THE EUROPEAN FRUIT LECANIUM, *LECANIUM TITLIAE* (L.) (HOMOPTERA: COCCIDAE), IN SOUTHWESTERN BRITISH COLUMBIA

by

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ABSTRACT

Lecanium tiliae normally has one annual generation in southwestern British Columbia. There was a partial second in a year following a mild winter. The heaviest infestations were on horse chestnut, Japanese plum, hawthorn, and maple, in that order. Hawthorn was damaged. The proportion of males tended to be higher in high than in low populations, and to decrease with increasing altitude. Severe winter cold caused marked population decreases and cold weather in June noticeable decreases. Natural enemies found in 1969-72 are listed.

The European fruit lecanium, *Lecanium tiliae* (L.) (formerly referred to as *L. coryli* (L.)), was introduced into southwestern British Columbia about 1903, probably from Holland (Lyne 1927). There were severe infestations in the Vancouver area in 1925-30, 1937-46, and 1964-72. The following observations on the biology and ecology of this scale were made in 1969-72, during a study of its natural enemies reported elsewhere (Rubin and Beirne 1975). They supplement observations by Glendenning (1925, 1931, 1933, 1934) and by Graham and Prebble (1953) on earlier infestations, and are based on collections of infested leaves or twigs.

Life-Cycle

There is normally one generation per year in British Columbia. The crawlers hatch from the eggs in May and feed on the leaves until late August when they become second instar larvae and migrate to the twigs and small branches, where they feed until September or October. Here they overwinter. No evidence could be found that they overwinter or fallen leaves, which sometimes happens in Europe (Krassilstchik 1915). The males appear early in April, after a pupation period of about a month. Egg-laying starts in May.

Host-Preferences

The lecanium scale feeds on various deciduous trees and shrubs. Regular surveys were made of the number of scales on leaves and on 50 cm of twig or branch, on six species of trees, selected as being common host-plants in the Vancouver area. A total of 241 random samples, containing 50,022 scales, were taken from the trees at different times. In addition, six selected samples, containing a total of 6,401 scales, were taken from heavy infestations on unidentified maple.

The average numbers of scales in the random samples of 50 cm of twig or branch were: horse chestnut 319 (17 samples); Japanese plum 81 (41); hawthorn 67 (48); maple 60 (29); black cherry 37 (25); and red alder 33 (15). Average on apple was 52 (3) and on sweet cherry 7 (2). The average for the selected samples from the heavy infestations on maple was 1,089 (6). The single most heavy infestation had 3,072 scales per 50 cm of maple branch.

Pest Significance

The scale becomes a pest by sucking juices from leaves and twigs of the trees and by producing honeydew that is a nuisance when it drops on cars and clothing and on which grows a black fungus or "sooty mould", *Fumago* spp., that inhibits photosynthesis.

Its pest importance is not always related directly to its population density. Trees such as horse chestnut that have large crowns suffer less damage than do trees with small crowns such as Japanese plum and hawthorn, even when horse chestnut has a more dense population than the others. Young trees are damaged most because they have the highest proportion of the young twigs on which the scales tend to concentrate. Hawthorn appeared to be particularly affected by scale attack in 1969-72: many infested twigs and small branches dried up and died; and infested leaves were usually smaller and sometimes thicker than non-infested ones. Tree damage in the 1925-30 infestation was sufficiently severe to warrant extensive

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spraying annually, which, incidentally, may have intensified that infestation by killing parasites of the scale.

Scales, especially males, were sometimes found trapped and drowned in the honeydew and in the secretions from the buds of some trees, notably of red alder.

Sex Ratio

In Europe males are usually rare, reproduction commonly is parthenogenetic, the sex ratio can be much influenced by climate, and the proportion of males decreases with increasing altitude (Thiem 1932). Glendenning (1925) found that males were much more numerous than females by about 3:1. In the present study, 19,359 scales were examined to determine their sex: 19.7% were males, or about 1:5.

There was wide variation in the proportion of males in scale populations on different host plants. It was above the average on Japanese plum (30%), horse chestnut and sweet cherry (27% each), but lower than the average on hawthorn (16%) and maple (14%, but 18% on the heavily infested trees), and much lower on red alder (8%) and black cherry (7%). In general, the proportion of males tended to be higher on hosts with high scale densities than on hosts with low ones.

Surveys of infestations at altitudes of up to 500 m indicated that, as in Europe, there is a decrease of 19% in the proportion of males with each increase of 100 m of altitude (significant at 5%). There was a decrease of 8% in the proportion of males with each increase of 10°C (significant at 5%).

Influences of Weather

At times in 1969-70 scale populations, as indicated by numbers per 50 cm of branch, decreased markedly. Some of these decreases coincided with the occurrence of weather extremes, as follows:

There were decreases on three species of host plants between November 26 and December 31, 1971: from 307 to 122, 301 to 83, and 396 to 82 scales per 50 cm. December 1971 was very cold, with average temperatures of -0.6° and 0.6°C at Burnaby Mountain and Vancouver Airport, respectively, as compared with the long-term winter monthly averages at those locations of 0.5°C and 1.7°C. Decreases on various host plants in the fall of 1970, from 31 to 7 between September 9 and 24, 62 to 12 between September 24 and October 8, 2,346 to 114 between November 15 and 21, coincided with a cold autumn and the beginning of a severe winter. There was also a decrease from 121 to 61 between February 1 and 16 and, on a similar plant, from 226 to 59 between March 3 and 12, both in the severe winter of 1970-71.

