

HILGARDIA

*A Journal of Agricultural Science Published by
the California Agricultural Experiment Station*

VOLUME 18

SEPTEMBER, 1948

NUMBER 11

APHID TRANSMISSION OF CAULIFLOWER-MOSAIC VIRUS

HENRY H. P. SEVERIN and C. M. TOMPKINS

THE MOST IMPORTANT SPECIES OF APHIDS ATTACKING CRUCIFEROUS CROPS IN CALIFORNIA

E. O. ESSIG

UNIVERSITY OF CALIFORNIA • BERKELEY, CALIFORNIA

**THE MOST IMPORTANT SPECIES OF APHIDS
ATTACKING CRUCIFEROUS CROPS
IN CALIFORNIA**

E. O. ESSIG

THE MOST IMPORTANT SPECIES OF APHIDS ATTACKING CRUCIFEROUS CROPS IN CALIFORNIA¹

E. O. ESSIG²

APHIDS cause great damage to cruciferous crops—broccoli, brussels sprouts, cabbage, cauliflower, kale, mustard, radishes, turnips, and others. These insects weaken, stunt, and sometimes even kill the plants by sucking the juice. They may make cabbage, brussels sprouts, cauliflower, and broccoli wholly unfit for market, for it is difficult or impossible to remove them from the heads of such plants. On seed farms, they may completely destroy the plants before harvest by infesting the seedstalks. They cause even greater losses by transmitting plant viruses, which may destroy the plants over considerable areas.

Three aphid species that breed on these plants are responsible for most of the damage in California. These are the cabbage aphid, *Brevicoryne brassicae* (Linnaeus); the turnip or false cabbage aphid, *Rhopalosiphum pseudo-brassicae* (Davis); and the green peach aphid, *Myzus persicae* (Sulzer). All three species have become world wide in distribution and are to be found generally throughout the ranges of the host plants. This paper assembles the salient facts on their synonymy, characteristics, life histories, distribution, and host plants, as a basis for studies on their transmission of viruses and on their control.

THE CABBAGE APHID

Brevicoryne brassicae (Linnaeus) (Van der Goot, 1915, 1918)^{3, 4}

Aphis brassicae Linnaeus (1746, 1758)⁵

Aphis raphani Schrank (1801)⁶

Aphis insatidis Boyer de Fonscolombe (1841)⁷

Aphis floris-rapeae Curtis (1860, p. 69–83)⁸

The cabbage aphid, *Brevicoryne brassicae* (Linnaeus) is usually more abundant on cruciferous crops than any other aphid and is therefore more injurious.

The cabbage aphid can be distinguished from other aphids by the large closely crowded colonies (fig. 1), the white waxy powdery covering over the bodies of the alate and apterous individuals, and the cruciferous host plant.

¹ Paper received for publication June 20, 1947.

² Professor of Entomology and Entomologist in the Experiment Station.

³ See "Literature Consulted" for citations, referred to in the text by author and date.

⁴ The genus *Brevicoryne* was proposed by B. Das and erected by Van der Goot in 1915 (1915 and 1918).

⁵ First referred to by Linnaeus in 1746 (1746) and described by him in 1758 (1758).

⁶ A synonym erected by Schrank (1801) for an aphid feeding on cabbage in Bavaria, Germany.

⁷ A synonym collected in the Province of Aix, France, previous to 1841, was described by Boyer de Fonscolombe (1841).

⁸ This species was described by Curtis in 1860 (1860, p. 69–83) and called the turnip-flower plant louse. In this article Curtis lists the suggested control measures (tobacco decoctions, lime dust, hand-picking infested parts of plants) and discusses at length the insect predators and parasites of this aphid.

The turnip aphid has often been confused with this species; differences are discussed on pages 412–13.

Mounted specimens are readily distinguished by the long antennal segment III, which in the alates is covered with circular secondary sensoria; by the very short cornicles; the long slender tarsi; and the unguis, spur, or filament of the terminal antennal segment, which is four to five times as long as the base. Figures 2 and 3 show details of the male and three forms of females.

