EFFECTS OF LOW WINTER TEMPERATURES ON SOME ORCHARD MITES[1]

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INTRODUCTION

Many observations have been made on the effects of abnormally severe winters on the mortality of insects, but very few records have been noted of the influence of such climatic conditions on the development of orchard mites. Yothers (1917), in discussing the effects of the freeze of February 2-4, 1917, upon citrus pests in Florida, stated that the rust mite, *Eriophyes oleivorus* Ashm., was nearly exterminated in those areas in which the minimum winter temperature varied from 15 to 20°F. Adults of the citrus red mite, *Paratetranychus citri* (McG.) [*Tetranychus citri* McG.,], were not affected, but the eggs were thought to have been killed, as the pest was not abundant the following summer. The mite *Tenuipalpus bioculatus* McG. was slightly reduced in number, but *Tetranychus yothersi* McG. appeared to have been seriously affected. Several other authors have published accounts of the influence of climatic factors on mite development, but these have been mainly concerned with the effects of summer temperatures on abundance.

The observations reported here were made in the Okanagan and Kootenay valleys of British Columbia during 1950, immediately after the coldest winter on record in Western Canada. Temperatures during November and December, 1949, did not fall below zero, but mean temperatures for December were one to four degrees below normal in the southern interior of the Province. Below-zero temperatures were common throughout January and the first few days of February, 1950. Records kept at the Summerland laboratory showed that these temperatures occurred in three cycles; the first from January 2 to 4 (minimum −9.0°F.), the second from January 13 to 18 (minimum −8.8°F.), and the third from January 24 to February 3 (minimum −15.9°F.). Minimum winter temperatures recorded at official weather stations were: −23°F. at Oliver, −16°F. at Penticton, −24°F. at Kelowna, −32°F. at Vernon, −37°F. at Kamloops, −16°F. at Nelson, and −20°F. at Creston. These temperatures were 15 to 20 degrees below normal in the interior valleys immediately north of the International Boundary (Boughner, 1950). As a result orchard trees of all types were severely damaged throughout the Okanagan Valley. In addition it might be expected that such abnormally low temperatures would have a detrimental effect on the invertebrate fauna of the orchards. It was the purpose of the investigation to determine the effects of the sub-zero temperatures on the mortalities of the overwintering forms of the following orchard mites: the European red mite, *Metatetranychus ulmi* (Koch); the two-spotted spider mite, *Tetranychus bimaculatus* Harvey; the Pacific mite, *Eotetranychus pacificus* (McG.); and *Eotetranychus flavus* (Ewing), known to growers as the yellow Willamette mite.

METHODS

Samples of overwintering mites were collected from the latter part of February to the end of April, 1950. Where possible these collections were made from a number of areas to obtain material subjected to various minimum winter temperatures. The minimum temperature given for each collection site was based largely on a compromise of records from a number of household thermometers and the nearest weather station, since the collection locale was often many miles from an official station.

European red mite mortality was determined by placing the spurs or twigs containing the winter eggs in

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TABLE I

Percentage Survival of European Red Mite Winter Eggs Subjected to Various Minimum Winter Temperatures and Incubated at 65, 75, or 85°F.

Area	Minimum winter temperature, °F.	Incubation temperature °F.	Eggs in sample	Survival per cent.
Nelson	—18	65	242	68.6
		75	453	62.3
		85	248	52.8
Oliver	—23	65	305	54.1
		75	102	46.1
		85	223	39.9
Vernon	—32	65	3079	15.8
		75	2674	12.6
		85	2542	10.4
Salmon Arm	—30 to —35	65	294	0.0
		75	500*	0.0
Salmon Arm	—35 to —38	65	489	0.0
		75	500*	0.0
Salmon Arm	—40	65	2500*	0.0

* Estimated

a constant temperature cabinet and incubating the eggs until they hatched. The eggs were incubated at 65, 75, or 85°F. and at a relative humidity of approximately 80 per cent.

The two-spotted spider mite, the Pacific mite, and the Willamette mite winter as mature females, generally in colonies under the bark scales of scaffold limbs and the trunk, and under fallen leaves and debris on the ground around the tree base. Mites that hibernate in the latter site obtain extra protection from cold by snow coverage. Accordingly, two samples of infested bark scales were taken at each collection point, one above snow line and the other below. These samples were gradually warmed to room temperature, and mortality was determined by comparing the numbers of living and dead mites. Only one collection of the Willamette mite was obtained, as at that time this mite was not known to occur in large numbers except in one orchard.