In 1971 a cold June was followed by a warmer than average July and August. Some scale populations decreased on various host plants from 133 to 35 between June 24 and July 15, 39 to 3 between June 30 and July 31, and 102 to 39 between June 30 and August 31.

The scale became active earlier than usual in the spring of 1970, following a very mild winter. This extension of its active period presumably was why there was an abnormal partial second generation in the fall of 1970.

It appears from these observations that temperature can be important in regulating scale populations.

Natural Enemies

The most important natural enemies in 1969-72 were the hymenopterous parasites *Blastothrix longipennis* (How.), *Metaphycus kincaidi* Timb., and *Coccophagus lycimnia* (Walk.). They are discussed elsewhere (Rubin and Beirne 1975).

The following is a list of the predators encountered:

Arachnida. Araneae (det. D. J. Buckle): *Araneus diadematus* Cl., *Araneus* sp., *Porhomma* sp., *Coriarachne brunneipes* Banks; Acarina (det. R. S. Downing): *Typhlodromus pyri* Scheut., *Amblyseius masseei* Nesb., *A. morgani* Chant, and various Tydeiade and saprophytic mites.

Insecta. Dermaptera (det. R. J. Lamb): *Forfiucula auricularia* L.; Hemiptera (det. G. J. Fields): *Anthocoris antevolens* White; Coleoptera (det. J. V. Richerson): *Chilocorus fraternus* LeC.; Neuroptera (det. K. H. Martin): *Hemerobius pacificus* Banks, *Hemerobius* sp. prob. *humulinus* L., *Chrysopa harrisii* Fitch.?, *C. carnea* Steph.?.

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NUMBERS OF *DENDROCTONUS RUFIPENNIS* (KIRBY) AND *THANASIMUS UNDATULUS* SAY AT PHEROMONE-BAITED POISONED AND UNPOISONED TREES

by

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ABSTRACT

Four times as many spruce beetles, *Dendroctonus rufipennis* (Kirby), were killed at spruce trees *(Picea engelmannii* Parry, *Picea glauca* (Moench) Voss) baited with frontalin and sprayed with insecticide than at trees baited but unsprayed. Many clerid predators, *Thanasimus undatulus* Say, were also killed at the baited and sprayed trees. Their numbers were correlated with those of killed spruce beetles. Other correlations show that sprayed and unsprayed trees were exposed to the same attacking spruce beetle population and that predation on the spruce beetles was occurring.

INTRODUCTION

A synthetic pheromone, frontalin (Kinzer *et al.*, 1969) causes aggregation in both sexes of spruce beetle *(Dendroctonus rufipennis* (Kirby)*)* and a clerid predator *(Thanasimus undatulus Say)*, when released from polyethylene capsules on living spruce trees *(Picea glauca* (Moench) Voss, *P. engelmannii* Parry*)* (Dyer, 1973). Insecticide sprayed onto the lower 3.0 m (10 ft) of tree boles kills all arriving insects, and thus prevents the establishment of galleries by spruce beetles and predation by *T. undatulus* (Dyer, 1973). Without insecticide, some arriving spruce beetles enter the bark of baited trees and attempt to reproduce, even though resistance by the tree may prevent subsequent egg hatching or development of brood. The predators, attracted to baited trees, arrive at about the same time as the first beetles, which gives them an opportunity for predation, which would probably not occur during natural attacks when some spruce beetles would have entered the bark before producing pheromone (Dyer, 1973). The following experiments carried out in 1973 and 1974 were designed to determine any differences in numbers of spruce beetles and predators at baited trees sprayed with insecticide, and the numbers of spruce beetles in baited, unsprayed trees.

METHODS

Near Prince George, B.C., 133 spruce trees, about 20.1 m (66 ft) apart in a line around a stand perimeter in the Naver forest, were baited with 1.0 ml of 1 part frontalin and 2 parts alpha-pinene, in May 1973. Two polyethylene capsules, containing the frontalin-pinene mixture, were placed on each tree on opposite sides at breast height. Every tenth tree was sprayed to drip with insecticide (lindane 0.5% in water) on the basal 3.0 m and was fitted with a wire-screen basket at the base (Dyer, 1973).

Collections from the baskets were made about twice a week, from June 14 to the end of August. In August, bark samples of 20.3 x 25.4 cm (8 x 10 inches) were removed from 25 trees randomly chosen out of the 91 attacked trees. A minimum of four samples was taken from each tree, one from each of the north and south aspects at breast height and at the base. If the attack height was greater than 1.8 m (6 ft) a further two samples were taken from the north and south aspects midway between breast height and attack height. The number of attacks, i.e. entrance holes, was counted for each sample.

In 1974, ten pairs of spruce trees were selected at about 403.3 m (1320 ft) intervals, in the Naver forest near the 1973 experiment.