Survival of the Beet Leafhopper in Southern Idaho During the Severe Winter of 1948-49

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The beet leafhopper (*Circulifer tenellus* (Bak.)) overwinters in the adult stage. Females are fertilized in the fall and live until spring. The males die during the winter. The effect of subzero temperature on winter survival of the insect needs to be better understood. Snow cover gives excellent protection to the soil surface from subzero temperatures. Carter (I)- showed from thermograph charts "that when snow fell prior to cold waves the temperatures at the surface of the soil were practically constant at around freezing point during the succeeding cold weather when air temperatures fell considerably below zero."

Hills (3) , studying the fall and winter survival of the beet leafhopper at Hermiston, Oregon, reported that during the month of January, 1930, there were 16 days of subzero air-temperature with a minimum of —38° F. During this period there were 15 inches of snow on the ground. These conditions had little, if any, effect on the insect. During the winter of 1932-33 there were 7 days of subzero air temperatures, with a minimum of —9° in December. There was no snow cover during this period, and the soil-surface temperature dropped to 2°. On February 9 the minimum air temperature decreased to —5°, also without snow cover, and the soil-surface temperature dropped to 5°. These extremely low soil-surface temperatures did affect the survival of overwintered female leafhoppers, as only 4 percent survived.

Later studies in southern Idaho corroborated Hills' conclusion that snow cover enables the leafhopper to withstand subzero air temperatures. The effect of low temperatures on beet leafhopper survival obtained under controlled conditions, as reported by Harries and Douglass (2) , showed that mortality evidently depends on the length of exposure, as well as on the degree of cold. Their data showed "complete mortality of groups of overwintering females in approximately 20 days of 30° F., 15 days at 20°, 11 days at 15°, 6 days at 10°, 2 days at 5°, less than 12 hours at 0°, and less than 5 hours at —4°. The average survival is roughly one-half these specified exposures. These results also seem to agree fairly well with those of Carter * * * who found that the overwintering famales rarely survived 4-hour exposures to —2° F., —10°, and —14° in a commercial refrigeration plant, or when chilled to 0° or lower in laboratory apparatus." They concluded from the above data that extended cold periods, when the ground is covered with snow or the soil-surface maximum temperatures do not rise above 32°

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[2] Numbers in parentheses refer to literature cited.

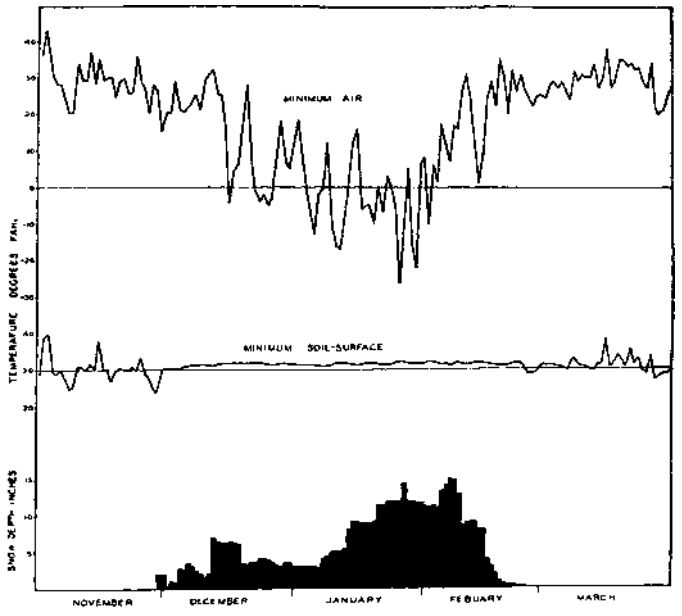

Figure 1. Minimum air and soil-surface temperatures, together with snow **cover, at Twin Falls, Idaho, for the winter of 1948-49.**

F. for **1** or 2 weeks or more to permit feeding or absorption of moisture, would seem to be very unfavorable for survival.

From this information it was expected that a very low survival of leafhoppers would follow the winter of 1948-49. Evidently, controlled-temperature studies are not dependable criteria for actual field conditions. It is probable that temperatures above the freezing point of the insect and up to 30° F. for any length of time would cause desiccation. Apparently, beneath snow, where the temperature was 31°-32° F., desiccation is very limited.

