

# LIFE HISTORY OF MACROSIPHUM ILLINOISENSIS, THE GRAPEVINE APHIS

BY A. C. BAKER,

*Entomological Assistant, Deciduous Fruit Insect Investigations, Bureau of Entomology,  
United States Department of Agriculture.*

## INTRODUCTION

A brief note recording the alternation in food plants by this species was published by Baker and Turner in 1915<sup>1</sup>. No complete account of the different forms, however, is at present in the literature. It seems best, therefore, in view of the economic importance of the insect, to record briefly the results of some more recent studies and to give an account of all the forms of the species. A brief popular account of the life history has been given by Quaintance and Baker.<sup>2</sup>

## NAME

The insect under discussion was first described and named by Shimer<sup>3</sup> as *Aphis illinoiensis*. Later Thomas<sup>4</sup> described it as *Siphonophora viticola*. For many years Shimer's name was lost sight of, owing, no doubt, to the obscurity of its publication, and practically all of the references to the insect as a pest are found under the name "*viticola* Thos." Davis,<sup>5</sup> in listing the aphids of Illinois, called attention to Shimer's description and placed "*viticola* Thos." as a synonym of "*illinoiensis* Shimer."

## OCCURRENCE

The species occurs quite abundantly on wild grapes (*Vitis* spp.) in the more southern parts of the country and often is quite destructive to cultivated varieties (Pl. 8, C, D). Specimens have been received from the District of Columbia, Georgia, Indiana, Maryland, Missouri, Mississippi, North Carolina, New Jersey, New York, Oklahoma, Pennsylvania, Texas, and Virginia. What may also be the same species was taken on grape by F. Noack, at Campinas, Brazil, during September, 1898.

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<sup>1</sup> BAKER, A. C., and TURNER, W. F. THE BROWN GRAPE APHID. *In Science*, n. s. v. 41, no. 1066, p. 834. 1915.

<sup>2</sup> QUAINANCE, A. L., and BAKER, A. C. APHIDS INJURIOUS TO ORCHARD FRUITS, CURRANT, GOOSEBERRY, AND GRAPE. U. S. Dept. Agr. Farmers' Bul. 804, 42 p., 30 figs. 1917.

<sup>3</sup> SHIMER, HENRY. A NEW GRAPE APHIS. *In Prairie Farmer*, v. 34 (n. s. v. 18), no. 20, p. 316. 1866.

<sup>4</sup> THOMAS, CYRUS. SIPHONOPHORA VITICOLA THOS., THE GRAPE-INHABITING APHIS. *In his* Eighth report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, p. 55. 1879.

<sup>5</sup> DAVIS, J. J. A LIST OF THE APHIDIDAE OF ILLINOIS, WITH NOTES ON SOME OF THE SPECIES. *In Jour Econ. Ent.*, v. 3, no. 6, p. 486. 1910.

## EGGS

The eggs are polished black and are laid upon the twigs of *Viburnum prunifolium*. They are usually placed most thickly close around the buds, although when the plants are thickly infested they may be distributed more evenly over the twigs. The eggs hatch sometimes during quite cold weather in the third week in March, but the insects produced from these first-hatched eggs are sometimes killed by frosts. Hatching continues until the early part of April.

## STEM MOTHER

When first hatched, the stem mother is of a very dark greenish-brown color. The young aphids, on hatching, seek out the buds and begin feeding. Here they remain until the buds open, and when the flowers begin to open it is not uncommon to find them crowded down into the flower clusters. They feed upon the stems of the individual blossoms, and when the petals begin to show the presence of the aphids is often not noticeable. They also, however, feed upon the twigs and somewhat upon the leaves.

**FIRST INSTAR.**—Color dark greenish brown, the abdomen lighter than the other parts of the body. Appendages black, as is also the head; abdomen with a few rows of darker spots. Antennæ of three segments; segment III measuring 0.064 plus 0.08 mm. Cornicles very short and tuberculate, being about 0.016 mm. long.

Found feeding on the twigs of *Viburnum prunifolium*.