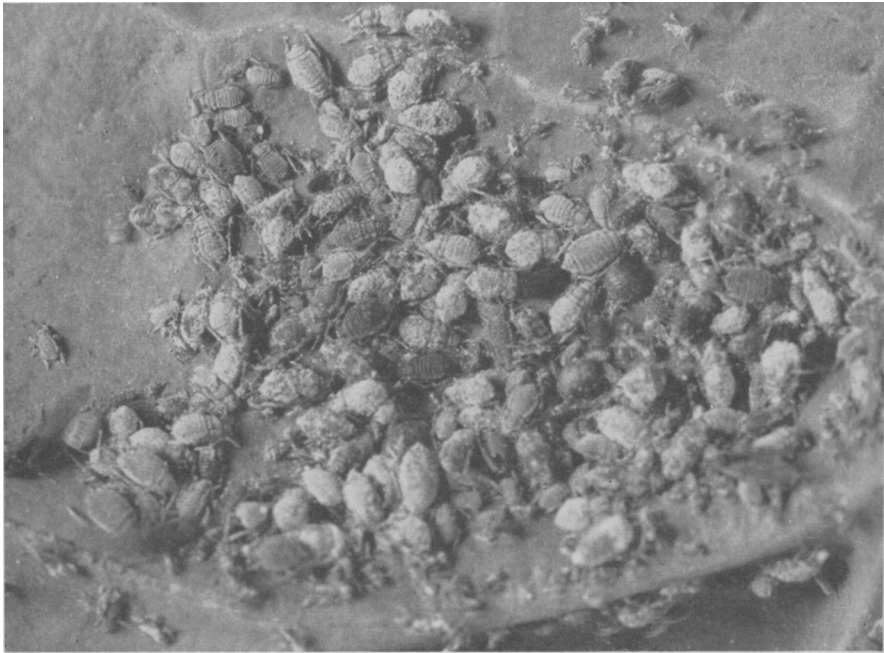


Fig. 1.—The cabbage aphid, *Brevicoryne brassicae* (Linn.): a typical colony on the underside of a cabbage leaf. The white powdery waxy covering is plainly shown on many individuals. ($\times 4$.)

Life History. In the warmer climates of the distribution of the cabbage aphid, there is continuous reproduction by parthenogenesis, and only apterous and alate parthenogenetic females occur. There may be as many as 30 or more generations during the year, so that extremely dense and destructive populations are built up. During the winter these populations may be slowed up and even reduced by cooler temperatures, rain, and other climatic factors. In California this aphid is found in prosperous colonies on wild mustard (*Brassica campestris*) and other native or weedy cruciferous plants. In summer and fall, many of the natural host plants disappear and the aphid is forced to cultivated crops, which may suffer severely from its attacks. Wherever summer rains occur, the native hosts continue to serve as reservoirs for feeding and breeding.

During spring—April and May—and fall—October and November—great numbers of winged migrants may be seen in California. They literally fill the air in certain areas along the foothills.

