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VOL. 24 - PART 2

FOREST APHIDAE OF NOVA SCOTIA

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ABSTRACT

The Forest Aphidae of Nova Scotia is a taxonomic, faunistic or synoptic study of the aphids or plant lice found on the forest trees and adjacent plants in forested areas of Nova Scotia, Canada. An effort was made to obtain some knowledge of the aphids on forest trees as an economically important group, causing debility when the infestation is severe as well as being vectors of pathogenic disorders in forest plants.

A permanent, representative, identified collection from forest trees and adjacent plants was made to serve as a basic reference collection for future studies. The collection is in the keeping of the Nova Scotia Museum of Science, Halifax, Nova Scotia, Canada. Synonymy within the genera and species taken was established where possible and unidentified material was checked with other collections or authorities. The taxonomic keys are illustrated both by means of plates containing the key characters and by fairly complete listings of photographic plates which illustrate aphid colony formations and host damage which they produce.

Alate, apterous and immature aphids were collected together with a part of the host plant. Alate forms were taken as far as possible since these forms are used primarily for identification to species. Ninety-five aphid species in thirty-three genera are listed at the end of this study which are given in the form of a host plant list together with an alphabetical listing by genera of the aphid species found. Distribution records for Nova Scotia are contained in the discussion of the species together with biological and morphological studies where necessary.

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FOREST APHIDAE OF NOVA SCOTIA

Kalman Dale Archibald¹

PART I

INTRODUCTION

Aphids have received and are receiving considerable attention from entomologists. Their complicated life cycles, their destructiveness to forest trees as well as other host plants, and their means of reproduction have attracted investigators from the fields of zoology, general biology and entomology. But in spite of this attention, the taxonomy of the aphids is still in confusion. This is possibly due, as Baker (1920a) points out, to the lack of correlation of biological and taxonomic facts and the failure of aphid investigators to consider the results of the work of others.

The confusion in systematic relationships that exists necessitates one of two things — either the taxonomist spends years of careful study of all references to species, establishing names by oldest authority and rejecting the rest as synonyms, or he temporarily gives up trying to give the name of the species, taking the entire group of Aphidae to genera only. This is what A. C. Baker (1920a) has done in his generic classification, which is a commendable step in the right direction. A. C. Baker made a further contribution to our knowledge of the Aphidae with his publication in 1917 of *Eastern Aphids, new or little known*.

In 1931, Hottes and Frison gave a systematic and descriptive account of the Aphididae of Illinois, and published valuable keys with illustrations, which has been of tremendous help in this present investigation. Gillette and Palmer (1913-1933) in a series of pamphlets on Colorado Aphididae have added considerably to an understanding of specialized morphology and life cycles of many aphids with accompanying color illustrations. These works have been brought up to

1. This paper is based upon a dissertation presented in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Graduate School of The Ohio State University. The research was performed under the auspices of the Nova Scotia Research Foundation, and at the suggestion of Mr. L. S. Hawboldt, Provincial Forest Entomologist, Nova Scotia, Canada.

date and published in 1952 as *Aphids of the Rocky Mountain Region*, by Miriam A. Palmer, a most commendable treatment of some 433 species. In this work, careful descriptions, life history, habits, and drawings are given for each species, thus making it possible to know quite definitely what the species are that are described.

In 1923 W. E. Britton published *The Hemiptera of Connecticut* which included a section on the Aphididae by Edith M. Patch. This treatise plus the food catalogue of the aphids of the world (1938) and a series of pamphlets by the same author, under *Maine Aphids*, have been one of the greatest contributions of any single individual in North America.

In the *Aphididae of Great Britain (1926-1929)*, Theobald has also made an extensive contribution but his work is of limited use in some respects, because of the inclusion of many color characters in his keys, which are extremely variable and difficult to determine in preserved and mounted material. His accounts, however, of the biology of each species to include as far as possible what is known of the life cycle, predators and parasites common to a species, the discussion of synonymy and description of forms, make this work invaluable from these standpoints.

A. F. Swain (1919) made a synopsis of California aphids similar to that of Hottes and Frison for Illinois, but published some years earlier. It is a clear, well developed treatise of value because like Hottes and Frison, he accompanies his species descriptions with good illustrations. Oestlund's *Aphids of Minnesota (1887)* and Hunter's *Aphididae of North America (1901)*, are also of value in the identification of aphids.

In the Maritime Provinces of Canada there are only a small number of published works on this group. The first published list or account of Maritime Aphids came from the Dominion Entomological Laboratory at Fredericton, N. B., by J. C. Burnham (1938) and later the work of L. S. Hawboldt (1946, unpublished) from the University of New Brunswick. In 1952 M. E. MacGillivray published a list of aphids of the genus *Aphis* from the Maritime Provinces of Canada. These are of special importance toward an understanding and classifying of the Aphidae of this region.

The present paper purports to set up a list similar to that of J. C. Burnham (Mrs. Jean Adams) for Nova Scotia.

and in addition, to throw some light on the phylogeny, characteristics and local distribution of the important species of the group. In many cases the aphids collected were not on forest trees, but as L. S. Hawboldt points out in his *Forest Aphididae* (1946), many of the aphids are of agricultural importance and specimens should be taken from shade trees and plants which are considered integral parts of forest types, so-called "indicator species", and also because many aphids do not confine themselves to one host in their life cycle.

Objectives

A statement of the objectives of this study are given in a form similar to those presented by L. S. Hawboldt at the start of this work, i.e., to obtain some knowledge of the aphids on forest trees in Nova Scotia as an economically important group, causing debility when the infestation is severe as well as being vectors of pathogenic disorders in forest plants. This knowledge to form part of the background necessary for future ecological studies and of the pathogens attacking forest trees.

By a knowledge of the forest aphids the following points are implied: (1) To make a permanent representative identified collection from forest trees and adjacent plants to serve as a basic reference collection for future studies. (2) To undertake a taxonomic treatment of all material, i. e., (a) to establish the synonymy within the genera and species taken, where possible, (b) to check unidentified material with other collections or authorities, and if still unknown to name or temporarily designate as new species. (c) to make a check list and catalogue of all material identified. (3) To construct taxonomic keys and host plant lists to facilitate identification of the species found. (4) To make distribution records for Nova Scotia (contained in the discussion of the species.) (5) To make biological and morphological studies where necessary.

Limitations

This study is not to be considered as revisional or monographic in scope. It is rather a taxonomic, faunistic or synoptic study of the plant lice found in the forested areas in the counties studied of Nova Scotia, Canada. References cited

in the text refer to the original descriptions of the species, or to descriptions contained in works already published. Free use has been made of all available keys and descriptions of aphid fauna. Since these available papers are the result of independent investigations, certain problems of synonymy and misidentification are bound to occur. Any mistakes in synonymy or identification are unintentional, but in some cases may be unavoidable. The author, however, will be obliged to accept the responsibility for the determinations as made. Responsibility for complete synonymy, however, is not to be assumed, although an effort has been made to compare material found with similar species described in the regional keys available and also with the established host plant records. Because of the lack of revisional papers in this group of insects a study of this kind is somewhat handicapped. The literature, though quite abundant, is often difficult to use with but a few outstanding exceptions.

The plan of classification followed is mainly that of A. C. Baker (1920a). This system is advantageous in that it uses external characters for the most part, observable in material that may not be too well cleared. Other systems of classification are based upon characters which require clearing of the specimens, and most of the aphids used in this study were not thus prepared.

The taxonomic keys included have been prepared for the determination of the alate viviparous females found on forest trees and adjacent plants in the counties studied of Nova Scotia and are, therefore, largely impractical if used elsewhere. In a faunistic paper, where ready and simple determination of species is one of the principal aims, the keys given are not necessarily constructed to show phylogenetic relationships, but are intended to make identification of the species included as simple as possible. Use has been made of the established works of Baker (1920a), Palmer (1952) and Hottes and Frison (1931a) and in some cases, where applicable, the keys have been constructed as modifications of the keys found in these papers, i. e. using key characters established by them for the separation of genera, species or other subcategories.

Figure citations given in the keys generally refer to a condition or type of character rather than to the specific genus or species indicated in the key. The photographs and

illustrations referred to in the text, however, are based upon actual specimens of the species under discussion. No attempt was made to draw the figure illustrations or to make the photographs to one scale. The comparisons to be made, therefore, are comparable only with respect to structural characteristics and general colony conformations as seen in the photographs.

The photographic plates are intended as another aid in the identification process in that it is hoped they will add to the knowledge of the various colony formations and types of damage done to the host plants. In the field such information is of value as well as in actual identification work later in the laboratory. They are in no way intended to substitute for line drawings of characters, but to add to this kind of information, serving as supplementary aids in classification and better understanding of the total ecology of the species.

Economic Importance

The aphid material collected in this study was not confined exclusively to forest forms, but aphid infestations found on shade trees and plants which are usually considered as integral parts or associated plant species of forest types were also observed in an effort to collect indicator types.

The economic importance of this group of insects has long been established particularly with reference to their destructiveness to agricultural and ornamental plants. Not so much is known of their relation to pathologic conditions of forest trees. However, their effects appear to be seasonal and their infestations are quite often periodic, rising and falling in the extent of infestation every few years depending upon such factors as, climate, rainfall, parasitism and other related conditions. When present in large numbers they are thought to be one of the causative factors producing general weakness and debilitation of forest tree growth.

The characteristic honey-dew exudate produced by aphids favours the secondary growth of molds and fungus types which further damage the growth of leaves and young shoots. It is also very probable that the aphids serve as vectors in the transmission of virus or other bacteriological parasites which produce still further pathological conditions in forest trees.

Many of the species met with will be of little or no economic importance, if one considers only the amount of destruction on the immediate host, but in the long term study of life cycles, the aphid of no seeming economic importance on its recorded host may be very destructive on its alternative or secondary host. By checking its growth at earlier stages in its life cycle, it may save important crops and the expensive use of sprays by the farmer. Most aphid species are readily killed by contact insecticides and the sooner these are applied to young colonies of aphids, the more effective is their use in the control of this insect. The importance of aphid destructiveness on grain crops alone was forcibly seen in Alberta the summer of 1949 when over a million dollars worth of barley was destroyed by their feeding.

The fact that aphids constitute one of the most injurious insect groups is briefly summarized by Palmer (1952, p. 5) as follows: "Their attacks on plants cause serious damage in three ways: (1) by robbing the plant of sap, (2) by the toxic action of their salivary secretions, injected during feeding, thus causing stunting of growth, deformation of leaves and even of fruit, or causing galls on leaves, stems or roots, (3) by acting as vectors of viruses which cause many diseases of plants. Since aphids are usually specific as to plants attacked and as to plant viruses carried in the capacity of vectors their taxonomy is highly important".

Acknowledgement

Special acknowledgement and thanks are due to those who have made this work possible: to Dr. H. D. Smith, President of the Nova Scotia Research Foundation, for the financial assistance of the Foundation without which this work could not have been undertaken and for his close and continued cooperation all along the way; to Mr. L. S. Hawboldt, Provincial Forest Entomologist, for his suggestions in regard to the problem, his loan of aphid literature, and for his checking of the identifications of the aphids collected in 1948 and a part of 1949; to Mrs. M. E. MacGillivray, Dominion Entomologist, Field Crop Insect Laboratory, Fredericton, New Brunswick, who has freely given many hours of her time and skill in checking and correcting the identifications of material collected from 1950-1953, whose assistance has been invaluable to the project in this and many other ways.

Special thanks are due those loyal assistants who worked on the project during the different summers: to Dr. Ralph J. Day, then a graduate student, Acadia University, who ably assisted in all phases of the project from 1948-1951; to Mr. Michael D. McInnis, then Instructor in Biology, St. Francis Xavier University, who assisted in the darkroom and field work from 1950-1952; to Dr. Merritt A. Gibson, then graduate student, McGill University, for his able assistance in the field, in the mounting of aphid material and in aphid identification and plant herbarium work from 1952-1954; to Mr. Ernest J. White, student, Dalhousie Medical School, whose skilled darkroom assistance from 1953-1956 made the printing of the photographic illustrations possible; to Mrs. Florence Hollingsworth Wright, graduate student, Denison University, for her willing and untiring help in the spring of 1954; to Miss Margaret Cleary for her excellent work in typing the final draft of the manuscript in 1954; to Mr. Leslie B. Slipp, student, Dalhousie Medical School, for his help in revising the line drawings and proofreading of the manuscript in 1955-1956.

Thanks are also due Mr. Wilfred Schoefield, and Dr. Ivan Hall, then graduate students, Biology Department Acadia University, who kindly checked the host plant identifications for 1948-1949; to Dr. Chalmers Smith, Botanist, Acadia University, for his kindly advice and checking of host material for 1950-1951; to Dr. Leon Smith, physicist, Denison University, for his kindly advice and assistance in the making and purchasing of certain photographic equipment and to the late Rev. Cyril Tobin, physicist, St. Francis Xavier University, for his help and kindly advice on photographic problems.

Grateful acknowledgement is here given to the following Nova Scotian institutions for the use of their facilities during various summers: Acadia University, Wolfville, 1948, and 1957; the Provincial Entomological Laboratory, Halifax, 1949; Saint Francis Xavier University, 1950-1956.

Special acknowledgement and appreciative thanks are given to Dr. Dwight M. DeLong, Professor of Entomology, The Ohio State University, who kindly supervised and aided in every way possible the pursuance of this project and the final writing of this paper; also to Dr. Frank Fisk and to Dr. Carl Venard, Department of Zoology and Entomology, The

Ohio State University, who kindly read and criticized this manuscript.

To all these and to those whose published works have been freely used and without which the work would have been impossible; and any others who may have helped and are unintentionally not mentioned, full appreciation of their service is here given.

General Procedure

Beginning in May, 1948, a taxonomic and faunistic study of the plant lice occurring on the forest trees and adjacent plants in forested areas was begun with the purpose of providing information concerning the number of kinds found in the Province in these various ecological areas, their characteristics, distribution, host relationships, seasonal adjustments, importance economically as potential enemies of forest trees, and something of their life cycles.



Fig. 1. A stand of mature spruce and fir, second growth, looking through an old log trail in the center of a deeply wooded area. Halifax County, Liscomb Game Sanctuary, July 27, 1951. (526)

Because of the lack of preliminary work in these areas of Nova Scotia, it was necessary to start with available works from New Brunswick. J. C. Burnham's work (1938), together with L. S. Hawboldt's thesis (1946) on the Forest Aphididae of New Brunswick, served as preliminary source material. A list was made and studied of known samples and hosts together with the prepared slides of material collected and identified by L. S. Hawboldt. These were used subsequently to check the first summer's collections as to species.



Fig. 2. A roadside clearing with new growth of wild raisin, ferns and blueberry with tamarack and spruce forest in the background. The aphid, *Aphis viburniphila* Patch, was found heavily infesting the stem tips of wild raisin. Halifax County, Lochaber Mines, July 24, 1951. (525)

Field investigations were made during the summers 1948-1954, beginning in late May or June and concluding in early September of each year. Various field "stations" were set up within a day's drive in any direction from the laboratories used the first three summers as follows:

Year	Location of Laboratory	Area Worked
1948	Acadia University, Wolfville	Kings County
1949	Provincial Entomological Laboratory, Halifax	Halifax and Northern Lunenburg Counties
1950	St. Francis Xavier University, Antigonish	Antigonish County

The field "stations" were chosen both as regards their accessibility and for type of forestation. For example, so far as possible pure stands were chosen of pine, spruce and fir (Fig. 1, 7); poplar; birch and maple; mixed stands of both hard and soft wood; old or mature stands (Fig. 1); younger, faster growing stands (Fig. 3, 7); cut-over areas, or areas burned over and recovering (Fig. 6); isolated "islands" of trees (Fig. 5); growth confined to one or the other side of a slope (Fig. 3); areas near the sea and areas of similar stands inland from the sea.

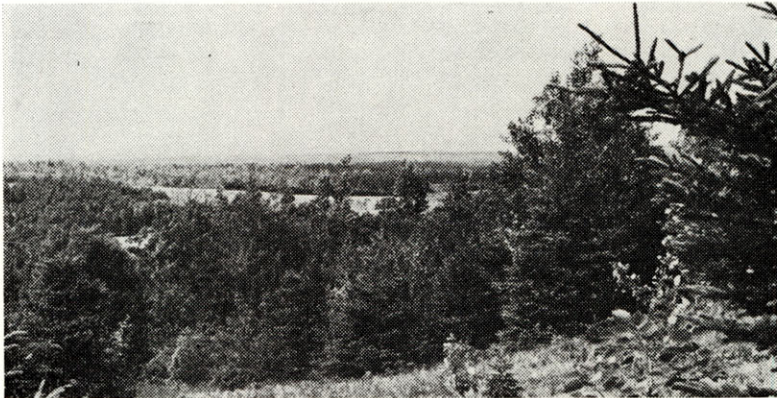


Fig. 3. Young growth confined to the south side of a rather steep slope ending in dense growth in the valley below. This station yielded much diverse aphid material. Antigonish County, Fairmont Road, Station 3, (Cloverdale), July 12, 1950. (447)

Pasture land with young timber growth (Fig. 6); bog, or semi-bog situations (Fig. 4); barrens or barren and rocky types of terrain with very thin subsoil; roadside clearings next to wooded areas (Fig. 2); isolated trees in open fields; roadside plantings of forest trees used for shade or ornamental purposes.



Fig. 4. A typical example of black or bog spruce growing in a swamp overlaying precambrian rocks. Many of these trees were infested with the large, bark-feeding aphid, *Cinara palmerae* (Gillette). Guysborough County, near New Harbour, July 16, 1953. (901.1)

Choice, also, was made of types of subsoil since this affected the type of plant growth, i.e., rocky, barren, sandy, clay, upland, lowland, boggy, etc., the choice of as many ecological situations as possible was followed in subsequent summers when working in other counties of the province.

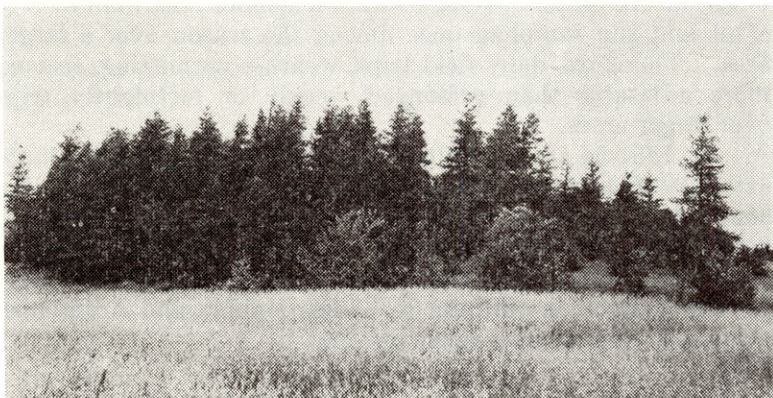


Fig. 5. An isolated island of tamarack, bordered by cherry, wild pear, apple and a few fir trees and surrounded by a cultivated field to the south and open hilly pasture to the north and west. This station was visited at intervals throughout four different summers and yielded much interesting data. Antigonish County, West River Road, June 29, 1950. (419)



Fig. 6. A cut-over area with good second growth of fir. The foreground area had been recently burned over. Nearly all firs in this and neighboring areas were excessively infested with the aphid, *Mindarus abietinus* Koch, in the early summer of 1950. This station was observed at intervals for four summers. Antigonish County, Beech Hill, Station 1, June 16, 1950. (409)

These various "stations" were visited at intervals of two to three weeks throughout the summer. In view of the migrating habits of aphids it was thought that this procedure might insure better coverage within a smaller area than merely a hit and run sampling once during the season over a larger area. Therefore, daily field trips, weather permitting, seemed more advisable than prolonged weekly or fortnightly trips over larger areas.

In 1951-54 the procedure was changed to allow for more extensive field trips of longer duration into the surrounding counties, in addition to local collecting from the established "stations". The usual practice was to make three such trips of approximately ten days to two weeks during the summer. In this manner, in addition to Kings, Halifax and Antigonish Counties, samples were taken as follows:

Time		Area Worked
1951	July	Antigonish, Richmond, Cape Breton, Victoria, and Inverness Counties.
	August	Antigonish, Guysborough, and Northern Halifax Counties.

1952	July	Antigonish, Pictou, Colchester and Cumberland Counties.
	August	Antigonish, Lunenburg, Queens, and Annapolis Counties.
1953	July	Antigonish, and Guysborough Counties.
	August	Antigonish, Richmond and Inverness Counties.
1954	July	} Antigonish, Lunenburg, and Queens Counties.
	August	

Further studies are anticipated in the southern half of the province as well as in Hants, Colchester and Cumberland Counties (Fig. 185).



Fig. 7. A young planted stand of red pine, *Pinus resinosa* Ait. Scattered colonies of the powdery pine needle aphid, *Eulachnus rileyi* (Williams), were found on the majority of these trees, as was also the case with a similar stand in Cumberland County in July 1952. Lunenburg County, East Chester, July 18, 1955. (1052)

Materials and Methods

Alate and apterous, mature and immature aphids, plus a part of the host plant were collected. An attempt was made, however, to take alate forms as far as possible, since these forms primarily are used for identification of the species. When this was not possible, the colony with a piece of the host plant was placed in a covered can or paper bag and brought to the laboratory. As the host plant became dry, usually winged forms would appear, provided there were last nymphal instar stages on the sample when it was brought into the laboratory. This usually took from two to four days. The alate forms were then placed into the special preservative. The samples of the host plants were pressed and later keyed according to Roland's "Flora of Nova Scotia" (1944-45), or in other keys as indicated on the host plant list.

Further observations were made relative to the abundance of the different species, habitat, date of collection, biological forms, and any abnormal appearance of the host plant associated with the presence of aphids such as distorted foliage, twig malformations and any other unusual conditions of the host plant noted. This latter information is written up under species descriptions.

Laboratory Procedure:

The technique followed in the laboratory procedure, first suggested by L. S. Hawboldt, was published by J. B. Maltais (1945) to which the reader is referred for details. The aphids were first preserved in a "sweet pickle", later to be dehydrated in alcohol. Clearing was accomplished with carbol-xylol followed by premounting in a thin mixture of Canada balsam and carbol-xylol. From the premounting fluid the aphids were mounted in balsam on microscope slides.

Essig (1942a:335) recommends a procedure for clearing aphids by the Caustic Potash or Lactic Acid method before mounting. This method is further elaborated by Essig (1948:9). After treatment with sodium hydroxide, the body contents are removed and the aphid is then cleared in clove oil or xylol and mounted in balsam on a microscope slide. This method was tried and found to be very satisfactory, though slower to perform than that of Maltais (1945), but with the added satisfaction of obtaining specimens more uniformly cleared.

Photography:

As a further aid to understanding the habits, host-aphid relationships, and host damage produced, a series of both black and white and color photographs was made of most of the forest aphids collected. Since the determination as well as description of aphids is dependent at many points on the color pattern, the Kodochrome transparencies not only aid in this process, but also serve very well for illustrative material for the presentation of papers on forest aphids.

The color pattern is very often lost during the preservation and slide-mounting process, hence the subsequent projection of the transparency along with microscopic examination of the specimen, aids measurably in the identification and description process. Furthermore, an actual record is obtained of colony pattern and host damage, which likewise are additional aids in characterizing the over-all biology of the species.



Fig. 8. Photographic set-up used in the field. Extension arms hold specimens in clothespins, adjustable for variable focal lengths. Extension bellows permit magnification up to 4 to 6 times the life size of specimens. 35 mm Praktiflex camera used for kodachrome pictures; Master Reflex $2\frac{1}{2} \times 2\frac{1}{2}$ camera or Praktiflex used for black and white negatives. The Strobonar IA speedlight was used subsequently with this set-up for better depth of focus and constancy of light source. (600.1)

Figure 8 illustrates the set-up for photographing aphids in the field. This was found to be essential, since it was relatively impossible to bring samples back to the laboratory, as the aphids would have by that time crawled from the host sample. It was found that the $2\frac{1}{4}$ negative size was advantageous when the image completely filled the negative, otherwise 35 mm black and white negatives, properly processed and enlarged, can produce as good and sometimes better negatives. In addition to natural sunlight used the first three summers, a Heiland Strobonar 1A speed light was added in 1953 and found to be very effective. Three cloth screens of white, blue and black were used for background.

THE PHYLOGENY OF THE APHIDAE

Fig. 9

Any discussion of phylogeny of the Aphidae ought also to include related groups of insects from which the family probably arose. Baker (1920) in his generic classification has set forth a phylogenetic tree of the group which is modified here to facilitate the understanding of the broader relationships of this family.

Different authors treat the groups in various ways. One of these methods is given here. Beginning with the order Heteroptera which includes all the variable-winged bugs, two main divisions or suborders occur, which are the Hemipterous branch or half-winged insects, such as: the water boatmen (Corixidae), backswimmers (Notonectidae), nabids (Nabidae), assassin bugs (Reduviidae), chinch bugs (Lygaeidae), squash bugs (Coreidae), stink bugs (Pentatomidae), et altera; and the Homopterous branch or uniform-winged insects. Since the aphids are included in this latter suborder our attention will be confined to it.

The Homoptera (Key to Families of Homoptera p. 27) are divided into two main series, the Auchenorrhyncha Dumeril 1806, and the Sternorrhyncha Amyot and Serville 1843 (Fig. 9). The Auchenorrhyncha, or those species having the tarsi mostly three-segmented and the rostrum arising from the ventral base of the head, include the Cicadidae (Cicadas), Membracidae (Treehoppers), Cercopidae (Froghoppers or Spittlebugs), Cicadellidae (Leafhoppers), Fulgoridae (Planthoppers or Lanternflies).

The Sternorrhyncha are characterized by one or two-segmented tarsi and the rostrum appearing to arise from between the forelegs (Essig, 1942, p. 307). This series includes the Psylliidae (Psyllidae, Chermidae) or jumping plant lice, which superficially resemble aphids in some respects. They differ from these in having strong jumping hind legs, relatively long antennae and differences in wing venation. The Aleyrodidae (Aleurodidae) or white flies, somewhat resembling tiny moths, have wing with simple venation covered with a white dust or waxy powder. In both these last two families the adults of both sexes are alate. The family Coccidae, made up of scale insects and mealy bugs, is usually considered the most specialized family, which is true in some respects, though some of this specialization may have been brought about through degeneration, i.e. females are wingless, often legless, without eyes, and sessile in habit; the males have only one pair of wings (sometimes are wingless), lack mouth parts and therefore do not feed.

The following consideration of the phylogeny of the Aphidae submitted here is modified from A. C. Baker's Generic Classification of the Hemipterous Family Aphididae (1920).

The two families of the superfamily Aphidoidea, the Aphidae and the Phylloxeridae, are separated on the following basis: the Phylloxeridae, are characterized by the presence of summer parthenogenetic, oviparous forms, and with fore-wings in which the stigma is formed by the radial sector. (Key to subfamilies of Phylloxeridae p. 28). The Aphidae are characterized by the presence of only sexual oviparous forms, and with fore-wings in which the stigma is formed by the radius. (Key to subfamilies of Aphidae p. 39).

On the basis of their anatomy and biology, the Aphidae are subdivided into four main subfamilies; the Mindarinae, Aphinae, Eriosomatinae and the Hormaphinae, which are as follows:

Subfamily 1. MINDARINAE

This subfamily is composed of one genus, *Mindarus*, which is the most primitive of the family Aphidae. The radial sector vein of the fore-wing arises at the proximal portion of the stigma which is the condition found in the wings of fossil aphids, as is also the stigmal formation. Furthermore the fact that this form feeds on conifers is also held by some to be a primitive habit. The sexes of *Mindarus* are more primi-

tive in that they still retain a functional beak and suck plant juices and the oviparous females lay multiple eggs, 8-10, whereas, the sexes of the Eriosomatinae are beakless, and the oviparous females never lay more than one egg. These latter two conditions are considered to be the more specialized.



Fig. 9. Phylogenetic tree of the Aphidae modified after A. C. Baker (1920a, p. 3). Groups marked with an asterisk include species discussed in this paper.

In other respects the Mindarinae resemble the Eriosomatinae and it is for this reason that some consider the genus *Mindarus* closely related to the Pemphigini, one of the tribes of the Eriosomatinae. The general form as well as antennal structure; the separate apterous sexes; the mode of copulation in which the male mounts the female, remaining inactive for long periods; these and other structures and habits reflect a kinship to the Eriosomatinae. It is possible that some such ancestor, similar to *Mindarus* may have been the progenitor of the Eriosomatinae.

Subfamily II. APHINAE

This subfamily is also quite primitive in that they are foliage or twig feeders, usually living in colonies, and have not developed any special method of life such as gall formation. Their wing structure includes a media that is twice-branched and antennae which are of six segments; thus showing limited reduction and specialization. The sexual forms are also very primitive, inasmuch as the males are very commonly winged and both sexes retain their beaks and feed like other forms, while, at the same time, the female develops a normal ovary and produces several eggs.

Subfamily III. ERIOSOMATINAE

Many of the species of this subfamily are subterranean, closely associated with ants. They have the ability to produce pseudogall and gall formations. This group is considered more advanced than the Aphinae but more primitive than the Hormaphinae. It is, however, in certain respects more specialized than the Hormaphinae. The group is separated from the rest of the Aphidae on the basis of the sexual forms, which are small, apterous and beakless, and do not take nourishment. That this was not their original conditions is indicated in the life history of the family and also by the fact that the sexual forms of some species have a beak when born, losing it at the first molting. The ovaries of the oviparous female have atrophied with the result that only one ovary develops and only one egg reaches maturity. It is also significant to point out that the alate forms possess distinct compound eyes, whereas the apterae do not develop them. The

wing venation is likewise reduced, the media of the fore-wing is never branched more than once, which is another example of specialization by reduction in this group.

Subfamily IV. HORMAPHINAE

The members of this subfamily are small, apterous aphids which possess beaks and feed but the specialization in the sexual forms is absent, i.e. the oviparous females lay many eggs. They are more specialized than the members of the other subfamilies in that they have a peculiar aleyrodiform stage (whitefly-like) which is different from anything else in the family. They also have developed peculiar wax glands which adds to their similarity to white-flies. (The Aleyrodidae or whiteflies are a separate, distinct family of the Homoptera prevalent often as greenhouse pests).

The discussion which follows is concerned with a more detailed treatment of each of the four subfamilies listed above.

The subfamily Mindarinae has already been designated as the most primitive of the Aphidae, consisting of but one genus, *Mindarus*, which is found on conifers, usually, *Abies balsamea*. Because of the known geologic age of conifers, this might indicate a host relationship established, perhaps prior to the advent of flowering plants.

The subfamily Aphinae is divided into four tribes, the Lachini, Aphini, Thellaxini and Panaphini, three of which are further subdivided into subtribes. Reference to Figure 9 will make these relationships clear.

In the tribe Lachini the beak structure, type of antennae and cornicles are of primitive origin. The radial sector of the forewing is short and straight, and has migrated toward the tip of the wing. The members of the group generally feed on conifers.

The subtribe Lachnina is characterized by the presence of six segmented antennae, rounded cauda and anal plate. The males are alate while the females are both apterous and oviparous.

The subtribe Eulachnina, while more specialized than the Lachnina is, nevertheless, in the same line of development. The members of the Eulachnina possess the same type of wing structure as the Lachnina, but differ in having a specialized form of body, cornicles and eyes. All other species of the other subtribes of Lachnini have a different wing structure.

In the subtribe *Cinarina* the radial sector vein is curved but it has not migrated to the tip of the stigma.

The species of the subtribe *Anoecina* are similar to the members of the subfamily *Eriosomatinae*, where they are frequently placed. However, the sexual forms are not beakless and the oviparous female develops more than one egg. The stigma is modified somewhat from the condition of the long narrow primitive type.

The subtribe *Tramina* is made up of highly specialized forms with extreme modification of the hind tarsi, similar to those found in the subfamily *Eriosomatinae*. The apterous forms of the subtribe *Tramina* are further characterized by insignificant cornicles.

Before taking up the tribe *Panaphini* two variant tribes, the *Thelaxini* and the *Greenideini*, should be considered, since they arose from the line of the subfamily *Aphinae* at approximately the same point as the tribes *Panaphini* and *Aphini*. Since it is not possible, with certainty to place them in either of the latter two tribes, they are given the rank of tribe themselves.

