets are grown.

yellow. Typical root symptoms are "hairy" root where the beet is partly covered by a mass of fine hair-like roots, and by dark concentric rings that show in a cross-section of the diseased root (*5*)*

Important breeding grounds of *E. tenellus* are found in southwestern Idaho. A study of the ecology of the insect in the field was made in this area in 1927, 1928, and 1929. Data were gathered at a number of "field stations" in the Lower Snake River Valley and tributary areas. These stations were selected as types of the breeding grounds of this region. A study was made of the type areas to determine their importance as breeding grounds, and to follow the host plant development in relation to the insect. Further notes on life history were also obtained.

These investigations were conducted in cooperation with the U. S. Department of Agriculture. The work was done at the same time and along similar lines as the ecological field studies of *E. tenellus* made at the laboratory of the Bureau of Entomology, U. S. Department of Agriculture, at Twin Falls, Idaho. For the purpose of this work, southern Idaho was divided at a point near Glenns Ferry. Carter (1) of the Bureau of Entomology conducted studies in the territory to the east and the Idaho Experiment Station to the west. In general, the more important breeding areas of this insect east of Glenns Ferry are relatively close to the sugar beet producing districts in Twin Falls, Gooding, Jerome, Cassia, and Minidoka counties, while the breeding areas to the west are distant. The survey of 1925 and 1926 (*4*) showed that the population of *E. tenellus* was higher in the area designated as southwestern Idaho, or the Lower Snake River Valley, than in other areas in the state. This region of high populations extends from Glenns Ferry to Weiser, including the Lower Snake River Valley and tributary areas. This study suggests the possible importance of these distant breeding grounds to the sugar beet industry of southern Idaho.

The observations and collections were made in the same

*Numbers in parentheses refer to "Literature cited", p. 51.

manner at each of the type stations. The data gathered are intended to give a detailed cross-section of the whole district studied. Each collection was quantitative, being the result of 50 sweeps with a 15-inch insect net from a representative growth of the given host plant at each station. In the early spring, before sweeping is possible or satisfactory, very careful observations were made on the tiny mustard plants, and collections of individual specimens of *E. tenellus* made with a small vial.

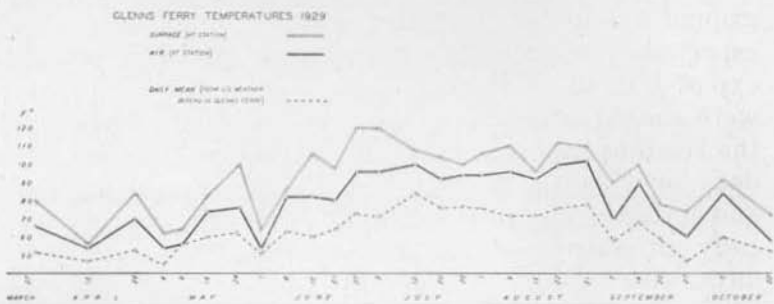

Fig. 3.

Temperatures taken on the collection dates at Glenns Ferry. These are typical for all the stations.

The daily mean temperature was obtained from the records of the United States cooperative Weather Bureau station in Glenns Ferry.

The desert plant community for each area was noted. By this is meant the native plants occurring on the undisturbed desert areas adjacent to the stations. Sage brush, *Artemisia tridentata* (Nutt), predominates over the whole region, though there are areas in the lower levels where greasewood, *Sarcobatus vermiculatus* (Torr.), is common, especially on the more alkaline areas along the Snake River. Shadscale, *Atriplex confertifolia* (S. Wats.), occurs sparsely among the greasewood and occasionally in pure stands covering rather large areas on the bench lands and in the hills.

The breeding grounds of *E. tenellus* in this region are made up of areas once farmed but later abandoned, waste areas within and adjacent to cultivated districts, pasture land, fence rows, ditch banks, roadsides, feed lots, and areas of seepy land in irrigated districts. Descriptions are given of the different stations selected to represent the more important types of breeding areas.

Air and surface temperatures were recorded at each station when the collection was made. The air temperatures were taken by holding a shaded thermometer about five feet from the ground, and the surface temperatures by placing the thermometer on the ground among a represen-ative growth of the host plants from which the collection was being taken. The thermometer when placed upon the ground was usually partially exposed to the sunshine, and, especially when among a sparse plant growth, it was often exposed to the full sunshine. The surface temperatures were consistently higher than the air temperatures unless the reading was made late in the evening, on cool cloudy days, or when the soil was wet. On these occasions the air and surface temperatures would be about the same. Practically all collections and observations were made on fair days, with a minimum of cloudy or windy days. This tended to make uniform conditions for gathering the data. No collections were made in a hard wind.

The higher surface temperatures would indicate higher temperatures in the environment of *E. tenellus* than standard shade temperatures. The insects are found in greatest numbers on a sparse growth of host plants, for there the surface temperature is higher than where the growth is rank or dense. A desert-like environment on dry areas with high temperatures seems to be more favorable for their development than wet areas with lower surface temperatures and a dense, rank host plant growth. Gasparin stated that a thermometer in full sunshine on sod shows more nearly the true temperature of the plant than one registering air temperature alone, and that "the warmth in the sunshine is to the warmth of the air in the shade as though one had been transported in latitude from three to six degrees farther south" (3). The variation from very sparse to very dense growth is found with all the host plants and whenever soil and moisture conditions produce a very dense host plant growth on any area, there is an accompanying decrease in *E. tenellus* populations.

The three years, 1927 to 1929, may be considered as years representing two distinct types from the standpoint of the seasonal factors affecting the insect. The years 1927 and 1929 were similar in that both were so-called "good" beet years, and 1928 represents a "bad" beet year. These two types may be divided roughly as follows: first, years with mild winters, early development of the spring host plants and of the insect, high populations, early migrations, and severe damage to beets; second, years with severe winters, late development of the spring host plants and of the insect, low populations, late migrations, and light damage to beets. Both types are included in this study.

Accordingto Carter (1, 2), winter temperature is an important factor in the mortality of overwintering forms of *E. tenellus* and he emphasizes the importance of "severe" or "mild" winters in his prediction for a "good" or an "unfavorable" beet year.

This held true for the winters of 1926-27, 1927-28, and 1928-29. The next winter, 1929-30, was severe, the minimum temperature being -22° F. at Twin Falls—the lowest since January, 1922. Although a "good" beet year was predicted for 1930, it turned out to be a year with severe curly-top damage to beets in the Twin Falls and adjacent areas.

In these studies of *E. tenellus* in southwestern Idaho, the subject of winter conditions and their effect on the insect was not taken up.

Distribution and Abundance of Host Plants

Data were obtained in this study from the following host plants of *Eutettix tenellus:*

Norta altissima (L.) Britton	Tumblemustard
Sophia parviflora (Lam.) Standl.	Flixweed or herb-sophia
Salsola pestifier A. Nels.	Russian thistle
Atriplex rosea L.	Redscale
Bassia hyssopifolia (Pall.) Kuntze*	Seepweed

*BASSIA HIRSUTA (L.) Aschers in Bul. 156, Univ. of Idaho Agri. Exp. Sta

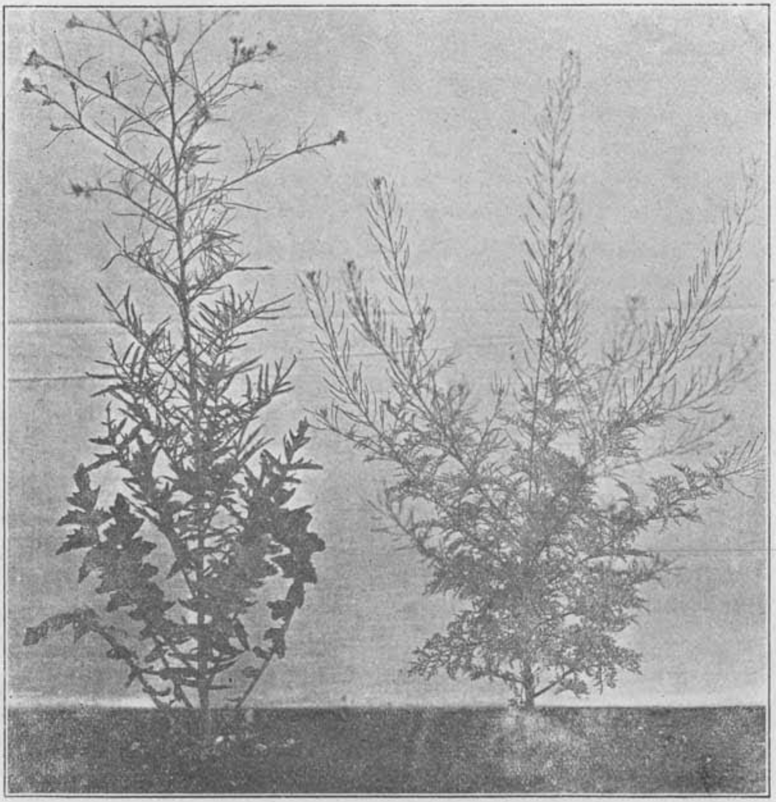

Fig. 4.

The two species of important spring host plants of **Eutettix tenellus.** A—Norta altissima, tumblemustard, B—**Sophia parviflora**, flixweed or herb-sophia.

These host plants are the most important because of the large area on which they predominate, their widespread distribution, and their high *E. tenellus* populations. There are many other host plants present but they are of less importance because of their sparse distribution.

Norta altissima is common over the entire area, though to a lesser extent on higher bench lands. It is most abundant on the lower areas along the Snake River and within the tributary valleys. It is found in the spring on abandoned dry farms, on waste places within cultivated districts, on feed lots, and on pasture land. The area on which this host occurs is very extensive and comprises many hundred acres of important breeding grounds.

Sophia parviflora is common over the same area as *N. altissima*, though it predominates on the higher bench lands such as the desert area near Mountain Home. In the spring many abandoned dry farms and waste areas here are covered with this plant.

N. altissima and *S. parviflora* belong to the mustard family and are referred to frequently as mustards.

Salsola pestifier is common over the whole area studied, and is very abundant in the Snake River and tributary valleys. It is the most abundant of the summer hosts and occurs on nearly all the mustard area. This plant and the two mustards are the most abundant and widely distibuted of the host plants in this area.

Atriplex rosea is found over the entire area, though sparsely distributed. It is most common in corrals, feed lots, pastures, and waste places on farms and stock ranches and along fences, roads, and irrigation ditches.

Bassia hyssopifolia is confined to seepy areas and wet alkaline spots throughout the irrigated districts and bottom lands of Lower Snake River and other valleys. Such land covers a large acreage that at present may be considered important breeding grounds, though the construction of a number of drainage canals is gradually reducing the seepy areas.

SUMMER HOST PLANTS OF THE BEET LEAF HOPPER

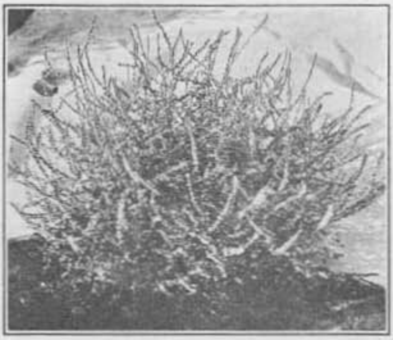

Fig. 5.

Russian thistle, **Salsola pestifer**, the most important of the summer host plants. It is common and widely distributed over the desert breeding areas of the beet leaf-hopper.

Fig. 6.