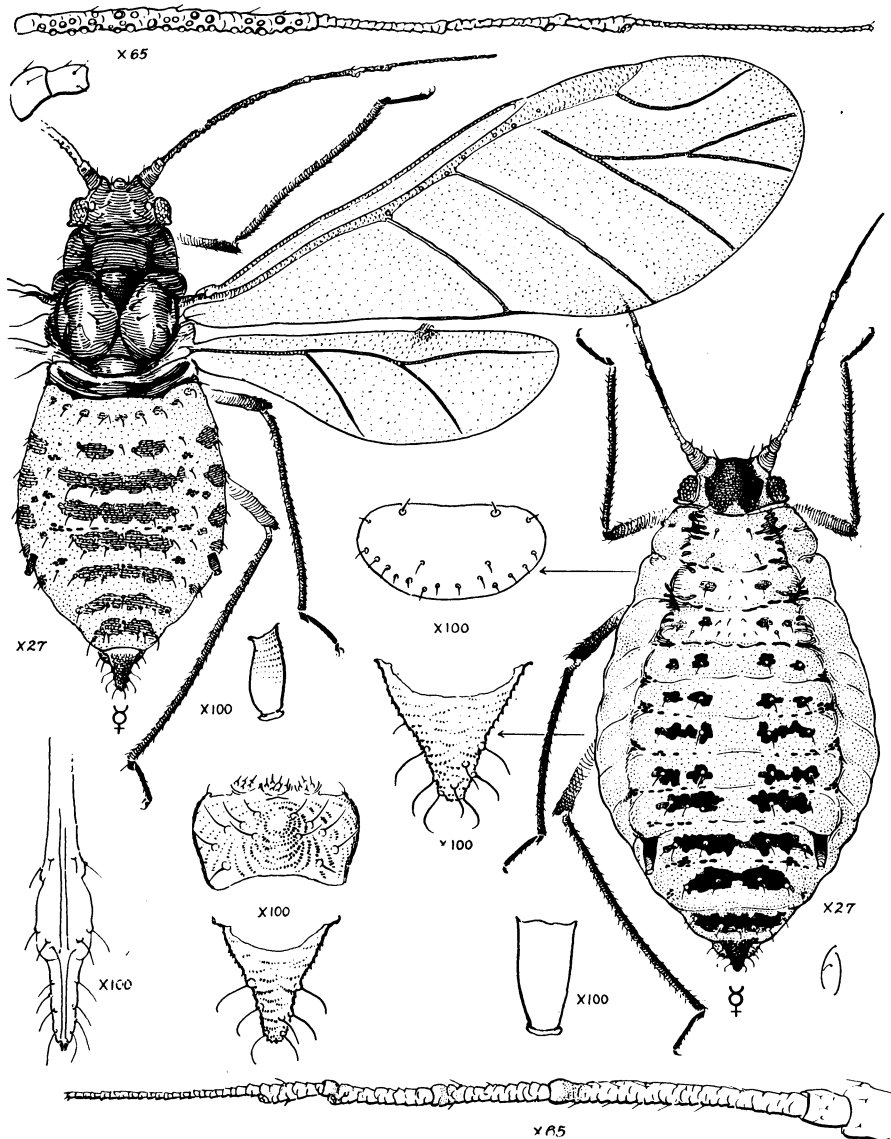


Fig. 2.—The cabbage aphid, *Brevicoryne brassicae* (Linn.): the alate and apterous viviparous females. The important body structures, including antennae, cornicles, anal plate, cauda, and tip of rostrum, used in identification, are greatly enlarged as indicated on the illustration. Note the long antennal segment III covered with sensoria and the long slender tarsi, which separate this aphid from others feeding on cruciferous plants. (Drawing by Frieda Abernathy.)

In the more northern reaches of its distribution, the spring and summer reproductives (migrants and alienicolae) are replaced in fall by sexuparae, or gynoparae. The sexuparae are apterous and alate viviparous parthenogenetic females that give birth to sexuales. Males and females of the sexuales (fig. 3)

mate, and the females lay eggs that survive the winter. Eggs of this aphid are usually laid on old stems or leaves of the cruciferous crops left in the fields. In northern Europe the eggs laid in October, November, and December hatch the following March, April, and May. Even in that climate a few adult viviparous females occasionally survive the winters, but ordinarily all of these perish,