The tribe *Thelaxini* is often placed with the subfamily *Eriosomatinae* because the oviparous female lays only one egg, but it is placed in the *Aphinae* stem here, because the sexual female is not degenerate, beakless, and nonfeeding, as is the case in the subfamily *Eriosomatinae*. The sexual female in this instance feeds upon the leaves of plants in the same manner as the viviparous forms. The members of this tribe are also more closely related to the subtribe *Phyllaphina* of the tribe *Panaphini* than to any other group.

The members of the tribe *Greenideini* have long cylindrical, swollen cornicles with prominent hairs; a condition not met with in any other tribe, except the subtribe *Macrosiphina*. The tribe *Greenideini* is believed to have separated from the *Aphinae* stem before the hairs of the cornicles disappeared.

The tribe *Panaphini*, members of which are characterized by the presence of a knobbed cauda and bifid or bilobed anal plate, are thought to have arisen later than the tribes *Lachnini* and *Aphini*, developing into two main branches represented by the subtribes *Panaphina* and *Chaitophorina*. These later two subtribes are in turn separated from each other on the basis of antennal variations.

The members of the subtribe Phyllaphina are considered to be the most primitive in this line of descent because the oviparous forms of some species are alate; a condition very seldom found in the family Aphidae. In the subtribe Panaphina the oviparous forms are apterous with cornicles moderately developed and with wing veins usually not reduced.

The subtribe Saltusaphina is closely related to the Panaphina but differs from it since its members have enlarged femurs, which function in leaping. Both of the sexual forms have lost their wings which the male retains in the subtribe Panaphina. Furthermore, the ocular tubercles in the Saltusaphina are absent, whereas they are conspicuous in the Panaphina.

The two most specialized subtribes of the tribe Panaphini are the Monaphina and the Drepanosiphina. The former is characterized by the lack of cornicles, whereas the latter possesses variable cornicles as well as the fact that the males are winged and the females have long narrow ovipositors.

The three remaining groups of the tribe Panaphini are the subtribes Chaitophorina, Fallawayina, and Pterocommina. The subtribe Chaitophorina is characterized by the presence of long hairs on the antennae and over the body. The members of this subtribe are more generalized, corresponding closely with the species of the subtribes Panaphina, the males usually being alate. The members of the subtribe Fullawayina are characterized by the absence of cornicles, whereas the subtribe Pterocommina possess cornicles which are cylindrical and swollen.

The tribe Aphini is made up of five subtribes, two of which are the Aphina and the Macrosiphina which took their origin from the Aphinae line of descent with the development of distant frontal tubercles and cornicles. The subtribe Aphina is further characterized by an extreme variability in the shape and size of the caudae and cornicles. The subtribe Macrosiphina is best characterized by the presence of prominent frontal tubercles.

The subtribe Cervaphina may be separated from the subtribe Aphina by the possession of long cylindrical cornicles and prominent abdominal spinelike projections. The antennal segments and wing venation are also reduced.

The subtribe *Pentalonina* is separated from the subtribe *Macrosiphina* by the possession of a peculiar wing venation. The radial sector is united with the upper branch of the media and the venation of the hind wing is reduced. This condition is considered specialized and therefore, places this group at the top of the tribe *Aphini*.

The subtribe *Setaphina* is characterized by the presence of highly specialized antennae and wings. The cornicles, cauda, and anal plate are, however rather generalized. Since the members of this group lack prominent cornicles as are found in the subtribes *Aphina* and *Macrosiphina*, some contend that this subtribe holds a rather doubtful position in the tribe *Aphini*. However, since the cornicles of the members of this group are not hairy, they must be separated from the tribe *Greenideini*.

By reference to Figure 9 it will be noticed that the subfamily *Eriosomatinae* contains five tribes and that of the subfamily *Hormaphinae*, three tribes. These tribes are not further separated into subtribes as was the case with the *Aphinae* stem.

Of the five tribes in the subfamily *Eriosomatinae*, the tribe *Eriosomatini* contains the most primitive forms, which are characterized by the presence of prominent cornicles and well developed wax glands. The typical host plant for the members of this group are the various species of elm. The summer forms of many species, however, alternate between the elm and the roots of various other plants. As a rule the species in this group do not form galls. The members of the tribe *Pemphigini* are similar to those of the tribe *Eriosomatini*, with the exception that they form galls on deciduous trees. Cornicles are present, but are reduced to mere rings and many members of the group secrete wax. The species of the tribe *Melaphini* are all gallformers like the *Pemphigini*, but have lost the cornicles entirely. In the *Prociphilini* cornicles are absent, but large wax plates have taken their places. The species live upon leaves which roll and crumple into pseudogalls.

The most specialized members of the subfamily *Eriosomatinae* belong to the tribe *Fordini*. These aphids are similar to those which belong to the tribe *Prociphilini*, i.e., the cornicles being absent and replaced by large wax glands. They are almost all subterranean in habits and associated with ants.

The most primitive members of the subfamily Hormaphinae belong to the tribe Oregmini. These aphids lack the aleyrodiform stage characteristic of the subfamily, but they possess distinct cornicles. Closely related to the tribe Oregmini are the members of the tribe Cerataphini. These aphids are more advanced than those of the tribe Oregmini in that they possess an aleyrodiform stage together with abundant wax glands, as well as cornicles. The alate forms possess annular sensoria; apterous forms are scale-like and live on leaves.

The aphids which belong to the tribe Hormaphini are all gall formers on both the primary and secondary host. They lack cornicles but have well-developed wax glands. They also possess a generation like the white-flies, the aleyrodiform stage. In general the members of the group represent a high degree of advancement in aphid evolution.

PART II TAXONOMY

In the various descriptions of species, the word "millimeter" or its abbreviation "mm" is omitted for the sake of brevity, when stating the comparative or actual lengths of various body parts. Body length is measured from vertex to tip of cauda. The unguis is measured from the permanent sensorium on base of antennal VI to tip of filament. The base of antennal VI is measured from basal joint to include permanent sensorium. Measurements of cauda are made from the dorsal aspect along median line. Color descriptions are those of dorsum, or as seen from the dorsal aspect. The characters emphasized are those of alate forms of the species, since in most cases, keys to these forms are the most readily available.

The use of both a compound microscope for detailed observation and making of measurements; and the wide-field binocular microscope for color comparisons and grosser measurements was found useful; together with Kodachrome projections on a small wall screen depicting the actual field conditions encountered on the host plant with the respective aphids in question. This series of Kodachrome slides was made simultaneously with the black and white photographs included in this paper.

The reference numbers of all collections and photographs included in this paper are found in brackets following the date in each case. Microscope slides of mounted specimens with the same series of reference numbers, are in the keeping of the Nova Scotia Museum of Science, Halifax, Nova Scotia, Canada.

KEY TO THE FAMILIES OF THE SUBORDER HOMOPTERA

(Coccidae, Aleyrodidae and Chermidae not included in this paper)

1. Beak arising from ventral base of head; antennae minute; bristle-like; tarsi 3-jointed; active and free-living (not described in this paper).....Series **Auchenorrhyncha**
- Beak apparently arising from between front coxae; antennae prominent, threadlike, or wanting; tarsi 1 or 2-segmented; relatively inactive or sedentary.....Series **Sternorrhyncha 2**
2. Radial sector of fore-wing absent; 3 oblique veins present; cornicles absent; antennae never 6-segmented; all females oviparous, (p. 28).....Fam. **Phylloxeridae**
- Radial sector of forewing present; 4 oblique veins present; antennae usually 6-segmented in alate forms (Fig. 10); only sexual females oviparous, parthenogenetic females viviparous (p. 32)....Fam. **Aphidae**

Suborder **HOMOPTERA**Family **PHYLLOXERIDAE** (Chermidae)

The Adelgids and the Phylloxerids

The members of this family are closely related to the aphids and are found in somewhat similar situations. They differ from the aphids in a number of respects, i.e., they lack cornicles, antennae 3-5 segmented, reduced wing venation in forewing, radial sector absent (fused with R_1); all reproductives are parthenogenetic or oviparous; males and sexually perfect females are dwarfed and wingless. The two subfamilies are given family status by some authorities.

KEY TO THE SUBFAMILIES OF FAMILY PHYLLOXERIDAE

1. Wingless agamic females, flocculent; antennae 5-segmented in alatae, segments III, IV, V with solitary sensorium, 4-segmented antennae in sexual forms, 3-segmented in wingless parthenogenetic females; wings roof-like when at rest. Species infest conifers, on needles, twigs or in galls (p. 28).....Subfamily **Adelginae**
(Cherminae)
- Wingless agamic females usually not flocculent; antennae 3-segmented in alatae; segment II with 2 sensoria; wings flat when at rest. Species not infesting conifers (not discussed in this paper)....Subfamily
..... **Phylloxerinae**

Family **PHYLLOXERIDAE**Subfamily **ADELGINAE**

Family Adelgidae, Mordvilko 1935, by some authors)

Chermes Linn. 1758

Adelges Vallot

Essig, 1942:324 makes this comment in a footnote with reference to this subfamily (or family), "the transference of the name *Chermes* to replace *Psylla* has made it necessary to adopt the name Adelgidae from the genus *Adelges* Vallot for this family". (No date was given for Vallot's genus). Hence, the genus name *Adelges* Vallot, not *Chermes* is used in this paper. The three species taken are assigned to this genus.

Family **PHYLLOXERIDAE**Genus **ADELGES** Vallot

The essential characters for this genus are very similar to those given for subfamily Adelginae in the key to the Subfamilies of Family Phylloxeridae above.

KEY TO THE SPECIES OF THE GENUS ADELGES

(Modified after Britton, 1923:329)

1. Gall well formed, pineapple shaped, not terminal. 2
- Gall not well formed, terminal; presence causing scraggly deformation of twig (Figs. 28, 29, 30) 3. *similis*
2. Forewing and anal vein not strongly curved; hindwing with M directed distad; winged form from gall ovipositing on *Larix* spp. 2. *lariciatus*
- Forewing with anal vein strongly curved; hindwing with M not directed distad. Winged form from gall ovipositing on *Picea* spp. (Figs. 26, 27) 1. *abietus*

Subfamily ADELGINAE

1. *Adelges abietus* (Linn.)

The Long-spurred Pineapple Gall Adelgid

Figs. 25, 26, 27

Chermes abietus Linn., 1758:454; Cholodkovsky, 1907; Patch, 1909:290; Craighead, 1950:134*Adelges abietus* (Linn.), Borrow and Delong, 1954:271

This is one of the commonest and most widespread gall insects found on the conifers of Nova Scotia. As the collection records show, it has been found in every county studied wherever white spruce is growing. The galls are well formed and appear as miniature pineapples in the axils of terminal branches. One not familiar with the normal growth of white spruce might mistake these galls for young carpellate cones. Where they are numerous they cause serious deformations of the branches, and small trees are sometimes ruined by their presence. Very often stem growth beyond the gall stops and the twig dies, resulting in the secondary new growth taking on a peculiar and irregular conformation (Fig. 25). Patch (1909:290) counted as many as 990 fresh galls on a single white spruce 3 feet tall.

The young galls are green, with a triangular-shaped red mark outlining the opening of each cell, which turns from purple to deep red as the gall matures. The galls measure from about $\frac{1}{2}$ to one inch in length and are made up of the swollen bases of adjacent needles, in which the adelgid lives (Fig. 27). These cells are closed until the emergence of the last nymphal instar late in August, at which time they open, allowing the emergence of these forms, which molt while on the

adjacent needles and become winged. Patch (1909:291) counted 50 cells in one gall, each containing from 8 to 12 nymphs.

According to her observations the species is monophagous in that these winged emergents appear from the middle to the last of August; lay yellow eggs on the needles of the host which hatch in two weeks into apterous forms which overwinter in the buds, usually of the same host. The following spring these apterous forms mature and lay a batch of 140 or more eggs, the young of which infest new needles which results in the new pineapple gall.

The fact that adjacent trees may not be infested when very close to one that is heavily infested, tends to support Patch's conclusions that this adelgid does not seek a different species of host plant and that it is usually monophagous on one host.

Winged oviparous forms have a golden brown body, with thorax lighter colored than abdomen; head and thoracic lobes dark. The wings have a decided greenish cast, especially in regions of the stigma and margin, the clear part of the wing being slightly yellowishgreen. For good descriptions of the various forms with figures, see Patch (1909:290).

Collections: Found in long-spurred pineapple galls in axils of terminal branches of *Picea glauca* (Moench) Voss (white spruce). ANTI-GONISH COUNTY: Route 7, August 9, 1950; Lochaber, July 26, 1951; West River Road, July 30, 1952; St. Andrews, July 4, 1953. CAPE BRETON COUNTY, Gillis Lake, July 12, 1951. VICTORIA COUNTY: New Harris, July 16, 1951; Aspy River Valley, August 17, 1951; Bay St. Lawrence, August 17, 1951; Neils Harbour, August 17, 1951. INVERNESS COUNTY: Port Hastings, August 13, 1951; Glendale, August 14, 1951; East Lake Ainslie, August 15, 1951; Cheticamp, August, 16, 1951; Port Hood, August 14, 1953. PICTOU COUNTY: Sunnybrae, July 28, 1951; Green Hill, July 5, 1952. GUYSBOROUGH COUNTY: St. Mary's River, July 27, 1951; Caledonia, July 28, 1951. (Reference numbers: 464, 631, 652, 821, 900.2).

Subfamily ADELGINAE

2. *Adelges lariciatus* (Patch)

The Short-Spurred Pineapple Gall Adelgid

Chermes lariciatus Patch, 1909:294; Britton, 1923:330

Because of the great similarity between the gall of *A. abietus* Linn., and this adelgid, collection records at first did

not differentiate between the two. Therefore the incidence of *A. lariciatus* (Patch) in Nova Scotia cannot be indicated without further study. It is, furthermore, quite possible that some of the records indicating *A. abietis* may be that of *A. lariciatus*. However, on the basis of existing records, *A. abietis* is far more extensive in occurrence than the latter.

The gall produced by this species, like that of *A. abietis*, is not terminal but occurs in the axils of terminal branches. The closed openings of each small needle gall are marked by wide russet lines giving a general russet color to the whole gall. The pineapple appearance is even more striking because of shorter needles than that of *A. abietis*. For this reason the name "short-spurred" is applied as contrasted to the "long-spurred" pineapple gall of *A. abietis*.

The winged oviparous forms of *A. abietis* and *A. lariciatus* are separated on the basis of the wing venation as indicated in key to the species above. Alatae have head and thoracic lobes dark, prothorax and abdomen light yellowish-green, extremities green; wings decidedly green with yellow proximal portion. As in the case of *A. abietis* the basic coloration darkens with the age of the individual. Patch (1909:294) describes, figures and pictures the galls, nymphs and alatae of this species. Her observations further indicate that the alternate host is Larch, i.e., "the migrants from the white spruce galls settled on the larch needles and oviposited," this migration occurring from the first to the middle of August.

Collections: In short-spurred pineapple galls on *Picea glauca* (Moench) Voss (white spruce) found in the axils of terminal branches. ANTIGONISH COUNTY, Route 7, August 9, 1950 (464).

Subfamily ADELGINAE

3. *Adelges similis* (Gillette)

Figs. 28, 29, 30

Chermes similis Gillette, 1907:15; Patch, 1909:301

Pineus similis (Gillette)

These forms were taken from very loosely formed galls, causing a scraggly appearance on the terminal branches of the new growth of white spruce, quite unlike the well formed and compact galls of *A. abietis* and *A. lariciatus*. These galls were of many shapes and sizes from about an inch to

over five or six inches in length. They varied in shape from straight to C-shaped with the longer ones sometimes being tightly coiled. Syrphid larvae were frequently found preying upon these adelgids, their access being made easy by the very loose nature of the gall.

The alatae are reddish brown with wings smoky, and body covered with considerable flocculence. Patch (1909:301) discusses the characters of the winged forms and something concerning the life cycle, though it is not sure whether the form is monophagous or alternates to a summer host. Galls, however, were found on white, red and black spruce in Maine. To date only galls from white spruce have been found in Nova Scotia. Gillette (1907:15) describes the species from Colorado and his comparison with Patch's slides indicates the same species in both regions.

Collections: On terminal branches of *Picea glauca* (Moench) Voss, in loose scraggly galls. Not common in the region. GUYSBOROUGH COUNTY, Sloane Lake, July 27, 1951; INVERNESS COUNTY, C. B., Kingsville, August 14, 1951; VICTORIA COUNTY, Aspee River Valley, August 17, 1951 (526).

Suborder HOMOPTERA

Family APHIDAE (Aphididae)

Aphides Linnaeus, 1758:452

Aphidae Sammonelle, 1819:232

Aphidina Burmeister, 1835:85

Aphididae Passerini, 1863; Buckton 1881

Aphidae Baker, 1921:101

The etymology of this family name has long been in a state of confusion, largely because Linnaeus did not properly define the application of the word *Aphis*. Buckton (1876) tried to derive the correct meaning but came to no final decision. According to Essig (1942a:331 footnote), the Greek scholar, John Varres suggested the meaning "unsparing", or "lavish", referring to the biotic potential of these insects, and C. J. B. Amyot, the French entomologist, thought the root meaning meant "to draw liquid", which is a characteristic of this group. Essig contends that the English form of the root is "aphid" and "therefore, the correct form of the family name is Aphididae and not Aphidae".

However, in Palmer (1952:3 footnote) the usage of "Aphidae" is considered correct, since it is in conformity with opinion 143 rendered by the International Commission on Zoological Nomenclature in 1943, which supersedes Essig's comments. (see Bull. Zool. Nomen., 1950:246, V4). This principle is therefore applied to the other lesser hierarchical subdivisions of this family in this paper, i.e. aphidinae becomes aphinae; aphidini becomes aphini and aphidina becomes aphina. This not only conforms with opinion 143 cited above, but also simplifies the usage of these terms.

MORPHOLOGY USED IN TAXONOMY

Baker, 1920a:2; Palmer, 1952:3

The principle structural and anatomical features used in most keys for the identification of the Aphidae are shown in Figure 10, which is an outline drawing of a composite alate aphid illustrating most of these characters. Color descriptions are included under the various species headings discussed in this paper at least for the alate forms. A great many of the older published keys used these color differences especially in keying out the species. It is impossible to include color illustrations though their value would be considerable. Some of the works of Gillette and Palmer (1924) or earlier, contain very beautiful colored plates of many of the principal aphid species.

Aphids are phytophagous insects usually living in colonies made up of parthenogenetic and sexual individuals which are the progeny of ovoviviparous females. They are rather small in size ranging from about one to at the most five mm. in length; more or less fragile, soft bodied and slow moving. The adult forms are both alate (winged) and apterous (wingless) and usually occur together in the same colony. They exist in various colors from pale yellow to green, or brown to black with considerable variation in color pattern with spotting, or stripes; being either pruinose or covered in varying degrees with a whitish flocculence or pulverulence. They feed wholly on plant juices, sucking it into a relatively small stomach and primitive filter chamber. They lack malpighian tubules which perhaps is one reason for the rather prolific excretion of honey-dew through the anus. Wigglesworth (1939) states that aphid honey-dew is composed of 16.7% sucrose, 24.5% invert sugar, 39.4% dextrin and 3.0% protein.

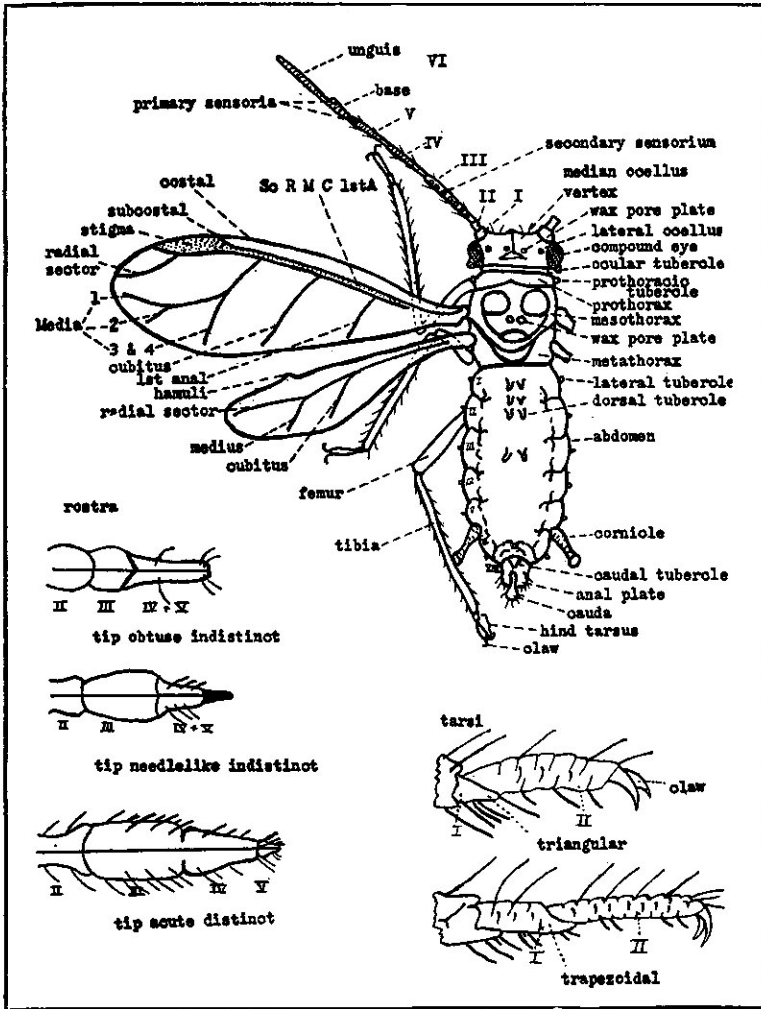


Fig. 10. Outline drawing of a composite aphid illustrating structures and terms used in this work for describing and keying the various species.

The head is rather small and closely joined to the prothorax with vertex flat, concave or produced, and with or without frontal tubercles. The eyes are compound and with or without an ocular tubercle. Alate forms and some apterous

males possess three ocelli. The antennae are quite variable, with from three to six segments, with segments I and II very short, and ending with a terminal filament (unguis) which varies greatly in length in different species. Antennal sensoria are variable in number and shape from circular and oval to transverse and band-like. The Rostrum is here considered as five-segmented with rostral IV and V fused in most aphid groups; it may be short extending to first coxae or longer than body; blunt, tapering or elongate.

In alate forms the thorax is well developed, but in the apterae it is not distinct being somewhat fused with the abdomen. Spiracles are present on the meso — and metathorax and often lateral tubercles are on the prothorax.

Wings occur on viviparous females and certain male sexuales, usually folded roof-like over the back when at rest. The forewings are larger with the typical or "normal" venation shown in Figure 10. Variations occur in the reduction of medial branches; shape of the radial sector and its relation to the stigma; and in coloration, presence or absence of fuscous; veins bordered or not, or clear. The hind wings are small, very reduced in some groups, with hamuli on the anterior margin and with fewer veins, reduced still more in certain groups. The legs vary from short to very long with considerable variation in the number, distribution and kind of hairs and spines, especially on the tibia, which in oviparous females is, in addition, often swollen and covered with sensoria. The tarsus is two-segmented, the first very short, and the longer second segment bearing two simple claws.

The number of segments making up the abdomen varies from eight to nine, all more or less indistinct, though more easily differentiated, possessing seven pairs of spiracles respectively. Figure 10 illustrates the positioning of lateral, dorsal and caudal tubercles, which vary in number and structure with different species. Wax glands, hairs or setae are also usually present. Cornicles (honey tubes or nectaries) which are oil or wax-secreting organs, occur on the fifth or sixth abdominal segment; sometimes they are wanting. Their shape varies from cylindrical, to swollen, straight to curved, truncate or mammiform, to mere pores; they may be smooth, imbricated, partly reticulated, or sometimes hairy; and with or without a flange on the distal end. The last two segments

are modified into the cauda (tail), and anal plate, structures peculiar to this family, which are very distinctive in the different species, varying from inconspicuous to rounded, or short, tapering to knobbed, to elongate tapering or spatulate. In male sexuales the genital organs are made up of a genital plate, penis and a pair of valves. In female sexuales the abdomen is often drawn out posteriorly into a long tapering tube.

For a more detailed and comprehensive treatment of the morphological characters found in the Aphidae, consult works such as the following: Patch (1909a) and others of her publications; Sanborn (1904); Swain (1919); Theobald (1926, 1927, 1929); Gillette and Palmer (1931); and more recently a most excellent compilation of over 433 species is figured and described by Palmer (1952).

LIFE CYCLE

No one aphid life cycle can adequately represent the variations encountered in the whole group. Generally speaking, however, a type known as heterogamy or cyclic reproduction typifies conditions found in which there is an alternation of summer asexual generations with a fall sexual generation. The various forms encountered in this cycle are as follows (Fig. 11):

Fundatrix (Stem Mother) hatches from the overwintering egg in the spring about the time the buds are beginning to open and is either apterous or alate. Upon maturity she begins to produce young parthenogenetically (without fertilization). Since the young hatch from the eggs internally, they are born alive (viviparous). This type of female is therefore ovoviviparous.

Fundatrigeniae are the parthenogenetic offspring of the stem mother and are either alate or apterous. They mature and give rise ovoviviparously to one or more generations. In some groups, i.e. Panaphina and Drepanosiphina, this form may be absent, only male sexuales being alate.

Migrantes (Migrants) are alate and arise from the second or third generation of apterous fundatrigeniae on the winter or primary host. Upon maturity they fly to a suitable summer or secondary host and then reproduce parthenogenetically

apterous forms. If they stay on the same or a similar winter host they continue to produce both apterous and alate forms.

Alienicolae (secondos) are apterous offspring on the summer hosts which continue to reproduce ovoviviparously throughout the growing season on the secondary host.

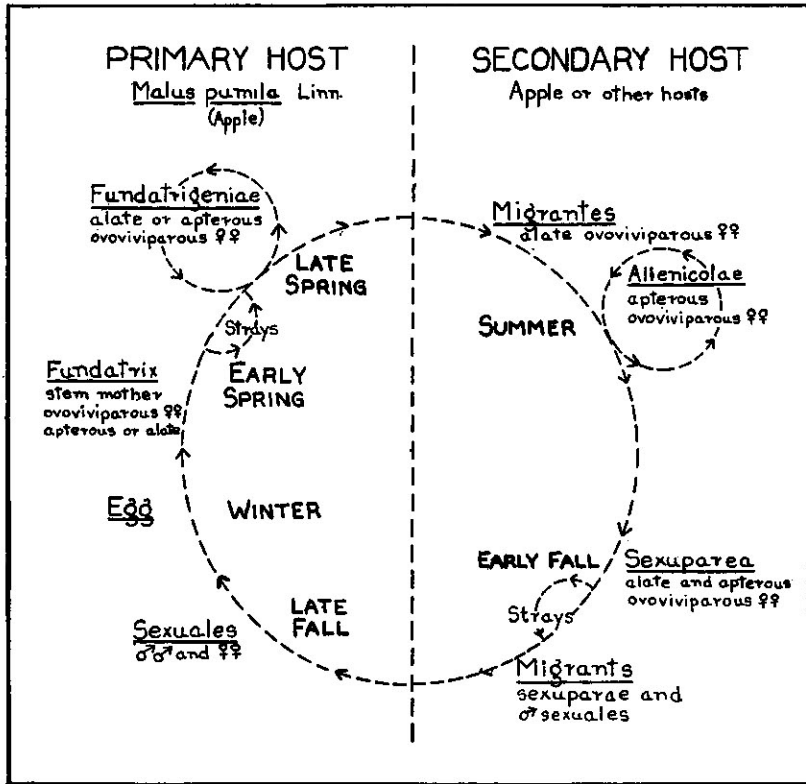


Fig. 11. Life cycle of *Aphis pomi* (DeGeer).

Sexuparae (gynoparae) represent the last viviparous generation produced on the summer host. They are alate or apterous and give rise parthenogenetically to sexuales, either on the summer host or after migrating back to the winter host.

Sexuales (sexes) are the male and female offspring of the *sexuparae* sometimes born on the summer host, but more frequently on the winter host. They quickly mature, mate,

and the apterous oviparous females lay from one to several eggs, usually on the bark of the winter host. Alate male sexuales more often occur on the summer host and fly back to the winter host and mate. Sexuales feed very little and usually die before winter.

The life history shows considerable variation between different species and in the same species in different climates. Most species are fairly specific as to host plants and many appear to be monophagous; others accept hosts within related plant groups. Contrary to popular opinion, relatively few species have a primary (winter host) which is usually a perennial or woody plant and from one to several secondary (summer hosts) which are usually annuals or herbaceous plants. There are also some species which are very cosmopolitan in habit accepting most any plant within normal flying range, i.e., *Myzus persicae* (Sulzer), *Macrosiphum euphorbiae* (Thos.) *Aphis gossypii* Glover. Some species which in cooler climates normally show alternation of hosts and the production of fall sexuales, may in warmer climates continue reproduction parthenogenetically throughout the year, i.e., *Aphis pomi* De Geer, *Aphis malifoliae* Fitch, which do so by maintaining parthenogenetic colonies on evergreen hosts (Essig. 1942:334). Apparently the production of sexuales is in some way correlated with climate, in a somewhat analogous way in which the production of alate forms appears to be correlated with the condition of the host plant, i.e., alatae will develop in the laboratory on drying pieces of host plants more quickly than when left on the live host in the field.

Many other varieties and exceptions may be encountered in the life history. Not all summer alate forms migrate in a normal migratory species. Apterous colonies may continue throughout the growing season on the winter host, simultaneously with colonies on the summer host. If this summer host is a perennial some members of the species may overwinter on it, not migrating back to the winter host. Other specific variations are considered under the species descriptions when they are known. For further discussion on this subject see Hottes and Frison (1931:130-135); Essig (1942:333-335) and Palmer (1952:4-5).

Many of the species met with will be of little or no economic importance, if one considers only the amount of destruction on the immediate host, but in the long term study of life cycles, the aphid of no seeming economic importance on its recorded host may be very destructive on its alternative or secondary host. By checking its growth at earlier stages in its life cycle, it may save important crops and the expensive use of sprays. Some of the more common pests are the woolly apple aphid, *Eriosoma lanigerum*, which is a universal pest on the apple and elm. *Aphis pomi* is difficult to control and is also widely distributed; *Macrosiphum rosae* is a common pest on the dooryard rose bush; *Aphis brassica* is the common cabbage aphid; while *Rhopalosiphum persicae* is a troublesome pest to the greenhouse curator. Most of these are readily killed by contact insecticides. The importance of aphid destructiveness on grain crops was forcibly seen in Alberta the summer of 1949 when over a million dollars worth of barley was destroyed by their feeding.

In fact, Aphids constitute one of the most injurious insect groups. "Their attacks on plants cause serious damage in three ways: (1) by robbing the plant of sap, (2) by the toxic action of their salivary secretions, injected during feeding, thus causing stunting of growth, deformation of leaves and even of fruit, or causing galls on leaves, stems or roots, (3) by acting as vectors of viruses which cause many diseases of plants. Since aphids are usually specific as to plants attacked and as to plant viruses carried in the capacity of vectors their taxonomy is highly important" (Palmer 1952, p. 5).