Redscale, **Atriplex rosea**, a host sparsely distributed over the desert areas but common around corrals, feed lots, and waste places throughout valley lands and cultivated areas.

Fig. 7.

A seepweed species, **Bassia hyssopifolia**, which is a common host on seepy, alkaline areas. A typical dense growth of the plant is shown. The growth is more sparse where there is less seepage.

These host plants are all introduced species. They came in as the agricultural areas were developed and spread rapidly over the waste and poorly cultivated lands, including abandoned areas once cultivated and extensive areas where dry farming has not proven successful.

The plants are divided in this study into spring hosts and summer hosts. The mustards constitute the spring hosts and are of importance from early spring to early summer. The other three are summer hosts, overlapping the mustards in early summer and extending into the fall months until their natural maturity, or until the first severe frost checks or stops their growth.

Life History

First Generation. *Pre-oviposition and egg period.* The only adults of *E. tenellus* collected during the months of February, March, and April have been females. No males have been collected during these months in the area studied. (Note: On March 12, 1930 at Homedale, an overwintering male was collected indicating that during some years a small percentage of males may survive the winter. This was the only overwintering male collected in five years of field work.) Mating, therefore, occurs the previous fall. The overwintering females develop their eggs during the early spring as soon as the temperature becomes favorable. Dissection of females collected at Glenns Ferry on March 12, 1927, and on February 22, 1928, showed the presence of full sized eggs in a few specimens and developing ovaries in others. Females collected March 28, 1929, at several stations contained mature eggs. Those collected earlier than these dates did not show this egg development.

Nymphal Period. In 1927, nymphs more than half grown were found May 10 to 14 at five different stations. They were found to be plentiful at Glenns Ferry and Bruneau on April 25, 1928, though most of them were very small. On May 9, 1929, they were first found from Glenns Ferry to Grandview, but were scarce and very small.

Adults. The first males of the season were collected soon after finding the nymphs. It is extremely difficult to find the first nymphs at the time of hatching, but comparatively easy to locate the first new adults. The first individuals to hatch are usually in the third or fourth instar before nymphs can be found for the first time in the spring, and so the first new adults are found soon after the first nymphs. The dates of the collection of the first male were: May 14, 1927; May 11, 1928; and May 16, 1929. The appearance of the males at this time indicated the completion of the first generation for the early hatched individuals. Males are used in this instance instead of females because it is often difficult to distinguish the new from the overwintering females without microscopic examination. The overwintering females are usually of a darker color than the summer forms, but oftentimes light colored ones are found that are quite similar in appearance to females of the new spring brood. The number of adults suddenly increases after this date and the peak of the first generation is reached at about the time of the migration or flight of these adults into the beet fields. (See population graphs.)

The first generation is produced almost entirely on the mustards. No other host plants are available for spring egg laying except occasionally *A. rosea* and that to a very limited extent. The data do not show an increase in the population of adults on the spring hosts after the first generation is completed. Often many nymphs of the second generation are found on the spring host plants but these plants are mature and dry before the nymphs develop to adults.

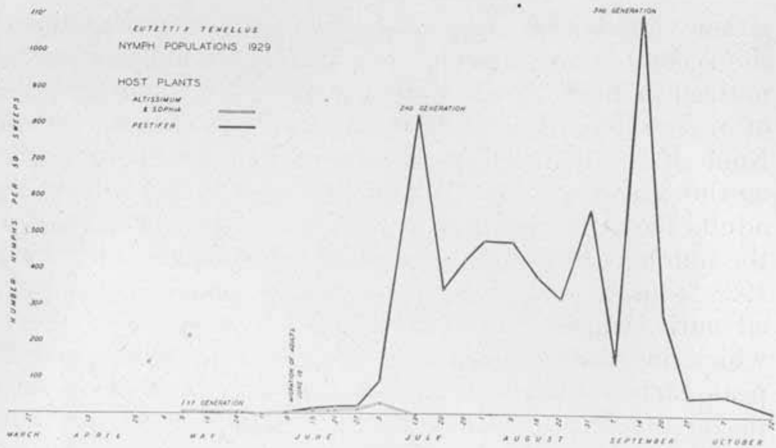

Fig. 8

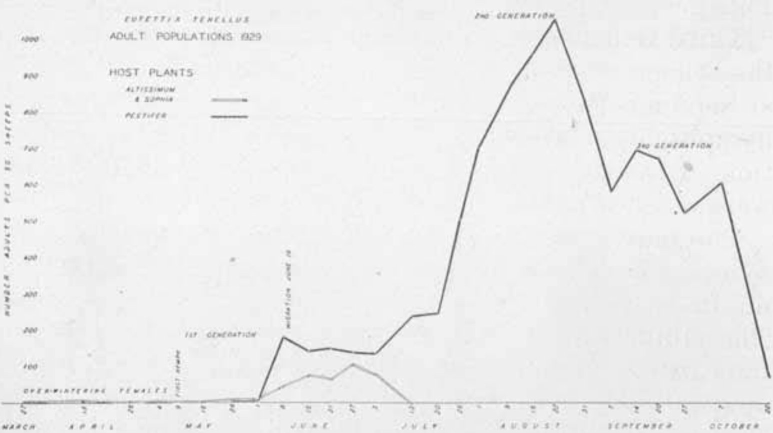

Fig. 9

Nymph and Adult populations of **Eutettix tenellus** through the season as obtained from weekly quantitive collections. The curve represents an average of the collections from three stations: Glenns Ferry, Grandview, and Mountain Home for the spring host plants (the mustards), and Glenns Ferry, Grandview, and Bruneau for the most important summer host plant **(Salsola pestifer).** The number of generations of the insect annually is indicated by this collection record.

Second Generation A great increase in the number of nymphs was noticed at several stations from July 5 to 8, 1927. Most of these were small, being the nymphs of the second generation. June collections showed nymphs to be either very scarce or absent. The sudden appearance of the second generation nymphs in large numbers was not noticed in 1928. They were first observed on a large area of *S. pestifer* on June 2, 1928, at the Grandview station. None of the leafhoppers, adults or nymphs, were present on this area until May 11, the date of the migration of the adults from the mustard areas. There was an increase in the numbers of adults at most of the stations in 1927 and 1928 from the time the second generation nymphs appeared until August 7. After this date a decline followed which indicated that the second generation reached its peak early in August. In 1929 there was a great increase in the number of nymphs until July 13, and in two to four weeks the second generation adults had reached a peak. This generation develops on the summer host plants.

Third Generation. During the three years of this study the collections from the last week in August to the middle of September show another increase in the number of nymphs, indicating the appearance of the third generation. In each year the highest populations during the year were reached in September at most stations.

The most accurate indication of the generations is the nymphal collections, since the late season adult collections might be the accumulation of more than one generation. The adult peaks follow the nymphal peaks from two to four weeks. Conditions favorable to the nymphal development extend two or three weeks into September, except in years of extreme drouth. The third generation can be considered as completed through the nymphal period. During September the temperatures drop and host plants start maturing rapidly. At this time nymphal populations gradually reduce, indicating that the insect development for the season is practically ended. However, nymphs are common throughout September and often well into October. With normal temperatures and host plant conditions during September and October, the adult period of the third generation may be to a large extent completed.

Hibernation. The populations of *E. tenellus* on the breeding grounds showed a rapid decrease in the fall as the host plants became dry. None of the insects can be collected from these dried and mature plants late in October and November. Small numbers have been found in a few late collections taken from the perennials, *Sarcobatus* and *Chrysothamnus*. Considerable mustard germinates on the breeding grounds following the fall rains. *E. tenellus* soon concentrate on these tiny plants, and on warm days in November can usually be found in rather large numbers. They are found to be active during the winter months when the surface temperature rises to about 50° F. and have been found to be quite active in February when the air temperature was as low as 44° F. and that of the surface 48° F. In 1929 the fall weather conditions were such that the summer host plants were not completely dried up until November, and the insects were collected in comparatively large numbers throughout October. By the end of November none were present on any of these host plants excepting at two stations where an occasional one was seen among dry *S. pestifer*.

Unusually dry weather prevailed in southwestern Idaho throughout the fall months of 1929 so that there was no fall germination of the mustards on the breeding grounds as is usually the case. Late in November *E. tenellus* were collected with a net in small numbers from *Artemisia tridentata* for the first time during the course of this study. Such collections were made at three of the stations from *Artemisia* which was the only living plant growth to be found adjacent to the dry host plant areas.

In the early spring the overwintering females are found on fall germinated mustards and occasionally on early grasses growing on the breeding grounds. The development of the eggs begins in February or March with the warmer weather. These females can be collected in the greatest numbers during March and April. They become scarce during May and are rarely collected by the time the adults of the first, or spring generation, appear.

Following the migration *E. tenellus* are common in the beet fields until harvest time, when by the removal of the beets, they are dispersed to nearby stubble, rubbish, fence rows, and waste places. Apparently but few of these survive the winter or remain within the cultivated areas since they are rarely found in the spring near the old beet fields excepting on occasional uncultivated patches that are similar to the desert breeding grounds. Such patches are small, scattered, and usually, at least, of little importance.

Typical breeding area of **Eutettix tenellus** in the early spring. The foot rule is standing among dead stalks of last season's plants, and the ground is sparsely covered with a new growth of **Sophia parviflora.** A similar condition exists where the other spring host plant, **Norta altissima** occurs. This spot is typical of the places where the overwintering females are found in the spring and where they insert their eggs in the plants.

Fig. 10

Host Plant Relationships

The two species of mustards, *N. altissima* and *S. parviflora*. have been found to be the only early spring host plants of importance in the area studied. It is on these plants that the overwintering females of *E. tenellus* lay their eggs, and on which the first generation develops. The summer host plants, *S. pestifer*, *A. rosea*, and *B. hyssopifolia* germinate during March and April, but the young plants remain small for so long that only occasionally can small numbers of the insects be collected from them until May or June, or until after the appearance of the adults of the first generation.

The mustards start to germinate early in March, though some also germinate in the fall after the first fall rains, except in years such as 1929 when there was practically no rainfall during the fall months. The rate of growth of the plants during March depends upon the late winter and early spring weather conditions. In 1927 they were from one to two inches high by the end of March. In 1928 the growth was rapid and plants were two to three inches high, affording satisfactory collecting with a net. In 1929 they were still germinating at the end of March and the few plants which were up early in the month were still less than one inch high. In 1927 and 1929 the plants in the mustard areas were not mature and dry until July. In 1928 they were mature a month earlier.

The life history data show that the first generation is produced practically altogether on the spring host plants and the succeeding generations are produced on the summer hosts. The annual flight of *E. tenellus* into the beet fields occurs at about the time the first generation is completed. This is before the summer hosts become important and before the second generation appears. The spring host plants are therefore fundamentally important in this problem in Idaho since they are the direct source and producers of the great numbers of these insects that fly into the beet fields every spring and that are the cause of such tremendous loss to the sugar beet industry.

The germination and growth of the summer hosts as well as of the spring hosts were earlier in 1928 than in 1927. In 1929 *A. rosea* grew almost as rapidly during March and April as the mustards, so the overwintering females deposited eggs in this host also. It is seldom, however, that host plants other than the mustards are available for early spring egg laying. There is an overlapping each year of the collections from the spring hosts and from the summer hosts of about a month or six weeks. The beginning of this period of overlapping is the date of the first collection of male and female adults of the first generation from the summer as well as the spring hosts. This date also immediately precedes or coincides with the date of migration or flight into the beet fields. There are very few if any nymphs present on the summer hosts during this period, but soon after this the populations increase rapidly. One or more of these summer hosts are found in various degrees of abundance on practically all the mustard areas and provide an ideal host plant sequence. From this time until near the end of the season the populations on the several summer host plants show a gradual increase, never disappearing entirely from the breeding grounds in the desert areas and waste places. The beet fields are not necessary for the continuity of the several generations of this insect through the season.