Studies of leafhopper survival under natural and cage conditions during the winter of 1948-49 in southwestern Idaho showed that this insect survived fairly well beneath a continuous snow cover ranging from 2 to 15 inches

for a period of 88 days, between November 30, 1948, and February 25, 1949. The winter was the coldest on record for southwestern Idaho. There were 24 nights of subzero weather at Twin Falls, Idaho, 17 of which were in January with a minimum of —26° F. Soil-surface thermographs showed that the temperature beneath the snow was from 31° to 32°F. Figure 1 shows the minimum air and soil-surface temperatures, together with snow cover. Figure 2 shows thermograph charts for air and soil-surface temperatures for the

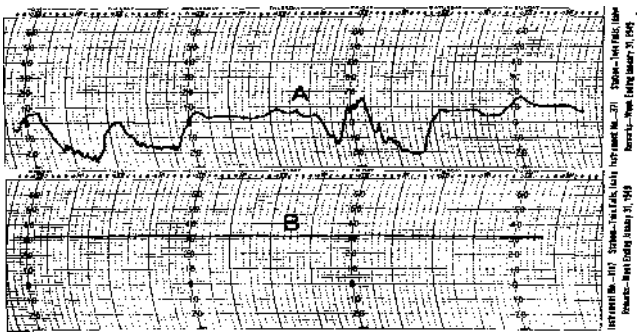

Figure 2. Thermograph records of air temperatures (A) and soil-surface temperatures under snow (B) for the week ending January 31, 1949, at Twin Falls, Idaho.

week ending January 31, 1949, during which period the coldest weather occurred.

Surveys in September, 1948, showed a comparatively low fall population of beet leafhoppers on Russian-thistle *(Salsola kali* var. *tenuifolia Tausch).* These leafhoppers entered the winter of 1948-49 under adverse host-plant conditions. Spring surveys in 1949 showed a moderate population of beet leafhoppers which had overwintered. This survey also showed widespread and abundant germination of its spring and summer host plants over most of southwestern Idaho. The spring of 1949 was warm and dry, very favorable conditions for the development of the spring generation of beet leafhoppers. The spring movement into beetfields on the west end of the Twin Falls irrigation tract averaged 626 adult leafhoppers per 100 square feet, as compared with a 15-year average of 805, even though about 2,600 acres of the more productive spring breeding areas were sprayed for the control of the spring migrants.

The beet leafhoppcr is known to have overwintered in some areas which have a colder climate than Twin Falls, Idaho, such as Billings, Montana, and the Big Horn Basin, Wyoming. No doubt snow cover was important in protecting them during subzero weather. Mean temperatures at stations

in these areas as well as at Kalispell, Montana, and Ephata, Washington, are illustrated in Figure 3. The mean normal temperature for the coldest of these areas was as much as 12° below that at Twin Falls, Idaho, and yet beet leafhoppers have survived several winters in these areas.

A review was made of the data on beet leafhopper survival during four other cold winters in southern Idaho, and it was found that the low temperatures did not reduce materially the overwintering population. The winters

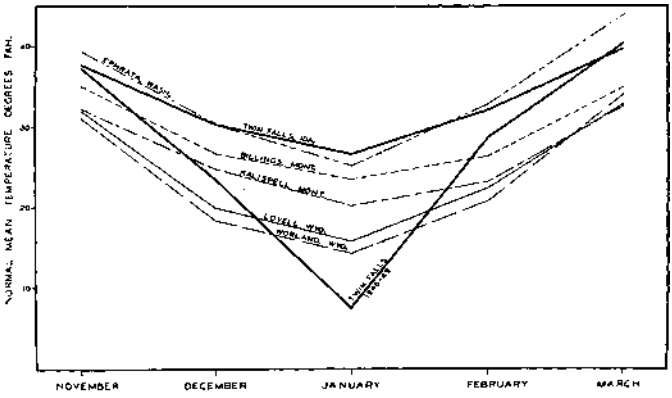

Figure 3. Mean monthly temperatures at Twin Falls, Idaho, for the winter of 1948-49 compared with the normal mean monthly temperatures for Twin Falls, Idaho; Billings and Kalispell, Montana; Lovell and Worland, Wyoming; and Ephata, Washington.

of 1928-29, 1931-32, 1932-33, 1936-37, and 1948-49 were outstandingly cold. The populations entering the first three winters were low, and the spring generation of beet leafhoppers following these winters was light. The 1936 fall population of beet leafhoppers was high and damage was severe in the spring of 1937. Subzero temperatures without snow cover are unfavorable to survival, and such conditions are more likely to occur during moderately cold winters than during the coldest of winters, since snow generally precedes subzero weather in southern Idaho. In general, cold winters do not seem to be unfavorable to the survival of the beet leafhopper because of the protection by snow cover.

Summary

The winter of 1948-49 was the most severe on record for southwestern Idaho. The temperature was subzero on 24 days during the winter, 17 of which were in January, with a low of —26° F. Snow covered the ground

continuously from November 30, 1948, to February 25, 1949, in southcentral Idaho. Soil-surface temperatures beneath the snow were from 31° to 32° F. Surveys in September, 1948, showed a comparatively low fall population of the beet leafhopper *(Circulifer tenellus* (Bak.)) on Russian-thistle. These leafhoppers entered the winter under adverse host-plant conditions. Spring surveys in 1949 showed a moderate population of overwintered beet leafhoppers, indicating that this insect survived fairly well beneath a continuous snow cover for a period of 88 days. A review of the data from four other cold winters also indicated a fairly good survival. During severe winters there is usually a snow cover adequate to protect beet leafhoppers from subzero temperatures.

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