KEY TO SUBFAMILIES OF THE FAMILY APHIDAE

1. Antennae, cauda or cornicles or all three well developed, sensoria circular or oval; wing veins not reduced (Fig. 10). Found exposed on plants (p. 40)..... **Aphinae**
- . Antennae short; cauda small (Fig. 183); cornicle reduced (Fig. 161) or small pore or wanting; sensoria transverse or annular (Fig. 133), sometimes circular; wing veins reduced, media once-branched (Fig. 110) or simple (Fig. 116). Found under flocculent secretions, in folded leaves, galls or roots. (Mindarus excepted)..... 2
2. Radial sector of fore-wing arising at proximal end of stigma (Fig. 110); cauda slightly produced; but not knobbed. Found in exposed situations (p. 164)..... **Mindarinae**

- Radial sector arising near distal end of stigma (Fig. 116); cauda semilunar or knobbed (Fig. 182); wax glands numerous. Found in concealed situations, i.e., flocculence, folded leaves, galls or roots. . . . 3
- 3. Cauda semilunar (Fig. 183); anal plate entire (Fig. 180); ovipara lay solitary egg; non-functioning mouth parts in sexuals (p. 147).
 **Eriosomatinae**
- Cauda knobbed (Fig. 182); anal plate bilobed (Fig. 182); ovipara lay several to many eggs; functional mouth parts in sexuals (p. 161).
 **Hormaphinae**

Family **APHIDAE**

Subfamily **APHINAE** Gillette and Palmer

Gillette and Palmer, 1931:830; Palmer, 1952:8

The members of this subfamily are characterized by having cornicles cylindrical or clavate, or as raised rims, usually on mammiform base, rarely absent. Cauda usually well developed, but various, sometimes short and rounded, or elongate, spatulate or cornical, sometimes knobbed. Wing venation generally normal throughout the group. Antennae long and slender, usually with circular or subcircular sensoria; unguis filamentous in most forms, but short in primitive forms. Compound eyes developed in apterae. Living exposed on plants, sometimes in curled leaves or on roots underground.

KEY TO TRIBES OF SUBFAMILY APHINAE

1. Radial sector of fore-wing straight (Fig. 113) or curved; cornicle mere rim, on broad, shallow cone (Fig. 162); mammiform; sometimes sessile rim on body. 2
- Radial sector curved, never straight (Fig. 112); cornicle elongate (Fig. 156), or truncate, sometimes pore-like or absent. 4
2. Cauda knobbed (Fig. 168). 3
- Cauda not knobbed (Fig. 172). 5
3. Anal plate entire (p. 146). **Thelaxini**
- Anal plate divided (not taken in region) (Subtribe Salusaphina) (p. 110). **Panaphini**
4. Cornicle truncate (Fig. 157), sometimes elongate, rarely ring, pore or absent; cauda knobbed (Fig. 173), anal plate bilobed or indented (Fig. 184); cauda always knobbed when cornicles elongate; cauda semilunar, anal plate entire if large hairy species (p.110). **Panaphini** (Callipterini)

- Cornicle elongate (Fig. 153), never truncate, rarely absent; cauda elongate, not knobbed, sometimes semilunar; anal plate entire; never hairy species (p. 41).....**Aphini**
- 5. Unguis stubby, much shorter than base antennal segment VI; radial sector straight (excepting *Anoecina*, *Tramina*, and *Lachnus*); antenna and cornicle hairy (excepting *Essigella*) (p. 98).....**Lachnini**
- Unguis much longer than base of VI (Fig. 134), radial sector curved; antenna and cornicle not noticeably hairy (p. 143). (Subtribe) **Phyllaphina**

Subfamily APHINAE

Tribe *APHINI* Gillette and Palmer

Aphidini Thomas, 1877:3; Baker, 1920:39

Aphini Gillette and Palmer, 1932b:369; Palmer, 1952:112.

The members of this tribe include most of the common species and as well, injurious forms of the known Aphidae. Because of their variety and abundance, a large number of genera exist, being separated chiefly on the basis of variations in cornicles, cauda, anal plate, frontal tubercles, body hairs, antennae and sensoria. Wax secretion is rare; cornicles usually elongate, rarely pore-like or truncate; antennae usually longer than half body length and with filamentous unguis; frontal tubercles prominent in one subtribe, *Macrosiphina*; 4-segmented rostrum, with fifth segment fused with IV; eyes with ocular tubercle; distinct and curved radial sector in forewings. Alternation between hosts is common with apterous and alate generations; oviparous females often apterous, males usually alate. Most often found free as colonies on leaves of trees and herbs or on twigs and roots, very frequently attended by ants.

KEY TO THE SUBTRIBES OF THE TRIBE APHINI

- 1. Head without prominent antennal tubercles (Fig. 132), rarely exceeding vertex; cornicles 4 times hind tarsus or shorter, not reticulated (Fig. 154); cauda usually shorter than twice hind tarsus (p. 42). **Aphina**
- Head with prominent antennal tubercles (Fig. 129), exceeding vertex; cornicles longer than 4 times hind tarsus, often reticulated (Fig. 153); cauda usually longer than hind tarsus (p. 67).....**Macrosiphina**

Tribe *APHINI*Subtribe *Aphina* Gillette and Palmer

Aphidina Baker, 1920a:40.

Aphina Gillette and Palmer, 1932b:369; Palmer, 1952:113).

In addition to tribal characters, the insects of this subtribe have frontal tubercles only slightly developed and rarely exceeding vertex (ocellus not included as part of vertex). The cauda varies, but is usually shorter than twice hind tarsal length. The cornicles are never reticulated, and usually never longer than 4 times hind tarsal length. Hairs are simple, pointed and short.

KEY TO THE GENERA OF THE SUBTRIBE APHINA

1. Antennae 6-segmented; cornicles cylindrical to tapering, or slightly swollen near distal end and with or without flange.....2
- Antennae 5-segmented; cornicles cylindrical to tapering (p. 60)..... *Cerosiphia*
2. Forewing with media twice-forked (Fig. 120).....3
- Forewing with media once-forked (p. 66)..... *Toxoptera*
3. Cauda usually not as long as cornicles; cornicles cylindrical, incrassate or clavate.....4
- Cauda long and broad, considerably longer than cornicles, longer than width at base; cornicles very short, about equal to width of base of cauda, swollen beyond middle in *alatae* and without flange (p. 61)..... *Hyalopterus*
4. Cornicle cylindrical to tapering (Fig. 154), not reticulated at distal end; cauda tapering to cylindrical (p. 42)..... *Aphis*
- Cornicle swollen, clavate, longer than entire length of cauda; cauda parallel-sided or tapering (p. 62)..... *Rhopalosiphum*

Subtribe *Aphina*Genus *APHIS* Linnaeus

Linnaeus, 1758:451; Buckton, 1879:31; Baker, 1920a:43; Palmer, 1952:116

The species of this genus are characterized as follows: head with frontal tubercles never exceeding slightly convex vertex. Antennae 6-segmented, unguis filamentous, with secondary sensoria subcircular, often with narrow rims. Forewings normal with twicebranched media; hind wings with

both media and cubitus present. Cornicles quite variable in length, but usually cylindrical and tapering. Cauda generally shorter than cornicles, tapering to cylindrical, often constricted near middle with denticulate surfaces. Anal plate is rounded. Hairs may be pointed or blunt; usually not longer than diameter of segment from which they arise; those on cauda, curved, and about as long as cauda. Lateral tubercles present, always on abdominal I and VII. Males usually alate; oviparous females apterous. Usual hosts, deciduous trees and herbaceous plants, living on leaves, twigs and roots. Baker (1920a:43) discusses the problems relative to the type for this genus, suggesting, *Aphis sambuci* Linn., set by Latreille, 1802.

KEY TO THE SPECIES OF THE GENUS APHIS

(Modified after Palmer, 1952:116; Hottes and Frison, 1931:176)

1. Cornicles smooth, not imbricated.....1. **cardui**
- Cornicles imbricated (Fig. 154).....2
2. Hind tibia of viviparae not bearing sensoria.....3
- Hind tibia of all viviparae bearing sensoria (Not taken in region)
3. Rostrum broadly obtuse (Fig. 10) IV and V shorter than twice width at base.....2. **cerasifoliae**
- Rostrum slender, IV and V longer than twice width at base.....4
4. Cauda not longer than broad.....5
- Cauda longer than broad.....7
5. Cauda bearing at least 6 hairs on each side.....12. **sambucifoliae**
- Cauda bearing fewer than 6 hairs on each side.....6
6. Cornicle shorter than 1.5 times base of VI.....3. **crataegifoliae**
- Cornicle at least 1.5 times as long as base of VI.....1. **cardui**
7. Cauda tapering, ending in a point (Fig. 174).....8
- Cauda not tapering, tip rounded (Fig. 166).....10
8. Unguis shorter than 3 times base of VI (Fig. 136), abdomen green or pink.....11. **saliceti**
- Unguis at least 3 times base of VI; abdomen brown-black to black or reddish-brown.....9
9. Antennae, with conspicuous setae, as long as, or longer than width of antennae; secondary sensoria on antennal III in irregular double row; on *Populus* spp.....7. **maculatae**
- Antennae with inconspicuous, translucent setae, not equal to width of antennae; secondary sensoria on antennal III in more or less straight and regular row; not on *Populus* spp.....5. **folsomii**
10. Cauda about as long as 2 times base of VI in apterae (Not taken in region).....**lutescens**
- Cauda never longer than 1.5 times base of VI.....11

11. Cauda not bushy, bearing 2-4 pairs of lateral hairs.....12
 -. Cauda bushy, bearing 5 or more pairs of lateral hairs.....14
12. IV longer than V.....6. *helianthi*
 -. IV not noticeably longer than V.....13
13. IV of alatae typically with sensoria (Species not taken in region)....
 -. IV of alatae typically without sensoria.....8. *neogillettei*
14. Unguis equal to III.....15
 -. Unguis usually distinctly shorter than III.....18
15. Cauda but slightly longer than wide (Fig. 170) rather wart-shaped distal to neck; several sensoria of IV of alatae...12. *sambucifoliae*
 -. Cauda distinctly longer than wide (Fig. 166), cylindrical to spoon-shaped distal to neck.....16
16. Sensoria not more than 10 on III of alatae.....10. *pomi*
 -. Sensoria more than 10 on III of alatae.....17
17. Sensoria typically absent on V in alatae.....4. *fabae*
 -. Sensoria typically present on V in alatae.....9. *oenotherae*
18. Unguis not longer than 1.5 times base of VI.....13. *spiraephila*
 -. Unguis 2-3 times base of VI.....19
19. Cauda about half as long as base of VI, hardly longer than broad.....14. *viburniphila*
 -. Cauda 2/3 to as long as base of VI, nearly twice as long as broad.....6. *helianthi*

Subtribe **Aphina**

1. *Aphis cardui* Linnaeus

The Plum and Thistle Aphid

Figs. 92, 104

Aphis cardui Linn., 1758:452; Kaltenbach, 1943:115; Baker, 17; Smith (R. H.), 1924 (circ.); Gillette and Palmer, 1932b: 387; MacGillivray, 1952:74; Palmer, 1952:127.

Brachycaudus cardui, van der Goot, 1915:254.

Anuraphis cardui, Theobald, 1927:233 (Synonymy).

A fairly common and variable species both as to host and as to color characteristics; varying from light green to almost shiny black, older forms usually of darker color, with large dorsal patch and bands on dorsum. Found generally clustered in compact colonies on the stem of host plant at the inflorescence and attended by several species of ants. On artichoke, however, alatae are green with black thorax and together with apterae scattered from growing tip along leaves to ground. Palmer (1952:127) and Patch (1914b:253) reports its presence on plum *Prunus* sp.) as winter host and thistle (*Cirsium*

lanceolatum) as summer host. In Nova Scotia, however, it was found more frequently on ragwort than on thistle. Theobald (1927:233) and Palmer (1952:127) describe and figure this species.

Important distinguishing characters: short cauda, long cornicles (.22-.32, twice as long as hind tarsal II); long rostral IV and V (.18-.20) and black body of alatae resulting from bands and dorsal patch.

Collections: Taken on three hosts as follows:

On *Helianthus tuberosus* Linn. (artichoke) in garden. ANTI-GONISH COUNTY, Antigonish, July 24, 1950 (453).

On *Senecio Jacobaea* Linn. (ragwort). ANTIGONISH COUNTY: Crystal Cliffs, August 16, 1950 (470); Route 7, July 30, 1952 (663); Cloverdale, July 28, 1953 (874); Antigonish, August 7, 1953 (878). PICTOU COUNTY, Sunnybrae (Stellarton), July 28, 1951 (470). GUYSBOROUGH COUNTY, Stormont, July 17, 1953 (847). INVERNESS COUNTY, Glendale, August 15, 1953 (911).

On *Cirsium* sp. (Tourn.) Linn. (thistle). LUNENBURG COUNTY, Tancook Island, August 9, 1952 (681). INVERNESS COUNTY, Maple Ridge, August 13, 1953 (893).

Subtribe *Aphina*

2. *Aphis cerasifoliae* Fitch

The Chokeberry Aphid

Figs. 43, 44, 69, 70

Aphis cerasifoliae Fitch, 1855:131; Thomas, 1879:93; Patch, 1914a: 260; Swain, 1919:97; Gillette and Palmer, 1932b:389; MacGillivray, 1952:74; Palmer, 1952:128.

This aphid has been taken on three different species of host plants and in all cases the type of infestation and host damage produced is very similar. Its occurrence is general and hosts attacked are usually heavily infested, causing a characteristic pseudogall formation by the curling and folding of the young terminal leaves (Plates VII, XIV). The colonies are usually large and very compact, typically inhabiting the underside of terminal leaves along leaf veins or on adjacent stem and inflorescence. A copious amount of honey-dew is present and ants are usually present in large numbers. The damage is severe and results in malformed terminal growth of the host plant. The Syrphid fly seems to particularly

favor ovipositing in the colonies of this aphid as they have been observed doing so on several occasions (Fig. 70).

The stem mothers (fundatrix) are pale yellowish green, but lack pulverulence, with body length slightly longer than apterous summer forms.

Apterous summer viviparae are pale green to somewhat bluish green, with head lighter color; thorax green with dark green mid-dorsal line, abdomen pale to bluish-green with dark green median line and darker green transverse lines between segments, separating the transverse bands of white flocculence. Cornicles pale with dusky tips, slender and slightly tapering cauda lighter with dark tip and tapering from broad base.

Alatae are pale to apple green with head, antennae, thorax, abdominal tubercles, cornicles, tip of cauda, femora and tarsi blackish. Body length 2-2.5 same as apterous forms, but smaller than fundatrix. Lateral tubercles on prothorax and all segments of abdomen. Forewing with second fork of media short.

Swain (1919:97), Patch (1914a:260) give descriptions with measurements of apterae and alatae Palmer (1952:128) also includes in addition descriptions and figures of sexuales.

Collections: On underside of curling terminal leaves of *Amelanchier Wiegandii* Neils (wild pear). ANTIGONISH COUNTY, Route 7, July 24, 1951 (521a).

On *Prunus pennsylvanica* Linn. (pin cherry). ANTIGONISH COUNTY, Route 7, July 10, 1953 (832a).

On *Prunus virginiana* Linn. (choke cherry). ANTIGONISH COUNTY, Cape George, June 23, 1953 (812).

Subtribe **Aphina**

3. *Aphis crataegifoliae* Fitch

The Long-beaked Clover or Hawthorn Aphid

Figs. 37, 48

Aphis crataegifoliae Fitch, 1851:66; Baker, 1919c:185 (Synonymy); Hottes and Frison, 1931a:190; Palmer, 1952:132.

Aphis brevis Patch, 1915c:431.

This species favors the terminal shoots and underside of young leaves of wild pear (Fig. 37), occurring in dense and rather extensive colonies. Apterous forms on this host are slightly lighter green with more pulverulence than those which

occur on english hawthorn (Fig. 48). The colonies are attended by numerous ants and are often preyed upon by large syrphid larvae (Fig. 37).

The apterae are generally from light to vivid leaf green with dark cornicles. Transverse bands of whitish pulverulence occurs across the thorax and abdomen. Alatae have black head and thorax with yellowish to pinkish-green abdomen; black lateral areas occur on abdominal VI, VII, and VIII. Other extremities dusky brown to blackish; cauda pale, broad and tapering. Cornicles cylindrical with denticulate imbrications.

Descriptions with figures of alate and male sexual forms are given by Palmer (1952:132). Hottes and Frison (1931a-190) report that "it over-winters on apple and hawthorn, from the leaves of which it migrates in summer to the stems and crowns of red clover and certain other plants". It has not been taken on the summer host in Nova Scotia as yet. The species, however, is of quite common occurrence on its winter host.

Collections: On terminal stems and underside of terminal leaves of winter host, *Amelanchier Wiegandii* Neils (wild pear). ANTIGONISH COUNTY, Route 7, June 29, 1950 (422a).

On terminal shoots and underside of leaves of winter host, *Crataegus monogyna* Jacq. (english hawthorn). ANTIGONISH COUNTY, Antigonish, June 10, 1952 (610); June 17, 1953 (809).

Subtribe *Aphina*

4. *Aphis fabae* Scopoli

The Bean Aphid

Figs. 83, 84, 103, 128

Aphis fabae Scopoli, 1763:136 and 139; Jones (M.G.), 1942:67; Jacob, 1945:102 and 1947:431; Palmer, 1952:135.

Aphis rumicis Linn., Davidson (J.), 1921:81 (misidentification); Horsfall, 1925:1; Franssen, 1927:16; Theobald, 1927:98 (Synonymy); Gillette and Palmer, 1932b:439; Hille Ris Lambers, 1934:27.

This species is commonly confused with *A. rumicis* Linn. The latter is distinguished from *A. fabae* Scopoli, by the slightly swollen hind tibia of ovipara; short thick cauda; absence of sensoria on IV of alate vivipara apterous male; and cornicle without a flange.

Forms of *A. fabae* Scopoli have been found most often on the common burdock and less frequently on curled dock in Nova Scotia. This species is highly polyphagous, especially as regards its summer host, appearing to have no secondary host specificity whatsoever. It is, furthermore, subject to much color variation according to the different plants infested, which in turn appears to affect its mealy covering as well as size. Structural characteristics which in some species are relatively constant, vary greatly in *A. fabae*, i.e., on antennal III, sensoria vary from 10 to 22 on different individuals and even vary on the same individual between the two antennae and cornicles vary considerably in their relative length to the cauda.

According to Theobald (1927:103) the species winters in the egg stage on *Chenopodium*, but Palmer (1952:136) lists *Euonymus* sp. (strawberry bush), *Viburnum opulus* (high bush cranberry), and *V. opulus* var. *sterili* (snowball) as the winter hosts. Theobald lists some 46, and Palmer 26, different summer hosts, many of which are common garden vegetables. Eggs are laid in the rather hit or miss fashion, some on young wood, but most at base of buds, yellow at first, then changing to black. The spring fundatrix produces apterous viviparae, which later produce alate summer migrants by late June or mid-July, which fly to some herbaceous host. Their eventual success depending upon which herbaceous host they happened to light upon. Beans, poppies and burdock serve as hosts on which they seem to thrive, causing severe leaf curl and general debilitation of host. By fall, alatae appear on these herbaceous plants and return to winter hosts and produce oviparous females, joined later by alate males.

Apterous forms on curled dock are velvety black, feeding head down on stems in closely compact colonies mostly on terminal shoots, but also extending part way down the stem. On *Arctium* sp. apterous forms are stem feeders, dark olive-green to black in color, those on *Arctium minus* (hill) Benth. being fairly heavily marked by four dorsal rows of pulverulent white spots on abdomen and two rows on thorax. (Fig. 84). Alate forms seemed to favor feeding on underside of adjacent leaves.

Very complete character description of all forms with figures are given by Palmer (1952:135) and Theobald (1927:98)

who also discuss synonymy. MacGillivray and Spicer (1953: 428) list under *Aphis rumicis* Linn., parasites found in this species; one cynipid, three braconids, and one species of pteromalid.

Collections: On terminal stems, underside of leaves and under inflorescence of *Arctium minus* (Hill) Benth. (common burdock). HALIFAX COUNTY, Halifax, July 20, 1949 (333). ANTIGONISH COUNTY, Antigonish, July 21, 1950 (451); JIMTOWN, July 22, 1950 (452); Antigonish, July 19, 1952 (650) and August 10, 1953 (880). LUNENBURG COUNTY, Tancook Island, August 9, 1952 (680).

On terminal growth in axils of flower clusters of *Rumex crispus* Linn. (curled dock). COLCHESTER COUNTY, Rossville, July 6, 1952 (637).

Subtribe *Aphina*

5. *Aphis folsomii* Davis

The Ivy Aphid

Figs. 120, 154, 174

Aphis folsomii Davis, 1908:143.

Alate and apterous forms were found generally distributed over vine but only where meristem centers were active on young shoots of host. Both forms are reddish brown in color. Alatae with antennal III .24 with from 4-8 secondary sensoria in straight row; IV .20 and V .22 with no sensoria; unguis .36 base .08; setae inconspicuous and translucent. Cornicles .20, cylindrical with flange and imbricated throughout entire length. Forewings normal, slightly smoky (fuscus); hindwings with media and cubitus. Anal plate rounded. Cauda .14 cylindrical to tapering, slightly constricted near base, rather bluntly pointed and with 6 hairs. Hind tibia .8; hind tarus .09. Width of head through eyes .44; antennae 1.26; body length 1.5. Rostrum to beyond third coxa; IV and V .14, rather long and narrow. Described from alate specimens collected.

Davis (1908:145) describes and figures the sexuales and viviparous forms of this species according to Britton (1923:293) who reports his taking it from *Ampelopsis quinquefolia*. Hottes and Frison (1931:194) have taken it on *Parthenocissus tricuspidata* in Illinois.

Collections: On growing meristems of *Parthenocissus quinquefolia* (Linn.) Planch. (virginia creeper, boston ivy). KINGS COUNTY, Wolfville, July 30, 1948 (13p). Not common.

Subtribe *Aphina*6. *Aphis helianthi* Monell

The Dogwood or Sunflower Aphid

Fig. 91

Aphis helianthi Monell, 1879:26; Gillette, 1927:346; Hottes and Frison, 1931a:196; Gillette and Palmer, 1932b:402; Palmer, 1952:141; MacGillivray, 1952:74.

Aphis oxybaphi Oestlund, 1887:62.

Aphis gillettei Cowen (in Gillette and Baker), 1895:120.

Aphis cornifoliae Fitch (misidentification), Gillette, 1910:407.

This species has been taken only once on the winter host, red osier dogwood. According to Hottes and Frison (1931a:126) and Palmer (1952:142) the over-wintering stage occurs in the egg on dogwood. Fundatrix with young in the spring often cause very serious damage to host by curling, twisting and otherwise malforming the new leaf growth. Summer alate usually migrate to sunflower, but Palmer (1952:142) lists eight other alternate herbaceous secondary hosts. The summer forms apparently do not produce leaf curl on summer hosts or later after migrating back to winter host, *Cornus* sp., in the fall.

Apterae and alatae were found at the base of terminal flowers and fruits of dogwood and attended by numerous rather large black ants. Apterous viviparae are yellowish green mottled on dorsum of abdomen with green; cornicles, cauda, anal plate and venter dusky to black. Alatae with head and thorax black; abdomen pale yellowish green and somewhat pulverulent; extremities similar to apterae. Adequate descriptions with figures are found in Palmer (1952:141).

In New Brunswick, this aphid was found by MacGillivray and Spicer (1953:428) to be parasitized by three species of braconids; *Aphidius* (*Lysaphidus*) *adelocarinus* Smith, *Aphidius* (*Lysiphlebus*) *testaceipes* (Cresson), and *Diaeretus* sp. *salicaphis* (Fitch).

Collections: On *Cornus stolonifera* Michx. (red osier dogwood) around base of terminal flowers and fruits; difficult to detect except for presence of numerous ants. ANTIGONISH COUNTY, Fairmont Road, July 5, 1950 (434).

Subtribe **Aphina**7. *Aphis maculatae* Oestlund

The Spotted Poplar Aphid

Figs. 39, 62

Aphis maculatae Oestlund, 1887:61; Gillette and Palmer, 1932b:412; Palmer, 1952:150.

Aphis populifoliae Fitch (misidentification); Davis, 1910d:489; Patch, 1913a:82.

Aphis davisii Patch, 1917:418.

Chaitophoroides populifoliae (Fitch), Knowlton, 1929c:36.

This aphid is usually found feeding on the upper leaf surface of poplar causing a very slight upward curl of the leaf. The alate viviparous females have black head and thorax; abdomen blackish brown with snow-white pulverulent spots on dorsum arranged in transverse rows of one row for each segment; cornicles black, long and cylindrical, slightly swollen near base; antennae with from 20 to 30 sensoria in irregular double rows on III; eyes and beak black; prominent lateral tubercles on thorax. General appearance of apterae similar to alatae, but young are light-rusty brown, mostly covered with powder except for naked middorsum of abdominal II and III.

Patch (1913a:82, fig. 55) describes and pictures this species under the name of *Aphis populifoliae* Fitch which is a misidentification. Further descriptions and figures are given by Palmer (1952:150).

Collections: On upper leaf surface of *Populus tremuloides* Michx., (trembling aspen). ANTIGONISH COUNTY: Crystal Cliffs, July 25, 1950 (458a); Fairmont Road, July 27, 1953 (867).

On upper and lower leaf surfaces and petioles of terminal branches of *Betula lutea* Michx., (yellow birch). CUMBERLAND COUNTY, Collingwood, July 7, 1952 (643). Not common.

Subtribe **Aphina**8. *Aphis neogillettei* Palmer

Figs. 93, 94

Aphis cornifoliae Fitch ("other collections"); Gillette and Palmer, 1932b:394, line 20.

Aphis neogillettei Palmer, 1938:352 and 1952:155.

Apterous summer forms occur in medium size, compact colonies, on the underside of leaves of dogwood, and cause rather severe leaf curl and wilt. The aphids favor the leaf midrib and tend to radiate out along the side veins. Most colonies found were attended by a great many large black ants; so many that at times the aphids were completely covered by them. Parasitized forms were common in most colonies observed.

The general body color, a dark olive-green; rather pale yellow appendages, with antennal VI, tips of cornicles, cauda, tibia and tarsi black. Color pattern of alatae similar, except head and thorax black. Cornicle cylindrical and more or less tapering and flanged; cauda about as wide as long, tapering bluntly.

All forms are described and figured by Palmer (1952:156) who also gives approximate dates for occurrence of these forms, and compares *A. cornifoliae* and *A. helianthi* with this species, pointing out significant character differences since the three species are easily confused.

A. cornifoliae differs from *A. neogillettei* by having greater number of sensoria on antennal III of alatae (more than eight) body color of viviparae not brown.

A. helianthi differs by having hairs on hind tibia and antennal III longer and more erect; shorter measurements of all parts antennal III and IV coalesced in sexuals.

Collections: On *Cornus stolonifera* Michx. (red osier dogwood) on underside of curled leaves. ANTIGONISH COUNTY, Route 7, July 24, 1951 (522); on August 23, 1951 (522) colonies gone from this host; August 23, 1951 (522.1) still present on nearby host in same area; July 10, 1953 (833); Antigonish, August 26, 1953 (925).

Subtribe **Aphina**

9. *Aphis oenotherae* Oestlund

The Evening Primrose Aphid

Aphis oenotherae Oestlund, 1887:62; Gillette, 1927:344 and 346; Palmer, 1952:158.

Aphis oenotherae var. *rufa*, Gillette and Palmer, 1932b:424.

Apterous and alate forms of this species were found feeding in the region of the floral peduncle of fireweed. The infestation was general on this host in the area, though not found since in the other counties worked.

Alatae have head and thorax black with light to olive-green or slate colored abdomen covered with pulverulent reticulations. Apterous forms similar in color to alatae but with head and thorax similar to abdomen. Tarsi and tip of tibiae black; cornicle, cauda, anal plate, bearing 6 pairs of hairs. Sensoria (11-22 on antennal III) circular and scattered IV, 3-16, same; V, 1-10, same. Rostrum long, reaching third coxae.

Descriptions and figures of apterous, alate and male alate are found in Palmer, 1952:158, who also points out that more study of this species is needed since it may prove to be a synonym of *A. epilobii* Kaltenbach (1843:64).

Collections: On *Epilobium augustifolium* Linn. (fireweed) in region of floral peduncle. Common only in area found, not elsewhere. KINGS COUNTY, Ridge Road, Wolfville, August 9, 1948 (67p).

Subtribe **Aphina**

10. *Aphis pomi* DeGeer

The Green Apple Aphid

Figs. 11, 67, 68, 118, 178

Aphis pomi DeGeer, 1773:53; Gillette, 1908d:303; Gillette and Taylor, 1908:23; Baker and Turner, 1916c:955; Matheson, 1919:686; Patch, 1923a:45 and 1929:698; Theobald, 1927:133; Hottes and Frison, 1931:210; Gillette and Palmer, 1932b:433; Palmer, 1952:164; MacGillivray, 1952:75.

Aphis mali Fabricius, 1794:216; Smith (J.B.), 1900:3.

Aphis pomi is very generally distributed throughout Nova Scotia, occurring most often on apple trees, found on abandoned farm land where once there was a thriving apple orchard. Occasionally these remnant orchard trees will be found surrounded by new growth of mixed deciduous and spruce or fir trees. Since they are unattended, they are most always infested with large compact colonies of these greenish aphids on the underside of terminal leaves and stems causing severe leaf curl and general malformation of the growing terminal branches (Figs. 67, 68).

One of the best accounts of the biology of this species is that of Baker and Turner (1916c:955), a summarized version of their account of the life cycle is as follows (Fig. 11):

In the fall a yellow egg is laid on the tender twigs or bark of older twigs of the apple. Later the egg changes to shining black and a rapid development follows. Following this it goes into the winter resting stage. In the spring, about April, the embryo revolutes and hatches out catalysed by the warmer temperature. The stem mother is wingless and matures in about ten days. This gives birth to winged and wingless summer forms, the winged forms predominating. A large number of generations (nine to seventeen) of summer forms follows. The number of winged forms increases during the summer and they fly to many different hosts or they may remain on the apple. Toward the end of the summer the number of winged forms decreases. Intermediates and wingless lines are also known in some colonies. The wingless sexes appear about September and occur in all generations. Mating begins toward the end of September, one male usually serving more than one female. During this time both sexes continue to feed. The alate oviparous female now migrates back to the apple if she has been abroad, or to some other plant of the numerous host list, or she may remain on the host and oviposit. If the eggs have not been fertilized they do not turn black but the fertilized eggs develop to the resting stage before the first frosts and the cycle begins again the following spring.

It should be noted that *Aphis pomi* may spend its whole life cycle on *Malus pumila* L., in which case the primary and secondary hosts are identical. On the other hand, however, as pointed out by Patch (1923:58) the summer alatae may migrate and live upon a great many secondary hosts, represented in as many as 24 botanic families. Furthermore, "this species seems to have a tendency to touch many of its hosts for the duration of but one or two generations" and then migrate to another summer host. Because of the polyphagous and migratory tendencies of this aphid, the possibility of its serving as a vector of plant bacterial and virus diseases becomes very great.

The newly hatched stem mother is dark green becoming light apple green when adult, with extremities blackish. Alatae have black head and thorax, with apple green or yellowish abdomen, sometimes with slight lateral darker green spots, with extremities blackish. Apterous forms of similar color

pattern to fundatrix, but with cauda elongate-cylindrical with slight constriction near base. More complete descriptions with figures of all forms including sexuales are given by Palmer, (1952:164). MacGillivray and Spicer (1953:428) report one pteromalid, *Pachyneuron siphonophorae* (Ashmead) and one braconid, *Trioxys (Trioxys)* sp. as parasitizing this aphid in New Brunswick.

Collections: On terminal leaves and stems of *Malus pumila* Linn. (apple). Common on unattended trees throughout province. **KINGS COUNTY,** Lake George Road, July 26, 1948 (100p). **ANTIGONISH COUNTY:** Route 7, June 29, 1950 (419); September 6, 1950 (419.1); July 3, 1951 (419). North Shore Road, July 11, 1950 (439); Lochaber, July 25, 1951 (419); West River Road, July 30, 1952 (652); Cape George Road, June 23, 1953 (815); Jintown, August 21, 1953 (920). **LUNENBURG COUNTY:** Mader's Cove, August 6, 1952 (666); Tancook Island, August 9, 1952 (682). **COLCHESTER COUNTY,** West of Rossville, July 6, 1952 (639).

On *Betula papyrifera* Marsh (paper birch) on underside of terminal leaves and stems. Heavy infestation causing leaf curl. This is the only instance of this species occurring on this host. It could be another of the many possible summer secondary hosts, though never recorded in the literature reviewed on this species. **LUNENBURG COUNTY,** Mahone Bay, August 6, 1952 (670).

Subtribe **Aphina**

11. *Aphis saliceti* Kaltenbach

The Green and Pink Willow Aphid

Figs. 75, 76, 136

Aphis saliceti Kaltenbach, 1843:103; Koch, 1854:118; Buckton, 1879:52; Gillette and Bragg, 1918a:89; Haviland (1920:311) Theobald, 1927:171; Hottes and Frison (1931a:217); Gillette and Palmer, 1932b:440; Palmer, 1952:172.