The populations on the several host plants usually reaches a peak during September. Earlier peaks are sometimes caused by the premature drying of the breeding areas because of drouth. This was noticed in 1928 when many of the *S. pestifier* areas became very dry in July so that during August the plant growth changed rapidly from succulent to transitional and dry, resulting in a decrease of populations on this host during August and September.

High populations of *E. tenellus* were found on *B. hyssopifolia* in 1927. In 1928 they were very much lower. The difference in the growth of this plant for the two years was very noticeable, and seems to account for this difference in population. In 1927 the seepy land was not extremely wet, possibly due to a shortage of irrigation water, while in 1928 there was an increase in water supply and seepage and a corresponding increase in the rank growth of this host. Higher populations were found on this host in 1929, the plant growth seeming to be less rank than in 1927. Numerous drainage canals were completed in 1928 and 1929 on several seepy areas in the Lower Snake River Valley, resulting in a less rank growth and in some cases even a partial elimination of this host. The field observations and data show that the populations are much smaller on a very rank growth of any of these host plants, and the highest numbers are found to occur on areas more sparsely covered with the given host.

These insects continue to breed on the summer host plants until the plants are mature and dry at the end of the season. Usually host plants are dry by the end of September, though occasionally collections which yield numerous *E. tenellus* are made in October. After they disappear from these dry plants, they may be collected in small numbers from certain perennials in the vicinity such as *Sarcobatus, Chrysothamnus*, and *Artemisia*. The host plants on which the insects are last found in the fall are the mustards which come up on the breeding grounds soon after the first autumn rains. In the spring the insects are first found on the mustards, which have germinated both in the preceding fall and during the spring.

The Migration

A distinct flight, or migration, of the first generation adults of *E. tenellus* occurs each year in Southern Idaho into Twin Falls and adjacent counties, coming from the breeding grounds in the west along the Snake River and tributary areas.

The migration takes place in years when there is an extreme scarcity of the insects as well as when they are abundant. It occurs even though there is an abundance of suitable succulent host plants on the breeding grounds, such as *S. pestifier* and *A. rosea*, and even while there are still considerable green spring host plants present on which many of the insects remain. It does not seem necessary to have beet fields to fly into, since great numbers migrated into the Twin Falls tract in 1928 when there were but two or three hundred acres planted to beets out of 200,000 acres of cultivated land in the tract. In their dispersal, however, some find whatever beets are planted. In 1929, though the numbers were much smaller than in 1928, seven of the insects were collected from a row of garden beets only ten feet long, on the day the migration was first noted. The nearest field of sugar beets was one mile away. They were also found at the same time in many of the more distant fields of sugar beets.

Field notes for 1926 show a very early development of the spring host plants. In 1930 they were somewhat earlier than in 1927 and 1929. There is a striking correlation between the spring development of these plants and the date of the migrations into the beet fields. The earlier migrations were accompanied by serious damage to beets in southern Idaho from 1926 to 1930. There are years when there is a high mortality among the overwintering females, making them relatively scarce in the spring, as in 1927 and 1929. The mustards were late in developing in 1927 and 1929. High spring populations were found in years of early development of spring host plants.

Table I

Dates of migration of *E. tenellus* into the Twin Falls tract, and beet damage with relation to development of spring and host plants and other factors.

Year	Migration Date	Spring Host Development	Spring Pop. of *E. tenellus*	Preceeding Winter	Damage to Beets
1926	May 8*	early	high	mild (1)	serious
1927	June 14	late	low	severe (2)	light
1928	May 12	early	high	mild (2)	serious
1929	June 10	late	low	severe (2)	light
1930	May 24	early	high	severe (2)	serious

The year 1930 was unusual in that serious curly top damage to beets in southern Idaho followed a severe winter with minimum temperatures ranging from -22° F. at Twin Falls to -33° F. at Parma. It is probable that the protective cover of snow present over southern Idaho mitigated the influence of the low temperatures on the mortality of the insect (1) pp. 9 and 65.

It is not known just where the western limit of the breeding areas is which furnish *E. tenellus* for this spring flight to the irrigated tracts of southern Idaho A few such areas are found along the western boundaries of the irrigated tracts of this section, and are scattered almost continuously from there on down the Snake River to beyond Weiser. The breeding grounds throughout this whole area are very similar, having the same host plants and practically the same seasonal development of both the hosts and the insects. This development is a few days earlier in the western portion than in the eastern, since migrations into the beet fields near Parma in the Boise Valley and near Weiser in the Lower Snake River Valley have been recorded as occurring from one to three or more

*Approximate. Date early in May.

days earlier than in the Twin Falls beet fields. At the time of the migration the dispersal of the insects has been found to cover a distance of at least forty miles across the Twin Falls tract, the approximiate distance from the nearest breeding grounds along the western side to the last beet fields near the east side. It seems quite possible that many might also fly as far or farther from the more distant breeding grounds to the west before reaching the first beet fields on the west side of the tract. The prevailing direction of the wind at many points between Twin Falls and Weiser is west and northwest and this might be an important factor in increasing the length of the flight since the important breeding grounds along the Snake River lie to the west and northwest of the sugar beet districts of southern Idaho.

Occasional areas of summer host plants occurred where there were no spring hosts present and on such areas *E. tenellus* appeared at the same time the flight occurred into the beet fields. These data show that the first generation adults also scatter to the summer hosts at the same time they fly into the beet fields, this being during the spring migration or flights from the breeding areas.

There is no record in the area studied to show that the insects migrate from the beet fields back to these distant breeding grounds, and no observations made within the desert or breeding grounds indicate that such a fall migration occurs.

"Field Station" Data

Explanation of terms used in tables:

Type of day: used to indicate the uniformity of weather conditions on field trips.

Temperatures (F.°): air, shaded thermometer 5 feet from ground; soil surface, thermometer on ground among host plants.

Host: Plant growth from which collection was made.

Growth: indicating density of stand of the host plants.

Succulence: rank indicates vigorous healthy condition; transitional indicates condition where growth has practically ceased and plant starts to dry up because of drouth or maturity; dry indicates plants dead from drouth or maturity.

Unit collection: 50 sweeps with net unless otherwise noted, as in early spring when leafhoppers are caught singly by hand with a vial.

The following symbols are used to indicate exceptions: *collected in vial, one hour; †collected in vial, 15 minutes; ‡collected in vial; §100 sweeps.

Host plants are abbreviated in tables II to IX as follows: parviflora, par.; pestifer, pest.; rosea, ros.; altissima, alt.; hyssopifolia, hys.; sarcobatus, sar.; chrysothamnus, chry.; and artemisia, art.

Glenns Ferry Station

Three miles north of Glenns Ferry within a cove opening to the Snake River on the south, with the higher desert plateau on the other three sides. Altitude 2556 feet. Exposure open. This is one of several similar areas in this section. *N. altissima*, *S. parviflora*, *S. pestifer*, and *A. rosea* are common here on farms and waste places. The desert plant community is *Sarcobatus* and *Artemisia*.

Table II
1927

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 11	cloudy	60	68	par.	new	rank	0	14	0	14*
Mar. 22	clear	60	66	par.	new	rank	0	18	0	18*
Apr. 19	clear	44	50	par.	dense	rank	0	8	0	8*
May 10	cloudy	70	68	par.	dense	rank	0	2	6	2*
May 14	clear	90	96	par.	dense	rank	1	3	20	4*
May 25	clear	86	84	par.	dense	transitional	2	2	2	4
June 7	clear	90	100	par.	sparse	transitional	12	29	1	41
June 21	clear	82	88	par.	sparse	trans. to dry	25	28	1	53
July 5	clear	86	90	par.	sparse	trans. to dry	6	48	0	54
Jun. 21	clear	82	88	pest.	sparse	rank	32	37	5	69
Jul. 5	clear	86	90	pest.	sparse	rank	13	34	3	47
Jul. 19	clear	100	103	pest.	sparse	rank	10	47	15	57
Aug. 7	clear	92	96	pest.	sparse	rank	14	116	41	130
Aug. 21	clear	95	96	pest.	sparse	transitional	18	44	57	62
Sep. 1	cloudy	80	84	pest.	sparse	transitional	146	105	264	251
Sep. 19	clear	88	92	pest.	sparse	transitional	439	212	170	651
Oct. 24	clear	80	78	pest.	sparse	dry	0	0	0	0

1927 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Jul. 19	clear	100	103	ros.	dense	rank	7	14	0	21
Aug. 21	clear	95	96	ros.	dense	transitional	14	24	10	38
Sep. 1	cloudy	80	84	ros.	dense	transitional	30	18	10	48
Sep. 19	clear	88	92	ros.	dense	transitional	26	19	3	45
Oct. 24	clear	80	78	ros.	dense	dry	0	0	0	0
					1928.					
Feb. 22	cloudy	44	48	par.	new	rank	0	46	0	46*
Mar. 20	clear	70	92	par.	dense	rank	0	31	0	31
Mar. 31	cloudy	58	60	par.	dense	rank	0	20	0	20
Apr. 13	clear	56	66	par.	dense	rank	0	9	0	9
Apr. 25	clear	66	90	par.	dense	rank	0	32	1	32
May 11	cloudy	72	75	par.	dense	trans. to dry	7	16	25	23
May 11	cloudy	72	75	pest.	dense	rank	4	4	0	8
Jun. 2	clear	74	80	pest.	sparse	rank	11	8	1	19
Jun. 21	clear	82	92	pest.	sparse	rank	41	46	4	87
Jun. 30	cloudy	60	66	pest.	sparse	rank	36	101	17	137
Jul. 21	clear	96	102	pest.	sparse	rank	863	588	1688	1451
Aug. 9	clear	110	112	pest.	sparse	transitional	820	788	549	1608
Aug. 31	clear	76	86	pest.	sparse	transitional	401	188	556	589
Sep. 18	clear	76	74	pest.	sparse	transitional	624	261	210	885
Oct. 8	clear	82	88	pest.	sparse	trans. to dry	192	181	86	373
					1929					
Mar. 8	clear	60	74	alt.	sparse	new	0	0	0	0*
Mar. 27	clear	66	80	alt.	sparse	new	0	0	0	0*
Apr. 13	cloudy	54	56	alt.	sparse	new	0	10	0	10†
Apr. 26	clear	70	84	alt.	sparse	new	0	1	0	1
May 4	cloudy	54	62	alt.	sparse	new	0	1	0	1
May 9	clear	56	64	alt.	sparse	new. Observed 1st nymphs			7	
May 16	clear	74	82	alt.	sparse	rank	0	0	2	0
May 24	clear	76	100	alt.	sparse	rank	1	3	3	4
Jun. 1	cloudy	54	64	alt.	sparse	rank	1	3	0	4
Jun. 8	clear	82	86	alt.	sparse	transitional	20	52	1	72
Jun. 15	clear	82	106	alt.	sparse	transitional	25	133	0	158
Jun. 21	clear	80	98	alt.	sparse	transitional	12	112	0	124
Jun. 27	clear	96	120	alt.	sparse	transitional	15	105	1	120
Jul. 3	clear	96	120	alt.	sparse	transitional	13	89	18	102
Jul. 13	cloudy	100	108	alt.	sparse	dry	0	0	0	0
Jun. 1	cloudy	54	64	pest.	sparse	rank	6	4	0	10
Jun. 8	clear	82	86	pest.	dense	rank	147	115	6	262
Jun. 15	clear	82	106	pest.	sparse	rank	87	80	9	167
Jun. 21	clear	80	98	pest.	sparse	rank	47	135	16	182
Jun. 27	clear	96	120	pest.	sparse	rank	62	96	13	158
Jul. 3	clear	96	120	pest.	sparse	rank	93	151	235	244