**SECOND INSTAR.**—Somewhat similar in color to the first instar, although of a more deep brown color rather than a greenish brown. Abdomen without apparent darker brown spots, but uniform brown. Appendages dusky to black. When first molted, the insects are an amber color. The empty skins are dusky. Antennæ of four or five segments; segment III, 0.08 mm.; IV, 0.06 mm.; V, 0.4 plus 0.08 mm.; cornicles, 0.05 mm.

Found in the same places as the first instar.

**THIRD INSTAR.**—Very similar in color to the second instar, although sometimes a little lighter. Antennæ of five segments; segment III, 0.112 mm.; IV, 0.08 mm.; V, 0.064 plus 0.112 mm.; cornicles, 0.064 mm..

Found in the same places as the earlier instars and also crowding down into the expanding buds.

**FOURTH INSTAR.**—Similar to the previous one in color. Antennæ of five segments; segment III, 0.16 mm.; IV, 0.08 mm.; V, 0.064 plus 0.112 mm.; cornicles, 0.112 mm.

**FIFTH INSTAR (ADULT).**—Color characters similar to those of the previous instars, but some of these forms are somewhat yellowish. Most of them, however, are a distinct reddish brown. Eyes deep brown, vertex dusky. Antennæ dusky, with the distal segment and the first two segments darker than the others. Legs similar in color to the antennæ, the tarsi and distal extremity of the tibiae dusky. Cornicles dark. Antennæ of five segments; segment III, 0.208 mm.; IV, 0.112 mm.; V, 0.064 plus 0.128 mm.; segments, particularly the distal one, distinctly imbricated, but without sensoria other than the usual ones. Cornicles 0.144 mm. long, without a distal flange, but with faint imbrications.

Found on the leaves, twigs, and flowers of *Viburnum prunifolium* L.

## SPRING MIGRANT

The spring migrants begin to appear in the second generation, although their number is not abundant until the third generation, and their production then gradually decreases for several generations. It is thus evident that the spring migration extends over a considerable period. It is at its height during the first week in May.

The spring migrants fly to wild grapes and to the grapes in vineyards. In Virginia, where the writer conducted his experiments, wild grapes often grew very close to the viburnums, and in some cases they even climbed over the viburnum bushes. In such cases migrants took grapes close at hand, although the vines in the viburnum bushes were not thickly infested. The migrants, however, are capable of rather extended flight, having been noted on grapes about a mile distant from the nearest viburnum bushes. It would appear that the first migrants developed take to the wild grapes in the vicinity of the viburnums, for the first migrant discovered upon the cultivated grapes was taken on April 28. This is considerably later than their first appearance. By May 1 this specimen had produced many young upon the grape, whereas the bulk of the migrants had not yet made their appearance.

**FOURTH INSTAR (PUPA).**—General color reddish brown, the wing pads, legs, and cornicles dark; eyes black. Antennæ yellowish brown with the distal segments dusky. Antennæ of six segments; segment III, 0.304 mm.; IV, 0.24 mm.; V, 0.208 mm.; VI, 0.096 plus 0.32 mm.; cornicles tapering, distinctly imbricated, and 0.336 mm. long. Length from vertex to tip of cauda, 1.36 mm.

**FIFTH INSTAR (ADULT).**—Color a deep reddish brown, appendages and cornicles darker, the tibiae with a lighter median area; eyes black; wings with dusky veins and stigma. The antennæ are distinctly imbricated on all segments excepting I and II. Segment III armed with from 6 to 14 sensoria arranged in an uneven row on the basal three-fourths of the segment. In some cases the sensoria cover the entire segment. They are uneven in size, some being fairly large while others are quite small. The cornicles are somewhat tapering, very distinctly imbricated, and with distal extremity not distinctly flanged. Cauda about half the length of the cornicles. Length of fore wing, 2.4 mm.; length from vertex to tip of cauda, 1.328 mm. The relative lengths of the antennal segments and cornicles are given in Table I.