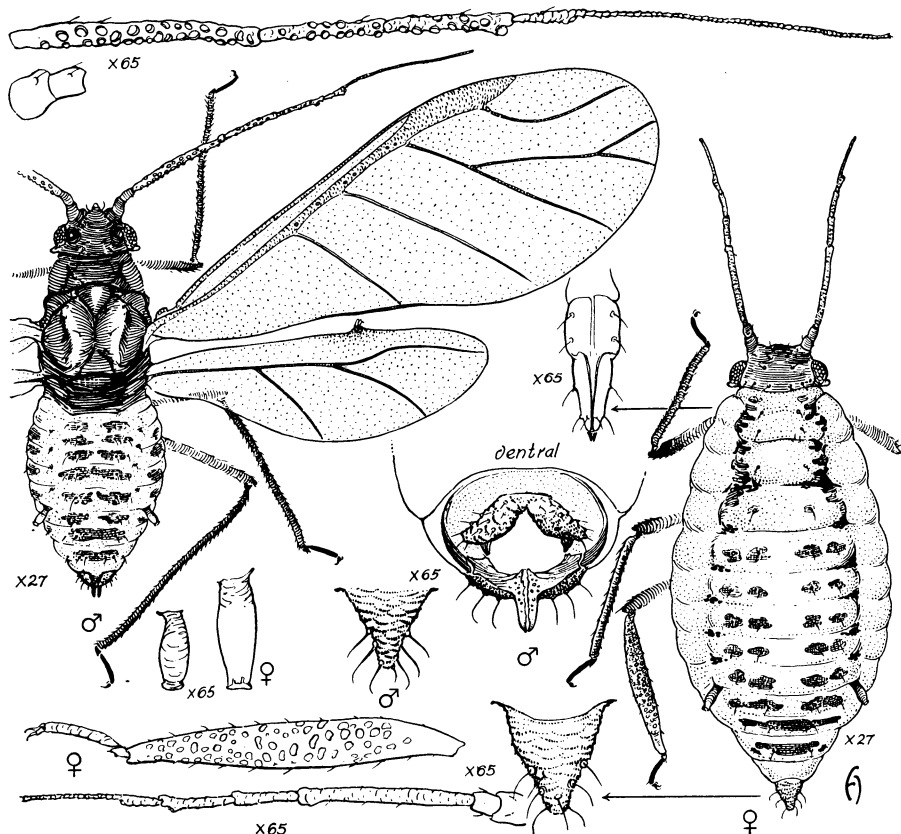


Fig. 3.—The cabbage aphid, *Brevicoryne brassicae* (Linn.): the alate male and the apterous oviparous female with important body structures used in identification greatly enlarged as indicated. The sensorialike structures on the swollen hind tibiae of the sexual female are characteristic of this sex. Note the numerous sensoria on antennal segments III, IV, and V of the alate male. (Drawing by Frieda Abernathy.)

and only the eggs remain to hatch in spring and give rise to the spring, summer, and fall colonies that are so destructive.

Host Plants. The host plants of the cabbage aphid belong almost entirely to the large, cosmopolitan family Cruciferae and include the following:

Arabiopsis thaliana

Arabis glabra

Barbarea vulgaris

Brassica adpressa

Brassica arvensis (*Sinapis*

arvensis)

Brassica caulorapa

Brassica chinensis

Brassica erucastrum (*Eru-*
castrum pollichii)

Brassica fruticulosa

Brassica hirta (*B. alba*)

Brassica juncea

Brassica juncea var. *cris-*
pifolia (*B. japonica*)

Brassica kaber (*B. cam-*
pestris)

Brassica muralis

<i>Brassica napobrassica</i>	<i>Cardamine hirsuta</i>	<i>Mathiola incana</i>
<i>Brassica napus</i>	<i>Cochlearia anglica</i> (C.	<i>Mimulus guttatus</i>
<i>Brassica nigra</i>	arctica)	<i>Myagrum perfoliatum</i>
<i>Brassica oleracea</i>	<i>Crambe</i> sp.	<i>Raphanus landra</i>
<i>Brassica oleracea</i> var.	<i>Diplotaxis tenuifolia</i>	<i>Raphanus maritimus</i>
<i>acephala</i>	<i>Eruca sativa</i>	<i>Raphanus raphanistrum</i>
<i>Brassica oleracea</i> var.	<i>Erucastrum obtusangulum</i>	<i>Raphanus sativus</i> var.
<i>gemmifera</i>	<i>Erysimum canescens</i>	<i>longipinnatus</i>
<i>Brassica pekinensis</i>	<i>Iberis</i> sp.	<i>Sinapis juncea</i> var. <i>napi-</i>
<i>Brassica rapa</i>	<i>Isatis tinctoria</i>	<i>formis</i> (<i>Brassica napi-</i>
<i>Bunias erucago</i>	<i>Lepidium amplexicaule</i>	<i>formis</i>)
<i>Cakile maritima</i> (C.	<i>Lepidium graminifolium</i>	<i>Sisymbrium officinale</i>
<i>edentula</i>)	<i>Lepidium ruderales</i> [sic]	<i>Sisymbrium sophia</i>
<i>Capsella bursa-pastoris</i>	<i>Lepidium sativum</i>	
<i>Capsicum frutescens</i> (C.	<i>Lunaria annua</i>	
<i>annuum</i>)	<i>Mathiola bicornis</i>	