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Jul. 13	cloudy	100	108	pest.	sparse	rank	135	128	1395	263
Jul. 20	clear	92	104	pest.	sparse	rank	142	246	486	388
Jul. 26	clear	94	100	pest.	sparse	rank	428	455	624	883
Aug. 1	clear	94	106	pest.	sparse	rank to trans.	542	856	833	1398
Aug. 9	clear	96	110	pest.	sparse	transitional	924	1025	776	1949
Aug. 16	cloudy	92	96	Pest.	sparse	transitional	795	861	503	1656
Aug. 22	clear	100	112	pest.	sparse	transitional	1054	979	624	2033
Aug. 31	clear	102	110	pest.	sparse	transitional	528	308	514	836
Sep. 7	clear	70	90	pest.	sparse	trans. to dry	697	383	187	1080
Sep. 14	clear	90	100	pest.	sparse	trans. to dry	451	143	1218	594
Sep. 20	clear (smoky)	70	78	pest.	sparse	trans. to dry	334	130	267	464
Sep. 27	clear	60	74	pest.	sparse	trans. to dry	190	101	22	291
Oct. 7	clear	84	92	pest.	sparse	trans. to dry	319	167	87	486
Oct. 22	clear	58	72	pest.	sparse	dry	28	19	5	47
Nov. 26	clear	48	56	pest.	sparse	dry	2	0	0	2

Mountain Home Station

South of Mountain Home on an abandoned farm near cultivated area surrounded by desert prairie. Altitude 3142 feet. Exposure open. A number of abandoned farms occur in this locality. *S. parviflora* is very common in the spring, with *A. rosea* and *S. pestifer* less common in the summer. This station is representative of the desert plains area extending from Glenns Ferry to Boise and is in an area of a higher altitude than the other stations. The desert plant community is *Artemisia*.

Table III

1927

Date	Type of Day	Temp. Air	Temp. Soil Sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 12	cloudy	58	58	par.	new	rank	0	0	0	0*
Mar. 22	clear	50	54	par.	dense	rank	0	0	0	0*

1927 (Continued)

Date	Type of Day	Temp., Air	Temp., soil	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Apr. 23	clear	70	70	par.	dense	rank	0	0	0	0*
May 25	cloudy	72	72	par.	dense	rank	0	0	0	0
Jun. 7	cloudy	86	94	par.	dense	rank	0	2	0	2
Jun. 21	clear	88	120	par.	dense	transitional	0	2	0	2
Jul. 5	clear	76	80	par.	dense	transitional	4	11	0	15
Jul. 19	clear	97	95	ros.	dense	rank	45	35	5	80
Aug. 7	clear	83	85	ros.	dense	rank	10	28	1	38
Aug. 21	clear	92	96	ros.	dense	rank	50	19	17	69
Sep. 1	clear	76	78	ros.	dense	transitional	101	63	48	164
Sep. 19	clear	88	87	ros.	sparse	transitional	85	35	13	120

1928

Date	Type of Day	Temp., Air	Temp., soil	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 20	clear	65	70	par.	dense	rank	0	2	0	2
Apr. 28	clear	60	66	par.	dense	rank	0	0	0	0
May 11	cloudy	72	82	par.	dense	rank	0	3	0	3
May 31	clear	73	75	par.	sparse	transitional	49	28	0	77
Jun. 18	clear	68	80	par.	sparse	transitional	6	39	0	45
Jun. 29	cloudy	58	64	par.	sparse	transitional	7	74	0	81
Jul. 20	clear	70	74	ros.	sparse	rank	28	63	4	91
Aug. 8	clear	80	76	ros.	sparse	rank to trans.	116	104	93	220
Aug. 31	clear	76	76	ros.	sparse	transitional	256	110	129	366
Sep. 18	clear	84	90	ros.	sparse	trans. to dry	111	75	95	186
Oct. 8	clear	76	82	ros.	plants tramped out by sheep		0	0	0	0
Sep. 18	clear	84	90	pest.	sparse	transitional	170	84	215	254
Oct. 8	clear	76	82	pest.	sparse	trans. to dry	92	90	16	182

1929

Date	Type of Day	Temp., Air	Temp., soil	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 27	clear	64	70	par.	dense	new	0	0	0	0‡
Apr. 13	cloudy	54	60	par.	sparse	new	0	3	0	3†
Apr. 26	clear	60	80	par.	sparse	new	0	1	0	1†
May 4	cloudy	56	62	par.	dense	rank	0	10	0	10†
May 16	clear	74	100	par.	dense	rank	0	0	0	0
May 24	clear	86	98	par.	dense	rank	0	1	3	1
Jun. 1	cloudy	48	62	par.	rain, no collection					
Jun. 8	cloudy	80	90	par.	dense	rank	22	18	4	40
Jun. 15	cloudy	64	72	par.	sparse	transitional	13	41	0	54
Jun. 21	clear	80	94	par.	sparse	trans. to rank	35	47	6	82
Jun. 27	clear	92	110	par.	sparse	trans. to rank	47	63	13	110

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Jul. 3	clear	90	110	par.	dense	transitional	46	60	39	106
Jul. 13	clear	100	110	par.	mature					0
Jun. 8	cloudy	80	90	ros.	dense	rank	5	12	2	17
Jun. 15	cloudy	64	72	ros.	sparse	trans. to rank	10	19	1	29
Jun. 21	clear	80	94	ros.	sparse	trans. to rank	20	38	10	58
Jun. 27	clear	92	110	ros.	sparse	transitional	41	24	24	65
Jul. 3	clear	90	110	ros.	sparse	trans. to rank	18	14	17	32
Jul. 13	clear	100	110	ros.	sparse	trans. to rank	33	30	190	63
Jul. 20	clear	84	102	ros.	sparse	trans. to rank	38	44	28	82
Jul. 26	clear	88	102	ros.	sparse	trans. to rank	49	58	28	107
Aug. 1	clear	92	106	ros.	sparse	transitional	117	160	43	277
Aug. 9	clear	90	98	ros.	sparse	transitional	145	101	37	246
Aug. 16	cloudy	90	94	ros.	sparse	transitional	257	143	70	400
Aug. 22	clear	90	92	ros.	sparse	transitional	268	92	195	360
Aug. 31	clear	90	92	ros.	sparse	transitional	580	168	918	748
Sep. 7	clear	62	80	ros.	sparse	transitional	217	83	99	300
Sep. 14	clear	84	94	ros.	sparse	trans. to dry	542	231	460	773
Sep. 20	clear (smoky)	72	80	ros.	sparse	trans. to dry	327	213	100	540
Sep. 27	clear	58	62	ros.	sparse	trans. to dry	725	409	146	1134
Oct. 7	clear	70	84	ros.	sparse	trans. to dry	74	80	9	154
Oct. 22	clear	70	76	ros.	sparse	dry	112	70	7	182

Bruneau Station

Along the edge of the foothills near Bruneau with desert hills to the east and farm land of the Bruneau Valley to the west. Altitude 2460 feet. Exposure west. *N. altissima* and *S. parviflora* occur in scattered patches in waste places but are not abundant. *S. pestifer* and *A. rosea* are common in the Bruneau Valley. The desert plant community is *Sarcobatus* *A. confertifolia* and *Artemisia*.

Table IV

1927

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph.	Total Adults
Apr. 23	clear	70	84	alt.	new	rank	0	6	0	6*
May 14	clear	92	110	ros.	new	rank	0	1	1	1*
Jun. 9	clear	74	102	ros.	dense	transitional	19	16	1	35
Jun. 21	clear	88	100	ros.	dense	transitional	8	18	3	26
Jul. 8	clear	92	112	ros.	dense	transitional	29	23	14	52
Aug. 21	clear	95	98	ros.	sparse	transitional	4	13	5	17
Sep. 1	clear	78	82	ros.	sparse	transitional	10	11	9	21
Sep. 19	clear	82	78	ros.	sparse	transitional	76	39	10	115
Oct. 24	clear	76	74	ros.	dry	no collection				
Jun. 9	clear	74	102	pest.	sparse	rank	17	20	1	37
June 21	clear	88	100	pest.	sparse	rank	15	14	0	29
Jul. 8	clear	92	112	pest.	sparse	rank	42	95	47	137
Jul. 21	clear	91	90	pest.	sparse	rank	45	204	34	249
Aug. 7	clear	83	80	pest.	sparse	rank	19	129	24	148
Aug. 21	clear	95	98	pest.	sparse	transitional	51	114	105	165
Sep. 1	clear	78	82	pest.	sparse	transitional	63	44	77	107
Sep. 19	clear	82	78	pest.	sparse	transitional	242	99	197	341
Oct. 24	clear	76	74	pest.	sparse	dry	4	2	0	6

1928

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph.	Total Adults
Mar. 20	clear	70	75	alt.	sparse	rank	0	64	0	64
Mar. 20	clear	70	75	par.	sparse	rank	0	6	0	6
Apr. 13	cloudy	56	72	alt.	sparse	rank	0	32	0	32
Apr. 13	cloudy	56	72	par.	sparse	rank	0	12	0	12
Apr. 25	clear	72	86	alt.	sparse	rank	0	11	0	11
May 11	cloudy	72	84	alt.	sparse	rank	1	1	0	2
Jun. 2	cloudy	74	80	pest.	sparse	rank	15	62	1	77
Jun. 21	clear	76	94	pest.	sparse	rank	24	126	17	150
Jun. 30	cloudy	64	78	pest.	sparse	rank	19	124	7	143
Jul. 20	clear	78	83	pest.	sparse	rank to trans.	18	125	28	143
Aug. 8	clear	82	84	pest.	sparse	transitional	27	112	49	139
Aug. 31	clear	90	94	pest.	sparse	transitional	28	29	39	57
Sep. 18	clear	86	92	pest.	sparse	transitional	45	22	48	67
Oct. 10	clear	54	58	pest.	sparse	trans. to dry	8	17	0	25

1929

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph.	Total Adults
Mar. 30	cloudy	40	44	mixture	dense	new	0	0	0	[illegible]