TABLE I.—Lengths (in millimeters) of antennal segments and cornicles of spring migrant of *Macrosiphum illinoisensis*, with host, and number of sensoria on antennal segment III

Date.	Host.	Segment III.	Number of sensoria on segment III.	Segment IV.	Segment V.	Segment VI.	Cornicles.
Apr. 28	Viburnum.....	0.432	13	0.336	0.272	0.096+0.32	0.368
Do.	do.....	.416	7	.352	.304	.112+.32	.4
Do.	do.....	.368	7	.32	.256	.112+.304	.352
Do.	do.....	.288	7	.32	.272	.112+.336	.352
May 1	Grape.....	.352	8	.304	.272	.096+.352	.336
May 4	do.....	.336	10	.288	.24	.096+.336	.416
May 5	do.....	.384	11	.336	.272	.112+.288	.368

## SUMMER WINGLESS VIVIPAROUS FEMALE

The summer wingless forms (Pl. 9, B, C) occur very abundantly throughout the summer. They reproduce very quickly during the early summer, so that seven generations have often reached maturity by the 1st of July. The wingless forms reach maturity a day or two before the winged forms of the same generation, so that during the season many more wingless generations are produced upon grape than there are of winged generations. The wingless insects vary considerably in size and color, sometimes being a distinct brown, while other specimens are deep black. They also vary considerably in size, the darker, smaller individuals occurring later in the summer. The number of young produced daily ranges from 6 to 10, and the insects live for three weeks or more.

The summer wingless and winged forms do considerable damage to the vines in some sections. They attack the growing clusters, sometimes thickly covering them, and the feeding of the insects causes the berries to drop. Some vines at Vienna, Va., which the writer had under observation produced scarcely any fruit owing to the attacks of the aphids. The berries dropped while still green and ranging in size from that of a pea to that of a small cherry. The fruit stems in nearly every case had become somewhat withered owing to the continued feeding of the insects. The young growing shoots and leaves are also very abundantly attacked, and when the aphids are numerous growth is more or less retarded. The most important injury, however, appears to be that caused to the fruit clusters.

FIFTH INSTAR (ADULT) (Pl. 9, C).—General color a deep reddish brown. Antennæ with the basal two segments and the distal segment dusky, the remaining segments yellowish brown, dusky at the joints; eyes black; hind legs and cornicles black, femora of the middle and fore legs and a band about their tibiæ yellowish brown, remainder black; cauda dusky. Length from vertex to tip of cauda, 1.272 mm. Measurements of the antennæ and cornicles as follows (Table II):

TABLE II.—Lengths (in millimeters) of the antennal segments and cornicles of the summer wingless vivipara of *Macrosiphum illinoisensis*

Generation.	Segment III.	Segment IV.	Segment V.	Segment VI.	Cornicles.
Third.....	0.4	0.32	0.256	0.096+0.256	0.48
Sixth.....	.416	.32	.272	.112+.336	.496
Seventh.....	.416	.288	.272	.112+.336	.48
Eighth.....	.464	.368	.224	.096+.352	.56

## INTERMEDIATE

Intermediates between the summer winged and the summer wingless forms have been found upon grape. These resemble more closely the winged form than they do the wingless one.

Thorax partially developed, some of the large wing muscles remaining. Wings represented by small pad-like structures about 0.4 mm. long. Antennæ and cornicles

practically like those of winged form, having a row of sensoria on segment III. Measurements of antennal segments average about as follows: Segment III, 0.432 mm. with about 9 sensoria; IV, 0.352 mm.; V, 0.256 mm.; VI, 0.096 plus 0.432 mm. Cornicles 0.495 mm.; length from vertex to tip of cauda, 1.92 mm.

#### SUMMER WINGED VIVIPAROUS FEMALE

Winged forms (Pl. 9, A, D) are produced in every generation from the second onward, but fewer winged line generations occur than wingless line generations. The winged forms show the same variations as the wingless ones, some specimens being large and light brown, while others are very small and black. The small dark forms occur during the hottest months of summer, while the large paler forms are usually met earlier in the spring. The winged forms produce an average of six young a day.