Some other plants reported as hosts are very questionable. They may have been only resting places for the dispersing or migrating alates.

Origin and Distribution. The cabbage aphid is one of the commonest species to be found throughout the temperate and subtropical regions of the world. This wide distribution has no doubt been made possible by the very extensive distribution and abundance of its cruciferous host plants. The many vegetables, ornamental flowering plants, and economic weeds have been carried through commerce to all inhabited lands and have become adapted in all except the most extreme climates.

The cabbage aphid has no doubt been associated with cultivated cruciferous crops in certain areas ever since they were developed by man. Its exact place of origin may never be definitely established. However, this insect appears to have first been associated with host plants originating in the Palaearctic Region and was early reported on wild and cultivated plants in Europe. It probably occurred on cabbages and related host plants long before it was recorded in print. Frisch (1734) is credited as having first brought this aphid to the attention of the public in 1734 when he reported it from Germany, described its work, and presented drawings that aid in its identification.

So far as I am able to ascertain, the cabbage aphid does not appear to be a serious pest of cruciferous crops in Asia. It is rarely found in lists of destructive insects from that continental area. Wu (1935) in his *Catalogus Insectorum Sinensium* does not list this species. Recently Ying-Tou Mao⁹ reviewed Chinese literature on aphids thoroughly, but found the cabbage aphid reported only from Hangchow, Fukien, and Taiwan. This species was not included in any of several large collections of aphids I have received from China. The shortage of records may simply indicate a lack of intensive study of this insect in China. Still, it is especially significant in view of the fact that many of the most important and useful members of the cabbage family originated in that country. It may be a further indication of the possible origin of the cabbage aphid in Northwestern Europe, the home of the cabbage.

The species does appear to be quite widely distributed in Japan and has been reported by many entomologists in that country.

From the information at hand, it appears possible that the cabbage aphid

⁹ Ying-Tao Mao. A list of Chinese aphids and their host plants. Typewritten manuscript.

may have originated in Western Europe in association with wild or sea cabbage, charlock, cabbage, cauliflower, brussels sprouts, kale, and other wild and cultivated cruciferous plants. Its counterpart in Asia and the Pacific islands appears to be the turnip aphid.

It is hardly practical to list all or even the larger geographical units throughout the world, especially in Africa and South America, where the cabbage aphid has been found. The following list has been compiled from many sources:

Asia: Astrakhan, Bessarabia, China (Amoy, Hangchow, Hopei, Kiangsu, Taiwan), Iraq, India (Lahore), Japan (Fukuoka, Hokkaido, Morioka), Palestine, Siberia, Syria, Transcaucasia

Africa: Bengal, Cape of Good Hope, Egypt, Eritrea, Kenya, Madagascar, Mauritius, Morocco, Nairobi, Natal, Nyassaland, Orange Free State, Rhodesia, Transvaal

Australia: Queensland, New South Wales, South Australia, Tasmania

New Zealand

Europe: Belgium, Czechoslovakia, France, Germany, Great Britain, Holland, Ireland, Italy, Lettland, Malta, Norway, Poland, Serbia, Spain, Sweden, U.S.S.R.