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Apr. 13	cloudy	58	68	ros.	dense	new	0	9	0	9†
Apr. 26	clear	76	110	ros.	dense	new	0	3	0	3†
May 4	cloudy	60	72	ros.	dense	new	0	5	0	5
May 9	clear	62	80	ros.	dense	new	0	0	6	0
May 16	clear	78	94	ros.	dense	rank to trans.	0	4	2	4
May 24	clear	86	96	ros.	dense	rank to dry	4	5	13	9
Jun. 1	cloudy	66	82	ros.	dense	rank to dry	6	8	1	14
Jun. 8	cloudy	80	88	ros.	sparse	transitional	34	31	6	65
Jun. 15	cloudy	82	100	ros.	sparse	transitional	38	87	0	125
Jun. 21	clear	82	98	ros.	sparse	rank	20	100	0	120
Jun. 27	clear	90	112	ros.	sparse	rank	32	82	1	114
Jul. 3	clear	84	100	ros.	sparse	rank	16	37	4	53
Jul. 13	cloudy	102	108	ros.	sparse	rank	18	61	188	79
Jul. 20	clear	84	100	ros.	sparse	rank to trans.	9	54	45	63
Jul. 26	clear	86	110	ros.	sparse	transitional	13	55	35	68
Aug. 1	clear	92	104	ros.	sparse	transitional	27	107	29	134
Aug. 9	clear	88	100	ros.	sparse	transitional	33	99	32	132
Aug. 16	cloudy	84	90	ros.	sparse	transitional	41	141	25	182
Aug. 22	clear	90	100	ros.	sparse	transitional	63	103	18	166
Aug. 31	clear	94	98	ros.	sparse	transitional	93	78	105	171
Sep. 7	clear	72	88	ros.	sparse	trans. to dry	85	81	57	166
Sep. 14	clear	94	110	ros.	sparse	transitional	108	74	80	182
Sep. 20	cloudy (smoky)	70	76	ros.	sparse	trans. to dry	92	41	24	133
Sep. 27	cloudy	58	70	ros.	sparse	trans. to dry	33	42	0	75
Oct. 7	clear	80	94	ros.	sparse	trans. to dry	8	10	1	18
Oct. 22	clear	70	74	ros.	sparse	dry	0	0	0	0
Jun. 1	cloudy	66	82	pest.	sparse	rank	2	2	0	4
Jun. 8	cloudy	80	88	pest.	sparse	rank	100	107	6	207
Jun. 15	cloudy	82	100	pest.	sparse	rank	82	138	32	220
Jun. 21	clear	82	98	pest.	sparse	rank	38	154	28	192
Jun. 27	clear	90	112	pest.	sparse	rank	76	114	17	190
Jul. 3	clear	84	100	pest.	sparse	rank	49	77	21	126
Jul. 13	clear	102	108	pest.	sparse	rank to trans.	71	177	455	248
Jul. 20	clear	84	100	pest.	sparse	rank to trans.	56	185	230	241
Jul. 26	clear	86	110	pest.	sparse	transitional	147	226	286	373

1929 (Continued)

Date	Type of Day	Temp., Air	Temp.,soil su	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Aug. 1	clear	92	104	pest.	sparse	transitional	101	222	202	323
Aug. 9	clear	88	100	pest.	sparse	trans. to dry	79	226	211	305
Aug. 16	cloudy	84	90	pest.	sparse	transitional	498	382	316	880
Aug. 22	clear	90	100	pest.	sparse	transitional	370	432	181	802
Aug. 31	clear	94	98	pest.	sparse	transitional	408	479	193	887
Sep. 7	clear	72	88	pest.	sparse	trans. to dry	331	211	95	542
Sep. 14	clear	94	110	pest.	sparse	trans. to dry	728	339	974	1067
Sep. 20	cloudy (smoky)	70	76	pest.	sparse	trans. to dry	731	372	412	1103
Sep. 27	cloudy	58	70	pest.	sparse	trans. to dry	534	301	26	835
Oct. 7	clear	80	94	pest.	sparse	trans. to dry	457	258	42	715
Oct. 22	clear	70	74	pest.	sparse	dry	5	6	0	11
Nov. 26	clear	52	62	pest.			Present (scarce)			

Grandview Stations

The *B. hyssopifolia* station is four miles north of Grand view on seepy land with northern exposure. The *S. pestifer* station is on a desert area five miles east of Grandview with open exposure. *N. altissima* is common in waste places during the spring. During the summer *B. hyssopifolia* is the predominating plant on all seepy and wet alkaline areas, with *S. pestifer* and *A. rosea* common on the drier waste places. Irrigated farms are found on the lower land along the Snake River. On either side are desert hills and prairies. The desert plant community is *Sarcobatus*, *A. confertifolia*, and *Artemisia*. Altitude 2375 feet.

Table V

1927

Date	Type of Day	Temp., Air	Temp., soil su	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Jun. 21	clear	96	104	pest.	sparse	rank	23	53	2	76
Jul. 8	clear	88	102	pest.	sparse	rank	34	54	136	88
Jul. 8	clear	88	102	pest.	sparse	rank	52	62	327	114
Jul. 20	clear	95	94	pest.	sparse	rank	113	265	413	378
Aug. 7	clear	80	85	pest.	sparse	rank	351	308	214	659
Aug. 21	clear	94	102	pest.	sparse	transitional	330	418	685	748
Sep. 1	clear	76	76	pest.	sparse	transitional	622	378	463	1000
Sep. 19	clear	76	78	pest.	sparse	trans. to dry	463	257	134	720
Oct. 24	clear	74	70	pest.	sparse	dry	0	2	0	2
Jun. 9	clear	70	85	hys.	sparse	rank	3	10	0	13
Jun. 21	clear	96	120	hys.	sparse	rank	12	17	0	29
Jul. 8	clear	88	102	hys.	sparse	rank	43	69	30	112
Jul. 20	clear	95	94	hys.	sparse	rank	29	86	34	115
Aug. 21	clear	95	100	hys.	sparse	rank	128	105	283	233
Sep. 1	clear	76	76	hys.	sparse	rank	676	420	884	1096
Sep. 19	clear	76	78	hys.	sparse	rank	708	243	624	951
Oct. 24	clear	74	70	Sar.			8	38	0	46

1928

Date	Type of Day	Temp., Air	Temp., soil su	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 20	clear	66	66	alt.	new	rank	0	10	0	10
Apr. 13	clear	56	70	alt.	sparse	rank	0	4	0	4
Apr. 25	clear	72	86	alt.	sparse	rank to trans.	0	4	0	4
May 11	cloudy	74	82	alt.	sparse	trans. to dry	4	4	57	8
Jun. 2	clear	78	90	alt.	sparse	trans. to dry	42	24	105	66
May 11	cloudy	74	82	pest.	sparse	rank	5	10	0	15
Jun. 2	clear	78	90	pest.	sparse	rank	25	48	31	73
Jun. 21	clear	75	90	pest.	sparse	rank	22	79	19	101
Jun. 30	cloudy	64	78	pest.	sparse	rank to trans.	21	81	7	102
Jul. 20	clear	84	88	pest.	sparse	trans. to dry	59	44	80	103
Aug. 8	clear	86	94	pest.	sparse	trans. to dry	165	189	175	354

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Aug. 31	clear	95	100	pest.	sparse	trans. to dry	90	40	71	130
Sep. 18	clear	90	96	pest.	sparse	trans. to dry	57	39	25	96
Oct. 10	clear	56	64	pest.	sparse	trans. to dry	25	39	12	64
Jun. 21	clear	74	80	hys.	sparse	rank	29	66	0	95
Jun. 30	cloudy	64	78	hys.	sparse	rank	0	0	0	0
Jul. 20	clear	84	94	hys.	sparse	rank	37	62	31	99
Aug. 8	clear	86	94	hys.	sparse	rank	32	57	41	89
Aug. 31	clear	95	100	hys.	sparse	rank	7	44	27	51
Sep. 18	clear	90	96	hys.	sparse	rank	94	20	70	114
				1929						
Mar. 29	clear	48	50	alt.	sparse	new	0	15	0	15‡
Apr. 13	cloudy	56	64	alt.	sparse	new	0	9	0	9†
Apr. 26	clear	74	92	alt.	sparse	new	0	4	0	4
May 4	cloudy	58	64	alt.	sparse	new	0	3	0	3
May 9	clear	66	80	alt.	sparse	new observed nymphs			2	
May 16	clear	78	92	alt.	sparse	transitional	0	3	0	3
May 24	cloudy	78	82	alt.	sparse	transitional	0	3	3	3
Jun. 8	cloudy	80	96	alt.	sparse	transitional	8	19	6	27
Jun. 15	cloudy	78	86	alt.	sparse	transitional	22	93	20	115
Jun. 21	clear	84	98	alt.	sparse	transitional	14	71	20	85
Jun. 27	clear	86	106	alt.	sparse	transitional	21	30	6	51
Jul. 3	clear	86	104	alt.	sparse	trans. to dry	6	17	31	23
May 24	cloudy	78	82	pest.	sparse	rank	0	1	0	1
Jun. 1	cloudy	52	60	pest.	dense	rank	1	1	0	2
Jun. 8	cloudy	80	96	pest.	dense	rank	22	48	2	70
Jun. 15	cloudy	78	86	pest.	dense	rank	11	24	3	35
Jun. 21	clear	84	98	pest.	dense	rank	18	52	18	70
Jun. 27	clear	86	106	pest.	dense	rank	36	29	37	65
Jul. 3	clear	86	104	pest.	dense	rank	13	23	16	36
Jul. 13	clear	102	116	pest.	dense	rank	36	154	630	190
Jul. 20	clear	84	102	pest.	dense	rank	35	75	328	110
Jul. 26	clear	90	100	pest.	sparse	trans. to dry	100	158	374	258
Aug. 1	clear	88	96	pest.	sparse	rank	131	254	406	385
Aug. 9	clear	93	104	pest.	sparse	transitional	97	271	451	368
Aug 16	cloudy	90	100	pest.	sparse	transitional	127	221	321	348
Aug 22	cloudy	94	96	pest.	sparse	transitional	116	212	166	328
Aug 31	clear	96	104	pest.	sparse	transitional	418	341	984	759

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Sep. 7	clear	74	82	pest.	sparse	transitional	76	46	146	122
Sep. 14	clear	90	96	pest.	sparse	transitional	255	165	1118	420
Sep. 20	cloudy (Smoky)	70	74	pest.	sparse	transitional	326	118	167	444
Sep. 27	clear	60	74	pest.	sparse	transitional	273	165	103	438
Oct. 7	clear	72	82	pest.	sparse	trans. to dr.	322	282	41	604
Oct. 22	clear	72	74	pest.	sparse	dry	113	42	18	155
Mar. 29	clear	48	58	hys.	dense	new	0	12	0	12†
Apr. 13	clear	60	78	hys.	dense	new	0	2	0	2†
Apr. 26	clear	70	108	hys.	dense	new	0	3	0	3
May 4	clear	62	76	hys.	dense	new	0	2	0	2
May 16	clear	78	92	hys.	dense	rank	0	0	0	0
May 24	clear	86	98	hys.	dense	rank	1	1	11	2
Jun. 1	cloudy	52	62	hys.	sparse	rank	3	3	2	6
Jun. 8	cloudy	80	98	hys.	sparse	rank	13	43	12	56
Jun. 15	rain									
Jun. 21	clear	86	94	hys.	sparse	rank	15	54	4	69
Jun. 27	clear	86	106	hys.	sparse	rank	40	46	6	86
Jul. 3	clear	86	104	hys.	sparse	rank	10	26	18	36
Jul. 13	clear	102	116	hys.	sparse	rank	66	100	251	166
Jul. 20	clear	84	102	hys.	sparse	rank	58	77	83	135
Jul. 26	clear	90	100	hys.	sparse	rank	85	94	106	179
Aug. 1	clear	88	96	hys.	sparse	rank	66	133	48	199
Aug. 9	clear	93	104	hys.	sparse	rank	77	175	77	252
Aug. 16	cloudy	90	100	hys.	sparse	rank	80	231	57	311
Aug. 22	cloudy	94	96	hys.	sparse	rank	21	147	31	168
Aug. 31	clear	96	104	hys.	sparse	rank	217	238	886	455
Sep. 7	clear	74	82	hys.	sparse	rank	104	79	91	183
Sep. 14	clear	90	96	hys.	sparse	rank to trans.	261	127	330	388
Sep. 20	cloudy (smoky)	70	74	hys.	sparse	rank to trans.	410	214	200	624
Sep. 27	clear	60	74	hys.	sparse	rank to trans.	560	313	105	873
Oct. 7	clear	72	82	hys.	sparse	transitional	181	228	19	409
Oct. 22	clear	72	74	hys.	sparse	dry	9	5	1	14

