Overwintering, springtime development and migration of some Aphidae, including Myzus persicae, of northwestern Montana

by Daniel Frederick Aldrich

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Entomology
Montana State University

Abstract:
The green peach aphid, Myzus persicae(Sulzer), was found overwintering in northwestern Montana as eggs on peach, Prunus persicae L. The potato aphid, Macrosiphum euphorbiae Thomas, was found overwintering as eggs on wild rose, Genus Rosa. Other species of Aphidae overwintering in the area on Prunus domestica L., .P. americana Marsh., P. virginiana L., and on Crategus spp. are identified. Spring hatching of Aphidae within the area was initiated within the last two weeks of March in 1977 and continued until at least mid April. Hatching was not found co-incident with a mean monthly maximum temperature of 4°C, but it occurred immediately thereafter (5°-7°C). Hatching was prior to the phenological date of first leaf-budding on common purple lilac, Syringa spp.

The 1977 spring migrations of Aphidae in northwestern Montana began in the second and third weeks of May and peaked one month later in mid- and later-June. Migrations were initiated during the period of mid-bloom for common purple lilac. Aerial aphid catches were directionally significant ($p = 0.01$) and appeared to be related to prevailing winds.

The primary reservoir of potato leafroll virus within the area was believed to be infected potato and tomato plants in home gardens.

Potato leafroll virus and some of the pertinent biology of its primary vector, Myzus persicae, are reviewed.

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Approved:

Norman L. Anderson
Chairperson, Graduate Committee

James M. Prickett
Head, Major Department

Henry L. Parsons
Graduate Dean

MONTANA STATE UNIVERSITY
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The green peach aphid, Myzus persicae(Sulzer), was found overwintering in northwestern Montana as eggs on peach, Prunus persicae L. The potato aphid, Macrosiphum euphorbiae Thomas, was found overwintering as eggs on wild rose, Genus Rosa. Other species of Aphidae overwintering in the area on Prunus domestica L., P. americana Marsh., P. virginiana L., and on Crategus spp. are identified. Spring hatching of Aphidae within the area was initiated within the last two weeks of March in 1977 and continued until at least mid April. Hatching was not found co-incident with a mean monthly maximum temperature of 4°C, but it occurred immediately thereafter (5°-7°C). Hatching was prior to the phenological date of first leaf-budding on common purple lilac, Syringa spp.

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INTRODUCTION

Flathead and Lake Counties (Flathead Valley) have been under potato production for around 50 years. Since 1970, the yearly acreage planted to potatoes has been between 3000 and 3500 acres (1200-1400 ha) and has yielded an annual harvest-crop value of a little less than $10,000,000, or approximately $3000 per acre. This represents nearly 50% of the total statewide acreage under potato production and at least 30% of the combined revenue from potatoes, wheat and hay for these counties (Montana, 1977a).

Well over half of the potato acreage in the Flathead Valley is devoted to certified seed potato production. Certification of this seed requires persistent disease control. Potato leafroll virus (PLRV) is the least tolerable of all the virus diseases of seed potatoes. The highest grades of seed potatoes, Nuclear and Elite I and II, allow no incidence of this disease in stocks. Foundation and Elite III grades tolerate 0.3% or less PLRV disease, and all the Certified grades will allow only 1.0% incidence of PLRV (Montana, 1977b). Potato crops disqualified as seed are reduced in value 25% to 50%. In addition, severe leafroll can reduce tuber yields 92% over healthy plants (Harper et al., 1975).

Except for the spread of leafroll via the propagation of infected tubers, the sole known means of its spread is by aphid-vector transmission. Of about 10 known aphid vectors of PLRV, the green peach

aphid, Myzus persicae (Sulzer), is the most efficient (Kennedy et al., 1962). Although PLRV has been incident within the Flathead Valley for several years, the presence of the green peach aphid was not verified until 1976.[1]

This study was undertaken to investigate the overwintering of the green peach aphid within the Flathead Valley and to determine the spring migration patterns of aphids, as a group, as these migrations related to the spread of virus diseases in potatoes. It was intended to identify potential factors affecting the prevalence and increase of this aphid and the incidence and spread of potato leafroll virus.

To approach a management plan for the control of Myzus persicae and the spread of potato leafroll virus, an understanding of the virus-vector relationship is necessary. A literature review of potato leafroll virus (Appendix D) and some of the pertinent biology of Myzus persicae (Appendix E) is included here to provide background understanding of the complexities of this relationship. The conditions that facilitate the outbreak of disease or trigger a virus-vector relationship favorable for disease spread are multiple and interrelated. While these reviews suggest many single factors important in approaching a management plan for virus-vector control, any one, or

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[1] O. G. Bain, 1976, Environmental Management Division, Montana State Dept. Agriculture, 1300 Cedar Ave., Helena, Montana 59601. Personal communication.

combination of them cannot be substituted for an in-depth understanding of the virus-vector interplay in a particular control circumstance. Therefore, the present work does not proffer a complete management plan, but rather identifies some of the factors particular to the Flathead Valley as these factors relate to the body of understanding included within the literature reviews.