Aphis salicicola Thomas, 1878:8 and 1879:212; Monell, 1879:24; Cowen (in Gillette and Baker), 1895:121 (misspelled "salicola"); Gillette, 1910:403.

These aphids infest the young terminal shoots and underside of new leaves of willow, causing the leaves to curl and terminal shoots to wilt or droop. They occur in very dense and compact colonies which are made up of apterous and alatae

individuals varying in color from light to medium green to a bluish green; others are often pinkish to rust-red or orange. They are very largely attended by ants, which are reported by Theobald (1927:175) to carry the aphids from place to place.

Hottes and Frison (1931a:217) and Theobald (1927:175) point out a peculiarity of this aphid in that the sexuales occur during spring or early summer. This is also the case with *A. rociadae* Cockerell. Haviland (1920:311) suggests the possibility that further study on the biology of particular aphids may reveal more frequent occurrence of sexuales in summer than is at present supposed to be and "that the disappearance of some forms, which is at present attributed to the migrations of a biphytophagous species to a second host plant, will prove to be part of the normal cycle of a monophytophagous species after the production of fertile ova". Theobald (1927:171) and others are not inclined to be in agreement with this idea, but hold to the generally accepted notion that in most species the sexuales occur in the fall. According to those who have worked with this species, it is monophagous on the willow.

The principle distinguishing characters of this species are the long yellow, prominent cornicles with dark tips in apterae; the two contrasting body colors, green and reddish-orange, long cauda in apterae, summer sexuales and antennal III of alatae with 5-7 sensoria. For complete descriptions and figures of all forms refer to the works of Theobald (1927:171) Gillette and Bragg (1918:89) and Palmer (1952:172).

Collections: On terminal stems and underside of new leaves of *salix* spp. (Tourne) Linn. (willow). Not very common, but hosts attacked usually heavily infested. **KINGS COUNTY**, Lake George Road, July 8, 1948 (78). **ANTIGONISH COUNTY**: Route 7, July 24, 1951 (517); and July 30, 1953 (662); Fairmont Road, July 27, 1953 (869a). **COLCHESTER COUNTY**, Rossville, July 6, 1952 (638).

Subtribe **Aphina**

12. *Aphis sambucifoliae* Fitch

The Elder Aphid

Figs. 132, 170

Aphis sambucifoliae Fitch, 1851:66; Sanborn, 1904:52; Davis, 1910:490; Essig, 1917:342; Swain, 1919:123; Gillette and Palmer, 1932b:441; MacGillivray, 1952:75.

Aphis sambuci Linn, Theobald, 1927:95.

Apterous and alate forms of this species were found clustering in very compact colonies on tender shoots and flower heads near the terminal ends of common elder and red-berried elder in Kings County. It has not been taken elsewhere. Where it occurs, the host is heavily infested, but generally it is an uncommon species. The incrustations of this aphid are always swarming with ants, in consequence of the great amount of honey-dew secreted, so much in fact that the growth of the plant is usually checked. Theobald (1927:98) lists two species of ants found on these aphids in Great Britain, i.e., *Myrmica rubra* and *Lasius fuliginosus*.

Swain (1919:123) reports the presence of this aphid in California; Sanborn (1904:52) describes the alate form found in Kansas; Hottes and Frison (1931:218) record its presence in the Chicago area, and comment that it was never taken on elder growing in the open, but rather in shaded situations. Theobald (1927:95) describes apterous and alate forms under the name *A. sambuci* L. evidently considering it synonymous with *A. sambucifoliae* Fitch, but Sanborn (1904:53) had already pointed out the difference between these two species, which are described and figured as distinct in Palmer (1952:173, 174).

Alate forms have head and thorax black; abdomen blackish green with two rows of powdery transverse bands on dorsum. Antennae, cornicles and cauda are black. Cauda broad and blunt, with slight basal constriction. Rostrum slender reaching third coxae. Apteræ of similar color pattern as alatae, but with greater amount of powdery patches on lateroventral margins of abdomen. Cornicles black, long and narrow with wider basal portions and imbricated. For complete descriptions and figures see Sanborn (1904:52); Theobald (1927:95) and Palmer (1952:174).

Collections: On terminal shoots and flower heads of *Sambucus canadensis* Linn. (common elder). KINGS COUNTY, Wolfville, July 5, 1948 (52).

On *S. pubens* Michx. (red-berried elder). KINGS COUNTY, Wolfville, July 29, 1948 (102p); White Rock, August 9, 1948 (13p).

Subtribe **Aphina**13. *Aphis spiraephila* Patch

The Gray Spirea Aphid

Figs. 109, 166

Aphis spiraephila Patch, 1914a:270; Gillette and Palmer, 1932b:448; Palmer, 1952:179.

The host plant of this aphid, meadow-sweet or hardhack, is very common generally throughout the province occurring in wet land, ditches, swamps, meadows, low pastures and bordering certain forest situations. The aphids affix themselves, head down, in very closely packed, dense colonies around the terminal stem, petiole, leaves, and flower buds of the host (Fig. 109), causing the terminal new leaves to curl and generally malform the growing stem tip.

Collectively the aphids in a colony give a grayish-blue or gray-black cast, occasionally brownish-black. Patch (1914a:270) records them as black; Palmer (1952:180), as brown. The forms in Nova Scotia agree more closely with Patch's description. A given small shrub may have as many as 12-14 separate colonies on the ends of as many terminal branches. According to Patch (1914a:270) the species is monophagous spending its whole cycle on the same food plant. Collection records show that it is found on this host throughout the growing season from early June until fall, thus to substantiate Patch's observations for this species in Maine.

Alatae have head and thorax black with grayish-blue-black abdomen, slightly marked by transverse pulverulent bars on dorsum. Cornicles cylindrical, tapering, imbricated and without flange. Cauda elongate and spoon-shaped. Apteræ similar except with greater amount of powdery reticulations. Unguis on antennal VI, rather short. For more detailed descriptions and figures see Gillette and Palmer (1932b:448).

Collections: In dense colonies on terminal shoots, petioles, leaves and floral buds of *Spiraea latifolia* Borkh. (meadow-sweet, hardhack). ANTIGONISH COUNTY: Route 7; June 12, 1950 (400); June 29, 1950 (400); September 16, 1950 (400.1); July 3, 1951 (400.2); July 25, 1951 (400.3). Malignant Cove, July 11, 1950 (438). Antigonish: June 2, 1952 (602); June 17, 1953 (810). St. Andrews, July 11, 1953 (876). Big Marsh, July 28, 1953 (876). GUYSBOROUGH COUNTY: Aspen,

July 25, 1951 (524). Melrose, July 16, 1953 (834). Port Felix, July 18, 1953 (860). Sloane Lake, July 27, 1951 (524). COLCHESTER COUNTY: Harmony, July 21, 1948 (85); Rossville, July 6, 1952 (638). LUNENBURG COUNTY, Spondu Lake, August 12, 1952 (695). QUEENS COUNTY, Caledonia, August 14, 1952 (700). INVERNESS COUNTY: Port Hastings, August 12, 1953 (886); Maple Ridge, August 13, 1953 (888).

Subtribe *Aphina*

14. *Aphis viburniphila* Patch

The *Viburnum* Aphid

Fig. 108

Aphis viburniphila Patch, 1917:416; Gillette and Palmer, 1932b:454; Palmer, 1952:185; MacGillivray, 1952:75.

This aphid was taken on two species of *Viburnum*. *V. casinoides* is a common shrub throughout Nova Scotia, often abundant in swamps, wet, barren, open low lands, and in open cut over roadside clearings. *V. alnifolium* is more common in hardwood situations in the central and northern parts of the Province. Despite the rather frequent occurrence of both of these host plants, very few were found infested with this or any other aphid. However, on those found infested, the colonies were quite numerous.

Fundatrix and first generation nymphs were found in early June; alate forms appearing by mid-July in central Nova Scotia and as late as mid-August in Northern Cape Breton. The colonies were found on one host (Fig 108) clustering at the base of the fruit, mostly alatae present. On other hosts they were found on the underside of curled terminal leaves and in the floral inflorescence. Patch (1917:416) states that the species is monophagous, present on *Viburnum* spp. all year.

Alatae with head and thorax brownish-black, thorax and abdomen dark greenish-brown and mottled. Cauda rather blunt to slightly tapering; cornicles cylindrical, flanged and imbricated. Antennal III with scattered, circular sensoria from 20-28. Apteræ similar color to alatae, but with dusky dorsal bands posterior to cornicles; appendages yellowish-white; dusky cauda, anal plate and cornicles. More complete descriptions with figures are found in reference cited above.

Collections: Rather infrequent on either host. Found on terminal leaves, stems and inflorescence of *Viburnum alnifolium* (Marsh). (hobble-bush). GUYSBOROUGH COUNTY, Country Harbour, July 16, 1953 (843).

On *V. cassinoides* Linn. (withe-rod, wild raisin). KINGS COUNTY, Lake George Road, July 26, 1948 (101). ANTIGONISH COUNTY, Antigonish, June 4, 1952 (608). GUYSBOROUGH COUNTY, Salmon River, July 26, 1951 (525). VICTORIA COUNTY, Neils Harbour, August 17, 1951 (533).

Subtribe **Aphina**

Genus CEROSIPHA Del Guercio

Cerosipha Del Guercio, 1900:116; Baker, 1920:46.

Metaphis Matsumura, 1918:1.

The species of this genus differ characteristically from those of the genus *Aphis* by having 5-segmented antennae in all forms with subcircular sensoria. The head is without prominent antennal tubercles; both wings normal venation; cornicles cylindrical to tapering; cauda somewhat tapering, *aphis*-like. Only one species taken in Nova Scotia. Genus type (monotypical), *Cerosipha passeriniana* Del G.

Subtribe **Aphina**

Cerosipha rubifolii (Thomas)

Sipha rubifolii Thomas, 1879:121.

Cerosipha rubifolii, Winter, 1929:193; Gillette and Palmer, 1932b:470.

Aphis rubifolii (Thomas) n. comb., Palmer, 1952:171.

This light greenish yellow aphid was taken on wild raspberry, where it formed a heavy infestation on stem and underside of leaves of new growth, resulting in rather severe leaf curl. Many ants were in attendance upon these aphids. Alatae not collected on hosts were obtained later in laboratory from last nymphal stages after a few days in storage cans. Hottes and Frison (1931:230) pictures the host showing the rumpled and curled leaves on ends of terminal branches. They also describe the alate and apterous forms. Winter (1929b:193) gives a good account of the species and summarizes the literature relative to it. Palmer (1952:171) lists this species as *Aphis rubifolii* (Thomas) n. comb., but does not

state her reasons for doing so. Most other authors list it in the Genus *Cerosipha*, largely because of the 5-segmented antennae, which character is used by Baker (1920:41) to separate this genus from the rest of the subtribe Aphinae.

The species characters are generally those given for the genus above. Palmer (1952:171) gives the body measurements for apterous, ovipara and male forms of the species.

Collections: On terminal stems and underside of curled leaves of *Rubus* spp. (wild raspberry, blackberry). LUNENBURG COUNTY, Mahone Bay, August 6, 1952 (669); Spondu Lake, August 8, 1952 (673). QUEENS COUNTY, Caledonia, August 14, 1952 (700). ANTIGONISH COUNTY, Route 4, June 27, 1953 (819). INVERNESS COUNTY, Maple Ridge, August 13, 1953 (896).

Subtribe **Aphina**

Genus HYALOPTERUS Koch

Hyalopterus Koch, 1854:16, Baker, 1920a:47; Palmer, 1952:204.
Hayhurstia Del Guercio, 1917:208.

The members of this genus are characterized by a convex vertex with frontal tubercles extending in line with vertex; 6-segmented antennae with circular sensoria; normal wing venation; cauda long, spoon-shaped and longer than cornicles; cornicles cylindrical, clavate and with or without flange; body with rather conspicuous pointed hairs. Only one species taken in Nova Scotia.

Genus type (fixed by Passerini, 1860), *Aphis pruni* Fab. (syn. for *A. arundinis* Fab.).

Subtribe **Aphina**

Hyalopterus atriplicis (Linn.)

Aphis atriplicis Linnaeus, 1761:262; Theobald, 1913a:1.
Aphis chenopodii Cowen (in Gillette and Baker), 1895:119.
Hyalopterus atriplicis, Hayhurst, 1909:88; Theobald, 1927:26;
Gillette and Palmer, 1932b:474; Palmer, 1952:205.

Apterous forms of this species were found inside of curved boat-shaped leaf pseudo-galls or in longitudinally folded leaves of lamb's quarters (pigweed). Theobald (1927:29, fig. 12) pictures the type of host damage caused by this aphid. In

Nova Scotia the infestation in all cases was heavy, generally affecting a high percentage of the leaves on the plants infested. Alatae developed in cans in laboratory a few days after collecting the sample.

Apterous forms have brown head with rest of body a yellowish-green, dorsum marked by four or five green lateral spots; somewhat pulverulent, eyes deep red to nearly black; cauda and cornicles pale yellowish-green with tips dusky, cauda elongate and parallel sided with slight basal constriction and rounded end; cornicles smooth with slightly swollen middle.

Alatae with green abdomen marked by darker green lateral areas and dorsal pulverulent crossbands; head and thorax black; eyes red; extremities brown with tips dusky; cornicle smooth, slightly swollen and flanged; cauda as in apterae with 3 pairs of hairs.

For further measurements and description with figures including sexuales, see Theobald (1927:26) who also includes synonymy and list of references to literature; also Palmer (1952:205); and Hayhurst (1909:88) who gives detailed descriptions of all forms and notes on the biology.

Collections: In folded leaves and curved boat-shaped pseudogalls on *Chenopodium album* Linn. (lamb's quarters, pigweed). ANTIGONISH COUNTY; Jimtown, July 22, 1953 (864); Antigonish, August 12, 1953 (883).

Subtribe **Aphina**

Genus RHOPALOSIPHUM Koch

Koch, 1854:23; Baker, 1920a:49 (Synonymy)

The members of this genus are characterized by having cornicles swollen, clavate and longer than entire length of cauda, which is parrallel sided or tapering. Wing venation is normal. Frontal tubercles about equal to vertex; antennae 6-segmented with circular sensoria narrow rimed. Four species under this genus were taken in Nova Scotia. Genus type (fixed by Gerstaerker, 1856), *Aphis nymphaeae* Linn.

KEY TO THE SPECIES OF THE GENUS RHOPALOSIPHUM

(Modified after Palmer, 1952:211)

1. Cornicle swollen (on median side) to nearly twice as wide in distal half as at base 2

- Cornicle indistinctly swollen to nearly cylindrical. 3
- 2. Rostral IV and V .15, coequal with hind tarsal II; cauda blunt parallel-sided with slight neck (Not taken in region) . . . **nymphaeae**
- Rostral IV and V .10, shorter than hind tarsal II; cauda tapering on distal half, definitely narrower than proximal portion. 3. **pseudobrassicae**
- 3. Unguis 1½-2 times base of VI; rostral IV and V short (.08-.09), broad. 2. **maidis**
- Unguis 4-5 times base of VI; rostral IV and V rather long (.11-.12) and narrow. 1. **fitchii**

Subtribe **Aphina**

1. *Rhopalosiphum fitchii* (Sanderson)

The Apple Grain Aphid

Fig. 38

Aphis mali Fabricius (misidentification), Fitch, 1855:49 (or 760); Weed, 1893:299.

Aphis fitchii Sanderson, 1902:137.

Aphis avenae Fabricius (misidentification), Matheson, 1919:750.

Aphis prunifoliae Fitch (misidentification), Baker, 1917b:410.

Rhopalosiphum prunifoliae, Baker and Turner, 1919b:311; Theobald, 1927:72; Gillette and Palmer, 1932b:486.

Rhopalosiphum fitchii (Sanderson), Palmer, 1952:215.

Very large compact colonies of this aphid were found on the terminal stems and underside of leaves of wild pear (Fig. 38). Apteræ, nymphs and a few summer alatae were collected from each colony. This species occurs on apple, pear and hawthorn as the winter host, the fundatrix hatching in early spring and giving rise to several apterous generations. By the end of June summer alatae migrate to grasses and corn where apterous colonies are developed. By October or earlier in Nova Scotia, alatae appear and migrate back to a winter host where sexuals are produced and the eggs laid. This species does not cause much leaf curl on apple, as a rule, since it lives largely on the blossoms and departs in the second generation in early summer, migrating to grain. On *Amelanchier* sp., however, the leaves were badly curled and because of the extent of the infestation, the leaves were discolored and dying.

Apterous summer viviparæ are apple green with transverse intersegmental darker lines of green between rows of pulverulence. There is a slight orange area at base of cornicles, which

is yellowish with black tips. Alatae are similar in color to apterae with dusky lateral areas and slight median bands on abdominal V-VIII. Cornicles are pale, slightly dusky at tips, cylindrical to vasiform, constricted before flange with faint imbrications. Cauda are elongate, parallel-sided and acute with slight constriction near base. For more complete descriptions with figures see Palmer (1952:215) and Theobald (1927:72) both of which give a rather full account of this aphid, its biology, life forms, synonymy and literature.

Collections: On terminal stems and underside of leaves in dense colonies on *Amelanchier Wiegandii* Niels (wild pear). ANTIGONISH COUNTY, Route 7, June 29; 1950 (422b); July 24, 1951 (521b); August 23, 1951 (aphids gone by this date, only few dead parasitized forms left).

Subtribe *Aphina*

2. *Rhopalosiphum maidis* (Fitch)

Corn Leaf Aphid

Aphis maidis Fitch, 1856:550; Forbes, 1885:25; Sanborn, 1905:58; Davis, 1909b:144; Patch, 1912a:173; Swain, 1919:108; Britton, 1923:294; Hottes and Frison, 1931a:205; Wildermuth and Walter, 1932:1; Gillette and Palmer, 1932b:415.

Rhopalosiphum maidis (Fitch), Webster, 1887:148; Palmer, 1952:217.

This olive to bluish-green aphid was found in a colony feeding on corn at the base of the tassel. Both apterous and alate forms were present with many black ants in attendance. It was also found heavily infesting the stem of the pineapple weed. Sanborn (1904:59) reports that this species "is gregarious, and attacks corn in practically the same manner as the chinch-bug. It is most numerous on the distal joint of the stalk, being protected by the sheath of the last leaf". Swain (1919:108) records it from California, though never as abundant as in mid-western states. Palmer (1952:218) indicates that it is general throughout the Colorado region. Hottes and Frison (1931a:205) report that it occurs in Illinois corn fields about midsummer and remains there until late fall, but rarely becomes a serious pest. Patch (1912a:173) reports its presence in Maine, but with no other direct comment concerning the Maine material.

The complete life cycle is not known; sexual forms never having been found. Because of its late appearance in Illinois,

it is suggested that the corn leaf aphid has an alternate host, not known as yet, or that it migrates each season from the south, where it is present throughout the winter. A treatment of the known biology of this aphid is given by Davis (1909b:144) with descriptions and figures.

Brief descriptions and figures are given for alate and apterous forms by Palmer (1952:217) from which a few summary statements follow. Apterous viviparae are pale bluish green, with darker areas about the cornicles. The body is slightly pulverulent. Alatae have head and thorax black; abdomen pale green with dusky lateral areas on abdominal segments anterior to cornicles, and dorsum darker posterior to cornicles. Cornicle, cauda and appendages are dusky. Rostral IV and V broad, extending to second coxa. Cornicle is incrassate, with slight constriction next to flange, and with serrate imbrications. Cauda parallel-sided, rounded at tip, broad neck with three pairs of hairs. Forewing with second fork short.

Collections: On *Zea Mays* (cultivated corn). LUNENBURG COUNTY, Mader's Cove, August 6, 1952 (665).

On *Matricaria matricarioides* (Less.) Porter, (pineapple weed). ANTIGONISH COUNTY, Antigonish, July 24, 1952 (651); August 7, 1953. KINGS COUNTY, Wolfville, August 3, 1953 (879).

Subtribe **Aphina**

3. *Rhopalosiphum pseudobrassicae* (Davis)

The Turnip Aphid

Figs. 89, 90

Aphis pseudobrassicae Davis, 1914a:231; Paddock, 1915:7; Davis and Satterthwait, 1916:915.

Rhopalosiphum pseudobrassicae, Gillette and Palmer, 1932b:487; Hottes and Frison, 1931a:240; Palmer, 1952:220.

One of the heaviest aphid infestations found on any plant in Nova Scotia was that of this aphid feeding on Sweet Rocket. The aphids were feeding in compact masses in the angles of what remained of the leaves and on the main stem from the ground to the tip of the plant, being most abundant on the upper third of the host (Fig. 89). Many of the aphids were parasitized in addition to being preyed upon by numerous ladybird beetles, syrphid fly larvae and larvae of undertermined

types. The over-all appearance of the host was that of dirtiness and complete debilitation; definitely succumbing to this aphid infestation.

Paddock (1915:7) reports that this species is not found on cultivated host plants from May until September in Texas, which possibly suggests an alternate host during the hot summer months. Hottes and Frison (1931a:240) note that in Illinois this species is a serious pest in spring and fall on garden crops, usually attacking cabbage and cruciferous plants. Palmer (1952:220) indicated that the species in Colorado occurs in alate and apterous forms all months of the year, but that in many cases it is very abundant and injurious in late summer and autumn. The short summer season in Nova Scotia, somewhat similar to that of Colorado, may explain the continuous presence of this aphid throughout the growing season; sweet rocket serving as one of a number of possible different alternate summer hosts.

The apterous forms are light green to yellowish, with spotted transverse rows, of light grayish pulverulence, intersegmentally arranged; cornicle, cauda and appendages pale to dusky. Head and thorax of alatae blackish; abdomen powdery green, with blackish lateral area on segments anterior to cornicles and narrow dorsal bands posterior to cornicles. Further descriptions with measurements and figures are found in Davis (1914a:231), and Palmer (1952:220).

Collections: On *Barbarea vulgaris* R. Br. (sweet rocket) on stems, leaves and blossoms in dense massive colonies. ANTIGONISH COUNTY, Antigonish, July 10, 1951 (505).

Subtribe **Aphina**

Genus TOXOPTERA Koch

Koch, 1856:253; Baker, 1920a:51; Palmer, 1952:226.

The members of this genus are very similar to those of the Genus *Aphis* but are separated on the basis of the forewing, the media being only once-branched. Antennae are 6-segmented with circular sensoria; cornicles elongate, cylindrical; cauda tapering; and head without prominent antennal tubercles.

Genus type (monotypical), *Toxoptera aurantiae* Koch (*aurantiae* Boyer).

Subtribe **Aphina***Toxoptera aurantiae* (Fonse).

Aphis aurantiae Boyer de Fonscolombe, 1841.

Toxoptera aurantiae Koch; Essig, 1911J:601; Davis, 1912:8; Swain, 1919:129.

This aphid was found feeding in the primary umbel of wild carrot, both apterous and alate forms present. Their body coloration was dark green to black.

The alatae keyed out to this genus in both Hottes and Frison (1931:175) and Palmer (1952:113); and in the latter it keyed to *T. aurantiae* (Fonse.) Swain's account (1919:129) of this species is not sufficient for confirming identification except that the coloration is similar; Palmer does not describe it. Davis' paper (1912:8) is unavailable at this writing. If it is *T. aurantiae*, it is errant to *Daucus* sp., the host on which it was found, as Swain (1919:129) reports it as the "common black louse of the citrus trees." It may possibly be a new species. Further description is necessary.

Collections: On floral head of *Daucus carota* Linn. (wild carrot, queen anne's lace). LUNENBURG COUNTY, Spondu Lake, August 8, 1952 (674).

Tribe **APHINI**Subtribe **Macrosophina** Baker

Baker, 1920a:53; Palmer, 1952:229.

The members of this subtribe are separated from the other subtribes of the tribe Aphini largely on the basis of the development of the antennal tubercles; well developed cornicles and long cauda. The frontal tubercles usually distinctly exceed the vertex; cornicles usually longer than hind tarsus, often four times and with reticulated distal end; cauda usually longer than hind tarsus. Wing venation is normal. Antennae 6-segmented, and equal to or greater than body length, secondary sensoria circular. Body hairs usually blunt to capitate, sometimes funnel-shaped. Lateral tubercles small or absent.

KEY TO THE GENERA OF THE SUBTRIBE MACROSIPHINA

1. Frontal tubercles diverging (Fig. 129) or slightly so; cauda medium to large, tapering, parallel-sided or constricted near base; more or less swollen (Fig. 163).....2
- Frontal tubercles converging (Fig. 131) or slightly so; cauda rather short and conical; cornicles long and slender (Fig. 156), or slightly clavate at distal end.....4
2. Cornicles clavate, more or less swollen (Fig. 150) (p. 68).....**Amphorophora**
- Cornicles cylindrical (Fig. 153).....3
3. Cornicles not reticulated (p. 77).....**Kakimia**
- Cornicles reticulated (Fig. 153) (p. 78).....**Macrosiphum**
4. Frontal tubercles slightly converging, not greatly exceeding vertex; hairs capitate, globose to funnel-shaped; antennal sensoria subcircular (p. 73).....**Capitorphorus**
- Frontal tubercles pronounced (Fig. 130), often converging, strongly gibbous; hairs blunt to slightly capitate; antennal sensoria subcircular with first segment gibbous. (p. 94).....**Myzus**

Subtribe **Macrosiphina**

Genus AMPHOROPHORA Buckton

Buckton, 1876:187; Baker, 1920a:54 (Synonymy); Mason, 1925:2; Theobald, 1926:176; Palmer, 1952:229.

The members of this genus are characterized by antennal tubercles which are prominent on the medial side, definitely exceeding vertex, with antenna I convex. Antennae equal to or greater than body length. Cornicles long, somewhat swollen in middle. Cauda elongate, shorter than cornicles, and either constricted or tapering at base. Hind tibia about equal to or longer than body. The shape of the cornicle and the length of the hind tarsus, shorter than base of VI, separates this genus from *Macrosiphum* with which it is often confused.

According to Mason (1925:4) there is very little data on the alternation of hosts in this genus, except for two species. Most other species appear to be monophagous on the one host. The most complete reference to this genus is that of Mason (1925: 11).

Genus type (monotypical), *Amphorophora ampullata* Buckton.

KEY TO THE SPECIES OF THE GENUS AMPHOROPHORA

1. Cornicles distinctly reticulated at tip.....4. **rubicola**
- Cornicles not distinctly reticulated at tip (Fig. 150).....2
2. Base of antennal VI longer than hind tarsal II.....3
- Base of antennal VI not longer than hind tarsal II.....5. **sonchi**
3. Secondary sensoria on antennal III of alatae more than 20 and irregularly arranged.....4
- Secondary sensoria on antennal III of alatae less than 20 (2-3) and arranged in straight row (Fig. 139).....2. **nebulosa**
4. Secondary sensoria on antennal III of alatae 35-41; of apterae 7-20.....3. **rubi**
- Secondary sensoria on antennal III of alatae 26-32; absent on III of apterae.....1. **crataegi**

Subtribe **Macrosiphina**1. *Amphorophora crataegi* (Monell)

The Four-Spotted Hawthorn Aphid

Siphonophora crataegi Monell, 1879:20.

Macrosiphum crataegi, Davis, 1911; Patch, 1914a:255; Hottes and Frison, 1931a:304; Gillette and Palmer, 1934:137.

Amphorophora crataegi (Monell), Palmer, 1952:233.

This must be a comparatively rare species in Nova Scotia, for it has been taken only once on hawthorn. It is rather unusual in appearance so much so that Patch (1914a:255), in typically feminine exuberance, speaks of it as an "elegant species" not uncommon around Orono, Maine. In Illinois, Hottes and Frison (1931a:304) list it as rare, but Palmer (1952:234) records it as "rather common" in Colorado.

Both alate and apterous forms were found feeding in rather small numbers on both the upper and lower leaf surfaces of hawthorn, causing the leaves to curl, apparently never abundant enough to cause severe damage or attract much attention. Various forms have been described by different workers: Davis (1911:fig. 10) recorded it from Chicago and figured the antennae of viviparous females; Patch (1914:255) described and figured the alate viviparous female; Hottes and Frison (1931a:304) describe, but do not figure, the apterous oviparous female; Palmer (1952:233) includes descriptions and figures of all forms of the species.

The stem mother is characterized by light lemon-yellow abdomen with two longitudinal green lines along dorsum, with dark tips on the light colored cornicles and appendages. The head is dark and the thorax yellow. The apterae are very light yellow, with two pairs of dark green spots arranged in a quadrangle on dorsum, two near bases of cornicles and two near metathorax; cauda, anal plate and cornicles are pale; appendages and tarsi are pale with dark tips. Cornicles are swollen, not reticulated; cauda broad and tapering. The alatae are very similar to apterae. For further descriptive detail with measurements, see Palmer (1952:233).

Collections: On leaves of *Crataegus macrosperma* var. *acutiboba* (Sarg.) Eggl. (hawthorn). ANTIGONISH COUNTY, Antigonish, August 26, 1953 (922a).

Subtribe **Macrosiphina**

2. *Amphorophora nebulosa* Hottes and Frison

Figs. 101, 139, 150, 163

Amphorophora nebulosa Hottes and Frison, 1931:275.

Alate, apterous and male forms of this species were found in rather small but dense colonies feeding head down on the stem tips adjacent to the floral heads of grass (*Poa* sp.) growing along the side of a path in a rather deeply wooded area. No apparent damage was evident to the host plants.

Hottes and Frison (1931:275) lists the color as essentially uniformly brown for both apterous and alate forms. These collected samples, however, give a more slate-gray coloration; other characters, however, fit well with those given by Hottes and Frison, to which the reader is referred in the reference given above.

Collections: Taken only once on *Poa* sp. (grass) on stem adjacent to floral buds. LUNENBURG COUNTY, Spondu Lake, August 12, 1952 (693).

Subtribe **Macrosiphina**

3. *Amphorophora rubi* (Kaltenbach)

The European Raspberry Aphid

Aphis rubi Kaltenbach, 1843:24.

Siphonophora rubi, Koch, 1855:191; Buckton, 1876:140.

Amphorophora rubi, Gillette, 1911a:381; Theobald, 1926:187 (Synonymy); Mason, 1925:52; Gillette and Palmer, 1934:140; Palmer, 1952:241.

Alate and apterous forms of this green aphid were found in dense colonies feeding head downward on the young stems of wild raspberry growing in a shaded woody situation of mixed deciduous trees. Quite a few of both forms were internally parasitized as was evident from the swelled, balloon-shaped and discolored abdomens.

Theobald (1926:190) reports this species as also occurring on the underside of leaves in great numbers causing the leaves to curl, but not producing severe damage. The occurrence of red forms is considered by him to be merely a variety. His observations over a period of years also led him to believe that the species is monophagous on *Rubus* spp., as does Mason (1925:57), and that it lives permanently on wild raspberry. Its presence on cultivated varieties is due mainly to alate females coming from the wild stock.

The summer apterae are green with slight median and lateral lines on dorsum; appendages pale with dusky tips. Cornicles are swollen slightly, without reticulations, but with few striae next to flange. Cauda are large, elongate-tapering with five pairs of lateral hairs. Alatae are similar to apterae, except head and thorax dark. This species can be distinguished from *A. rubicola* which occurs in the same host as follows: no dusky spot on forewing; cornicles shorter than antennal III and without reticulations; antennae longer than body; rostral IV and V shorter than base of antennal VI. For more complete descriptions and figures the reader is referred to Theobald (1926:187); Mason (1925:52) and Palmer (1952:241).

Collections: On young stems and underside of leaves of *Rubus* spp. (wild raspberry, blackberry). CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (645b).

Subtribe **Macrosiphina**

4. *Amphorophora rubicola* (Oestlund)

The Spotted-Winged Raspberry Aphid

Macrosiphum rubicola Oestlund, 1886:27 and 1887:78.

Nectarosiphum rubicola (Oestlund), Swain, 1919:77.

Amphorophora rubicola, Mason, 1925:58; Gillette and Palmer, 1934:141; Palmer, 1952:242.