FIFTH INSTAR (ADULT) (Pl. 9, A).—General color dark brown. The color, however, varies greatly, some specimens being a deep black and others being almost of a yellowish color. Thorax black; eyes, hind legs, and cornicles black, middle and fore legs with yellowish bands around the segments and with the areas about the joints black. Wings hyalin, the veins and stigma dusky. Antennæ distinctly imbricated and with from 7 to 13 sensoria on segment III. Cornicles tapering, strongly imbricated, slightly curved and held outward from the body. Length of forewing, 2.72 mm.; length from vertex to tip of cauda, 1.44 mm. Relative lengths of antennal segments and cornicles given in Table III.

TABLE III.—Lengths (in millimeters) of antennal segments and cornicles of summer winged vivipara of *Macrosiphum illinoisensis*, with the number of sensoria on antennal segment III

Generation.	Segment III.	Number of sensoria on segment III.	Segment IV.	Segment V.	Segment VI.	Cornicles.
Third.....	0.416	11	0.32	0.304	0.144 + 0.384	0.4
Sixth.....	.4	8	.336	.272	.096 + .32	.4
Eighth.....	.352	13	.336	.24	.096 + .336	.384
Do.....	.272	7	.24	.208	.08 + .352	.32

#### FALL MIGRANT

The fall migrants are produced upon the grapes during the early part of October and are found upon the viburnum depositing young oviparous females during the second week in that month. They are somewhat different in general appearance from the summer forms, being lighter and smaller.

FIFTH INSTAR (ADULT).—General color reddish brown, rather pale as compared with the summer winged form. Thorax and sternal plate black; antennæ dusky; cornicles and hind legs black; anterior and middle legs yellowish brown, dusky at the joints; wings hyalin with dusky veins and stigma. Antennæ (Pl. 8, B) strongly imbricated, segments III, IV, and V with sensoria as indicated in Table III. Cornicles tapering, distinctly imbricated, and not enlarged on the distal tip. Cauda and anal plate black. Length of forewing, 2.7 mm.; length from vertex to tip of cauda, 1.44 mm.; measurements of antennal segments and cornicles given in Table IV.

TABLE IV.—Lengths (in millimeters) of antennal segments and cornicles of fall migrant of *Macrosiphum illinoisensis*, with number of sensoria on antennal segments III, IV, and V

Segment III.	Number of sensoria on segment III.	Segment IV.	Number of sensoria on segment IV.	Segment V.	Number of sensoria on segment V.	Segment VI.	Cornicles.
0.304	16	0.272	13	0.224	6	0.112 + 0.32	0.272
.384	28	.304	16	.288	8	.112 + .352	.352
.304	17	.256	18	.224	7	.096 + .336	.256

## MALE

The males are produced a little later than the fall migrants, but can be found flying at the same time and may be taken on the viburnums in company with the fall migrants. Thus they are on the trees in many cases before the oviparous females are mature. They remain feeding upon the leaves until such time as copulation is possible.

FIFTH INSTAR (ADULT).—General color a pale reddish brown, often, however, of a distinct greenish color. Appendages dusky; eyes black; wings hyaline with dusky veins and stigma. Antennæ (Pl. 8, A) distinctly imbricated and segments III, IV, and V irregularly covered with very many small circular sensoria. Cornicles short, distinctly tapering and imbricated. Forewing 2 mm. long; length from vertex to tip of cauda, 1.2 mm. Relative lengths of antennal segments and cornicles given in Table V.

TABLE V.—Lengths (in millimeters) of antennal segments and cornicles of male of *Macrosiphum illinoisensis*, with number of sensoria on antennal segments III, IV, and V

Segment III.	Number of sensoria on segment III.	Segment IV.	Number of sensoria on segment IV.	Segment V.	Number of sensoria on segment V.	Segment VI.	Cornicles.
0.336	31	0.272	29	0.224	15	0.08 + 0.32	0.176
.352	30	.256	27	.208	15	.08 + .336	.16
.288	38	.224	35	.176	19	.08 + .336	.144
.288	35	.224	28	.176	17	.08 + .352	.144

## OVI PAROUS FEMALE

The oviparous female is a small, dark reddish aphid produced during the early part of October on the viburnum. It feeds upon the twigs and may be found until frost kills all the insects. Each oviparous female lays three to six eggs close about the buds or occasionally scattered along the twigs.