North America: Canada (British Columbia, Ontario, Quebec, and other provinces), United States (every state), West Indies (Cuba, Puerto Rico, Santo Domingo), Bermuda, Guatemala, Mexico

South America: Argentina, Brazil, Chile, Colombia, Virgin Islands

South Pacific: Fiji, Hawaii

THE TURNIP APHID¹⁰

Rhopalosiphum pseudobrassicae (Davis)

Aphis pseudobrassicae Davis (1914, p. 231)

Lipaphis pseudobrassicae (Davis) (Mordvilko, 1928, p. 200)

Aphis mathiolellae Theobald (1918) (Hall, 1926, p. 24)

The turnip or false cabbage aphid is almost as destructive to cruciferous crops as is the cabbage aphid. It appears to have originated in Asia, where it has a wide distribution. It has apparently been introduced into many other countries and has become widely distributed in many localities.

It was no doubt early confused with the cabbage aphid and became firmly established in most areas before it was recognized as a distinct species. In fact, its true identity was not discovered until 1914 when it was described as *Aphis pseudobrassicae* by Davis (1914, p. 231) from specimens collected by W. J. Schoene on cabbage at Geneva, New York on July 15, 1912, and on mustard and kale taken at Evansville, Indiana, November 20 of the same year. In September and October, 1913, additional material was taken on radish and turnip at Lafayette, Indiana, and on turnip at College Station, Texas, by F. B. Paddock (1915).

In size and general appearance it greatly resembles the cabbage aphid. However, in California, it seems to have less powdery wax on its body. Specimens of whole colonies over large areas may appear bright green and almost devoid of the white waxy secretion so characteristic of the cabbage aphid. However, pulverulent forms do occur here. Specimens are paler in color than the cabbage aphid and lack the broad transverse broken dark bands on the dorsum of the alates and apterous forms; antennal segment III is much

¹⁰ This common name has also been used for the cabbage aphid, *Brevicoryne brassicae* (Linn.). The turnip aphid is also known as the false cabbage aphid.

shorter; tarsi are shorter; cornicles are longer; there are secondary sensoria present on antennal segment III and IV of the alates; the unguis, spur, or filament of the terminal antennal segment is three times the length of the base; and the cauda is triangular in shape. Important characters for identification are shown in figure 4.