This species is found on the same or similar hosts as *A. rubi* and can be easily confused with it. In fact, they may occur

together on the same stem. Reference number 645a (*A. rubicola*) and 645b (*A. rubi*) were so found.

The apterous forms are greenish-yellow with median and lateral stripes of darker green. Cornicles and antennae are dark; legs pale brown with tips of tarsi and tibiae black; cauda pale. Alatae are similar to apterae except head and thorax brown, antennae, cornicles and legs blackish. Fore wings with dusky spot at apex between stigma and cubital veins extending into stigmal cell. Cornicles are long, dilated in middle, slightly curved, and reticulated near flange.

This species can be distinguished from *A. rubi* by the dusky spot on tip of forewing; reticulated cornicle, wider than width of hind tibia, dusky color; and longer (.19) rostral IV and V, (.15 in *A. rubi*). Very complete descriptions of this species are given by Mason (1925:58). It is thought to be monophagous as is *A. rubi*.

Collections: On stems and underside of leaves of *Rubus* spp. (raspberry, blackberry). ANTIGONISH County: West River Road, July 30, 1952 (659); Route 7, July 30, 1952 (661). CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (645a). LUNENBURG COUNTY, Tancook Island, August 9, 1952 (684).

Subtribe **Macrosiphina**

5. *Amphorophora sonchi* (Oestlund)

The Green Thistle Aphid

Fig. 86

Rhopalosiphum sonchi Oestlund, 1886:34.

Rhopalosiphum dianthi (Schrank) (mistaken synonymy), Oestlund, 1887:76.

Rhopalosiphum sonchi, Gillette and Taylor, 1908a:34 (Synonymy.)

Amphorophora cosmopolitana Mason, 1925:16 (Synonymy).

Amphorophora sonchi, Gillette and Palmer, 1934:142; Knowlton and Allen, 1945:114.

Alate and apterous forms of this species were found in a compact, dense colony spreading upward over the terminal stem and inflorescence of sow thistle (Fig. 86).

The apterous females and nymphs on *Sonchus* sp. are pale yellow green, or pale bluish-green to almost white, covered with a pruinose secretion; antennae and legs brownish, with tips of tarsi and tibia blackish. Cornicles, cauda and eyes brown. Alatae have greenish-yellow abdomen, often with

dusky lateral areas and dorsal patch; head and thorax dark. Legs, cornicles and cauda yellow, with tip of cornicles dusky. Cornicles swollen in middle to twice width at base, with few imbrications below flange. Cauda tapering, with slight neck. All forms are described very completely by Mason (1925:16) together with complete discussion of synonymy and known biology of the species.

This species alternates between *Ribes* sp. (currant) as the winter host and such plants as *Sonchus* sp. (sow thistle), *Lactuca* sp. (wild lettuce) as the summer hosts. On *Ribes* sp. it occurs on the underside of leaves usually causing them to curl and cluster. On the summer hosts (Fig. 86) it forms compact dense colonies on the leaves, stems and floral inflorescence, producing two or more generations, and may remain on these plants until late fall, returning to the winter host, *Ribes* sp. where oviposition occurs. The eggs are deposited on twigs of currant and turn glistening black. Most of the other species of this genus are not known to alternate, but are thought to be monophagous in habit. Mason (1925:26) reports the species to be fairly world-wide in distribution.

Collections: On underside of leaves of *Ribes* sp. (currant) as winter host; on leaves, stems and inflorescence of *Sonchus* sp. (sow thistle) and *Lactuca* sp. (wild lettuce) as summer host. ANTIGONISH COUNTY: Antigonish, August 12, 1953 (881); August 26, 1953 (923). INVERNESS COUNTY: East Lake Ainslie, August 15, 1951 (530). Two alatae taken in transit on *Populus tremuloides*; not feeding. LUNENBURG COUNTY: Mahone Bay, August 6, 1952 (668); Tancook Island, August 9, 1952 (683).

Subtribe **Macrosiphina**

Genus **CAPITOPHORUS** van der Goot

van der Goot, 1913:84.

The members of this genus are separated largely on the basis of the presence of hairs or spines which are capitate, globose or funnel-shaped. These capitate hairs occur especially on the prominent antennal tubercles, vertex of the head, and first antennal segment. The body hairs in general, however, are of this type. The 6-segmented antennae are armed with circular sensoria. Wing venation is normal. Cornicles elongate, slender, cylindrical or slightly clavate. Lateral tubercles

usually absent. Ocular tubercles inconspicuous. Cauda rather short, tapering to parallel-sided or spoonshaped.

Genus type (fixed by van der Goot, 1913) *Aphis carduinus* Walker.

KEY TO THE SPECIES OF THE GENUS CAPITOPHORUS

1. Cauda blunt or rounded at apex; cornicle more or less clavate flange oblique, few striae beneath flange..... 2. *ribis*
- Cauda tapering to point at apex; cornicle cylindrical, flange not oblique, imbricated throughout..... 1. *fragaefolii*

Subtribe *Macrosiphina*

1. *Capitophorus fragaefolii* (Cockerell)

The Strawberry Aphid

Fig. 148

Myzus fragaefolii Cockerell, 1901:101.

Myzus fragariae Theobald, 1912:223.

Capitophorus fragaefolii, Hottes and Frison, 1931a:283; Palmer, 1952:256.

Capitophorus potentillae (Walker), (misidentification), Gillette and Palmer, 1934:153.

Capitophorus fragariae (Theobald), Thomas and Jacob, 1941:107; Hodson, 1937:409 (Synonymy).

These rather small greenish apterous aphids were found in a colony feeding on the underside of leaves of wild rose, a common plant in open fields in Nova Scotia. Collections taken to laboratory yielded alate forms in a few days. The alatae keyed out to this species using Palmer (1952:249).

Alate forms have dark brown head and thorax with light yellowish-green abdomen that has a dusky patch on the apical half and a few small dusky spots on the basal segments and dusky lateral spots. Legs pale yellowish with tip of segments and tarsi dark. Cornicles and cauda pale yellowish-green. Wings have smoky black veins and stigma. Hairs are capitate but scanty; short on body, longer and swollen on head and antennal I and II.

Apterae are very pale green, some being nearly transparent; appendages pale green to dusky. Capitate hairs on body, numerous and conspicuous. Cornicles long and thin, cylindrical, slightly curved, with slight flange and faint imbrications. Cauda pallid green, with two pairs of lateral hairs and a median

sub-apical one, tapering, with slight basal constriction. Eyes blackish with ocular tubercle. For further descriptive data with measurements and figures refer to Theobald (1926:246); Palmer (1952:256); sexual forms are described by Davidson (1914a:127).

Palmer (1952:257) reports that she has observed this species migrating from rose to strawberry and continuing abundant reproduction on the latter host. Her descriptions include discussion of the slight morphological differences which occur in this species when found on its respective hosts, pointing out, however, that "intergrading forms occur so that no definite line of distinction can be drawn" between these "slight and rather unstable differences in length and proportion of antennal segments and cornicles". Though reported as common in Colorado, it is not possible to say how frequent it occurs in Nova Scotia, since most collecting has been confined to forested and adjacent areas. This species would not be expected to be as common in these types of areas as in the more agricultural ones.

Collections: On underside of leaves of *Rosa* sp. L. (wild rose), as possible winter host. ANTIGONISH COUNTY, Lochaber, 10 miles E., July 4, 1953 (827).

Also reported to be found on *Fragaria* spp. (strawberry) and *Potentilla* spp. (cinquefoil) as possible summer hosts, though not taken on them in Nova Scotia.

Subtribe **Macrosiphina**

2. *Capitophorus ribis* (Linn.)

The Currant Aphid

Fig. 97

Aphis ribis Linnaeus, 1758:451.

Myzus ribis, Gillette and Bragg, 1917b:338; Haviland, 1919:8 (Biology).

Capitophorus ribis, Theobald, 1926:229 (Synonymy); Gillette and Palmer, 1934:155; Palmer, 1952:268.

This fairly large yellowish-green aphid was found in both alate and apterous forms feeding in compact to scattered colonies on the underside of leaves of hemp nettle. They are of a delicate, rather translucent shade of yellowish-green, such that their reaction to light is decidedly negatively photo-

tropic. At the moment the leaf is turned to the sunlight, the forms immediately crawl to the shaded side of the leaf. By the time a photograph could be taken, only a few forms remained on the exposed side of the leaf (Fig. 93).

Alatae, with abdomen pale yellowish-green, translucent, with four pairs of dusky lateral areas and dorsal patch; head and thorax olive colored; eyes red; hairs mostly capitate. Cauda, anal plate, and cornicles very pale yellow. Wings with yellow insertions; dusky veins and stigma.

Apterae pale yellowish-green to pale yellow, sometimes darker green mottlings; hairs capitate; eyes red, with ocular tubercles. Lateral tubercles absent. Antennae pale to transparent, thin and longer than body. Cornicles slightly concave, smooth. Cauda tapering with three pairs of lateral hairs. For discussion of sexuales and further descriptive detail with figures and measurements, see Theobald (1926:229) and Palmer (1952:268).

In regard to the life cycle, the eggs are laid at the base of buds and under loose epidermis of currant shoots. The young hatching out the following spring resemble small glass-like larvae under the leaves, causing puffed red blisters on the upper leaf surface under which these nymphs are found in great numbers. Migrants appearing in late June or July fly to a number of different summer hosts, i.e., *Galeopsis* sp. (hemp nettle), *Lamium* sp. (red dead nettle), *Strachys* sp. (hedge nettle), *Polygonum* sp. (knotweed), *Leonurus* sp. (motherwort), and on these produce a number of summer generations. In the fall, winged migrants fly back to *Ribes* sp. and there produce the fall sexuales. The details of the biology of this species are well given by Haviland, (1919:8).

In New Brunswick, MacGillivray and Spicer (1953:423) report that this species has been found parasitized by the braconids, *Aphidius* (*Aphidius*) *ribis* Haliday and *Aphidius* (*Lysiphlebus*) *testaceipes* (Cresson). Theobald (1926:233) reports the former braconid species to be the chief enemy of this currant aphid, as "often whole colonies....have been all killed" by them. The parasite fungus *Empusa aphidis* also attacks this aphid and may kill whole colonies. Haviland (1919:8) records finding two chrysochid larvae on these aphids, as well as the mite, *Anystus cornigera* Koch. Predators such as syrphid larvae, *Syrphus ribesii*, and coccinellids, *Catabomba pyrastris*, are also found preying upon individuals in the colony.

Collections: On underside of leaves of summer host, *Galeopsis tetrahit* Linn. (hemp nettle). On leaves of *Ribes* sp. as winter host, causing puffed red blisters on upper leaf surface. Summer hosts: ANTI-GONISH COUNTY, JIMTOWN, August 12, 1952 (697). LUNENBURG County, Spondu Lake, August 12, 1952 (697).

Subtribe **Macrosiphina**

Genus **KAKIMIA** Hottes and Frison

Myzus (*Kakimia*) Hottes and Frison, 1931a:344.

Kakimia, Gillette and Palmer, 1934:159; Palmer, 1952:275.

The species composing this genus are characterized by having frontal tubercles only moderately well developed, extending slightly beyond convex vertex. Secondary sensoria are circular on III, and often also on IV and V of alatae. Wing venation is normal. Cornicle is widest at base, apex slightly swollen. Cauda, medium length with narrow constriction near middle, tapering. Hairs slightly capitate, on hind tibia and antennae equal in length to diameter of segment. Only one species taken in Nova Scotia.

Genus type (monotypical), *Myzus* (*Kakimia*) *thomasi* Hottes and Frison.

Subtribe **Macrosiphina**

Kakimia purpurascens (Oestlund)

Nectarophora purpurascens, Oestlund, 1887:81

Macrosiphum purpurascens, Hottes and Frison, 1931a:318

Kakimia purpurascens (Oestlund), Gillette and Palmer, 1934: 166; Palmer, 1952:281.

This rather small species was taken from the host plant in both alate and apterous forms. The colonies were small and scattered on the leaves of the host. Apteræ are yellowish-green to dark-green with a brownish area on dorsum. Antennae dusky, 6-segmented with sensoria on III (8-10); cornicles dusky towards apex, cylindrical, broader at base and imbricated; cauda pale, slender, tapering to a point and with four pairs of lateral hairs. Rostrum very short and broad, less than length of hind tarsus.

Alate forms have dusky green head and prothorax with dark brown thoracic lobes; abdomen similar color as apterae. Antennae dusky beyond base of III and with 19-26 sensoria on III and 5-9 on IV. Cauda pale. Other characters similar to apterae.

Hottes and Frison (1931a:318) states that this species found on meadow rue, "has the peculiar habit of producing sexual forms early in the year and late in the season it is to be found in the egg stage only." They give good descriptions of sexuales of this species. Palmer (1952:281) describes the apterous and alate forms with figures and measurements.

Collections: On leaves of *Hieracium floribundum* Wimm. and Grab. (kingdevil). ANTIGONISH COUNTY. Route 7, July 30, 1952 (657).

Subtribe **Macrosiphina**

Genus **MACROSIPHUM** Passerini

Siphonophora Koch, 1855:150 (Preoccupied).

Macrosiphum Passerini, 1860:27; Baker, 1920a:57, Palmer, 1952:285.

Nectarophora Oestlund, 1887:78.

Macrosiphon Del Guercio, 1913:188.

Illinoia Wilson, 1910a:318.

The members of this genus are characterized by prominent diverging frontal tubercles, exceeding usually concave vertex. Wing venation is normal. Antennae are 6-segmented with subcircular sensoria, equal to or exceeding body length. Cornicles are long, cylindrical, normally reticulated, may be tapering, two times or more rostral IV and V. Cauda long, tapering, parallel-sided or spatulate, two times rostral IV and V. Anal plate rounded, ocular tubercles present. Lateral tubercles not evident. Males normally alate, oviparae apterous. Found on leaves and twigs of deciduous plants, not in galls.

Genus type (fixed by Passerini, 1860), *Aphis rosae* Linn.

KEY TO THE SPECIES OF THE GENUS **MACROSIPHUM**

(Modified after Palmer, 1952:286)

1. Cornicle not reticulated; longer than five times hind tarsal II. 7. **psi**
- Cornicle reticulated (Fig. 153)..... 2
2. Rostrum acute (Fig. 10), may end in needlelike point..... 3
- Rostrum obtuse, not pointed..... 4

3. Unguis shorter than antennal III; 23-30 secondary sensoria on antennal III..... 4. *frigidae*
 -. Unguis not shorter than antennal III; 36-53 secondary sensoria on antennal III..... 6. *ludoviciana*
 4. Cornicle longer than four times hind tarsal II..... 6
 -. Cornicle not longer than four times hind tarsal II..... 5
 5. Sensoria on antennal III more than 15 in alatae (34-44), more than 7 in apterae (19-26); cauda long, pointed (.50-.55)..... 10. *rudbeckiae*
 -. Sensoria on antennal III fewer than 15 in alatae (5-12), fewer than 7 in apterae (1-2); cauda shorter, somewhat constricted (.20-.28)..... 5. *granarium*
 6. Cornicle distinctly longer than antennal III..... 7
 -. Cornicle not distinctly longer than antennal III..... 9
 7. Sensoria on antennal III of alatae not in single row, more than 8..... 9. *rosae*
 -. Sensoria on antennal III of alatae in single row..... 8
 8. Cornicle and appendages heavy black; cornicle of alatae about equal to, never longer than, antennal III; antennal III of alatae 1.03..... 8. *pseudorosae*
 -. Cornicle pale at base with dusky apical portion; appendages pale, cornicle of alatae longer than antennal III; antennal III of alatae .70-.92..... 11. *solanifolii*
 9. Cauda especially in apterae longer than $\frac{1}{2}$ of cornicle (Fig. 164)..... 2. *ambrosiae*
 -. Cauda shorter than $\frac{1}{2}$ of cornicle..... 12. *valerianae*
 -. Cauda about same length as $\frac{1}{2}$ of cornicle..... 10
 10. Hairs on cauda fewer than 7 on each side..... 3. *erigeronensis*
 -. Hairs on cauda at least 7 on each side (Fig. 171)..... 1. *albifrons*

Subtribe *Macrosiphina*

1. *Macrosiphum albifrons* Essig

Essig's Lupine Aphid

Figs. 107, 171

Macrosiphum albifrons Essig, 1911c:543; Soliman, 1927:108; Gillette and Palmer, 1934:171; Knowlton, 1935a:114; Palmer, 1952:290.

This species heavily infests the host plant, colonies being scattered on the underside of leaves and along the upright stem. Present in one colony (Fig. 107) were several adult coccinellid beetles as well as their larvae preying upon these aphids. On the stem several syrphid larvae were feeding on apterous aphids. No parasitized forms were noticed.

The apterae are bluish-green, somewhat pulverulent; extremities dusky with tips blackish, tarsi black; cauda pale. The cylindrical cornicle is reticulated at distal end. Cauda rather long and tapering with 8 pairs of lateral hairs. Alatae have head and thoracic lobes brown, with prothorax and abdomen bluish-green, and pulverulent. Gillette and Palmer (1934:171) and Palmer (1952:290) give further technical data and measurements on all forms of this species.

Collections: On underside of leaves and on stems of *Lupinus polyphillus* Lindl. (lupine), heavily infested when found, not generally common. KINGS COUNTY, Wolfville, July 25, 1948 (99p). ANTIGONISH COUNTY, Antigonish, July 10, 1951 (504).

Subtribe **Macrosiphina**

2. *Macrosiphum ambrosiae* (Thomas)

The Brown Ambrosia Aphid

Figs. 87, 88, 95, 96, 143, 153, 164

Siphonophora ambrosiae Thomas, 1877 (1878):4.

Siphonophora solidaginis, Williams, 1910:86.

Macrosiphum solidaginis (Fabricius) (misidentification), Gillette, 1911c:383; Davis, 1911a:34.

Trilogenaphis kosacaudis Knowlton, 1928d:79; Smith and Knowlton, 1937b:271 (Synonymy).

Macrosiphum ambrosiae, Hottes and Frison, 1931a:298; Gillette and Palmer, 1934:172; Palmer, 1952:291; MacGillivray and Spicer, 1953:429.

This common cosmopolitan aphid is found practically everywhere, collections have been made where any one of a number of its herbaceous host plants are growing. Brown to sepia colored, it is usually found on pearly everlasting and on any one of the various species of golden rod. It occurs early in June and persists on these plants throughout the growing season. Typically they feed in a head-down position on the host stem in rather compact colonies (Figs. 87, 88). Alate forms are usually present from the last of June on through the season, together with nymphs and apterous viviparous females.

On some hosts the apterous forms appear dark brown to sepia with dusky appendages, black cornicles and rostrum. On *Solidago* spp. and *Aster* spp. the forms are often blood-red in color. Palmer (1952:292) suggest that since the two color

varieties appear structurally indistinguishable, and until "biological transfer tests determine the relation between these forms, it seems best to leave" this red variety in this species. It is possible that the type of host plant utilized may influence the color developed. This species is often confused with *M. rudbeckiae* but may be distinguished by its darker red color, lack of a lighter shade at base of cornicles, and by the presence of dusky hair bases on dorsum of abdomen. Otherwise, the two species are very similar structurally.

MacGillivray and Spicer (1953:429) list only one internal parasite, the braconid wasp, *Aphidius* (*Aphidius*) *polygonaphis* (Fitch) as attacking this aphid. Very seldom, if at all, has it been seen preyed upon by any of the various aphid predators in Nova Scotia.

For further technical descriptions with figures and measurements the reader is referred to Gilletté and Palmer (1934:172) and Palmer (1952:291).

Collections: On at least six different species of herbaceous host plants, as follows:

On *Anaphalis margaritacea* (Linn). B. and H. (pearly everlasting), on terminal leaves. ANTIGONISH COUNTY: North Shore Road, July 12, 1950 (445); Beech Hill Road, August 18, 1950 (472); West River Road, July 30, 1952 (659); Fairmont Road, July 27, 1953 (870.1). GUYSBORO COUNTY, East of Melrose, July 16, 1953 (838). INVERNESS COUNTY; Port Hastings, August 12, 1953 (884); Maple Ridge, August 13, 1953 (891.1); Port Hood, ten miles South, August 14, 1953 (900.1); Port Hood, August 14, 1953 (902); Glendale, August 15, 1953 (909). CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (647).

On *Erigeron* sp. (fleabane), on terminal leaves. INVERNESS COUNTY, Glendale, August 14, 1951 (529).

On *Eupatorium maculatum* Linn. (joe pye weed), on terminal leaves and base of inflorescence. ANTIGONISH COUNTY, Route 7, August 9, 1950 (461).

On *Aster umbellatus* Mill. (tall white aster), on stem; and *Aster* sp. (Tourn.) Linn. HALIFAX COUNTY, Franklin Park, Halifax, September 10, 1949 (343). INVERNESS COUNTY, Port Hood, August 14, 1953 (904).

On *Solidago* spp. Linn. (golden rod), on upper third of stem. HALIFAX COUNTY: Rocky Lake, July 21, 1949 (344); Waverly Game Sanctuary, August 12, 1949 (346). ANTIGONISH COUNTY: Fairmont Road, July 3, 1950 (426); Antigonish, June 19, 1952 (611); Beech Hill, July 2, 1952 (620); Route 7, July 30, 1952 (656). INVERNESS COUNTY, Glendale, August 15, 1953 (908).

Subtribe **Macrosiphina**3. *Macrosiphum erigeronensis* (Thomas)

The Canadian Fleabane Aphid

Fig. 106

Siphonophora erigeronensis Thomas, 1877:7.*Macrosiphum erigeronensis*, Hottes and Frison, 1931a:304; Gillette and Palmer, 1934:177; Palmer, 1952:304; MacGillivray, and Spicer, 1953:429.

This is a fairly common aphid found on the flower stalks, upper parts of stems and in the inflorescence of a number of common herbaceous plants (Fig. 106). It is not as frequent in occurrence, however, as *M. ambrosiae* or *M. rudbeckiae*, both of which also occur on similar host plants. The species is subject to being parasitized. MacGillivray and Spicer (1953:429) list one pteromalid and one cynipid as being raised from parasitized forms of this aphid in New Brunswick.

Apterae are pale to medium green and in some colonies appear even very dark. Tip of cornicles are black; tibiae and antennae beyond base of III dusky; cauda pale, very pointed, tapering and rather long with 1-4 capitate to straight hairs on tip. Alatae similar, except head, thorax, base of cornicle, antennae beyond base of III, black. Unguis shorter than antennal III; cornicle equal in length to antennal III. For further description data with measurements and figures, the reader is referred to Hottes and Frison (1931a:305) and Gillette and Palmer (1934:177).

Collections: Found on each of the following host species.

On *Anaphalis margaritacea* (Linn.) B. and H. (pearly everlasting), on base of floral inflorescence. LUNENBURG COUNTY, Spondu Lake, August 8, 1952 (676).

On *Aster* spp. (Tourn.) Linn., on upper part of stem and in inflorescence. ANTIGONISH COUNTY, West River Road, July 30, 1952 (658).

On *Hieracium floribundum* Wimm. and Grab. (kingdevil), on stem and leaf bases. Colonies scattered. CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (648a).

Subtribe **Macrosiphina**4. *Macrosiphum frigidae* (Oestlund)*Nectarophora frigidae* Oestlund, 1887:83.*Macrosiphum frigidae*, Essig, 1911c:546; Gillette and Palmer, 1928:6 and 1934:179; Knowlton and Allen, 1938c:80; Palmer, 1952:306.

This rather dark metallic, shining green species has been taken only once on the host, yarrow. Apparently it is not too common in Nova Scotia. The colony was entirely apterous, located in the inflorescence and directly under it on the stem feeding head down. Samples taken in cans yielded alatae in a few days.

The apterae are characterized by dark metallic green body color with cornicles, cauda and anal plate black. Cauda constricted near base, rather long; cornicles cylindrical, apical tips reticulated, not longer than antennal IV and with one or two lateral hairs near middle. Antennal III with 12-26 sensoria. Alatae similar except head and thorax black; antennal III with from 23-30 tuberculate sensoria. More complete descriptions with figures of all forms of the species are found in Gillette and Palmer (1934:179) and Palmer (1952:306), who also report taking it from leaves and tender stems of *Artemisia* sp. Linn. (wormwood).

Collections: On the base of floral inflorescence of *Achillea Millefolium* Linn. (yarrow). LUNENBURG COUNTY, Tanook Island, August 9, 1952 (678).

Subtribe **Macrosiphina**

5. *Macrosiphum granarium* (Kirby)

The English Grain Aphid

Fig. 102

Aphis granarium Kirby, 1798:238.

Siphonophora granaria, Buckton, 1876:114; Pergande, 1904:14.

Macrosiphum granarium, Phillips, 1916:463; Theobald, 1926:70 (Synonymy); Gillette and Palmer, 1934:182; Palmer, 1952:310.

A small colony of apterous viviparous females and nymphs was found on grass, *Poa* sp., feeding on the inflorescence and on the stem at the base of the inflorescence (Fig. 102). Alate forms developed in cans taken to the laboratory.

The apterous stem mother is dark apple green above and darker below, almost silvery with head brownish. Eyes deep red-brown. Cornicles black, reticulated at distal ends. Cauda pale green with six lateral hairs and one sub-apical hair. Femorae green, rest of legs dark. Antennae less than body length.

Summer apterous forms are grass-green to yellow or pink. Head brownish; dark spots on dorsum. Cornicles

black, cylindrical, wider at base with apical ($\frac{1}{4}$ to $\frac{1}{3}$) portion reticulated; shorter than antennal III. Cauda long, pale yellowish-green, slightly constricted near base and when seen laterally is curved upward; about $\frac{2}{3}$ length of cornicles. Legs yellow, with distal ends and tarsi black. Alatae similar, except head and thoracic lobes yellowish-brown; antennal III with from 5-12 sensoria; only 1-2 in apterae. All forms of this species are fully described and figured in Phillips (1916: 463) and in Theobald (1926:71) which the reader may consult for further technical details.

The species is very cosmopolitan infesting a large variety of different host plants such as, wheat, barley, oats, corn, and many grasses. Occasionally it becomes a serious pest on corn and wheat. Hottes and Frison (1931a:308) report that in Illinois this species "overwinters both in the egg stage and as viviparous females on grasses and autumn-sown cereals". Theobald (1926:74) infers that overwintering is in the egg stage only. Alate forms appearing on grass in spring migrate to corn, reproducing there by parthenogenesis until fall. On corn these aphids attack the young ears and cause the developing grain to become hard and dry, at which time fall alatae develop and fly back to grasses and produce sexuales, mostly females, joined later by males from elsewhere. Hottes and Frison (1931a:308) state that the pink forms are "mainly responsible for the production of the sexual forms".

This species is subject to many parasites and predators which aid greatly in holding their numbers in check. Theobald (1926:75) states that they are frequently attacked by chalcids causing the aphids so parasitized to turn deep brown in color. Buckton (1876:114) lists two braconids, one of which is a hyperparasite on the other. Phillips (1916:463) lists 8 Coleoptera, 3 Diptera and 8 Hymenoptera, some of which are hyperparasites. The species is further preyed upon by several kinds of mites as well as certain fungi. MacGillivray and Spicer (1953:428) in their list of aphid parasites in New Brunswick do not list this species, though in the light of its known occurrence and habits, one would expect it would be found parasitized.

Collections: At base of inflorescence and in the floral buds of *Poa* spp. (grass). GUYSBOROUGH COUNTY, East of Melrose, July 16, 1953 (840).

Subtribe **Macrosiphina**6. *Macrosiphum ludoviciana* (Oestlund)

The Wormwood Aphid

Fig. 85

Siphonophora ludoviciana Oestlund, 1886:23.*Nectarophora ludoviciana*, Oestlund, 1887:80.*Macrosiphum ludoviciana*, Soliman, 1927:117; Hottes and Frison, 1931a:315; Gillette and Palmer, 1934:187; Knowlton and Allen, 1938c:81; Palmer, 1952:313.

There may be some question as to the correct identification of this aphid. It keys out to this species in Hottes and Frison (1931a:294), but there is no further description concerning it to verify the determination. In Palmer (1952:287) it keys out to *M. frigida* (Oestlund), but it fits more closely her description of *M. ludoviciana* as to structural characteristics, i.e., cauda, cornicles, antennae, number of sensoria on antennal III, rostrum and hairs but varies in color pattern as well as the host plant from which it was taken.

The apterous forms have pale yellowish head and thorax, with dark to slate-green abdomen, possessing darker dorsal stripe, extending from thorax to tip of abdomen, and seven segmental, laterally placed dorsal pulverulent spots (Fig. 85). The antennae, appendages and cornicles are shining black. Wings clear with normal venation. Alate forms are similar but with head and thorax black.

Collections: On the upper part of stem of *Achillea Millefolium* Linn. (yarrow). Hottes and Frison (1931a:315) report it from *Artemisia* sp.; Palmer (1952:314) lists it on *Artemisia* spp., *Eurotia* sp. and *Tanacetum* sp. CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (649). ANTIGONISH COUNTY: St. Andrews, 10 miles South, July 4, 1953 (826); West River Road, July 30, 1952 (652). LUNENBURG COUNTY, Spondu Lake, August 8, 1952 (672).

Subtribe **Macrosiphina**7. *Macrosiphum pisi* (Kaltenbach)

The Pea Aphid

Aphis pisum Harris, 1782:66.*Aphis onobrychis* Boyer de Fonscolombe, 1841:169.*Aphis pisi* Kaltenbach, 1843:23.*Macrosiphum pisi*, Folsom, 1909:41; Davis, 1915: Bul. 276 (Synonymy) Theobald, 1926:127; Hottes and Frison, 1931a:317; Gillette and Palmer, 1934:193; Palmer, 1952:320.*Acyrtosiphon pisum* (Harris), Hille Ris Lambers, 1947a:247.

Greenish apterous forms were found on the underside of leaves and along the stem just below the floral inflorescence. The individuals were scattered and not in a compact colony. Alate forms developed later in cans in the laboratory. This is another field species which has not been commonly encountered in forested or semiforested situations in Nova Scotia.

The apterae are pale green, spindle-shaped, smooth, shiny or glaucous. The tapering cauda and appendages are pale; tarsi and tips of tibiae black; cornicles pale, blackish distally, rather long and slender, without reticulations. Abdomen often with 6 spots on each side.

Alate forms are various shades of green from pallid to grass-green, and at times with slight mealy coat. Head and thorax are yellow-brown. Eyes are deep red sometimes appearing black. Wings with stigma yellow to greenish. Other characters are similar to apterae. These and the other forms of the species are rather completely described and figured by Davis (1915:Bul. 276 with synonymy) and Theobald (1926: 128).

The species is very cosmopolitan on a variety of leguminous plants and has no true alternate host plant of a different group, i.e., woody plant. Clovers serve as the primary or winter host on which the eggs are laid, or on which the apterous viviparous females may also overwinter. The entire life cycle may be spent on the clover.

In late June or July migrants from the clover appear on peas or beans or other legumes and reproduce there until fall. At which time winged migrants return to clover or perennial peas and produce the sexuales. Both alate and apterous males may be produced. According to Davis (1915:Bul. 276) the average life span of the aphid is 39 days. Colder climate seems to induce sexuales to form; in the warmer climates the species may reproduce viviparously indefinitely; whereas in milder climates eggs as well as oviparous females overwinter.

The parasites and predators of this species are described by Folsom (1909:41). MacGillivray and Spicer (1953:429) list 2 pteromalids, one ceraphronid and one braconid as parasitizing this species in New Brunswick.

Collections: On underside of leaves and on stems of *Trifolium pratense* (Linn.) (red clover). Not common in forested or semiforested areas worked. ANTIONISH COUNTY, Antigonish, August 12, 1953 (882).

Subtribe **Macrosiphina**8. *Macrosiphum pseudorosae* (Patch)

The Green and Red Rose Aphid

Nectarophora pallida Oestlund, 1887:84 (preoccupied).*Macrosiphum pseudorosae* Patch, 1919:206; Hottes and Frison, 1931a:318; Palmer, 1936b:746 and 1952:320.