Boise Station

Three miles south of Boise along edge of bench above Boise Valley. Altitude 2739 feet. Exposure north. Desert prairie extends to the south and the cultivated valley lies to the north. *S. parsiflora* is common in the spring and *S. pestifer* in the summer, but the host plant areas are not extensive. The desert plant community is *Artemis a.*

TABLE VI

1927

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Apr. 23	clear			par.	new	rank	0	0	0	0*
May 11	cloudy			par.	dense	rank	0	0	0	0*
May 25	cloudy	64	62	par.	dense	rank	0	0	0	0*
Jun. 7	cloudy	80	88	par.	dense	rank to trans.	2	1	0	3
Jun. 21	clear	88	102	par.	dense	transitional	3	2	0	5
Jul. 7	clear	82	82	par.	dense	dry	1	3	0	4
Jul. 7	clear	82	82	pest.	sparse	rank	2	12	0	14
Jul. 19	clear	99	100	pest.	sparse	rank	0	11	0	11
Aug. 8	clear	78	80	pest.	dense	rank	5	29	2	34
Aug. 21	clear	85	82	pest.	dense	rank	15	43	5	58
Sep. 3	clear	77	80	pest.	dense	rank	17	27	25	44
Sep. 21	clear	82	82	pest.	dense	transitional	21	15	1	36
1928										
Apr. 28	clear	54	58	par.	dense	rank	0	0	0	0
May 19	clear	80	90	par.	dense	transitional	0	0	0	0
May 31	clear	73	78	par.	sparse	transitional	0	9	0	9
Jun. 18	clear	74	90	pest.	dense	rank	0	5	0	5
Jun. 29	cloudy	60	66	pest.	dense	rank	2	10	0	12
Jul. 20	clear	82	92	pest.	dense	rank	9	31	6	40
Aug. 8	clear	96	100	pest.	dense	rank	44	81	68	125
Aug. 31	clear	88	96	pest.	dense	transitional	40	17	83	57
Sep. 18	clear	86	86	pest.	dense	transitional	128	64	70	192
Oct. 8	clear	76	78	pest.	dense	trans. to dry	52	45	6	97
1929										
Mar. 27	clear	60	62	par.	sparse	new	0	0	0	0†
Apr. 18	clear	60	74	par.	sparse	new	0	0	0	0
May 16	clear	68	70	par.	dense	rank	0	1	0	1
Jun. 8	cloudy	64	74	par.	dense	rank	1	3	3	4
Jun. 26	clear	70	78	par.	dense	rank	2	2	0	4
Jul. 12	clear	74	86	par.	sparse	trans. to dry	1	8	6	9

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Jul. 31	cloudy	82	84	pest.	sparse	rank	19	105	16	124
Aug. 19	clear	74	82	pest.	dense	rank	23	93	52	116
Sep. 7	clear	70	72	pest.	sparse	transitional	27	17	45	44
Oct. 7	cloudy	74	76	pest.	sparse	trans. to dry	89	41	7	130

Deer Flat Station

Within desert bench land area ten miles southwest of Nampa, with irrigated farm area on the north and Snake River Valley on the south and west. Altitude 2600 feet. Exposure open. There are a number of abandoned dry farms within this area on which *N. altissima* and *S. parviflora* occur in the spring with the former predominating. *S. pestifer* is common in the summer. The desert plant community is *Artemisia.*

TABLE VII
1927

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 23	clear	60	65	alt.	new	rank	0	4	0	4*
Apr. 20	clear	48	54	alt.	dense	rank	0	20	0	20*
Apr. 20	clear	48	54	alt.	dense	rank	0	0	0	0
May 13	clear	76	88	alt.	dense	rank	0	1	0	1
Jun. 8	cloudy	66	68	alt.	dense	transitional	2	6	0	8
Jun. 18	clear	82	100	alt.	defoliated	transitional	9	22	2	31
Jul. 7	clear	94	104	alt.	defoliated	trans. to dry	1	1	34	2
Jul. 7	clear	94	92	pest.	sparse	rank	8	6	5	14
Jul. 20	clear	96	114	pest.	sparse	rank	99	143	88	242
Aug. 8	clear	90	104	pest.	sparse	trans. to dry	166	272	76	438
Aug. 21	clear	70	74	pest.	sparse	trans. to dry	169	123	158	292

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Sep. 2	clear	76	88	pest.	sparse	transitional	163	94	209	257
Sep. 20	clear	75	78	pest.	sparse	transitional	139	58	22	197
Oct. 24	clear			pest.	sparse	dry	0	0	0	0
Oct. 24	clear			Chrysothamnus		dormant	4	3	0	7
					1928					
Feb. 23	clear	38	42	par.	sparse		0	0	0	0*
Mar. 21	clear	66	70	par.	new	rank	0	30	0	30*
Apr. 26	clear	68	76	par.	sparse	rank	0	1	0	1
May 17	clear	75	86	par.	sparse	rank	0	6	11	6
May 17	clear	75	86	alt.	sparse	rank to trans.	0	2	0	2
May 30	clear	65	80	alt.	sparse	transitional	2	12	0	14
Jun. 20	cloudy	84	88	alt.	sparse	transitional	4	37	6	41
Jun. 29	cloudy	58	60	alt.	sparse	trans. to dry	1	12	0	13
May 30	clear	65	80	pest.	sparse	rank	18	32	5	50
Jun. 20	cloudy	84	88	pest.	sparse	rank	24	50	2	74
Jun. 29	cloudy	58	60	pest.	sparse	rank	5	35	3	40
Jul. 20	clear	88	94	pest.	sparse	rank	163	234	78	397
Aug. 8	clear	100	106	pest.	sparse	rank to trans.	709	730	627	1439
Aug. 31	clear	82	92	pest.	sparse	transitional	283	145	224	428
Sep. 18	clear	78	80	pest.	sparse	trans. to dry	296	127	487	423
Oct. 8	clear	76	78	pest.	sparse	dry	131	97	19	228
					1929					
Mar. 29	clear	48	70	alt.	sparse	new	0	3	0	3†
Apr. 18	clear	62	80	alt.	sparse	new	0	4	0	4
May 17	clear	72	78	alt.	dense	transitional	0	1	0	1
Jun. 7	clear	78	100	alt.	sparse	transitional	10	32	7	42
Jun. 26	clear	76	94	alt.	sparse	dry	2	6	0	8
Jul. 12	clear	80	92	alt.	sparse	dry*	0	0	0	0
Jun. 26	clear	76	94	pest.	sparse	rank (short)	20	56	4	76
Jul. 12	clear	80	92	pest.	sparse	rank	33	47	67	80
Jul. 31	clear	96	110	pest.	sparse	transitional	259	424	301	683
Aug. 19	clear	78	94	pest.	sparse	transitional	181	137	159	318
Sep. 13	clear	92	100	pest.	sparse	rank	603	292	1229	895
Oct. 5	cloudy	72	74	pest.	sparse	trans. to dry	314	205	63	519
Nov. 27	clear	48	54	artemisia			1	0	0	1

*Dry and mature except in small patches along road.

Homedale Stations

The *S. pestifer* station is two miles south of Homedale and represents the dry or desert waste land. Exposure open. *B. hyssopifolia* station is five miles south of Homedale and represents the seepy, wet alkaline areas. Exposure open. There is an abundance of waste land throughout the farming districts of this part of the Snake River Valley. *N. altissima* and *S. parviflora* are common in the spring and *S. pestifer* and *B. hyssopifolia* in the summer. Much of this waste land is seepy, wet alkaline areas being common over the district. On such land *B. hyssopifolia* predominates. Altitude 2200 feet. The desert plant com munity is *Sarcobatus, A. confertifolia,* and *Artemisia.*

TABLE VIII
1927

Date	Type of Day	Temp., Air	Temp., soil su	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Apr. 22	clear	52	54	alt.	dense	rank	0	40	0	40*
May 13	clear	78	102	alt.	dense	rank	0	0	3	0*
Jun. 8	cloudy	70	72	pest.	dense	rank	0	6	0	6
Jun. 18	clear	78	88	pest.	dense	rank	3	14	0	17
Jul. 7	clear	87	98	pest.	dense	rank	0	7	25	7
Jul. 20	clear	94	102	pest.	dense	rank	26	26	3	52
Aug. 8	clear	95	98	pest.	dense	rank	19	102	22	121
Aug. 20	clear	90	90	pest.	dense	rank	6	32	5	38
Sep. 2	clear	84	96	pest.	dense	rank to trans.	35	42	131	77
Sep. 20	clear	80	80	pest.	dense	transitional	174	82	163	256
Oct. 24	clear			pest.	dense	dry	0	0	0	0
May 13	clear	78	102	par.	new	rank	0	0	14	0*
Jun. 8	clear	70	72	hys.	sparse	rank	8	12	4	20
Jun. 18	clear	82	98	hys.	sparse	rank	12	11	2	23
Jul. 7	clear	87	98	hys.	sparse	rank	14	22	9	36
Jul. 20	clear	94	110	hys.	sparse	trans. to dry	30	51	96	81
Aug. 8	clear	92	102	hys.	sparse	rank	5	47	8	52
Aug. 20	clear	90	90	hys.	sparse	rank	3	22	6	25
Sep. 2	clear	84	96	hys.	sparse	rank	19	37	71	56
Sep. 20	clear	80	80	hys.	sparse	rank	42	21	44	63
Oct. 24	clear			hys.	sparse	dry	0	0	0	0

1928

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
May 17	clear	74	84	pest.	new	rank	0	1	2	1
May 30	clear	64	90	pest.	dense	rank	2	3	0	5
Jun. 20	cloudy	86	92	pest.	dense	rank	3	13	2	16
Jun. 29	cloudy	70	78	pest.	dense	rank	1	11	2	12
Jul. 20	clear	86	90	pest.	dense	rank	7	15	28	22
Aug. 8	clear	100	102	pest.	dense	transitional	28	107	87	135
Aug. 31	clear	72	76	pest.	dense	transitional	37	53	195	90
Sep. 18	clear	70	70	pest.	dense	transitional	301	107	308	408
Oct. 8	clear	76	78	pest.	dense	trans. to dry	138	94	57	232
Mar. 21	clear	76	86	par.	new	rank	0	6	0	6
Apr. 26	clear	70	88	par.	sparse	rank	0	7	0	7
May 17	clear	74	84	hys.	dense	rank	0	1	2	1
May 30	clear	64	90	hys.	dense	rank	12	17	0	29
Jun. 20	cloudy	86	92	hys.	dense	rank	9	21	0	30
Jun. 29	cloudy	70	78	hys.	dense	rank	16	17	1	33
Jul. 20	clear	86	88	hys.	dense	rank	1	10	16	11
Aug. 31	clear	72	76	hys.	dense	rank	13	15	9	28
Sep. 18	clear	70	70	hys.	dense	rank to trans.	66	35	70	101
Oct. 8	clear	76	78	hys.	dense	rank to trans.	40	22	7	62