FIRST INSTAR.—General color greenish brown, almost uniform, the appendages, however, a little darker. Antennæ of four segments; segment III, 0.08 mm.; IV, 0.032 plus 0.112 mm.; cornicles very small and tubercle-like. Length from vertex to tip of cauda, 0.48 mm.

SECOND INSTAR.—General color more reddish than the first instar, otherwise similar. Antennæ of four segments; segment III, 0.144 mm.; IV, 0.048 plus 0.16

mm. Cornicles cylindrical, often slightly tapering toward the tip. Eyes black. Length from vertex to tip of cauda, 0.64 mm.

THIRD INSTAR.—General color deep reddish brown with black eyes; antennæ dusky toward the tip and composed of five segments. Segment III, 0.112 mm.; IV, 0.064 mm.; V, 0.048 plus 0.192 mm. Cornicles 0.064 mm., somewhat tapering. Length from vertex to tip of cauda, 0.8 mm.

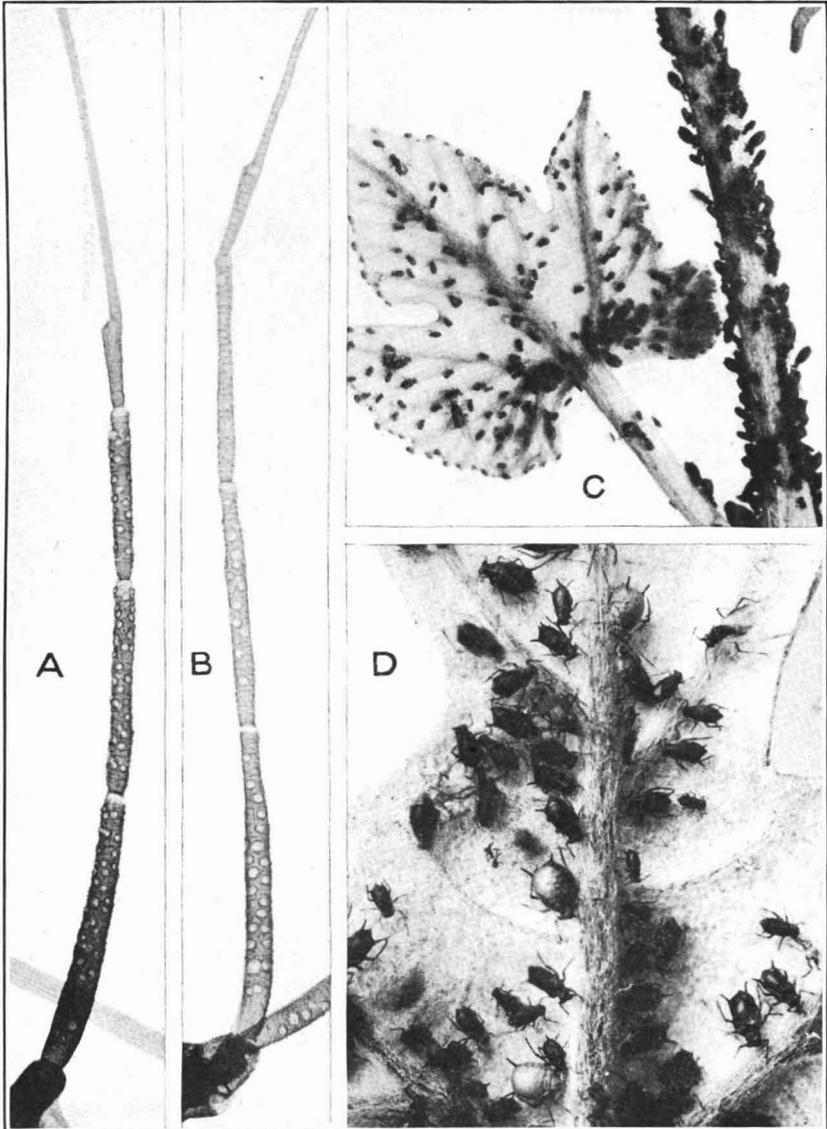
FOURTH INSTAR.—Color characters similar to those of the third instar, but somewhat lighter in general color. Antennæ of five segments. Segment III, 0.192 mm.; IV, 0.112 mm.; V, 0.08 plus 0.208 mm. Cornicles 0.96 mm., tapering, and rather broad. Hind tibia somewhat swollen. Length from vertex to tip of cauda, 0.96 mm.