This is apparently another marginal species occasionally encountered in semi-forested situations in Nova Scotia. According to Patch (1919:207) it is found on wild rose and golden ragwort (*Senecio aureus* Linn.). Hottes and Frison (1931a:318) report taking it from wild rose, plus seven other herbaceous hosts including *Oenothera biennis* Linn. Palmer (1952:321) lists three herbaceous hosts other than rose. Alate and apterous forms were found twice on *Oenothera biennis* Linn. in Nova Scotia, but not on wild rose.

This species resembles very closely *M. solanifolii* (Ashmead) but differs from it by its heavy black antennae and cornicles. Patch (1919:206) reports the antennae to be so black "that it is difficult to prepare a mount which shows the distribution of the sensoria". Also, the apterous forms usually have longer antennae than in *M. solanifolii*. The general body color is rose red or green, as is the case for *M. gei*, occurring in either color variety. The beak is short and stout; antennal III with about 14 sensoria arranged in a row; none on IV. Cornicle never longer than antennal III, and reticulated on apical end about one-fifth of length; yellowish cauda. The sexual forms have not been described.

Collections: On underside of leaves of *Oenothera biennis* Linn. (common evening primrose). KINGS COUNTY, White Rock, July 19, 1948 (62). ANTIGONISH COUNTY, Route 7, July 30, 1952 (664).

Subtribe **Macrosiphina**9. *Macrosiphum rosae* (Linn.)

The Rose Aphid

Figs. 98, 129, 159

Aphis rosae Linnaeus, 1758:452 and 1761:260.*Siphonophora rosae*, Buckton, 1876:103.*Nectarophora rosae*, Oestlund, 1887:81.*Macrosiphum rosae*, Essig, 1911c:550; Patch, 1914a:268; 1919:205; Theobald, 1926:65; Soliman, 1927:119; Gillette and Palmer, 1934:171; Palmer, 1952:321.

Alate and apterous forms of this aphid in both red and green varieties in the same colony were found on the floral buds and terminal stems of cultivated rose and wild rose (Fig. 98). The species is found quite commonly throughout the region, more especially however, on cultivated than on wild varieties of rose host plants. Patch (1919:205) points out that there are at least three species of rose aphids, and each of them has two distinct color varieties, green and pink, i.e., *M. rosae*, *M. solanifolii* and *M. pseudorosae*. Theobald (1926:70) states that the usual or predominant color is green.

Apterae are green with contrasting black antennae and cornicles; appendages with dark distal ends on femora, tibiae and tarsi, the remainder of the appendages are green. Basal region of antennal III with 12-23 sensoria of two sizes. Cauda pale, with slight neck and bearing 3-5 pairs of lateral hairs and 2 preapical ones. The red variety has exactly the same morphology as the green form.

Alatae have black head and thorax; pale green abdomen with 3 pairs of black lateral areas. Antennae are very long; antennal III with 42-58 round sensoria. Cauda pale, cornicles black, long and thin, with apical region reticulated, remainder imbricated. Further technical descriptions with figures are found in Theobald (1926:66) Soliman (1927:119) and Patch (1914a:268).

Theobald (1926:69) states that the winter phase is passed in the egg which is laid in very late fall, and also as apterous females, and that in mild winters viviparous reproduction may continue. The eggs hatch in early spring and by June alate forms are produced which fly to other rose plants, or different branches on the same host, and start new sexual colonies. According to Patch (1919:205) *M. rosae* is monophagous on the rose, but hastens to add that there is the possibility of a secondary food plant used as a summer host. Theobald (1926:70) mentions *Dipsacus* sp. as being infested with *M. rosae*. The colonies are usually well attended by several species of ants.

The species is parasitized by several kinds of wasps. MacGillivray and Spicer (1953:430) list one braconid and one ceraphronid as parasitizing this species in New Brunswick. A number of species of lady bird beetles and their larvae, as well as at least two kinds of syrphids prey upon *M. rosae*. Theobald (1926:69) also states that "sparrows and chaffinches eat them in large numbers."

Collections: On *Rosa* spp. (wild rose) and *Rosa floribunda* (cultivated rose) feeding on floral buds and terminal stems. ANTIGONISH COUNTY, Antigonish, July 21, 1950 (450) and July 24, 1950 (454).

Subtribe **Macrosiphina**

10. *Macrosiphum rudbeckiae* (Fitch)

The Goldenglow Aphid

Figs. 99, 100, 105, 169

Aphis rudbeckiae Fitch, 1851:66.

Macrosiphum rudbeckiae (Fitch), Essig, 1911a:400; Soliman, 1927:124; Hottes and Frison, 1931a:330; Gillette and Palmer, 1934:193; Palmer, 1952:322; MacGillivray and Spicer, 1953:430.

This is one of the commonest and most widespread aphid species in Nova Scotia. It has been found, rather abundantly in all counties studied, with the possible exception of the most northern part of Cape Breton. It appears to be cosmopolitan in nature, but confined to summer herbaceous hosts, more especially various species of *Solidago* (goldenrod). It makes its appearance early in the season and continues to be found on the same hosts throughout the season. Hottes and Frison (1931a:321) "indicate that it is not a true migratory species". The records thus far from Nova Scotia would substantiate this statement. Perhaps *Solidago* spp. serves as the primary host upon which the species lives throughout the year. Summer alatae, flying to nearby herbaceous hosts of closely allied species, setting up new viviparous parthenogenetic colonies. The fall winged forms, then migrate back to *Solidago* spp., producing sexuales, the oviparous females of which oviposit on that host. This is a supposition based on available evidence; further investigation is needed for verification.

The stem mother appears dull brick-red with a dusky shade on head and abdomen. Legs and cornicles are brown. Body length about two-thirds that of apterous summer forms. Sensoria on antennal III about 8.

Apterous summer forms are blood red with shiny abdomen. Anal plate pale red; cauda pale red, tapering to point and with slight constriction near base, bearing 8 pairs of lateral hairs and 3-6 dorsal ones, 2/3 or more length of cornicle. Cornicles with proximal half brownish, distal half dusky black, and re-

ticulated, not longer than antennal III. Body length 3.7-4.5, largest of forms. Legs with yellowish tibia, tips black; tarsi black.

Alatae similar to summer apterae except head and thorax red, abdomen blood-red. Antennal III with 34-44 sensoria. Wing venation normal. Body length approximately 3/4 that of apterae. For further descriptive data with figures and measurements, see Essig (1911a:400), Soliman (1927:124) and Palmer (1952:322).

According to MacGillivray and Spicer (1953:430) the species is parasitized by one braconid, one cynipid and two species of pteromalids in New Brunswick. Predators observed in Nova Scotia include one aphid lion (*Chrysopidae*) found on *Solidago* sp. and several larval Syrphids also on that host.

Collections: On stems and underside of leaves of at least six species of herbaceous plants. One of the most common and widespread aphid species in Nova Scotia.

On *Aster* (Tourn.) Linn. spp., on terminal stems feeding head down. INVERNESS COUNTY: Maple Ridge, August 13, 1953 (890 and 892); Glendale, August 15, 1953 (907).

On *Aster umbellatus* Mill. (tall, white aster), on terminal stems and base of inflorescence. KINGS COUNTY, Scott's Bay, August 23, 1948 (76p). HALIFAX COUNTY, Halifax, September 10, 1949 (343). ANTIGONISH COUNTY, Route 7, August 9, 1950 (463).

On *Hieracium* (Tourn.) Linn. spp. (hawkweed), on terminal parts of the plant. GUYSBOROUGH COUNTY, Country Harbour, July 16, 1952 (842).

On *Hieracium scabrum* Michx. (rough hawkweed). Aphids feeding head downward on hairy stems. CUMBERLAND COUNTY, Collingwood, July 7, 1952 (641).

On *Senecio Jacobaea* Linn. (ragwort, stinking willie) on terminal stems and floral inflorescence. ANTIGONISH COUNTY, Jintown, August 21, 1953 (917a).

On *Solidago* Linn. spp. (goldenrod), on terminal stems and under floral inflorescence, typically feeding head downward, KINGS COUNTY: Wolfville, June 17, 1948 (5 and 6); July 4, 1948 (51); September 8, 1948 (14p). White Rock, August 3, 1948 (105p and 107p). HALIFAX COUNTY: Sandy Lake, July 20, 1949 (338); Waverly Game Sanctuary, August 12, 1949 (344). ANTIGONISH COUNTY: Fairmont Road, July 3, 1950 (426); June 28, 1951*; July 3, 1951*; June 26, 1952*; July 27, 1953 (868). Malignant Cove, July 12, 1950 (446). Crystal Cliffs, July 24, 1950 (456). Route 7, August 9, 1950 (462); September 7, 1950 (462.1)* (Not as abundant as in August); July 10,

1953 (832.2)* Beech Hill, August 14, 1950 (469). West River Road, July 30, 1952 (652). Antigonish, June 5, 1952 (607)*. Cape George, June 23, 1953 (812.1)*. Route 4, June 27, 1953 (816)*. Cloverville, July 28, 1953 (871.1)*. Jimtown, August 21, 1953 (918). Lochaber, July 25, 1951 (426)*. RICHMOND COUNTY, Lochlomond, July 11, 1951 (426)*. INVERNESS COUNTY; Maple Ridge, August 13, 1953 (891). Port Hood, August 14, 1953 (903). Inverness, August 14, 1953 (906.1)*. Glendale, August 15, 1953 (914). VICTORIA COUNTY, Baddeck, July 16, 1951 (514). CUMBERLAND COUNTY: Chignecto Game Sanctuary, July 8, 1952 (648)*. Wentworth Valley, July 7, 1952 (640)*. Collingwood, July 7, 1952 (643)*. PICTOU COUNTY, Green Hill, July 5, 1952 (630). COLCHESTER COUNTY, Rossville, July 6, 1952 (637)*. GUYSBOROUGH COUNTY: Country Harbour Road, July 16, 1953 (841). Country Harbour Valley, July 17, 1953 (845). LUNENBURG COUNTY, Spondu Lake, August 8, 1952 (672)*. *Field Observations; specimens not taken.

Subtribe **Macrosiphina**

11. *Macrosiphum solanifolii* (Ashmead)

The Potato Aphid

- Siphonophora euphorbiae* and *S. euphorbicola* Thomas, 1877:6.
Siphonophora solanifolii Ashmead, 1882:92.
Nectarophora asclepiadis Cowen (in Gillette and Baker), 1895:123.
Nectarophora heleniella Cockerell, 1903a:168.
Illinoia solanifolii (Ashmead), Soliman, 1927:133.
Macrosiphum gei (Koch), (misidentification or disputed synonymy), Theobald, 1926:108; Hottes and Frison, 1931a:306; Hille Ris Lambers, 1933:170 (Synonymy).
Macrosiphum euphorbiae, Gillette and Palmer, 1934:178; Hille Ris Lambers, 1939:84.
Macrosiphum solanifolii (Ashmead), Patch, 1907:235, 1911:81, 1915c:111, 1925a:10; Gillette and Palmer, 1934:195; Palmer 1952:324; MacGillivray and Spicer, 1953:430.

This is another fairly common cosmopolitan species occurring in Nova Scotia on a number of summer herbaceous plants as well as the common wild and cultivated rose. It is probable that no other aphid has attracted any more attention nor resulted in the publication of more papers than this species, largely because of its economic importance as a pest on crops such as potatoes, peas, pumpkin, squash, raspberry, currant, etc. It is likewise true that probably no other aphid species has acquired any more different synonyms than this one. (see Hille Ris Lambers, 1933:170 and 1939:84).

The life cycle was worked out by Patch (1907:238, 1911:83, 1915c:111 and 1925a:13) through a period of years. Reading her various accounts of the many attempts to solve this problem, in an effort to try to find a vulnerable point in its life cycle, as a possible means of control, is like reading the story of an adventure. But it places before one the picture of the complexities involved and the various and devious ways and means used to surmount the problem. Stated now, very briefly, it has been found that the rose seems the most likely winter or primary host upon which the eggs are laid late in the fall, turning shining black with age. In the spring both green and pink forms develop from the eggs, giving rise to one or more generations of apterous forms on the rose, feeding on the succulent growth and especially around the base of the flora buds. Alate forms appear very soon and fly to a number of alternate herbaceous summer hosts. Patch (1915c:111) states that both apterous and alate forms migrate. These alate migrants may produce up to 50 young in a fortnight, which under favorable conditions mature in two weeks and repeat the process. Thus during late July and August whole fields of potatoes, peas, etc., may be covered by these aphids. By mid-September the return of the fall migrants (alatae) to the winter host, rose, has largely taken place, where sexuales are produced and oviposition occurs. These aphids, no doubt, play an important part in serving as vectors for potato mosaic diseases and as carriers for other fungoid parasites.

Fortunately, the species is one of the most highly parasitized known as well as being subject to much predation by syrphid larvae, aphid lions, lady-bird beetles, etc. MacGillivray and Spicer (1953:430) list 8 braconids, 2 cynipids, 6 pteromalids and 2 ceraphronids known to parasitize this aphid in New Brunswick. It would appear from this, that perhaps the best control in the long run, is biological, utilizing this rather vast number of different predators and parasites, in addition to the fungus which also destroys the aphids.

The stem mother on rose is medium green with light yellowish head; pale appendages except tips of antennal segments and cornicles; tibia dusky; cauda pale. Apterous summer forms are either pink or pale green and may occur together in the same colony. Cornicles pale, elongate and with dusky reticulated tip equal to hind tarsal II. Cauda rather elongate and pointed with 5 pairs of lateral hairs, and one

preapical one. Antennal III with 10-18 sensoria in alate and from 2-6 in apterous forms, in single row; segments III, IV, and V with distal ends dusky and VI entirely black. Alate forms very similar to apterous except head and thoracic lobes yellowish. Very complete descriptions of all forms are found in Theobald (1926:108) and Patch (1911:81 and 1915c:111) as well as good summarized version in Palmer (1952:325).

Collections: On at least four different hosts as follows:

On *Eupatorium perfoliatum* Linn. (boneset) on base and in the floral inflorescence; colonies scattered. KINGS COUNTY, White Rock, July 19, 1948 (64). LUNENBURG COUNTY, Spondu Lake, August 8, 1952 (675).

On *Hieracium floribundum* Wimm. and Grab. (kingdevil); stem feeding alate and apterous forms in scattered colonies. CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (648b).

On *Lathyrus japonicus* Willd. (wild pea); in scattered colonies on stem and both sides of leaves, all apterous taken, alatae developed in cans later in laboratory. LUNENBURG COUNTY, Tancook Island, August 9, 1952 (685).

On *Rosa floribunda* (cultivated rose); both alate and apterous, green and pink forms feeding at base of floral buds; dense colony. ANTI-GONISH COUNTY, Antigonish, July 24, 1950 (454a).

Subtribe **Macrosiphina**

12. *Macrosiphum valerianae* (Clarke)

Nectarophora valerianae Clarke, 1903:253.

Macrosiphum valerianae Soliman, 1927:137 (Types lost); Gillette and Palmer, 1928:18 and 1934:199; Palmer, 1952:329.

This alate viviparous aphid was part of a mixed colony found on ragwort, and made up of *M. rudbeckiae* and *Rhopalosiphum* sp. Koch. It definitely differs from these latter two species and keyed out in Palmer (1952:286) to the above named species. However, she does not mention having taken this species from *Senecio* sp., but lists *Valeriana edulis*, *Rudbeckia* sp. and *Epilobium angustifolia* as hosts. Representatives of all three of these latter host genera are found in Nova Scotia (see Roland, 1944). Either the aphid taken is aberrant to *Senecio* sp. or the identification is incorrect, or it is a new host. With the exception of having 20 sensoria on one antennal III and 23 on the other, the rest of the description fits very

closely. Palmer lists antennal III with from 15-19 sensoria in alate viviparous forms.

The body color is brown, with rostrum extending to between second and third coxae. Cauda are dusky, long and tapering to sharp point, bearing 4-6 lateral pairs of hairs and single dorsal preapical one. Cornicles black, except base, which is pale; elongated cylindrical, wider at base, tip reticulated and flanged, extends posteriorly to tip of cauda with imbrications denticulate. Hairs slightly capitate, especially on antennae. Wing venation is normal.

Collections: On *Senecio Jacobaea* Linn. (ragwort, stinking willie) feeding at base of inflorescence. ANTIGONISH COUNTY, Jimtown, August 21, 1953 (917c).

Subtribe **Macrosiphina**

Genus MYZUS Passerini

Passerini, 1860:27, 1920a:57 (synonymy); Mason, 1940:3.

The prominent antennal tubercles, converging or gibbous, especially in the apterae, serve as one distinguishing character for the members of this genus. The six-segmented antennae have segment I gibbous, secondary sensoria circular. Wing venation is normal. Cornicles are long, cylindrical, sometimes clavate; cauda short and conical. Hairs are blunt or slightly capitate and short on appendages. No lateral tubercles are present.

Genus type (fixed by Passerini 1860), *Aphis cerasi* Fabricius.

KEY TO THE SPECIES OF THE GENUS MYZUS

(Modified after Hottes and Frison, 1931:335)

1. Cornicles distinctly imbricated throughout (Fig. 156); hind tarsal II longer than rostral IV and V; primary sensorium on base antennal VI equal in size to surrounding sensoria.....1. **cerasi**
- Cornicles not distinctly imbricated throughout; hind tarsi II not longer than rostrai IV and V; primary sensorium on base antennal VI larger than small surrounding sensoria.....2. **persicae**

Subtribe **Macrosiphina**

1. *Myzus cerasi* (Fabricius)

The Black Cherry Aphid
Figs. 71, 72, 122, 131, 156

Aphis cerasi Fabricius, 1775:734.

Muzus cerasi, Gillette and Taylor, 1908a:42; Gillette, 1908d:362; Ross, 1917:434; Wimshurst, 1925:85; Theobald, 1926; 292 (synonymy); Gillette and Palmer, 1934:201; Eichmann, 1936:1-6 (Life history); Mason, 1940:6; Palmer, 1952:335.

The black cherry aphid is a very common and widespread pest on cherry trees throughout Nova Scotia. It is propagated on the common wild pine cherry which serves as the primary winter host. The colonies are usually found heavily infesting the terminal growing tips, locating on the underside of young leaves. They propagate rapidly into a compact colony resulting in dense sticky masses, causing leaves to curl into closed tufts and deforming the young shoots. The whole mass is attended by numerous ants which feed on the sticky honey-dew produced. This honey-dew exudate being caustic, results in burning the foliage causing it to turn brown and die. It also serves as a base upon which black soot fungus grows to further disfigure the foliage and fruit (Figs. 71 and 72). The terminal infested leaves will be dead by mid-July, thus affecting the over-all total growth and thriftiness of the cherry tree.

In the fall, sexuales occur on the cherry, the females ovipositing amongst the bud scales or on the bark. Wimshurst (1925:85) reporting on the life cycle of this aphid describes the newly laid eggs as yellowish-green, becoming shiny black. The spring fundatrices hatch before the buds open and feed upon the buds and leaves as they open. These give rise to numerous generations of apterae, which by late June produce summer alatae. Wimshurst (op. cit.) reports that these alatae fly to a summer host such as, *Lepidium* sp. (peppergrass) or *Galium* sp. (bedstraw) and there produce numerous summer generations. Apteræ left on the cherry continue reproducing throughout the summer. In the fall, alatae from the summer hosts are produced which return to the cherry and there give rise to sexuales. Apteræ left on the cherry do likewise, with the possibility that male sexuales are only produced on the summer host. Theobald (1926:299) makes the suggestion that if this latter condition is true, then "the continuance of the life-cycle depends on the existence of a secondary host plant".

Eichmann (1936:1-6) failed to find this species migrating to *Lepidium* spp. or any other possible summer host, although the aphids left the cherry. Ross (1917:434), however, found them migrating to *Lepidium* spp. as a summer host. Palmer (1952:336) suggests that possibly this difference in observation may be due to the fact that two different species are involved. At any rate no alternate summer host has been found in the Colorado region.

Very complete technical descriptions with figures of all forms of this species are found in Theobald (1926:292) with synonymy, and Palmer (1952:335) to which the reader is referred.

According to Wimshurst (1925:85) and Theobald (1926:299), *Myzus cerasi* (Fab.) is parasitized by six species of braconids, one prototrypid, and one cynipid wasp. Predators include adult coccinellids and larvae, syrphid fly larvae, immature *Anthocoris* bugs, and young immature spiders of the family Epeiridae.

Collections: On the underside of leaves of *Prunus pensylvanica* Linn. (pin cherry) causing severe leaf curl and browning of the leaves, eventually killing them. Very common throughout province and severe pest on all types of cherry. **KINGS COUNTY:** Wolfville, June 22, 1948 (22); June 28, 1948 (16); North Mt. Lookoff, August 23, 1948 (74p); White Rock, August 3, 1948. **HALIFAX COUNTY,** Mill Lake Road, July 8, 1950 (331.1) (Other notations of its occurrence in this county were made). **ANTIGONISH COUNTY:** Route 7, June 12, 1950 (402); June 29, 1950 (420); September 6, 1950 (Infestation gone on this date from 402); July 24, 1951 (Same host as 402, but not infested in 1951). Antigonish, June 5, 1952 (606); June 4, 1953 (803). Fairmont Road, June 26, 1952 (Notation of occurrence). Beech Hill, June 5, 1953 (806). St. Andrews, July 4, 1953 (825a). Antigonish, two miles S.E., July 11, 1953 (833.3). Cloverdale, July 28, 1953 (871.1). **PICTOU COUNTY:** Green Hill, July 5, 1952 (631). **GUYSBOROUGH COUNTY:** Port Felix, July 18, 1953 (858a).

Subtribe *Macrosiphina*

2. *Myzus persicae* (Sulzer)

The Green Peach Aphid

Aphis persicae Sulzer, 1776:105.

Aphis dianthi Sehrank, 1801:114.

Siphonophora achyrantes Monell, 1879:18.

Myzus malvae Oestlund, 1886:31.

Myzus persicae, Passerini, 1860:35; Gillette and Taylor, 1908a:32; Gillette, 1908d:359; Theobald, 1926:318; Hottes and Frison, 1931a:339; Mason, 1940:15 (desc. and synonymy); Palmer, 1952:340; MacGillivray and Spicer 1953:430.

Despite the cosmopolitan nature of this species and the wide variety of its summer hosts, it has been taken only once, and in this instance was part of a mixed colony with *Myzus cerasi* (Fab.). It is apparently quite common in occurrence in New Brunswick as is revealed by the study of its parasites by MacGillivray and Spicer (1953:430). The only possible explanation might be that field work has been largely confined to forested and semi-forested situations. This species would be more apt to occur in the agricultural areas of the province. It is a potential enemy of considerable economic importance, infesting as summer hosts a wide variety of cultivated flowers, garden crops, plants grown in greenhouses; as well as the winter hosts, peach, apricot, cherry, plum, and flowering almond, the only wild winter host being the pin cherry (*Prunus pensylvanica* Linn.) on which it was found.

There is a considerable literature available concerning this species dealing with practically all phases of its biology, its destruction and control. The species is subject to a great deal of variation in color and is somewhat polymorphic depending upon the host on which it feeds. The summer form on vegetables and herbs has often been confused with *Rhopalosiphum* spp. because of its swollen cornicles, swollen frontal processes, and longer antennae in the apterae. The spring form on the winter host has cylindrical cornicles, large frontal processes, and apterae with short antennae, which is typical of the Genus *Myzus*. Very complete descriptions and technical data with figures on all forms of the species can be found in Gillette and Taylor (1908:32), Theobald (1926:318), Mason (1940:15), and a good concise summary in Palmer (1952:340).

According to MacGillivray and Spicer (1953:430) in their list of aphid parasites in New Brunswick, *Myzus persicae* (Sulzer) is parasitized by eight species of braconids, one cynipid, four pteromalids, and two ceraphronid wasps. Outside of *Macrosiphum solanifolii* (Ashmead) this species is the next most heavily parasitized aphid found in New Brunswick. The proximity of this province to Nova Scotia would lead one to expect a similar situation to prevail in Nova Scotia as regards

this aphid species. Theobald (1926:327) includes further, the Chalcid wasp, *Aphelinus* sp. which turns the aphid shiny black, and *Lysiphlebus* sp. which causes the host to swell and turn gray or light drab color. Predators include several species of syrphid larvae and lady-bird Beetles respectively, in addition to fungi which is a very effective means of natural control, similar to that in the case of *Myzus cerasi* (Fab.).

Collections: On underside of leaves of *Prunus pennsylvanica* Linn. (pin cherry). Uncommon in forested areas of the province. GUYSBOROUGH COUNTY, Port Felix, July 18, 1953 (858b).

Subfamily APHINAE

Tribe LACHNINI Wilson

Wilson, 1911b:51; Palmer, 1952:9.

The members of this tribe are considered the most primitive of the subfamily Aphinae; the Mindarinae are the most primitive of the Aphidae. The stigma of the fore wing is elongate and the radial sector straight (except in part, *Anoecina* and *Lachnina*). Rostrum is often five-segmented with short unguis (shorter than base of VI); sensoria oval or subcircular; antennae and body hairy; frontal tubercles lacking. Cornicles on cones, mammiform, hairy and with flange. Cauda and anal plate are rounded. Sexuales generalized, similar to other forms; females apterous.

KEY TO THE SUBTRIBES OF THE TRIBE LACHNINI

1. Radial sector of fore wing curved and of moderate length; hind tarsal I triangular (Fig. 10), hardly longer than wide.....2
- Radial sector short and straight (Fig. 111); near tip of wing; hind tarsal I trapezoidal, longer than wide.....3
2. Hind tarsal II $\frac{1}{2}$ or more of length of tibia, tarsal I minute (Fig. 10); cornicle mere ring or absent; head divided; wing venation usually faint (Not taken in region)..... **Tramina**
- Hind tarsal II never exceeding $\frac{1}{3}$ length of hind tibia, tarsal I normal size; cornicle mammiform; stigma short and thick (p. 99)..... **Anoecina**
3. Rostrum needlelike (Fig. 10), V well developed and distinct (p. 100)..... **Cinarina**
- Rostrum obtuse, V vestigial, sometimes appearing coalesced.....4
4. Form elongate, very narrow; radial sector straight (Fig. 113), cornicle mere ring or small cone, not hairy; antennae with bristles; eyes

without ocular tubercles. Feeding on needles of conifers (p. 108)
 **Eulachnina**
 Form not elongate; radial sector more or less curved (in *Longistigma*
stigma is elongate, reaching apex of wing); cornicles on hairy cones;
 eyes with ocular tubercles. Feeding on twigs, bark and leaves of
 deciduous trees and shrubs. (Not taken in region)..... **Lachnina**

Tribe *LACHNINI*

Subtribe **Anoecina** Baker

Baker, 1920a:13.

The members of this subtribe are characterized by having the radial sector of the forewing curved and the media once-branched but not faint. The antennae are six-segmented, with long hairs and subcircular sensoria. The cornicles arise from shallow hairy cones. Only one genus found in Nova Scotia.

Tribe *LACHNINI*

Genus ANOECIA Koch

Koch, 1856:275; Baker, 1920a:13; Palmer, 1952:9.

In addition to the characters listed under the subtribe, the terminal filament (unguis) is shorter than VI; cauda and anal plate are rounded; hind wings have two cross veins. Baker (1920a:13) notes that the spring forms are colonial and exposed, while the summer forms are usually subterranean on roots.

Genus type (monotypical), *Anoecia corni* (Fabricius).

Tribe *LACHNINI*

Anoecia querci (Fitch)

The White-Banded Dogwood Aphid

Eriosoma querci Fitch, 1859:804.

Eriosoma cornicola Walsh, 1862:304.

Anoecia quercia Baker, 1916e:359; Cutright, 1925:187; Hottes and Frison 1931a:152; Gillette and Palmer, 1931:833; Palmer 1952:12.

Characteristically this species alternates in its life cycle between its summer host, roots of grasses, and its winter host

Cornus sp. Hottes and Frison (1931a:152) suggest that "querci" is a misnomer, since the species normally does not appear on oak except as a "drift" errant to oaks. Baker (1916e) gives a good description of this species and the problem related to its synonymy; Palmer (1952:12) summarizes character descriptions.

Collections: Only one alate specimen was taken on *Sagittaria* sp. in the Greenhouse, Acadia University, KINGS COUNTY, May 25, 1949. The species is errant to *Sagittaria*, probably being a "drift" on way to summer host (2x-3p).

Tribe *LACHNINI*

Subtribe *Cinarina* Börner

Börner, 1930:125; Palmer, 1952:19. Only one genus.

Genus *CINARA* Curtis

Cinara Curtis, 1835:sec. 576; Hottes, 1930b:185; Palmer, 1952:20. *Lachniella* Del Guercio, 1909a:286; (syn. of *Lachnus*, same type set).

Wilsonia Baker, 1919a:212 and 1920a:18 (preoccupied).

Dilachnus Baker, 1919a:253 and 1920a:16 (preoccupied).

Lachnus Burmeister, (misidentification), Baker, 1920a:16.

Panimerus Laing, 1926:322 (preoccupied).

Neochmosis Theobald, 1929:129.

The general characteristics of this genus are as follows: robust body from 3-5 long, usually bearing rather long erect hairs; bronze to black in color, with sometimes a pattern of white powdery exudate. The cornicle is a mere rim usually found on a mammiform hairy base. The six-segmented antennae, with unguis shorter than half of base, is shorter than body and covered with hairs. Fore wing with straight radial sector reaching almost to tip of wing, and rather elongate stigma; media is faint and either once or twice forked. Rost- rum is long, reaching length of body or beyond, segments IV and V lance like, and V distinct. Found on bark and twigs of Coniferae.

Species appear to be rather specific as to host according to Palmer (1952:20) who has conducted host transfer tests in an attempt to prove otherwise. Until further information is

available, especially concerning the sexual cycle, it seems wise to hold to the idea of rather strict host specificity. Hottes and Frison (1931a:153) point out that the genus *Cinara* is considered to be one of the most primitive of living aphids and that they show rather strict fidelity to the pines of Pinaceae upon which the entire non-migratory life cycle is spent. The stem mothers hatch from the over-wintering egg and produce apterous viviparous females. These in turn produce parthenogenetically others like themselves, as well as viviparous alate females, and finally alatae or apterous males and oviparous females are produced in the fall which mate, the oviparous females laying the over-wintering eggs.

Species differentiation in this group is exceedingly difficult, especially of forms from closely related host plants. Identification of collected species was made by the use of keys in Palmer (1952:20) and Hottes and Frison (1931:153), a summarized version of each is included, sufficient to key out the seven species taken in Nova Scotia.

Genus type (fixed by Curtis 1835:Sec. 576), *Aphis pini* Linn.

KEY TO THE SPECIES OF THE GENUS CINARA (A)

(Modified after Palmer, 1952:20)

1. Hairs on hind tibia of apterae not longer than diameter of tibia. 2
- Hairs on hind tibia of apterae longer than diameter of tibia. 8
2. Hind tarsal II hardly equalling one-tenth of length of hind tibia.
On *Abies*. 1. **curvipes**
- Hind tarsal II one-tenth or more of length of hind tibia; hairs not
capitate on body, may be blunt on hind tibia. 3
3. IV 1.5 or more times VI with unguis. 4
- IV shorter than 1.5 times VI with unguis. 6
4. Hairs on hind tibia .05 or longer. 5
- Hairs on hind tibia not longer than .05. (Not taken in region)
. **coloradensis** or **schwarzii**
5. III not longer than .60 on *Pinus* (Not taken in region). **edulis**
- III longer than .60 on *Abies*. 1. **curvipes**
6. Hairs on hind tibia strongly reclinate, at angle of 30 degrees or less. . 7
- Hairs on hind tibia, at angle of more than 30 degrees with tibia
. (other species not taken in region).
7. Rostral IV .20-.23, antennal V not longer than IV (Not taken in re-
gion. **schwarzii**
- Rostral IV .28-.33, antennal V longer than IV. 7. **thatcheri**
8. Cornicle, at base, not more than .20 in diameter; hind tibia in apterae
longer than half body; rostrum attaining cornicles. 4. **piceicola**

- Cornicle, at base, more than .20 in diameter; hind tibia less than two-thirds length of body; rostrum surpassing cornicles. .3. **palmerae**

KEY TO THE SPECIES OF THE GENUS CINARA (B)

(Modified after Hottes and Frison, 1931a:153)

1. First tarsal segment nearly 1/5 length of second segment exclusive of claws.5. **pinicola**
- First tarsal segment 1/3 to 1/2 length of second segment exclusive of claws.2
2. Hind tibia uniformly dark brown.6. **strobi**
- Hind tibia with basal and apical portions dark brown, area between yellowish-brown, the two colors contrasting.3
3. Hairs on antennae short, spine-like, little if any longer than width of antennal segments.2. **laricis**
- Hairs on antennae longer, up to twice the width of antennal segments.3. **palmerae**

Subtribe **Cinarina**

1. *Cinara curvipes* (Patch)

The Bow-legged Aphid

Fig. 16

Lachnus curvipes Patch, 1912a:161; Wilson, 1923:267; Knowlton, 1930:158.