1929

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 29	clear	44	64	all 4 hosts	dense	new	0	2	0	2†
Apr. 18	clear	64	82	alt.	dense	new	0	3	0	3
May 17	clear	78	88	alt.	sparsre	trans.	0	0	0	0
Jun. 7	cloudy	76	82	pest.	sparse	rank	3	5	0	8
Jun. 26	clear	80	90	pest.	dense	rank	0	4	0	4
Jul. 12	clear	80	90	pest.	dense	rank	5	23	7	28
Jul. 31	clear	96	110	pest.	sparse	rank	63	124	116	187
Aug. 19	clear	86	96	pest.	dense	rank	39	121	93	160
Sep. 13	clear	92	98	pest.	sparse	transitional	449	166	792	615
Oct. 5	cloudy	66	70	pest.	sparse	trans. to dry	187	162	9	349
May 17	clear	76	82	par.	sparse	rank	0	5	0	5
Jun. 7	cloudy	76	82	par.	sparse	rank	1	10	0	11
Jun. 26	clear	80	90	par.	sparse	transitional	5	7	1	12
Jul. 12	clear	86	96	par.		mature	0	0	0	0
Mar. 29	clear	48	72	hys.	sparse	new	0	3	0	3†

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Apr. 18	clear	64	82	hys.	sparse	rank	0	1	0	1
Jun. 7	cloudy	76	82	hys.	dense	rank	4	4	0	8
Jun. 26	clear	80	90	hys.	dense	rank	6	17	0	23
Jul. 12	clear	86	96	hys.	sparse	transitional	7	9	20	16
Jul. 31	clear	96	110	hys.	sparse	rank to trans	65	83	95	148
Aug. 19	clear	86	96	hys.	sparse	rank to trans.	26	62	7	88
Sep. 13	clear	92	98	hys.	sparee	transitional	53	45	160	98
Oct. 5	cloudy	66	70	hys.	sparse	rank to trans.	116	47	37	163

Wilder Station

One mile east of Wilder within irrigated district on bench land south of Boise Valley. Altitude 2400 feet. Exposure open. There is very little waste land or desert area in the vicinity. The desert plant community has been eliminated by cultivation but was probably *Artemisia*. There are various host plants on waste places on farms, along the roads, and railroad right-of-way. *N. altissima* and *S. parviflora* are common in the spring and *B. hyssopifolia* in the summer.

TABLE IX
1927

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 24	clear	56	60	par.	new	rank	0	4	0	4*
Apr. 22	clear	58	62	par.	dense	rank	0	24	0	24*
May 13	clear	70	90	par.	dense	rank	0	0	2	0*
Jun. 8	cloudy	66	72	par.	sparse	transitional	4	4	0	8
Jun. 18	clear	72	100	par.	dense	transitional	3	2	0	5
Jul. 7	clear	84	100	hys.	dense	rank	40	13	7	53
Jul. 20	clear	90	98	hys.	dense	rank	62	102	38	164
Aug. 8	clear	93	100	hys.	dense	rank	26	124	8	150
Aug. 20	clear	84	86	hys.	dense	rank	15	156	13	171

1927 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Sep. 2	clear	82	98	hys.	dense	rank	27	97	51	124
Sep. 20	clear	80	78	hys.	dense	rank	13	13	1	26

1928

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 21	clear	78	94	par.	new	rank	0	1	0	1
Apr. 26	clear	76	90	par.	dense	rank	0	4	0	4
May 17	clear	68	86	par.	dense	transitional	0	3	0	3
May 30	clear	60	74	par.	sparse	transitional	4	14	3	18
Mar. 21	clear	78	94	hys.	new	rank	0	0	0	0
May 17	clear	68	86	hys.	dense	rank	0	1	0	1
May 30	clear	60	74	hys.	dense	rank	10	15	1	25
Jun. 20	cloudy	82	85	hys.	dense	rank	5	19	0	24
Jun. 29	clear	72	86	hys.	dense	rank	4	14	0	18
Jul. 20	clear	86	90	hys.	dense	rank	7	41	11	48
Aug. 8	clear	100	102	hys.	dense	rank	3	62	10	65
Aug. 31	clear	66	64	hys.	dense	transitional	14	25	29	39
Sep. 18	clear	70	70	hys.	dense	transitional	48	17	52	65

1929

Date	Type of Day	Temp., Air	Temp., soil sur	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 29	clear	40	50	hys.	dense	new	0	9	0	9
Apr. 18	cloudy	64	68	hys.	dense	new	0	1	0	1
May 17	clear	78	90	hys.	dense	rank	0	0	0	0
Jun. 7	cloudy	80	90	hys.	sparse	rank	2	7	0	9
Jun. 26	clear	80	98	hys.	dense	rank	22	21	0	43
Jul. 12	clear	88	104	hys.	sparse	rank	9	18	6	27
Jul. 31	clear	96	110	hys.	sparse	rank	54	135	54	189
Aug. 19	clear	86	94	hys.	dense	rank	74	125	10	199
Sep. 13	clear	92	102	hys.	sparse	rank to trans.	160	85	118	245
Oct 5	cloudy	62	66	hys.	dense	transitional	166	99	15	265

Sandhollow Station

Within the hilly desert area north of the Snake River Valley with the Boise Valley to the east and Payette Valley to the west. Altitude 2400 feet. Exposure open. Abandoned dry farms are scattered over this area on which *N. altissima* and *S. parviflora* are common in the spring and *S. pestifer* more sparsely present in the summer. The desert plant community is *Artemisia*.

TABLE X

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
1927										
Mar. 24	clear	60	50	par.	new	rank	0	2	0	2*
Apr. 21	cloudy	62	74	par. and alt.	dense	rank	0	20	0	20*
May 11	cloudy	70	77	par. and alt.	dense	rank	0	7	0	7*
May 26	cloudy	68	80	par. and alt.	dense	rank	0	1	2	1
Jun. 7	cloudy	82	80	par. and alt.	dense	rank	3	8	0	11
Jun. 18	cloudy	76	74	par. and alt.	dense	trans.	19	9	4	28
Jul. 6	clear	82	90	par. and alt.	dense	trans. to dry	3	5	16	8
Jul. 19	clear	94	96	par. and alt.	dense	trans. to dry	7	18	2	25
Sep. 3	clear	76	84	pest.	sparse	transitional	79	43	28	122
Sep. 21	clear	70	69	pest.	sparse	transitional	23	12	7	35
Oct. 24	clear			pest.	sparse	dry	0	0	0	0
1928										
Feb. 23	clear	38	42	alt.	new	rank	0	0	0	0*
Mar. 21	clear	78	78	alt.	sparse	rank	0	2	0	2
Mar. 21	clear	78	78	par.	sparse	rank	0	10	0	10
Apr. 26	clear	80	84	alt.	sparse	rank	0	3	0	3
May 18	clear	76	78	par.	sparse	rank	0	0	0	0
May 29	cloudy	70	74	alt.	sparse	transitional	6	12	3	18
May 29	cloudy	70	74	pest.	sparse	rank	2	8	4	10
Jun. 20	cloudy	82	90	pest.	sparse	rank	30	76	11	106
Jun. 29	clear	72	88	pest.	sparse	rank	8	60	1	68
Jul. 20	clear	86	90	pest.	sparse	rank to trans.	23	60	147	83
Aug. 9	clear	96	106	pest.	sparse	transitional	161	179	157	340
Aug. 30	clear	86	98	pest.	sparse	transitional	77	33	70	110
Sep. 19	clear	70	76	pest.	sparse	trans. to dry	88	34	16	122
Oct. 9	clear	82	90	pest.	sparse	trans. to dry	131	139	15	270
1929										
Mar. 28	cloudy	62	64	alt.	sparse	new	0	6	0	6†
Apr. 18	cloudy	62	64	alt.	sparse	new	0	6	0	6†
May 17	clear	76	90	alt.	sparse	transitional	0	3	0	3
Jun. 7	cloudy	84	92	alt.	sparse	transitional	7	7	1	14
Jun. 26	clear	84	90	alt.	sparse	transitional	2	19	1	21
Jul. 12	clear	92	110	alt.		mature and dry	0	0	0	0

1919 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Jun. 7	cloudy	84	92	pest.	sparse	rank	19	18	1	37
Jun. 26	clear	84	90	pest.	dense	rank	6	12	0	18
Jul. 12	clear	92	110	pest.	dense	rank	9	21	13	30
Jul. 31	cloudy	92	95	pest.	sparse	rank	189	474	128	663
Aug. 19	clear	88	96	pest.	sparse	transitional	91	240	79	331
Sep. 12	clear	86	94	pest.	sparse	trans. to dry	226	120	542	346
Oct. 5	cloudy	76	84	pest.	sparse	trans. to dry	446	326	46	772
Nov. 29	clear	60	68	artemisia			0	3	0	3

Weiser Station

Five miles south of Weiser in the Snake River Valley in Oregon. Altitude 2150 feet. Exposure open. Irrigated valley land lies on the east and dry farms (some of which are abandoned) on the west, scattered through the desert hills of eastern Oregon. Waste place near sheep pens. *N. altissima* and *S. parviflora* are common in spring and *S. pestifer* and *A. rosea* common in summer. Desert host plant community *Sarcobatus* and *Artemisia*.

TABLE XI
1927

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
May 12	cloudy	72	78	par.	dense	rank	0	0	0	0*
May 27	cloudy	56	58	ros.	sparse	dry	0	0	1	0
Jun. 8	cloudy	58	62	ros.	sparse	rank	1	2	0	3
Jun. 18	clear	88	100	ros.	sparse	rank	6	6	0	12
Jul. 6	clear	93	100	ros.	sparse	rank to trans.	0	5	0	5
Jul. 20	clear	84	92	ros.	sparse	rank to trans.	4	7	2	11
Aug. 9	clear	90	104	ros.	sparse	transitional	30	49	14	79
Aug. 20	clear	94	102	ros.	sparse	transitional	27	16	17	43

1927 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Sep. 2	clear	80	84	ros.	sparse	trans.	46	19	41	65
Sep. 20	clear	88	92	ros.	sparse	trans.	39	4	2	43
Oct. 24	clear			ros.	sparse	dry	0	0	0	0

1928

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Feb. 23	clear	38	42	par.	new	rank	0	0	0	0*
Apr. 26	clear	68	66	par.	dense	rank	0	1	0	1
May 18	clear	82	94	ros.	sparse	rank	0	0	0	0
May 29	cloudy	70	85	ros.	sparse	rank	4	1	0	5
May 29	cloudy	70	85	alt.	sparse	transitional	2	6	0	8
Jun. 20	clear	76	82	ros.	sparse	rank	6	9	0	15
Jun. 29	cloudy	66	72	ros.	dense	rank to trans.	2	7	0	9
Jul. 20	clear	72	72	ros.	dense	rank to trans.	8	10	3	18
Aug. 8	clear	90	86	ros.	dense	transitional	18	63	14	81
Aug. 30	clear	80	82	ros.	dense	transitional	13	15	58	28
Sep. 19	clear	68	78	ros.	dense	trans. to dry	15	18	33	33
Oct. 9	clear	68	74	ros.	dense	trans. to dry	62	60	3	122
May 29	cloudy	70	85	pest.	sparse	rank	4	1	0	5
Jun. 20	clear	76	82	pest.	sparse	rank	5	35	0	40
Jun. 29	cloudy	66	72	pest.	dense	rank	1	17	0	18
Jul. 20	clear	72	72	pest.	dense	rank	65	98	174	163
Aug. 8	clear	90	86	pest.	dense	transitional	14	67	94	81
Aug. 30	clear	80	82	pest.	dense	transitional	30	32	68	62
Sep. 19	clear	68	78	pest.	dense	transitional	62	22	19	84
Oct. 9	clear	68	74	Pest.	dense	transitional	124	91	12	215