FIFTH INSTAR (ADULT).—General color yellowish to reddish brown, eyes black; cauda and anal plate dusky; antennæ with the basal two segments and with the distal segment dusky; legs dusky, sometimes lighter on the median area of the tibiæ. Antennæ of six segments; segment III, 0.16 mm.; IV, 0.128 mm.; V, 0.128 mm.; VI, 0.08 plus 0.224 mm. All segments except the first two distinctly imbricated, no sensoria except the usual ones present. Cornicles distinctly tapering and imbricated, 0.096 mm. long, dusky in color; hind tibia somewhat swollen, 1.36 mm. long and armed with about 50 small, irregularly placed, circular sensoria. Length from vertex to tip of ovipositor, 1.44 mm.

PLATE 8

*Macrosiphum illinoisensis*:

- A.—Antenna of male.
- B.—Antenna of fall migrant.
- C.—Colony on grape leaf.
- D.—Colony on grape leaf, more enlarged.



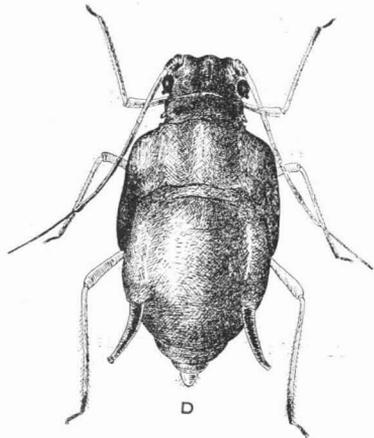
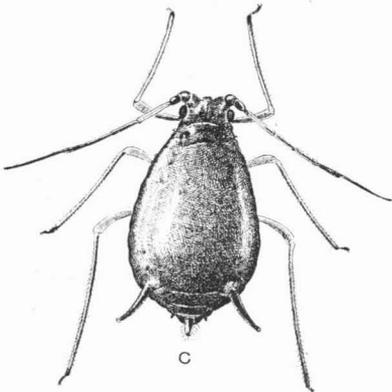
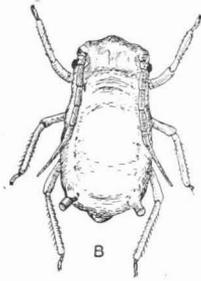
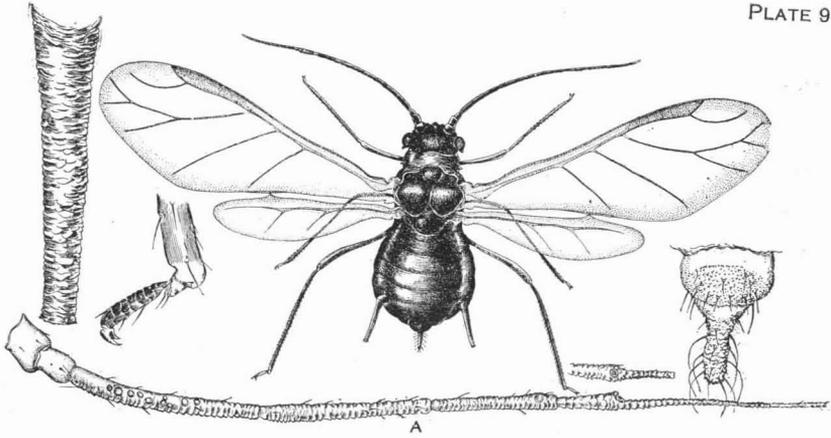


PLATE 9

*Macrosiphum illinoisensis*:

- A.—Summer winged viviparous female, and details.
- B.—Summer wingless viviparous female, first instar.
- C.—Summer wingless viviparous female, fifth instar or adult.
- D.—Pupa of summer winged viviparous female.