Cinara curvipes, Gillette and Palmer, 1931:850; Palmer, 1952:28.

Cinara utahensis Knowlton and Smith, 1938b:55 (new synonymy).

This large bronze colored aphid with both alate and apterous forms was found feeding on the stem of the previous year's growth near the top of a young white spruce at the junction where the new growth occurred. The colonies were very dense and attended by numerous large black ants. Patch (1912a:161) reports it as common on *Abies balsamea* Mill, but to date it has not been found on this host in Nova Scotia.

The apterous forms have a dark brown to blackish head, black thorax and bronze colored abdomen, very slightly flocculent caudad of cornicles. The legs are yellowish in region of femora, yellowish brown tibiae, with distal tips black, tarsi black. Tuberculate cornicles, cauda and anal plate are black. The species is very active when disturbed.

Collections: On stems near new growth of *Picea glauca* (Moench) Voss. Beaver Mountain, ANTIGONISH COUNTY, July 4, 1952 (624).

Subtribe **Cinarina**2. *Cinara laricis* (Hartig)

Figs. 20, 21, 162, 172, 181

Lachnus laricis Hartig, 1839:645.*Aphis laricis* Walker, 1848a:102.*Cinara laricis* (Hartig), Hottes and Frison, 1931a:155.*Lachnus laricifex* Fitch, Patch, 1912a:164.*Panimerus laricis* Walker, Theobald, 1929:135.

Wherever stands of tamarack (larch, hackmatack) have been found, *Cinara laricis* (Hartig) is found feeding on some of the trees in the stand. The colonies are usually rather small, but compact and from one to several colonies will be found on trees infested. They prefer bark feeding situations on stems from one to three years old, clustering about the stem between and at the base of needle clumps. The alate forms, especially, are very active, the apterous and nymphal forms crawling away more slowly when disturbed.

Alate forms have dark brown heads with bronze colored thorax and abdomen, with prothorax and thorax marked by black lines. White pulverulency occurs both dorsally and ventrally on head and thorax. The abdomen is sparsely hirsute, dark bronze in color, slightly pulverulent and with a pale mid-dorsal line as well as scattered black spots and dark transverse markings. Apterous forms are very similar to alatae; younger nymphs are more uniformly lighter brown color with little or no pulverulence.

Shoutenden (1906:203) describes the oviparous females; Theobald (1929:135) and Wilson (1923) give good descriptions of the other forms. Under the name of *Lachnus laricifex* Fitch, Patch (1912a:164) presents drawings and descriptions of apterous and alate forms from Maine.

Collections: On younger stems of *Larix laricina* (Du Roi) Koch feeding on bark. ANTIGONISH COUNTY: Antigonish, June 2, 1952 (600); September 17, 1952 (703); June 17, 1953 (810); Big Marsh, July 28, 1953 (877); Route 7, June 12, 1950 (401); June 29, 1950 (421); September 6, 1950 (401.1); July 10, 1953 (832.1). West River Road, July 3, 1951 (401); July 30, 1952 (652). CAPE BRETON COUNTY: Gillis Lake, July 15, 1951 (511). CUMBERLAND COUNTY: Wentworth Valley, July 7, 1952 (640). GUYSBOROUGH COUNTY: Aspen, July 25, 1951 (511). Melrose, July 16, 1953 (836). New Harbour,

July 17, 1953 (848); July 18, 1953 (852). Sloane Lake, July 27, 1951 (511). INVERNESS COUNTY: Glendale, August 15, 1953 (910); Kingsville, August 14, 1951 (511). Maryville, August 14, 1953 (901). Queensville, August 15, 1953 (916). KINGS COUNTY: Lake George Road, July 26, 1948 (104p). RICHMOND COUNTY: Black River, July 11, 1951 (506). Isle Madame, July 11, 1951 (506.1). VICTORIA COUNTY: Baddeck, July 16, 1951 (511).

Subtribe *Cinarina*

3. *Cinara palmerae* (Gillette)

The Spotted Spruce Aphid

Figs. 17, 18

Lachnus palmerae Gillette, 1917a:135.

Cinara palmerae (Gillette) and Palmer, 1931:863; Hottes and Frison, 1931a:156; Palmer, 1952:38.

A large dark brown, bronze, to blackish aphid living in small to very large colonies on the bark of spruce. Forms collected on *Picea glauca* were more brownish; those from *Picea mariana* more blackish, and colonies on this latter host were far larger and more dense, extending in some cases up to two feet along the main trunk of young black spruce (Fig. 18). On *P. glauca* the colonies were largely confined to the apical part of young trees located in the stem axils of the top-most new branches; usually with many red ants in attendance. Adjacent trees of the same species in any given area were not necessarily infested. Colonies seem to occur on spruce here and there, but the host infested may have up to several colonies distributed over its branches. Younger trees are usually far more heavily infested than older ones of the same species. This aphid is found sporadically on individual spruce trees over wide areas in the counties studied, but its incidence has never been so great as that of *Mindarus abietinus* Koch on *Abies balsamea* (Linn.) Mill, especially in the summer of 1950, when practically every tree in areas infested was attacked.

The first instar nymphs are ashen grey covered with considerable pulverulence. The dark brown or bronze apterous forms have a broken pattern of pulverulence, especially, on lateral aspects of abdomen. Extremities in general are blackish. Alate forms are similar in color and size with apterae. Gillette (1917a:135) and Palmer, 1952:38 have full descriptions and figures of all forms of this species.

Collections: On stems of spruce and *Larix laricina* (Du Roi) Koch (larch) as follows:

On *Picea glauca* (Moench) Voss, (white spruce): Pictou County; Colington Forks, June 24, 1950 (412). ANTIGONISH COUNTY: Beech Hill, June 5, 1953 (807); Somer's Road, June 13, 1950 (404). CAPE BRETON COUNTY: Gillis Lake, July 14, 1951 (509); Gillis Lake, July 12, 1951 (510). GUYSBOROUGH COUNTY, Larry's River, July 18, 1953 (853a).

On *Picea mariana* (Mill) B.S.P., (black or bog spruce): GUYSBOROUGH COUNTY, New Harbour, July 17, 1953 (849); Whitehead, July 18, 1953 (856); INVERNESS COUNTY: Maple Ridge, August 13, 1953 (894); Inverness, August 14, 1953 (906).

On *Larix laricina* (Du Roi) Koch, (larch): HALIFAX COUNTY, Waverly Game Sanctuary, August 22, 1949 (348).

Subtribe *Cinarina*

4. *Cinara piceicola* (Cholodkovsky)

The Dark Brown Spruce Aphid

Fig. 19

Lachnus piceicola Cholodkovsky, 1896c:148; 1898:659.

Cinara piceicola, Palmer, 1945:447; 1952:39.

Apterous and alate forms were found feeding head downward on a young green stem of white spruce attended by rather large black ants. They affix themselves in such a fashion beneath adjacent needles, that they are difficult to see, especially the younger nymphal forms which are lighter green in color, more or less blending with the green color of the stem. Apterous females are greenish to grayish yellow with black specks on the abdomen. Alatae are similar, but with head and thorax dusky to blackish, and with two dark green lateral stripes along each side of the abdomen.

Cholodkovsky (1896c:148) gives a brief account of the life history as reported by Palmer, (1945:448), "Living on last year's bark of *Picea excelsa* and by the end of May often covering entire limbs of younger trees at which time the alate viviparae appear. Sexuials appear by the end of June and beginning of July. However, the viviparae as well as the sexuials continue till the middle of September. The eggs, yellowish for the first few days, then black, are laid on the needles". Palmer, (1945:448; 1952:39) describes and figures this species giving diagnostic characters.

Collections: On new and last year's stems of *Picea glauca* (Moench) Voss, (white spruce). INVERNESS COUNTY, Port Hastings, August 12, 1953. Not common (887).

Subtribe **Cinarina**

5. *Cinara pinicola* (Kaltenbach)

Lachnus pinicola Kaltenbach, 1843:154.

Lachnus abietis Fitch, Wilson, 1923:262.

Dilachnus pinicola (Kaltenbach), Wilson, 1923:262.

Cinara pinicola (Kaltenbach), Hottes and Frison, 1931a:156.

Panimerus pinicola Kaltenbach, Theobald, 1929:129.

This aphid was identified by means of keys in Hottes and Frison (1931a:153) and Wilson (1923:260). This identification was questioned by M. E. MacGillivray. It may be a different species than that listed since its color pattern does not seem to fit that described by Wilson (1923:262). Apterous specimens were pale green to dark green rather than light cinnamon-brown. Key characters used in both keys, however, brought it to *C. pinicola* (Kaltenbach). Until further verification is possible, tentatively it will rest as this species.

This species occurred in scattered colonies along the stem of white spruce. No alate forms were present on June 2 nor on June 7, but one alate was found on June 19, and more were obtained from samples taken into the laboratory on this latter date.

Good descriptions and figures concerning this aphid are given by Theobald (1929:129) and Wilson (1923:262).

Collections: On young stems of *Picea glauca* (Moench) Voss, (white spruce). ANTIGONISH COUNTY: Fairmont Road, July 4, 1950 (431); Beech Hill, July 2, 1952 (618); Antigonish, June 2, 1952 (601). INVERNESS COUNTY: Port Hastings, August 12, 1953 (887). Not common.

Subtribe **Cinarina**

6. *Cinara strobi* (Fitch)

The Pine Bark Aphid

Figs. 24, 111, 125

Eriosoma strobi Fitch, 1851:69.

Lachnus strobi Fitch, 1851:69 (Cited in Wilson 1923:266).

Dilachus strobi (Fitch), Wilson, 1923:266.

Cinara strobi (Fitch), Hottes and Frison 1931a:157.

These rather large active aphids are found in more or less compact colonies feeding on nascent or year old bark of young white pine usually attended by numerous black ants. When disturbed they crawl around on the underside of the stem or up or down from their place of origin. They occur generally throughout the counties studied, though never very abundant. Host trees are scattered or occur in isolated areas in central or northern counties. Younger hosts are the most heavily infested.

Apterous females are bronze to shiny metallic black, with a mid-dorsal line extending from prothorax to cauda. Usually with three pairs of white pruinose spots, one pair laterally placed on thorax, one anterior and one posterior to the jet black cornicles on abdomen. Legs are black and strongly curved. Antennae are long and slender, with unguis on VI finger-like; III, IV, and V light colored at base and black distad; VI black; III longer than IV and V; rostrum extends to beyond hind coxae; cornicles with wide sloping base; cauda with rounded tip, broadly acute; long drooping hairs over body, antennae and legs. General color and size of alatae similar to apterae. See Wilson (1923:266) for description and measurements of this species.

Collections: On nascent or year bark of *Pinus strobus* Linn. (white pine). KINGS COUNTY: Aldershot, September, 1948 (x-1); White Rock, July 23, 1948 (93). HALIFAX COUNTY: Waverly Game Sanctuary, August 22, 1949 (347). ANTIGONISH COUNTY: Fairmont Road, July 3, 1950 (425); Jintown, August 21, 1953 (919). GUYSBOROUGH COUNTY, Sloane Lake, July 27, 1951 (527). RICHMOND COUNTY, C.B., Grand Anse, July 11, 1951 (507). INVERNESS COUNTY, C. B., Glendale, August 14, 1951 (529); August 15, 1953 (913). LUNENBURG COUNTY, Spondu Lake, August 11, 1952 (686). COLCHESTER COUNTY, West Rossville, July 6, 1952 (639). PICTOU COUNTY, Scotsburn, July 6, 1952 (633).

Subtribe *Cinarina*

7. *Cinara thatcheri* Knowlton and Smith

Cinara thatcheri Knowlton and Smith, 1938b:66; Palmer, 1952:50.

This aphid keyed out to *C. thatcheri* (Palmer, 1952:21). Both apterous and alate forms were present on stem and needles of white spruce. Apterous forms cinnamon-brown; mottled

and speckled with black or entirely black; with scattered patches and streaks of pulvulence, especially on median line. Alatae with dark brown thorax and lighter brown abdomen and similarly marked as apterae. Young nymphs are light yellow color with translucent appendages. Palmer (1952:50) reports this species to be the same as *C. schwarzii* except: "longer rostral IV (.28-.30, not .20-.23) and antennal V (longer than IV, not approximately equal)".

Collections: On stem and needles of *Picea glauca* (Moench) Voss (white spruce). Only colony found. ANTIGONISH COUNTY, Fairmont Road, July 27, 1953 (870).

Tribe *LACHNINI*

Subtribe *Eulachnina* Baker

Baker, 1920a:14

The subtribe *Eulachnina* and *Lachnina* can be separated from the subtribe *Anoecina* and *Tramina* because in the former two the radical sector is straight, extending to the tip of the wing; in the latter two subtribes this vein is curved. The *Eulachnina* are further characterized by a narrow, elongate body, eyes without ocular tubercles, rounded cauda, shallow cornicles not elevated on hairy cones, and an obtuse rostrum. Usually found living on conifers on the needles. Only one genus found in Nova Scotia.

KEY TO THE GENERA OF SUBTRIBE EULACHNINA

1. Antennae six-segmented, with spines or hairs.....2
- Antennae five-segmented, naked or with minute bristles (Not taken in region).....*Essigella*
2. Media once branched (Fig. 113), antennae with long stout spines; cornicles mere ring (p. 108).....*Eulachnus*
- Media twice branched (Not taken in region).....*Todalachnus*

Subtribe *Eulachnina*

Genus *EULACHNUS* Del Guercio

Del Guercio, 1909a:327; Baker, 1920a:15; Palmer, 1952:16.

The characters in addition to those given under the subtribe are: six-segmented antennae with long spines; fore wings

with media once branched and faint; hind wings with media and cubitus faintly indicated. Usually found on pines, living on the needles.

Genus type (fixed by Wilson, 1911:54), *Lachnus agilis* Kaltenbach.

Subtribe *Eulachnina*

Eulachnus rileyi (Williams)

The Powdery Pine Needle Aphid

Figs. 22, 23, 113

Lachnus sp. near *agilis*, Gillette, 1909c:385.

Lachnus rileyi Williams, 1910:24.

Eulachnus rileyi, Davis, 1914a:169; Knowlton, 1930:158; Gillette and Palmer, 1931:836; Hottes and Frison, 1931a:157; Palmer, 1952:17.

This species is very similar to *E. agilis* (Kaltenbach) but differs according to Gillette and Palmer (1931:837) and Hottes and Frison (1931a:157), on account of the absence of secondary sensoria on antennal III. However, Palmer (1952:17), states that neither species has secondary sensoria on antennal III, but would differentiate *E. agilis* as follows: "Brown body, (*E. agilis* green) slightly longer antennae and hind tibia and different host". Since the Nova Scotia specimens are olive-brown color in the apterae; brown to bronze in the alate and lack secondary sensoria on antennal III, *E. rileyi* seems a better designation than *E. agilis*. (One specimen, however, does show one secondary sensorium on antennal III). Palmer admits to the close similarity between these species and states that none of the "characters are clearly distinctive". Davis (1914a:169) also describes all forms of the species.

The apterous forms were lined up in a single row along the needles or red pine with their abdomens pointing upward. At intervals, single individuals would waggle their abdomens as if to force the beak further into the needle substance. Their bodies were covered with a grayish flocculence including the appendages. Alate forms were more bronze in color with less flocculence. Syrphid larval predators were present feeding on the aphids, and a number of alate forms were swelled up, probably being parasitized by braconid larvae; some dead,

others dying. The apterous forms gave the general appearance of minature "toads" lined up along a pine needle.

Collections: On needles of *Pinus resinosa* Ait. (red pine). CUMBERLAND COUNTY, Chignecto Game Sanctuary, July 8, 1952 (644). QUEENS COUNTY, Tobecoatic Game Sanctuary, August 5, 1954 (996). LUNENBURG COUNTY, East Chester, July 18, 1955 (1052).

Subfamily APHINAE

Tribe PANAPHINI Palmer

Callipterini Oestlund, 1887:34.

Panaphini Palmer, 1952:59.

The members of this tribe have long, slender antennae, with relatively few subcircular or oval sensoria in viviparae. Cornicles are truncate, rather short, and often sculptured, rarely elongate or mere pore or absent. Cauda are knobbed and anal plate bilobed; sometimes both are rounded. Fore wing with radial sector surved, often faint or absent; media twice branched. Tarsal I triangular; rostrum obtuse, with I fused to VI. Living exposed on foliage of plants; some forms solitary, others colonial; one group, *Saltusaphina*, can jump or leap. Sexuales similar to other forms; females apterous, males usually alate.

KEY TO SUBTRIBES OF TRIBE PANAPHINI

1. Cornicles a mere ring (Fig. 158).....2
- Cornicle truncate or elongate (Fig. 157).....3
2. Cornicle a mere ring (Fig. 158) on a low cornical base (p. 143).....
- **Phyllaphina**
- Cornicle a mere ring not on a low conical base (p. 123).... (**Monellia**)
- **Panaphina**
3. Body, vertex and usually antennae with conspicuous spinelike hairs; anal plate not deeply divided; frontal tubercle not developed (Fig. 130); radial sector distinct (Fig. 112).....4
- Body, vertex and antennae not with conspicuous spine-like hairs or if with conspicuous hairs; anal plate deeply divided (*Panaphis*); frontal tubercles developed (Fig. 127); radial sector faint (Fig. 115).....5
4. Cornicle truncate, reticulated, enlarged at base (Fig. 157) (p. 111).....
- **Chaitophorina**
- Cornicle elongate, cylindrical or vasiform, not truncate, not reticulated (Fig. 152) (p. 144)..... **Pterocommina**

5. Fore wing with radial sector indistinct or lacking (Fig. 114) (except in *Euceraphis*, *Oestlundiiella* and *Neosymydobius*); cornicle not much longer than width at base (Fig. 160) (p. 123)..... **Panaphina**
 Fore wing with radial sector distinct; cornicle much longer than width at base (Fig. 151) (p. 121)..... **Drepanosiphina**

Tribe *PANAPHINI*

Subtribe **Chaitophorina** Baker

Baker, 1920a:33; Palmer, 1952:90.

The subtribe Chaitophorina is composed of aphids which are characterized by having numerous long hairs on the body, legs and usually antennae, as the meaning of the subtribe name implies. Other characters include rounded or knobbed cauda which are never elongate. Truncate cornicles, never much longer than diameter at base, and with reticulations on apical portion (except *Hoplochaitophorus*). Anal plate is rounded, or indented, but never divided. Wing venation normal. Usually found as colonies and are slow moving when disturbed.

KEY TO THE GENERA OF THE SUBTRIBE CHAITOPHORINA

1. Cauda distinctly knobbed (Fig. 168); cornicle reticulated (Fig. 157); anal plate rounded or merely emarginate (p. 111)..... **Chaitophorus**
- Cauda rounded.....2
2. Cornicles with apical portion swollen, wider than basal portion with distinct flange at apex (Fig. 152) (*Clavigerus*, Subtribe *Pterocommina*) (p. 145)..... **Pterocomma**
- Cornicles with basal portion wider than apical portion, trapezoidal; third antennal segment short, less than twice width of head through eyes (p. 114)..... **Periphyllus**

Subtribe **Chaitophorina**

Genus CHAITOPHORUS Koch

Koch, 1854:1; Baker, 1920a:33 (synonymy); Britton, 1923:281; Palmer, 1952:90.

The members of this genus are characterized by having the cauda knobbed, and anal plate rounded or indented; the antennae are 6-segmented, with unguis twice or more times longer than base of antennal VI. The cornicles are truncate; in length about equal to width; imbricated proximally with

distal tip reticulated. Otherwise, characters are as listed under subtribe.

Genus type (fixed by Gerstaecker, 1856:202), *Aphis populi* Linn.

KEY TO THE SPECIES OF THE GENUS CHAITOPHORUS

1. Antennal III of *alatae* with 9-14 secondary sensoria arranged in irregular double row (Fig. 142); antennal IV with from 0-5 sensoria 2. **populifolae**
- Antennal III of *alatae* with 2-7 secondary sensoria arranged in a single row; no sensoria on antennal III..... 1. **populellus**

Subtribe **Chaitophorina**

1. *Chaitophorus populellus* Gillette and Palmer

The Clear-winged Poplar Aphid

Figs. 52, 53

Chaitophorus populellus Gillette and Palmer, 1928:15 and 1931:917
Palmer, 1952:90.

In the descriptions given in the above references, nothing is said concerning how this aphid infests the poplar. The type of pseudo-gall, formed resembles very closely that of *Thecabius populi-conduplicifolius* (Cowen) (Palmer, 1952:371) and was so classified tentatively. But the apterous forms within the folded leaves upon examination are very close to the descriptions for *Chaitophorus populellus* Gillette and Palmer (1928:15). No alate forms were present and none developed in the laboratory. Hence, the identification is based on nymphal and apterous material.

The infestation was found only once on the youngest terminal leaves of a small balsam poplar tree growing in a stand of mixed deciduous trees and open plots of grass near the bottom of the west side of a rather steep slope. The infested leaves were tightly folded together in a loose type of pseudo-gall (Fig. 52). Opening the leaf revealed the apterous colony feeding on either side of the leaf midrib (Fig. 53). Re-visiting the area in three successive summers did not reveal its presence again.

The apterae were very light yellowish-green with a darker green spot on dorsum of abdomen. They were quite small and very slow to move when disturbed. Measurements and technical description fits closely that of Palmer, (1952:90).

Collections: In folded terminal leaves of *Populus balsamifera* Linn. (balsam poplar). ANTIGONISH COUNTY, Station 4, North Shore Road, July 12, 1950 (447).

Subtribe **Chaitophorina**

2. *Chaitophorus populifoliae* Davis

The Clear-winged Aspen Aphid

Figs. 61, 117, 142, 157, 168, 175

Aphis populifoliae Fitch, 1851:66.

Chaitophorus populifoliae (Fitch) (misidentification), Oestlund, 1887:38.

Chaitophorus populifoliae (Oestlund, Davis, 1910d:489; Hottes and Frison, 1931a:163; Gillette and Palmer, 1931:918; Palmer, 1952:92.

This species was found most often infesting the petioles and undersides of leaves, sometimes the upper surface also, of *Populus* spp. It occurs infrequently, but hosts attacked are usually heavily infested. The upper surface of leaves on large trees will glisten with honey-dew exudate falling from aphids clinging to the underside of leaves above. In some cases the infested leaves will form welts or become cup-shaped or curled and turn partially brown, eventually rotting as a result of secondary fungoid infestation. The colonies varied from rather compact to quite scattered, though for the most part the individual aphids were fairly well separated (Fig. 61). A brown species of ant is usually in attendance upon the colony.

Hottes and Frison (1931a:163) state that "very little is known concerning the biology and distribution of this species". Palmer (1952:92) lists two species of *Populus* and one of *Quercus* as hosts, indicating dates of summer apterae from June 13 to Oct. 2, alatae from June 22 to September 25 and sexuales, October 2. The inference would be that this is possibly a monophagous aphid since no mention is made of an alternate summer host, or else it is not known. It has been found on two species of *Populus* and one of *Salix* in Nova Scotia in either late June or July; not being found as yet in August or September.

The apterous forms are pale green with a tinge of yellow, with thorax and abdomen marked by transverse darker bands which thin out in the center of dorsum giving the appearance

of a lobulated lighter colored oval spot. Alate forms have black head and thorax with similar abdominal markings. Sensoria on antennal III range from 9-17 and are irregularly arranged; from 0-5 sensoria are found on antennal IV. All forms of this species are figured and described by Palmer (1952:92) or Gillette and Palmer (1931:918), to which the reader is referred.

Collections: Found on these host species as follows:

On *Populus grandidentata* (Michx) (large-toothed aspen) on underside of leaves, occasionally upper surface. KINGS COUNTY, Aylesford, June 30, 1948 (45). HALIFAX COUNTY: Paper Mill Lake, June 28, 1949 (315). Still Water Lake, July 8, 1949 (332b). ANTI-GONISH COUNTY: North Shore Road, July 12, 1950 (443). Crystal Cliffs, July 25, 1950 (457). INVERNESS COUNTY, Margaree Forks, July 17, 1951 (515).

On *Populus tremuloides* Michx. (trembling aspen), on petiole and underside of leaves, colonies scattered. PICTOU COUNTY, Green Hill, July 5, 1952 (632).

On *Salix* (Tourn.) Linn. (willow), on stem and underside of leaves in heavy infestation. ANTIGONISH COUNTY, Fairmont Road, July 27, 1953 (869).

Subtribe Chaitophorina

Genus PERIPHYLLUS van der Hoeven

Hoeven, van der, 1863:7; Baker, 1920a:34 (synonymy); Palmer, 1952:94.

The members of this genus are characterized by possessing cornicles which are rather short, truncate, wider at base, with apical end imbricated or reticulated. Cauda and anal plate are rounded. Antennae 6-segmented (except for small lamellate or hairy dimorphs usually produced in summer); sensoria on antennal III of alatae oval; none on apterae. Normal wing venation. Prominent spine-like hairs over body and extremities. Sexuals with functional mouth parts; males alate or apterous; ovipara and fundatrix apterous. Forms living in the foliage of trees.

Genus type (monotypical), *Periphyllus testudo* van der Hoeven (synonym of *P. testudinacea* Fernie).

KEY TO THE SPECIES OF THE GENUS PERIPHYLLUS

(Modified after Palmer, 1952:95)

1. Terminal filament (unguis) at least 3 times or longer than base of VI.....2
- Unguis shorter than 3 times base of VI.....3
2. Unguis about 3 times length, base of VI; antennal III of alatae with 19-25 sensoria.....4. *testudinacea*
- Unguis at least 4 times length base of VI; antennal III of alatae with 8-12 sensoria.....2. *lyropictus*
3. Unguis hardly twice length base of VI; wings with veins heavily bordered with fuscous; cornicle shorter than base of VI.....3. *populicolus*
- Unguis 2-3 times length base of VI; wings clear; cornicles longer than base of VI.....1. *americanus*

Subtribe Chaitophorina

1. *Periphyllus americanus* (Baker)

The American Maple Aphid

Chaitophorus americanus Baker, 1917a:428 and 1918:86.*Periphyllus palmerae* Knowlton, 1947b:24.*Periphyllus americanus* (Baker), Craighead, 1950:129 (list); Palmer, 1952:95.

Apterous and alate forms of this species were taken during the early part of June on *Acer* spp. In all cases, by June 17-23 the colonies were gone or only a few forms were left on the maple hosts. The aphids were located on the underside of leaves along the principal veins and at the apex of the petioles. When examined the first week in June the infestations were heavy, the colonies being rather compact and dense.

Nothing is said in the available literature as to the migratory habits of this species, the inference being that it is possibly monophagous on maple. However, the fact that in all cases, on three different species of maple, the colonies were practically gone by June 17-23 would infer that they had migrated to some other summer host. On June 19 scattered alate forms, rather large and dark in color, were found on the underside of leaves of horse chestnut in the same vicinity. No colonies were as yet visible. These could have been the migratory alate forms in transit to another summer host, or possibly the horse chestnut was that host. Further investigation is needed.

The apterous forms are green with a slightly darker dorsal median line on the abdomen. Alate forms have blackish head, thorax, antennae cornicles and distal ends of femora. The abdomen is marked by darker lateral areas and band across dorsum. Unguis is 2-3 times length base of antennal VI; wings clear with normal venation; cornicle longer than base of VI. According to Palmer (1952:95) the species produces dimorphs between May 10 to September 2 in the Colorado region. Dimorphs are rather characteristic to members of this genus, none, thus far, have been taken in Nova Scotia. For further descriptive data with figures and measurements refer to Palmer (1952:95).

Collections: On underside of leaves and on leaf petioles of host. Not common in regions studied in Nova Scotia.

On *Acer rubrum* Linn. (red maple), ANTIGONISH COUNTY, Antigonish, June 2, 1953 (801).

On *Acer saccharinum* Linn. (silver maple), ANTIGONISH COUNTY, Antigonish, June 2, 1953 (802).

On *Acer saccharum* Marsh (sugar maple), ANTIGONISH COUNTY, Antigonish, June 2, 1953 (800); Cape George, June 23, 1953 (813).

On *Aesculus Hippocastanum* Linn. (horse-chestnut); ANTIGONISH COUNTY, Antigonish, June 19, 1953 (811a).

Subtribe *Chaitophorina*

2. *Periphyllus lyropictus* (Kessler)

The Norway Maple Aphid

Chaitophorus lyropictus Kessler, 1886:171.

Chaitophorus aceris Linn. (misidentification), Gillette, 1909c:387; Davis, 1910d:414.

Periphyllus lyropictus, Hottes and Frison, 1931a:170; Hille Ris Lambers, 1947:228; Craighead, 1950:129 (list); Palmer, 1952:97).

These aphids were found feeding on young stems and on the underside of young leaves of *Acer* spp. As in the case of *P. americanus*, they make their appearance in May and early June. Collections on June 4 contained no alatae; on June 10 they were present in noticeable numbers and by the last week in June the colonies had disappeared from the Maples. Hottes and Frison (1931a:170) state that "the entire life history is spent upon its host". The simple question becomes, if this is

so, why do they leave this early spring host? And upon leaving, where do they migrate? They also state, further, that "no dimorphs have thus far been observed" in Illinois. None have been taken to date in Nova Scotia.

The apterous forms are characterized by extremities being black, rest of body pale green. Cauda semi-lunar; cornicles almost cylindrical with distal ends reticulated. Alatae are similar but antennal III with 8-12 sensoria, more in apterae. Unguis is 4-5 times base of antennal VI. Body hairs of two kinds, fine and heavy, spine-like. Wings clear with normal venation. Other forms, with more complete descriptions and figures, are found in Palmer (1952:97) to which the reader is referred.

Collections: On underside of young leaves and stems of host. Rare in occurrence in Nova Scotia. Found most frequently in May and June.

On *Acer rubrum* Linn. (red maple), HALIFAX COUNTY, Kearney Lake, June 14, 1949 (306).

On *Acer saccharinum* Linn. (silver maple); KINGS COUNTY, Wolfville, June 3, 1949 (x-25); ANTIGONISH COUNTY, Antigonish, June 4, 1952 (604).

Subtribe **Chaitophorina**

3. *Periphyllus populicolus* (Thomas)

The Cloudy-winged Aspen Aphid

Figs. 59, 60, 112, 121

Chaitophorus populicola Thomas, 1877:10; Essig, 1909c:98.

Periphyllus populicola (Thomas), Gillette and Palmer, 1931:924; Hottes and Frison, 1931a:172.

Periphyllus populicolus (Thomas), Palmer, 1952:99.

This is one of the commonest aphids found on poplar trees in Nova Scotia. Wherever poplar grows, young trees in a given area will almost inevitably be infested with this aphid on the terminal growing tips, and in practically every instance are attended by medium sized black ants in considerable numbers. This is likewise the case in Illinois as reported by Hottes and Frison (1931a:172), who also state that dimorphic forms are not produced by this species. Perhaps because of its prevalence and easy accessibility, feeding as it does on the upper leaf surface, female syrphids are very often found ovipositing or on near the aphid colony (Fig. 59).

Trembling Aspen is a very common tree found in practically every type of open or semi-open, or cut-over situation in the province. These aphids very definitely favor the younger, faster growing trees and invariably locate on the younger terminal leaves and stems. The infested leaves at first curl upward at the sides, later becoming discolored a dirty blackish color. With the continuance of the infestation secondary fungoid parasites begin to take root in the honeydew exudate on the leaves, resulting finally in the ruination of terminal growth and together with syrphid larvae predators and internal parasites, bring a great reduction in numbers to the aphid colony. However, alate forms are present throughout most of the growing season, hence migration to new leaves on the same or to another host continues all summer, and colonies in various stages of development are found throughout the season. The species is apparently monophagous living out its entire life cycle on the poplar.