1929

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymph	Total Adults
Mar. 28	cloudy	60	64	alt.	sparse	new	0	0	0	0†
Apr. 19	cloudy	54	58	alt.	sparse	new	0	8	0	8†
May 17	clear	64	94	alt.	sparse	new	0	0	0	0
Jun. 7	clear	82	88	alt.	sparse	transitional	1	11	4	12
Jun. 26	clear	84	94	alt.	sparse	transitional	4	10	1	14
Jul. 12	clear	94	104	alt.	dry and mature		0	0	0	0
Jun. 7	clear	82	88	ros.	dense	transitional	4	3	0	7
Jun. 26	clear	84	94	ros.	dense	rank to trans.	17	5	1	22

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymprs	Total Adults
[illegible]	clear	94	104	ros.	dense	transitional	14	11	4	25
Jul. 31	clear	94	102	ros.	sparse	trans. to dry	2	10	0	12
Aug. 19	clear	72	72	ros.	sparse	transitional	2	15	1	17
Sep. 12	clear	86	96	ros.	sparse	trans. to dry	14	8	38	22
Oct. 6	cloudy	74	76	ros.	sparse	trans. to dry	78	59	32	137
Aug. 19	cloudy	72	72	ros.	sparse	rank	26	48	31	74

Ontario, Oregon, Station

Station at junction of Malheur and Snake River Valleys. Altitude 2190 feet. Exposure open. Malheur Valley extends west into hilly desert of eastern Oregon with Snake River Valley on the east. *N. altissima* and *S. parviflora* are common in the spring, and *A. rosea* and *S. pestifer* in the summer. Collections from the mustard species at several points from 6 to 12 miles west of Ontario and from other hosts on waste land 5 miles west of Vale. The desert plant community is *Sarcobatus Artemisia.*

TABLE XII
1927

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymphs	Total Adults
Apr. 22	clear	60	84	alt.	new	rank	0	10	0	10*
May 12	cloudy	72	78	alt.	dense	rank	0	0	0	0*
May 27	cloudy	60	68	par.	sparse	rank to trans.	2	1	3	3
Jun. 8	cloudy	58	64	par.	sparse	rank to trans.	12	15	0	27
Jun. 18	clear	93	104	par.	defoliated	trans. to dry	9	21	0	30
Jul. 6	clear	92	102	pest.	sparse	rank	1	10	5	11

1927 (Continued..

Date	Type of Day....	Temp., Air	Temp.,soil sur.	Host	Growth	Succulence	Male	Female	Nym.	Total Adults
Jul. 20	clear	88	104	pest.	sparse	rank	40	112	256	152
Aug. 9	clear	83	90	pest.	sparse	rank	169	227	271	396
Aug. 20	clear	92	96	pest.	sparse	rank to trans.	79	196	147	275
Sep. 2	clear	80	85	pest.	sparse	transitional	159	87	163	246
Sep. 2	clear	80	85	ros.	sparse	transitional	69	50	48	119
Sep. 20	clear	85	88	pest.	sparse	transitional	238	124	221	362
Sep. 20	clear	85	88	ros.	sparse	transitional	36	7	2	43
Oct. 24	clear		rosea	ros. and pest.		dry	0	0	0	0
				1928						
Feb. 23	clear	38	42	alt.	new	rank	0	0	0	0*
Apr. 26	clear	78	76	par.	sparse	rank	0	2	0	2
Mar. 21	clear	70	70	alt.	sparse	rank	0	6	0	6*
May 17	clear	80	92	alt.	sparse	rank	0	0	0	·0
May 29	cloudy	68	84	alt.	sparse	trans.	0	0	0	0
Jun. 18	clear	72	74	ros.	sparse	rank	6	9	0	15
Jun. 29	cloudy	66	72	ros.	sparse	rank to trans.	0	5	0	5
Jul. 21	clear	78	82	ros.	sparse	transitional	4	13	3	17
Aug. 8	clear	90	86	ros.	sparse	transitional	16	25	21	41
Aug. 30	clear	72	78	ros.	sparse	transitional	48	12	121	60
Sep. 19	clear	66	72	ros.	sparse	transitional	33	17	40	50
Oct. 9	clear	74	86	ros.	sparse	trans. to dry	84	55	4	139
May 17	clear	80	92	pest.	sparse	rank	0	0	0	0
May 29	cloudy	68	84	pest.	sparse	rank	4	22	0	26
Jun. 18	clear	72	74	pest.	sparse	rank	5	40	0	45
Jun. 29	cloudy	66	72	pest.	sparse	rank	3	12	0	15
Jul. 21	clear	78	82	Pest.	sparse	rank	29	76	137	105
Aug. 8	clear	90	86	pest.	sparse	transitional	68	120	181	188
Aug. 30	clear	72	78	pest.	sparse	transitional	116	42	208	158
Sep. 19	clear	66	72	pest.	sparse	transitional	82	39	68	121
Oct. 9	clear	74	86	pest.	sparse	transitional	96	62	32	158
				1929						
Mar. 28	cloudy	64	66	alt.	sparse	new	0	2	0	2†
Apr. 19	cloudy	60	68	alt.	sparse	new	0	3	0	3†
May 17	clear	68	84	alt.	dense	rank	0	1	0	1
Jun. 7	clear	82	92	alt.	sparse	transitional	6	26	5	32
Jun. 26	clear	84	108	alt.	sparse	transitional	5	4	2	9

1929 (Continued)

Date	Type of Day	Temp., Air	Temp., soil sur.	Host	Growth	Succulence	Male	Female	Nymphs	Total Adults
Jul. 12	clear	92	114	alt.	dry		0	0	0	0
Jun. 26	clear	84	108	pest.	sparse	rank	18	14	4	32
Jul. 12	clear	92	114	pest.	sparse	rank	32	35	56	67
Jul. 31	clear	94	97	pest.	sparse	rank	158	286	261	444
Aug. 19	clear	80	84	pest.	sparse	transitional	55	117	73	172
Sep. 12	clear	90	94	pest.	sparse	trans. to dry	186	99	300	285
Oct. 6	cloudy	76	80	pest.	sparse	trans. to dry	438	238	31	676
Nov. 29	clear	52	54	sage			2	1	0	3

Soil Analysis

The soil analysis of the different stations showed the soluble salts to be highest at the *Bassia* stations. There was no great difference between *Salsola* and *Atriplex* stations.

It was observed that on the soils with the lowest wilting coefficients the host plants had a tendency to mature earlier, or become dry before the end of the season because of an apparently greater susceptibility to drouth.

Average soluble salt content of soil on summer host plant areas, parts per million:

	1-6 inches deep	12-18 inches deep
S. pestifer	915	2337
A. rosea	900	1686
B. hyssopifolia	15593	15733

Soil analysis of the mustard areas is not given since the mustards occur in the spring on practically all the summer host plant areas.

TABLE XIII

Soil Analysis at Lower Snake River Valley Stations.*

Station	Depth Soil Sample	Wilting Coefficient	Soluble Salts p. p. m.
Glenns Ferry	1 in.-6 in.	7.7	400
S. pestifer	12 in.-18 in.	10.9	580
Mountain Home	1 in.-6 in.	17.1	1900
A. rosea	12 in.-18 in.	15.3	3840
Bruneau	1 in.-6 in.	7.1	1420
S. pestifer	12 in.-18 in.	5.4	820
Grandview	1 in.-6 in.	8.1	1060
S. pestifer	12 in.-18 in.	6.8	1260
Boise	1 in.-6 in.	11.6	580
S. pestifer	12 in.-18 in.	15.8	320
Deer Flat	1 in.-6 in.	12.5	1360
S. pestifer	12 in.-18 in.	13.3	4200
Homedale	1 in. 6 in.	6.7	1260
S. pestifer	12 in.-18 in.	8.5	3240
Homedale	1 in.-6 in.	11.8	42840
B. hyssopifolia	12 in.-18 in.	14.7	27680
Wilder	1 in.-6 in.	9.7	3400
B. hyssopifolia	12 in.-18 in.	13.8	10320
Sandhollow	1 in.-6 in.	13.6	1360
S. pestifer	12 in.-18 in.	20.1	9400
Weiser	1 in.- 6 in.	14.7	420
A. rosea & S. pestifer	12 in.-18 in.	18.4	920
Ontario	1 in.-6 in.	8.2	380
A. rosea & S. pestifer	12 in.-18 in.	8.6	300
Grandview	1 in.-6 in.	7.9	10540
B. hyssopifolia	12 in.-18 in.	10.6	9200

State Distribution of *Eutettix tenellus* Baker, 1925-1929

A survey of the distribution and relative abundance of *E. tenellus* and of its host plants in the state of Idaho was made by the writer in 1925 and 1926 (*4*). This survey

* Analyses of soil samples by Bureau of Chemistry and Soils. United States Department of Agriculture.

was contined in a general way during 1927, 1928, and 1929 to obtain data on the distribution and abundance of the insect and its host plants over a period of years.

Northern Idaho: A very material decrease in the numbers of the beat leafhopper in northerr Idaho was noted in 1927 and 1928, though the geographic distribution remained practically the same as in 1926. The insect was readily collected in 1926 on all the common host plants and occasionally in rather large numbers. In 1927 and 1928 many sweepings were made on the same host plants and in the same localities, but only in comparatively few cases was the insect found, and usually the only hosts from which it was collected were beets and mangels found in gardens or small plots, and from *S. pestifer* in canyons and valleys.

The distribution and abundance of the host plants in northern Idaho was found to be about the same in 1926, 1927, and 1928. The populations of the insect were very low in August of 1927 and 1928 which would appear to indicate that this territory is rarely a favorable breeding ground. It is probable, however, that *E. tenellus* is able to maintain itself every year in the more favorable localities occurring in the canyons and valleys of the Snake, Clearwater, and Salmon rivers.

Southern Idaho: Conditions typical of southern Idaho are given in detail in the text of this bulletin.

Eastern Idaho: The distribution of *E. tenellus* and its host plants in eastern Idaho remained practically the same from 1925 to 1929. The insects could be found on the more common host plants and especially on sugar beets, *S. pestifer*, and *A. rosea*. The *E. tenellus* populations were high in some years and low in others An abundance of host plants, other than beets, occurs every year in the eastern portion of the Snake River plains area from Minidoka to Rexburg. Here the insects are found in varying degrees of abundance in different years. In the extreme eastern and southeastern part of the state they are common on relatively few areas because of the mountainous nature of the country.

Extensive *E. tenellus* breeding grounds of importance in Idaho are limited to the Snake River plains area which extends from Weiser on the west to Rexburg on the east. Other breeding areas throughout the state are smaller and more restricted and are probably seldom of more than local importance.

Literature Cited

(1) Carter, W.

1930. Ecological Studies of the Beet Leaf Hopper. United States Department of Agriculture Technical Bulletin 206, 114 p., illus.

(2)

1927 to 1930. Reports (annual) on Sugar Beet Prospects and Leaf Hopper Conditions for Twin Falls, Jerome, Minidoka, and Cassia Counties, Idaho. United States Bureau of Entomology, Beet Leaf Hopper Investigations at Twin Falls, Idaho.

(3) Gardner, Bradford, and Hooker.

Fundamentals of Fruit Productions, p. 236. McGraw-Hill, 1922

(4) Haegele, R. W.

1927. The Beet Leaf Hopper (*Eutettix tenellus* Baker). A Survey in Idaho. University of Idaho Agricultural Experiment Station Bulletin 156, 28 p., illus.

(5) Severin, H. H. P.

1929. Curly Top Symptoms on the Sugar Beet. University of California Agricultural Experiment Station Bulletin 465, 35 p., illus.