DESCRIPTION OF THE STUDY AREA

The area investigated by this study, the south Flathead Valley, is located between 114° and 114°30' west longitude and between 47°20' and 48° north latitude. It comprises most of the area of Lake County, Montana and lies within the southern-most region of the Rocky Mountain Trench, a structural depression stretching through British Columbia, Canada, to about 160 km south of the study area on the west side of the continental divide. The valley is bounded by the Mission Mountains on the east, rising abruptly from the valley floor at about 900m up to around 2500m, above alpine terrain. On the west side of the study area is the Flathead River. Beyond the river the topography rises into more arid coniferous forest but less abruptly than east of the valley basin (Fig. 1).

The valley was made by geological uplifts and downdrops along fault lines. The valley depression was enhanced by glacial action that scoured the land surface and left numerous moist potholes (Owen, 1958). The Flathead River Basin abounds with more water than any other basin in Montana, and this water drains through the Flathead Valley (Fig. 2) (Montana, 1976).

The study area is around 988,000A (400,000 ha), one-tenth of which is water area. Over half the land surface of Lake County is montane forest, with another 30% equally divided between rangeland and irrigated pasture. Only 2% of the county is devoted to irrigated

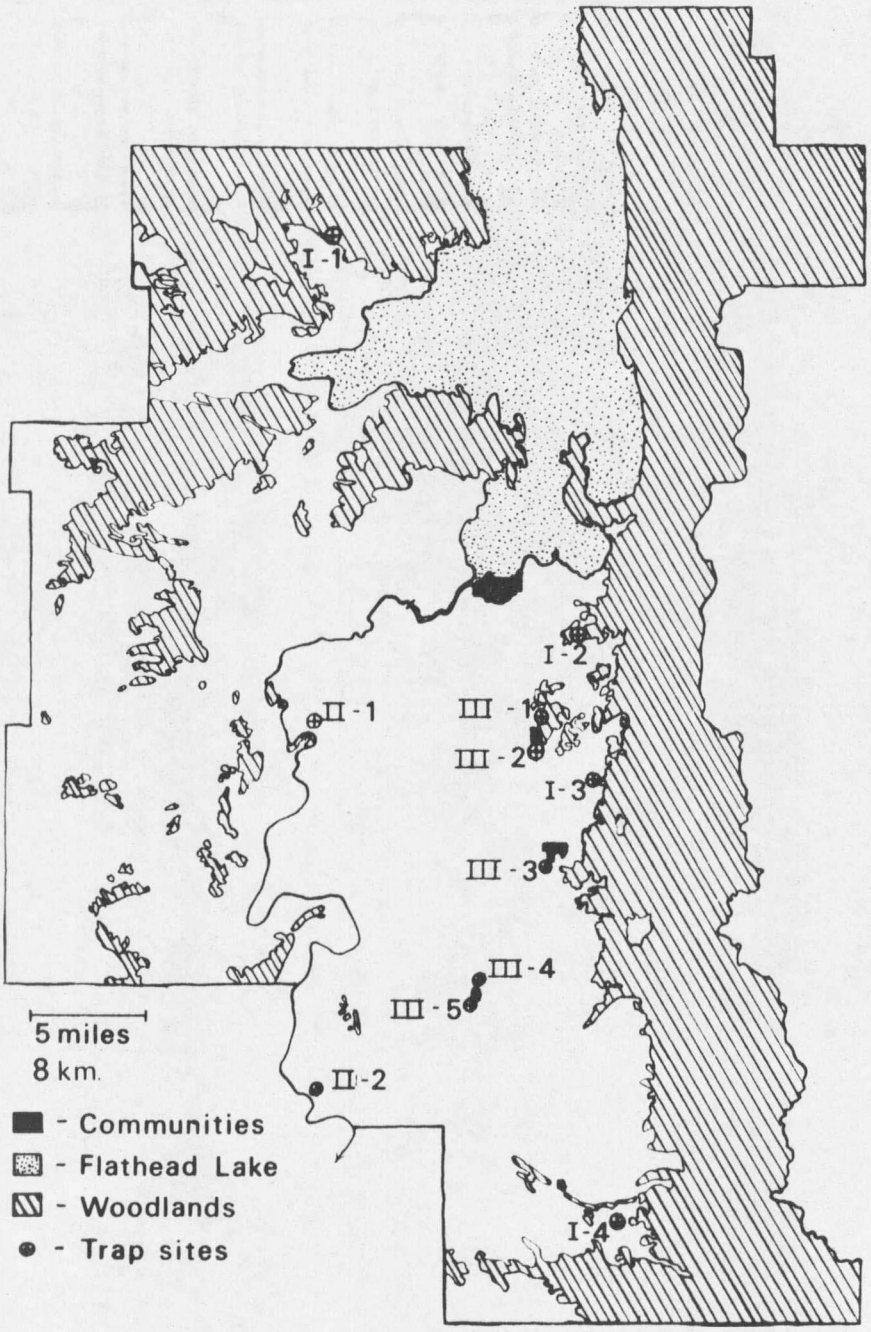

Figure 1. Aphid trapping sites in relation to suburban communities and montane woodlands in south Flathead Valley of northwestern Montana.