The stem mothers have a brown head and prothorax with a deep grayish-green abdomen. Distal parts of tibiae, tarsi, antennal VI and distal tip of V are black. Apterous forms appear sometimes brownish and at other times almost black or very dark green, with a pale V-shaped area on dorsum with its apex pointed anteriorly (Fig. 60).

Alatae are similar to apterae except abdomen more often shows dusky bands and lateral spots. The most distinguishing character is the heavily fuscous bordered wing veins, especially in fore wings. Cornicles are shorter than base of antennal VI, with broad base and reticulated tips; cauda rounded and anal plate sinuate. Hairs are spinelike on vertex of head, but mixed with fine and heavy hairs over body and rather numerous. Antennae 6-segmented with III bearing 11-24 secondary sensoria with narrow rims; unguis hardly twice length base of VI. For further description data with figures see Palmer (1952:99) or Gillette and Palmer (1931:924).

Collections: On the upper surface of new leaves, especially on young trees of *Populus* (Tourn.) Linn. spp. Colonies usually clustered along principle veins near base of leaf. Very common throughout the province wherever poplar is found. Found on the following hosts:

On *Populus tremuloides* Michx. (trembling aspen). KINGS COUNTY: Wolfville, July 17, 1948 (61); August 9, 1948 (70p) and (11p). White Rock, July 19, 1948 (65); August 3, 1948 (106p) and (108p). Lake

George, July 26, 1948 (97). Aylesford, June 7, 1949 (119). HALIFAX COUNTY: Sandy Lake, July 7, 1949 (329.1). Rocky Lake, July 21, 1949 (340). Waverly Game Sanctuary, August 12, 1949 (345). Sackville Race Track, August 23, 1949 (350). ANTIGONISH COUNTY: Fairmont Road, July 3, 1950 (427); July 27, 1953 (866). Crystal Cliffs, July 25, 1950 (458b). Route 7, July 24, 1951 (519); July 30, 1952 (654). West River Road, July 30, 1952 (652)*. INVERNESS COUNTY, East Lake Ainslee, August 15, 1951 (531). VICTORIA COUNTY, Neil's Harbour, August 17, 1951 (532). LUNENBURG COUNTY: Spondu Lake, August 8, 1952 (673)*; August 12, 1952 (690)* and (691). Mader's Cove, August 6, 1952 (667). CUMBERLAND COUNTY, Collingwood, July 7, 1952 (643)*. QUEENS COUNTY, Caledonia, August 14, 1952 (698).

On *Populus grandidentata* (Michx.) (large-toothed aspen). KINGS COUNTY: Sunken Lake, August 3, 1948 (114p). Blomidon, August 23, 1948 (118p). HALIFAX COUNTY: Paper Mill Lake, June 28, 1949 (314). Still Water Lake, July 8, 1949 (332a). Rocky Lake, July 21, 1949 (339c). Waverly Game Sanctuary, August 12, 1949 (345a); August 22, 1949 (349)*. Sheldrake Lake, August 30, 1949 (353)*.

*Field observations; no specimens taken.

Subtribe *Chaitophorina*

4. *Periphyllus testudinacea* (Ferne)

The European Maple Aphid

Fig. 47

Periphyllus testudo van der Hoeven, 1863:1.

Philophorus testudinatus Thornton, 1852 (desc. not pub.).

Chaitophorus testudinatus (Thornton), Baker, 1918:87.

Periphyllus testudinatus (Thornton), Theobald, 1929:37 and 355; Gillette and Palmer, 1931:920.

This aphid is of very infrequent occurrence in Nova Scotia. It was taken twice on *Acer* sp. and twice on *Fraxinus* sp. The latter host has not been recorded for this aphid, but scattered colonies were present on the terminal stems and petioles. Theobald (1929:39) records it from four species of maple and also from *Ribes* sp. Though he does not mention any alternation of hosts, possibly *Ribes* spp. might serve in this capacity. Palmer (1952:102) briefly describes this species but indicates it has not been found in Colorado.

A similar condition exists in this species as was found for *P. americanus* and *P. lyropictus* in that the apterous colonies appear in middle to late May or the first week in June. On

June 4, no alatae were found on the host, though they were obtained two days later in the laboratory from collected apterous forms. On June 6 alatae were found on the host plant. By June 19, there were only a few scattered aphids left on the maple. Apparently the colonies had migrated elsewhere. Further observations will be taken for all three of these species. Published accounts do not include comments on the possible biology of the life cycle, except to infer a monophagous existence.

The species appears to be not only highly polymorphic but as well varies considerably in coloration. On the same host plant, two different colonies were located which gave the appearance of two distinct species. One being composed of dark colored apterous forms, and the other of rather whitish-yellow aphids. After mounting, they both keyed out in Palmer (1952:95) to this species. Theobald's description (1929:38) more or less substantiates this observation since he states that the color varies from dark green to slaty gray-green.

Both alate and apterous forms vary in color from dark blackish-green to yellowish-gray. Wings clear, veins not bordered with fuscous as in *P. populicolus*, but costa yellowish. Legs yellowish-white to yellowish-green, except femora which is dark; distal ends of tibiae and tarsi black. Antennae dark, shorter than body; unguis about 1/3 shorter than III; 19-20 sensoria on III of alatae. Cornicles truncate, reticulated and deep olive-green. Dimorphs occur with 6 longitudinal rows of dorsal plates, and foliate lateral plates. Antennae 4-segmented. More inclusive descriptive data with figures are found in Theobald (1929:37) and Palmer (1952:102) to which the reader is referred.

Collections: On young stems near petiole and stem axils, and on underside of leaves of host.

On *Acer saccharum* March (sugar maple), in dense colonies in early June. Left host by last week in June. ANTIGONISH COUNTY, Antigonish, June 4, 1952 (603); June 20, 1952 (612b).

On *Fraxinus americana* Linn. (white ash) on terminal stems and on both sides of leaves in dense and scattered colonies. ANTIGONISH COUNTY, Antigonish, June 20, 1952 (614, 615).

Tribe *PANAPHINI*Subtribe *Drepanosiphina* Baker

Baker, 1920a:31; Palmer, 1952:85.

The members of this subtribe have the cornicles more or less prominently developed, much longer than broad. Frontal tubercles somewhat exceed vertex; antennae longer than body. Cauda, knobbed; anal plate indented slightly. Wing venation normal. Oviparous female with ovipositor elongated.

KEY TO THE GENERA OF THE SUBTRIBE DREPANOSIPHINA

1. Cornicle swollen at base (p. 121).....*Drepanaphis*
- Cornicle not swollen at base (Not taken in region). *Drepanosiphum*

Subtribe *Drepanosiphina*Genus *DREPANAPHIS* Gel Guercio

Del Guercio, 1909b:49; Baker, 1920a:31; Smith, 1941:226; Palmer, 1952:85.

This genus is characterized by elongate cornicles, over twice as long as broad; somewhat swollen at base. Cauda knobbed; anal plate indented in viviparae. Frontal tubercles distinct; antennae bearing minute hairs. First femur stout compared to second and third. Elongate ovipositor in oviparae; fundatrix alate. Found on leaves of trees.

Genus type (monotypical), *Siphonophora acerifolii* Thomas.

KEY TO THE SPECIES OF THE GENUS *DREPANAPHIS*

1. Dorsal tubercles on abdominal I developed into finger-like projections (Fig. 149)..... 2
- Dorsal tubercles on abdominal I underdeveloped..... 4
2. Dorsal tubercles on abdominal I, II, and III not all same size (Fig. 149)..... 3
- Dorsal tubercles on abdominal I, II, and III all the same size (Not taken in region)..... *granovskyi*
3. Dorsal tubercles on I and III nearly the same length and diameter..... 1. *acerifolii*
- Dorsal tubercles on I and III not of the same length or diameter; I shorter and smaller than III..... 2. *parvus*
4. Dorsal tubercles on abdominal III .22-.30 long, united more than halfway (Not taken in region)..... *spicatum*
- Dorsal tubercles on abdominal III .07-.12 long, united very shallowly, less than halfway..... 3. *utahensis*

Subtribe **Drepanosiphina**1. Genotype *Drepanaphis acerifolii* (Thomas)

The Maple Aphid

Figs. 33, 34, 134, 138, 149, 151

Siphonophora acerifolii, Thomas, 1877:4.*Drepanaphis acerifolii*, Baker, 1923:286; Hottes and Frison, 1931a: 246.

(Description of sexuals); Gillette and Palmer, 1931:912; Palmer, 1952:86.

Mostly alatae were found with a few light yellow colored immaturae on the undersurface of leaves, both actively feeding (Fig. 33). The alatae were of brown color speckled with white and with white flocculence exuding from the abdomen, which bore dorsal spines. The eyes were conspicuously crimson colored. The colonies were generally scattered over the leaf surface, not compacted into a dense mass and were fairly active when disturbed (Fig. 34), which made them difficult to photograph. Hottes and Frison (1931a:246) states that the species is monophagous appearing in early spring and producing sexual forms in the fall. The walks beneath infested trees are kept moist by the falling of honey-dew. Most maples in the area of Antigonish were heavily infested, although similar hosts in more wooded situations were not infested or only lightly so. Descriptions of this species are found in Sanborn (1904); Patch (1923b); Hottes and Frison (1931a) and Palmer (1952).

Collections: On underside of leaves of *Acer saccharinum* L. (silver maple). HALIFAX COUNTY, Kearney Lake, June 14, 1949; ANTI-GONISH COUNTY, Antigonish, August 18, 1951; GUYSBOROUGH COUNTY, Melrose, July 16, 1953. Taken annually (1950-53) on same trees on St. Francis Xavier Campus, Antigonish, Nova Scotia. (304, 534, 835).

Subtribe **Drepanosiphina**2. *Drepanaphis parvus* (Smith)

Fig. 31

Smith, 1941; Smith and Knowlton, 1943.

Both alate and apterous forms of this light green species were found in scattered colonies on the underside of the terminal leaves of red maple, causing them to form a type of loose pseudo-

gall (Fig. 31). The leaves bend downward at the petiole attachment and the sides of the leaves curl inward forming a loose hemisphere. The edges of the leaves were dead, turning a dark brown color. By mid-July this species had left this host. Descriptions for the species of the genus *Drepanaphis* are found in Smith (1941) and Smith and Knowlton (1943).

Collections: On the underside of leaves in pseudo-galls of *Acer rubrum* L. ANTIGONISH COUNTY, Antigonish, June 20, 1952 (613). Not common.

Subtribe **Drepanosiphina**

3. *Drepanaphis utahensis* Knowlton and Smith

Fig. 32

Drepanaphis utahensis Knowlton and Smith, 1943:174.

The infestation of this species is similar in type to that of *D. acerifolii* on silver maple, occurring in scattered colonies on the undersurface of the leaves of sugar maple (Fig. 32). However, it was much more abundant, every leaf within reach being heavily infested. The upper surface of all leaves was covered with honey-dew exudate from the aphids on the leaves above them. Alatae and all stages of nymphal development occurred together. The thorax of the alatae is dark, but covered with a whitish powdery secretion. The fore wings show the presence of fuscous markings along tips of veins, base of radius and border of stigma; the base of the hamuli of the hind wings is also marked with fuscous. Nymphal forms are light yellow in color and rather translucent.

Collections: On underside of leaves of *Acer saccharum* Marsh. ANTIGONISH COUNTY, Antigonish, August 22, 1951 (535); June 20, 1952 (612a); August 26, 1952 (702), all on the same host.

Tribe **PANAPHINI**

Subtribe **Panaphina** Palmer

Callipterina Baker, 1920a:25.

Panaphina Palmer, 1952:62.

There are a number of interesting characters which tie the members of this subtribe together. For one thing, the species are usually solitary, though smaller species may colonize.

They live on the bark and leaves of plants and are active when disturbed. Apterous viviparous females other than fundatrix, are not produced in some genera, males are alate, oviparae apterous. Cornicles are truncate, short, nonreticulated; may be rim or pore. Cauda usually knobbed, rounded, or rarely elongate. Anal plate usually indented or bilobed. Forewing with media twice-branched, but with radial sector usually indistinct or absent; wings often cloudy with fuscous, mottled or banded. Capitate hairs often found on apterae; spines and tubercles frequently found on body. Antennae 6-segmented, sensoria circular to elongate, segments with setae or spines. Six genera are represented in collections from Nova Scotia.

KEY TO THE GENERA OF THE SUBTRIBE PANAPHINA
(CALLIPTERINA BAKER)

(Modified after Palmer, 1952:63)

1. Frontal tubercle not exceeding vertex 2
- Frontal tubercle exceeding vertex 3
2. Anal plate distinctly divided or bilobed (Fig. 176) (p. 131) . **Myzocallis**
- Anal plate only slightly indented or entire (p. 138) . . **Neosymydobius**
3. Hairs capitate in alatae (p. 126) **Cepogilletta**
- Hairs not capitate in alatae 4
4. Secondary sensoria circular or oval (Fig. 137), hairs capitate or pointed 5
- Secondary sensoria transverse, more or less narrow; hairs minute and not capitate even in apterae (Fig. 145) (p. 127) . . . **Euceraphis**
5. Cornicle not on mammiform base; hairs capitate in nymph and apterae (p. 124) **Calaphis**
- Cornicle on mammiform base; hairs short, not capitate in apterae pp. 142) **Oestlundia**

Subtribe **Panaphina**

Genus **CALAPHIS** Walsh

Fig. 40

Walsh, 1862:301; Baker, 1920a:26; Palmer, 1952:63.

The members of this genus may be characterized by possessing secondary sensoria on antennal III, circular or oval; permanent sensorium at base of unguis oval and ciliated; antennae longer than body; unguis much longer than base of VI. Cornicle not on mammiform base, but short and truncate.

Cauda knobbed; anal plate bilobed at least in viviparae. Fore-wing with veins smoky; media twice-branched; radial sector faint or absent. Frontal tubercles developed beyond vertex. Living on foliage more or less solitary. Only one species found in Nova Scotia.

Genus type (monotypical). *Calaphis betulella* Walsh.

Subtribe **Panaphina**

Calaphis betulaecolens (Fitch)

Fig. 137

Aphis betulaecolens Fitch, 1851:66.

Calaphis betulaecolens (Fitch). Davis, 1909a:30-42; Baker, 1916b: 184-189; Hottes and Frison, 1931a:244; Palmer, 1952:65 (Footnote): MacGillivray and Spicer, 1953:428.

The apterous agamic forms of this species are light yellowish-green and translucent. They occur in scattered colonies in isolated configurations on the underside of leaves of *Betula* sp. similar to that shown in figure 40. This species was also taken from a mixed infestation, one containing *Euceraphis deducta* Baker; the other *Euceraphis betulae* (Koch). No particularly apparent damage was evident on the host plant leaves other than a slight wilting effect. In some cases, practically every leaf was so infested, which in such instances, would certainly affect the thriftiness of the tree.

Alate viviparous females are described as follows from material collected: head and thorax orange; yellow to brownish-yellow; abdomen pale, rather translucent yellowish-green, sometimes with woolly flocculence on dorsum. Wing veins bordered with fuscous, especially at marginal tip; radial sector faint becoming dark at wing edge. Frontal tubercles prominent. Anal plate pale yellow, indented slightly. Cauda pale, knobbed, with 3 or 4 pairs pointed hairs. Cornicles (.12) truncate, short with slight medial constrictions, poorly flanged. Rostral IV and V (.16) rather slim and pointed, extending to second coxae. Appendages with distal halves of tibiae dusky; hind tarsi II (.16) dusky. Width of head through eyes (.56); ocular tubercles present. Antennal III (1.26) with 15 oval sensoria; IV (.83); V (.69); base of VI (.27) with ciliated circular sensorium; unguis (.73); antennal hairs pointed, shorter than diameter of segment bearing them.

Distal halves of antennal III, IV, V dusky; proximal halves pale yellow. Apterous agamic females similar to *alatae* in measurements and coloration.

MacGillivray and Spicer (1953:428) list 3 braconids and one pteromalid wasp as parasitizing this aphid species in New Brunswick. Similar parasites would be expected in the adjoining province of Nova Scotia, though no work along this line has been attempted as yet.

Collections: Scattered on underside of leaves of the following hosts:

On *Betula lutea* Michx. (yellow birch). PICTOU COUNTY, Green-Hill, July 5, 1952 (628).

On *Betula papyrifera* Marsh (white, paper birch). GUYSBOROUGH COUNTY, Larry's River, July 18, 1953 (854a). INVERNESS COUNTY, Glendale, August 15, 1953 (912).

On *Betula populifolia* (wire birch). INVERNESS COUNTY, Margaree, July 16, 1951 (512a). HALIFAX COUNTY, Sandy Lake, June 29, 1949 (318.1).

Subtribe **Panaphina**

Genus **CEPEGILLETTEA** Granovsky

Granovsky, 1928b:113-119; Hottes and Frison, 1931a:246 (list).

Description for genus unavailable. Only one species taken in Nova Scotia.

Subtribe **Panaphina**

Cepegilletea myricae (Patch)

Calaphis myricae Patch (In Britton, 1923:275).

Cepegilletea myricae (Patch), Granovsky, 1928b:113-119.

A young apterous colony of olive-green colored aphids of this species was found scattered on the underside of leaves of the sweet fern, moving very quickly when disturbed. No *alatae* were present but two developed in cans in the laboratory two days later. This is the only recorded instance of taking this aphid in Nova Scotia. Hosts of this type however, have not been examined as frequently as trees and shrubs. Apparently the life history is unknown.

The alate females have prominent frontal tubercles, inner margins approximately length of antennal I. Veins of fore wings bordered with light brown fuscous; radial sector absent, otherwise venation normal. Antennal VI (.20) with from 18-24 sensoria in nearly straight row, in center of segment. Antennal IV (.14), V (.12), base of VI (.04) and unguis (.17). Cauda knobbed, spatulate, and as long as cornicle, with long hairs on spatulate knob. Apteræ with capitate hairs; antennal III with 15-20 circular sensoria in straight row. For further descriptive data see Patch (In Britton 1923:275).

Collections: On underside of leaves in scattered colonies on *Comptonia peregrina* (Linn.) Coulter (sweet fern). LUNENBURG COUNTY, Spondu Lake, August 12, 1952 (696).

Subtribe **Panaphina**

Genus **EUCERAPHIS** Walker

Walker, 1870:2001; Baker, 1920a:28 (Synonymy); Theobald, 1927:372; Palmer, 1952:68.

The species of this genus are characterized by the possession of well developed frontal tubercles; six-segmented antennae, longer than body and with narrow to transverse sensoria on III located near the base; unguis about equal to base of VI; sensorium at base of VI ciliated. Wings with normal venation. Cornicles short and truncate; cauda usually knobbed and rather large; anal plate entire to slightly indented. Body hairs pointed in all forms. Forms usually large, solitary, living on leaves and twigs of trees. Sexes similar to other forms. Three species taken in Nova Scotia.

Genus type (set by Walker, 1870), *Aphis betulæ* Linn. (Syn. *Callipterus betulæ* Koch).

KEY TO THE SPECIES OF THE GENUS EUCERAPHIS

1. Unguis (antennal filament) nearly equal to base of VI (two-thirds or longer).....1. **betulæ**
- Unguis shorter than base of VI (not longer than two-thirds of base) . . . 2
2. Unguis approximately one-half length of base of VI; antennal III (1.5) is three times width of head through eyes.....3. **gillettei**
- Unguis approximately one-third length base of VI; antennal III (2.2) is four times width of head through eyes.....2. **deducta**

Subtribe **Panaphina**1. *Euceraphis betulae* (Koch)

The European Birch Aphid

Fig. 45, 115, 145, 184

Callipterus betulae Koch, 1855:217; Buckton, 1881:15.*Euceraphis betulae* (Koch), Gillette, 1910:371; Baker, 1917a:425; Theobald, 1927:373; Palmer, 1952:68; MacGillivray and Spicer, 1953:429.

This rather large yellowish-green aphid has been taken on four species of birch, but is present on *Betula lutea* Michx. more frequently than other species. It is often found together with the closely related species, *E. gillettei* Davidson and *E. deducta* Baker. In fact, when collecting samples from host trees it is impossible to distinguish between these three species. Only after the material is mounted and then microscopically examined can any difference be observed, and even then, these differences are to be questioned as to whether they are significant, or merely possible variations within a large species complex. Palmer (1952:69) when describing *E. gillettei* Davidson points out that "this species may be a variety of *E. betulae* (Koch), being separated apparently by the shorter unguis in proportion to base of VI (not exceeding one-third of the length of base of VI, while in *E. betulae* the unguis exceeds one-third of the base of VI). However, the variations merge together." This last statement agrees with the findings of material in Nova Scotia.

Comparative checks with the number, distribution and kind of sensoria on antennal III merge, ranging from 16-24 in all three varieties. The length of rostral IV and V overlap. Within a series of mounted specimens, the relative length of unguis to base of VI ranges from one possible proportion to another. Because of these apparent similarities all specimens are called *E. betulae*, unless clearly meeting the extremes represented in the other two species as indicated in key to species above. One case in point was a collection from *Betula papyrifera* Marsh (455a) in which most of the individuals in the colony were *E. betulae* (Koch), but some varied to become *E. gillettei* Davidson.

The nymphs tend to colonize on the underside of birch leaves forming a woolly mass. The leaves curling upward

between the principle veins and becoming discolored. Alatae are solitary, usually also on the underside of leaves and are very active when disturbed. One alate viviparous female (Fig. 45) shows the characteristic woolly body covering, fuzzy legs and antennae. Theobald (1927:376) states that apterous viviparae are not known in the species, which is a rather peculiar variation in the typical aphid life cycle. The sexuales, described by Theobald (op.cit.) and Palmer (1952:68), occur in numbers late in November. Hottes and Frison (1931a:249) indicate that because of the extensive records concerning this species across North America, *E. betulae* is likely to be found wherever its host grows as a native tree.

Alate viviparous forms have head and thoracic lobes brown; prothorax and abdomen yellowish-green, sometimes with black dorsal bands on abdominal IV and V; more or less completely covered by a woolly substance. Cornicles short, greenish, with apex dusky. Cauda knobbed, greenish, about equal in length to cornicle. Anal plate pale, slightly emarginate. Antennae longer than body, with from 18-24 transverse sensoria near base of III, longest antennal segment (2.2), almost equal to IV and V. Body length from 2.7 to 3. Rostral IV and V (.14) and reaching between first and second coxae. For complete descriptions of all forms with figures see Theobald (1927:373) and Palmer (1952:68).

MacGillivray and Spicer (1953:429) list one species of braconid wasp as parasitic on this aphid in New Brunswick. None have been observed from Nova Scotia, nor have predators been found feeding on these apids. Often, however, ants have been in attendance.

Collections: Scattered on underside of leaves of the host, more or less solitary, usually dropping when disturbed. Usually plentiful when found, but very scattered in occurrence throughout region.

On *Betula alba* Linn. (white birch). KINGS COUNTY, Wolfville, June 30, 1948 (3a).

On *Betula lutea* Michx. (yellow birch). HALIFAX COUNTY, Kearney Lake, June 14, 1949 (307). ANTIGONISH COUNTY, Jintown, August 12, 1950 (466). VICTORIA COUNTY, New Harris, July 16, 1951 (466.1). INVERNESS COUNTY, Route 19 (Margaree), July 16, 1951 (512b).

On *Betula papyrifera* Marsh (paper birch). ANTIGONISH COUNTY, Crystal Cliffs, July 24, 1950 (455a).

On *Betula populifolia* Michx. (wire birch). HALIFAX COUNTY, Rocky Lake, July 21, 1949 (339a). INVERNESS COUNTY, Route 19, (Margaree), July 16, 1951 (512b).

Subtribe **Panaphina**2. *Euceraphis deducta* Baker

The Birch Aphid

Euceraphis deducta Baker, 1917a:429; Britton, 1923:279.

This species is considered as a variant of *E. betulae* (Koch). It occurs on the same hosts and in similar locations of the underside of leaves and often is mixed in with *E. betulae* in the same colony. It is here considered distinct on the basis that the unguis is approximately one-third the length of base of VI; and antennal III (2.2) is about 4 times width of head (.52) through the eyes. Body coloration and habits similar to *E. betulae*. Not common in region.

Collections: On underside of leaves of *Betula* spp. as follows:

On *Betula lutea* Michx. (yellow birch). HALIFAX COUNTY, Sandy Lake, July 6, 1949 (322.1), (324b).

On *Betula populifolia* Michx. (wire birch). HALIFAX COUNTY, Sandy Lake, June 29, 1949 (318).

Subtribe **Panaphina**3. *Euceraphis gillettei* Davidson

The Birch Aphid

Euceraphis sp. Gillette, 1910:321.*Euceraphis gillettei* Davidson, 1915:421; van der Goot, 1913:69-155; Gillette and Palmer, 1931:904; Palmer, 1952:68.

This species occurs in the same situations as *E. betulae* and is considered by van der Goot (1913:69-155) and Gillette and Palmer (1931:905) to be a "variety of *E. betulae* (Koch)" and further that "that species appears to be quite variable and authorities differ as to characters." *E. gillettei* is here distinguished by usually having fewer sensoria on antennal III; unguis shorter, approximately one-half length of base of VI, and antennal III (1.5) is about three times width of head through the eyes. Any variants collected in Nova Scotia not meeting these criteria were called *E. betulae* (Koch).

Alatae have brownish head and thorax with abdomen yellowish-green usually covered with woolly flocculence, and showing presence of two pairs of wart-like dorsal tubercles. Other characters are as for the genus.

Collections: On the underside of leaves of *Betula* spp. *Alatae* solitary, apterous nymphs usually more or less colonial as follows:

On *Betula alba* Linn. (white birch). HALIFAX COUNTY, Rocky Lake, July 21, 1949 (342).

On *Betula lutea* Michx. (yellow birch). HALIFAX COUNTY, Sandy Lake, July 6, 1949 (322), (324a). ANTIGONISH COUNTY, Antigonish, August 26, 1953 (924).

On *Betula papyrifera* Marsh. (paper birch). HALIFAX COUNTY, French Village, July 7, 1949 (326), (327). ANTIGONISH COUNTY, Antigonish, August 26, 1953 (924).

On *Betula populifolia* Michx. (wire birch). HALIFAX COUNTY, Mill Lake, July 8, 1949 (330a). ANTIGONISH COUNTY, Crystal Cliffs, July 24, 1950 (455b). PICTOU COUNTY, Green Hill, July 5, 1952 (629a).

On *Fagus grandifolia* Ehrh. (beech). Mixed colony in which was found *Phyllaphis fagi* (Linn.) and many *E. gillettei* Davidson. The latter is errant to *Fagus* sp., and may have been in transit. HALIFAX COUNTY, Kearney Lake, July 20, 1949 (335).

Subtribe Panaphina

Genus MYZOCALLIS Passerini

Passerini, 1860:28; Baker, 1920a:29 (synonymy); Palmer, 1952:70.

The species of this genus are characterized by possessing fore-wings with radial sector usually faint, remaining venation normal. Antennae with minute hairs; unguis greater than half length base of VI. Apteræ and nymphs with capitate hairs; inconspicuous and pointed in alatae. Cornicles truncate with distinct neck, and on widened base. Cauda knobbed; anal plate bilobed, not divided. Somewhat obtuse rostrum. Frontal tubercles not well developed, but vertex in alatae usually produced forward. Found living on leaves of hosts. Five species taken in Nova Scotia.

Genus type (fixed by Passerini, 1860), *Aphis coryli* Goeze.

KEY TO THE SPECIES OF THE GENUS MYZOCALLIS

1. Unguis longer than base of antennal VI; wings clear, veins not bordered with fuscous; or only very slightly so. 2
- Unguis same as or shorter than base of antennal VI; wing veins bordered with fuscous. 3
2. Vertex produced slightly beyond inner margins of antennal tubercles; wings clear, not bordered with fuscous, small stigmal spot brown; hind tibia (.8-1); rostral IV and V (.13-.14) rather pointed

- 3. **coryli**
- Vertex produced about equal to inner margins of antennal tubercles; wings with costal region lightly bordered with fuscous, veins not bordered; hind tibia (.42); rostral IV and V (.06) blunt. .5. **walshii**
3. Unguis about same length as base of antennal VI; 4-6 circular or oval secondary sensoria on antennal III spaced near middle or proximal two-thirds of segment; wings heavily bordered with fuscous, or on costal margin, stigma and wing tip..... 4
- Unguis shorter than base of antennal VI; 12-16 oval to transverse secondary sensoria at base of segment; wings with fuscous at marginal ends of veins and along costal region..... 4. **tiliae**
4. Antennal III with 3-4 circular secondary sensoria near middle of segment (Fig. 140); hairs on antennae pointed (.01); frontal tubercles developed slightly beyond produced vertex..... 1. **alnifoliae**
- Antennal III with 4-5 oval secondary sensoria, well spaced in proximal two-thirds of segment; hairs on antennae capitate (.023); frontal tubercles about even with produced vertex..... 2. **bella**

Subtribe **Panaphina**

1. *Myzocallis alnifoliae* (Fitch)

Figs. 77, 127, 140, 167

Lachnus alnifoliae Fitch, 1851:67.

Myzocallis alnifoliae (Fitch), Granovsky, 1928a:546 (desc.); Hottes and Frison, 1931a:256 (list).

These small light-yellowish aphids are usually found scattered on the underside of leaves resting in the angles between the median and radial leaf veins of *Alnus* sp. (Fig. 77), and occasionally they infest hazelnut in a similar fashion. Because of their small size and scattered location, they do not appear to produce too much damage, though when a host is attacked, most of the leaves on it become so infested, thus to produce a total effect which must result in some debilitation to the host. Hottes and Frison (1931a:256) report taking it in Illinois and was found "to be exceedingly abundant on the underside of leaves of alder (*Alnus* sp.)." In Nova Scotia the species is not too common, but crops up here and there on the hosts mentioned above.

Alate viviparae are described from material taken as follows: body color light yellowish-green to light green; eyes red with red ocular tubercles. Wings with veins bordered with fuscous especially near proximal ends; radial sector faint;

media twice-branched. Frontal tubercles slightly developed beyond vertex. Body length 1.6 Antennae (1.77) with distal ends of III-VI black; 4 circular sensoria on III near middle; unguis (.144), base of VI (.136). Cornicle (.08) truncate with base wider than black tip. Cauda (.12) knobbed with long spines. Anal plate deeply cleft, 2-lobed and with numerous spines. Rostral IV and V (.11) extends slightly beyond first coxae, rather blunt. Hind tibia (.1) with hairs (.028) pointed, less than diameter of segment; hairs on antennae, very short (.01) and pointed, Granovsky (1928a:546) describes all forms with figures, and summarizes present known distribution.

Collections: On underside of leaves scattered along mid-vein and radial leaf vein of host. Sporadic in occurrence but more common in central part of province.

On *Alnus* B. Ehrh. supp. (alder). COLCHESTER COUNTY, Harmony, July 21, 1948 (89). KINGS COUNTY, White Rock, July 23, 1948 (96), North Mountain Lookoff, August 23, 1948 (75p). HALIFAX COUNTY, Kearney Lake, June 4, 1949 (308). ANTIGONISH COUNTY, Jimtown, August 19, 1950 (473). INVERNESS COUNTY, Port Hastings, August 13, 1951 (528).

On *Corylus cornuta* Marsh (hazelnut). LUNENBURG COUNTY, Spondu Lake, August 8, 1952 (672).

Subtribe **Panaphina**

2. *Myzocallis bella* (Walsh)

Figs. 78, 114

Aphis bella Walsh, 1862:299.

Myzocallis bella (Walsh), Davis, 1910d:407; Hottes and Frison, 1931a:257.

This small greenish-yellow aphid is found scattered along the mid-rib region on the underside of leaves of Oak (Fig. 78). In the few cases found both alate and apterous forms were present. At no time was the infestation severe and on a given host only a few leaves were found infested; the damage, therefore, appears to be rather slight. All forms are exceedingly active and immediately crawl to other side of leaf when disturbed, or alatae may fly. The species has been found only three times in three different years. Oaks are not too abundant in Nova Scotia, perhaps accounting for the scarcity of this aphid species.