RESULTS

Differences in the survival of the European red mite winter eggs subjected to various low winter temperatures are shown in Table I. Between 52.8 and 68.6 per cent. of the eggs survived a temperature of −18°F. Where −32°F. was experienced, only 10.4 to 15.8 per cent. of the eggs remained alive. No larvae could be reared from eggs collected in the Salmon Arm area, where temperatures of −30 to −40°F. were common. The results indicated that all winter eggs of the European red mite would be killed by a minimum temperature between −32 and −35°F. and that this might be the minimum isotherm that could determine the possible northern limit of existence of this mite. Subsequent field observations, however, proved that this was not the case. Although the European red mite could

not be found in the Salmon Arm orchards in June or July, 1950, several specimens were observed in August, and by the spring of 1951 it was common enough that control measures would probably be required sometime during the year. In the Okanagan Valley, the European red mite was not particularly troublesome in 1950, but this may have been due to the application of the parathion "pink" spray, which gave excellent control in the majority of orchards for the remainder of the season.

The results also indicate that a relatively cool spring may be more conducive to the occurrence of large populations of the European red mite than very warm weather when winter eggs are incubating. Fewer larvae were obtained when the eggs were incubated at 85°F. than at 75 or 65°F.

Mites that overwinter in the adult stage appear to be less resistant to extremely low temperatures than those, such as the European red mite, that overwinter as eggs. Of the three mites investigated that winter in the adult stage, the two-spotted spider mite may be the hardiest: 37.2 per cent. survived a temperature of −23°F., whereas only 5.6 to 6.2 per cent. of the wintering adults of the Pacific mite remained alive after being exposed to −22°F. and less than one per cent. of the adults of the Willamette mite survived a temperature of −20°F. Table II demonstrates the value of the protection offered by the snow cover, the survival being much higher below than above the snow line.

TABLE II

Percentage Survival of the Two-spotted Spider Mite, the Pacific Mite, and the Willamette Mite Subjected to Various Minimum Winter Temperatures.

Mite	Area	Minimum winter temperature °F.	Collection above or below snow line	Winter adults in sample	Survival per cent.
Two-spotted spider mite	Oliver	—23	above	3839	37.2
			below	1676	46.0
	Salmon Arm	—30	above	3000*	0.0
			below	457	31.3
	Kamloops	—37	above	3000*	0.0
Pacific mite	Summerland	—22	above	839	6.2
			above	1816	5.6
	Kelowna	—25	above	282	0.0
			below	220	41.8
	West Summerland	—30	above	2000*	0.1
			below	2593	35.1
Willamette mite	Summerland	—20	above	5000*	0.1
			below	5973	14.6

* Estimated

Although these three pests were greatly reduced in numbers in many areas, the reduction was not sufficient to be of economic importance to the fruit grower. In 1950, the two-spotted spider mite did more damage in the Okanagan Valley than at any time previously; severe infestations were very common from Penticton north to Salmon Arm. Pacific mite populations were slightly larger than in 1949, and medium to severe infestations occurred in several orchards. The Willamette mite, which was found in the fall of 1949 at Summerland for the first time in the Province, occurred throughout the Valley from the International Boundary north to Kamloops. Severe infestations developed in a number of orchards.

SUMMARY

In the British Columbia fruit- growing area the coldest winter on record occurred in 1950. Temperatures of −15 to −15°F. were common. This was 15 to 20 degrees below normal.

Field collections of the overwintering forms of the European red mite, the two-spotted spider mite, the Pacific mite, and the Willamette mite were made from the latter part of February to the end of April, 1950, to determine the effects of the low winter temperatures. Practically 100 per cent. of the European red mite winter eggs were killed in the Salmon Arm area, where temperatures of −30 to −40°F. were common. The European red mite was not found in this area until August, 1950, but by the spring of 1951 it was common enough that control measures were necessary. The two-spotted spider mite appeared to be the hardiest of the three forms that winter as adults. Although these three mites were greatly reduced in numbers by the cold winter, summer populations were larger during the growing season of 1950 than in 1949.

References

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A PRELIMINARY LIST OF THE HEMIPTERA OF THE KOOTENAY VALLEY[1]

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INTRODUCTION

Studies to determine the insect vector or vectors of the little cherry virus disease in the Kootenay Valley were carried out during the seasons of 1946-49. As part of the investigation a survey was made of the insects occurring on sweet cherry and other host plants common in the Valley. Although all orders of insects were collected, little interest was taken in other than the Hemiptera, since nearly all the virus vectors known belong to that order. The accompanying list forms only part of the total.

METHODS, HOSTS, AND COLLECTION AREA

Collecting was done by various means: (1) a sweeping net, (2) knockdown sprays and a large canvas ground sheet, (3) a hand suction apparatus, and (4) 6-inch-by-12-inch plywood boards coated with "Deadline" tanglefoot on one surface and hung by wire loops in tree or shrubs. The last-named method proved highly satisfactory and yielded species that were not taken from the same hosts by any other means. There was some difficulty in removing the tanglefoot from the specimens. The most successful procedure involved placing a drop of kerosene on each specimen, which was then loosened and removed from the board with dissecting

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