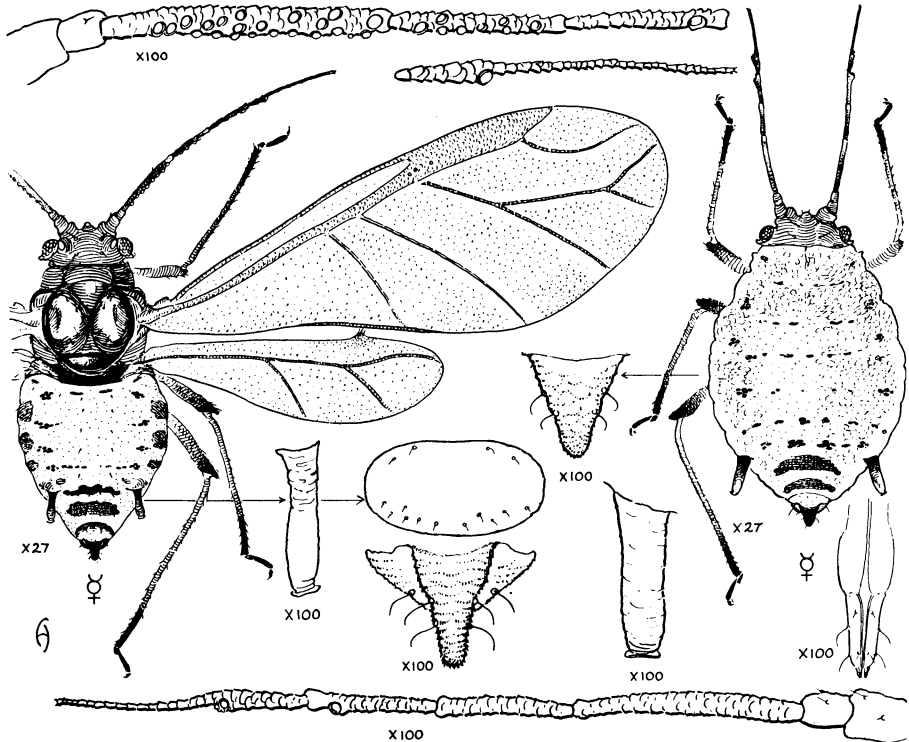


Fig. 4.—The turnip or false cabbage aphid, *Rhopalosiphum pseudobrassicae* (Davis): alate and apterous viviparous females with the antennae, cornicles, anal plates, caudas, and tip of rostrum greatly enlarged as indicated. Note the sensoria on both antennal segments III and IV of the alate. (Drawings by Frieda Alberthy.)

Life History. The life history is similar to that of the cabbage aphid. Allen and Harrison (1941) have studied the life history in the south and state that there are 15 to 46 generations a year; 50 to 100 young are produced by a single female; aphids live as long as 2 months; no sexuales appear in the south; living forms occur throughout the year; most damage is done during the winter months—October to and including the following March. The life history in the northern limits of distribution has not been studied and, although sexual forms are probably produced, they have not been reported.

Host Plants. The host plants are similar to those of the cabbage aphid, but are as yet not so well known. The following are reported to date:

Barbarea vulgaris
Brassica caulorapa
Brassica cernua

Brassica juncea (B.
rugosa)
Brassica kaber (B.
campestris)

Brassica napobrassica
Brassica napus
Brassica nigra

<i>Brassica oleracea</i>	<i>Chrysanthemum</i>	<i>Nasturtium officinale</i>
<i>Brassica oleracea</i> var. <i>acephala</i>	<i>coronarium</i> (?)	(<i>Roripa nasturtium</i>)
<i>Brassica oleracea</i> var. <i>botrytis</i>	<i>Descourainia sophia</i>	<i>Phaseolus</i> sp. (?)
<i>Brassica oleracea</i> var. <i>capitata</i>	<i>Gynandropsis speciosa</i> (?)	<i>Ranunculus sceleratus</i> (?)
<i>Brassica pekinensis</i>	<i>Lactuca sativa</i>	<i>Raphanus raphanistrum</i>
<i>Brassica rapa</i>	<i>Lepidium campestre</i>	<i>Raphanus sativus</i>
<i>Capsella bursa-pastoris</i>	<i>Lepidium virginicum</i>	<i>Raphanus sativus</i> var. <i>longipinnatus</i>
	<i>Lycopersicon esculentum</i> (?)	<i>Thlaspi arvense</i>
	<i>Mathiola incana</i>	

Distribution. As previously indicated, this aphid probably originated in Asia and has spread by commerce throughout many other parts of the world. So far no records of its occurring in Europe have been noted in publications, which seems quite remarkable. The following distribution is known:

Asia: China (Chekiang, Hopei, Kiangsu, Kwangtung, Shantung, Taiwan), Korea (Sui-gan), India, Iraq, Japan (general, Daito Jina), Java, Loochoo, Siam, Sumatra

Africa: Egypt, Cape Colony, Maroc, Uganda

Australia: New South Wales

New Zealand

North America: Canada (British Columbia, Manitoba, Ontario, Quebec); United States (throughout much of the entire country: actually reported from Alabama, California—Berkeley, El Centro, Half Moon Bay, Lompoc, Los Angeles, Riverside, San Francisco, Stanford University, Stockton, Ventura—Connecticut, Florida, Georgia, Illinois, Indiana, Louisiana, Maine, Maryland, Mississippi, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Wisconsin), Bermuda, Puerto Rico

South America: Argentina, Trinidad

South Pacific: Hawaii (Hawaii, Oahu)

THE GREEN PEACH APHID¹¹

<i>Myzus persicae</i> (Sulzer)	<i>Aphis persicaecola</i> Boisduval (1867)
<i>Aphis persicae</i> Sulzer (1776, p. 105)	<i>Siphonophora achyrantes</i> Monell (1879)
<i>Aphis dianthi</i> Schrank (1801)	<i>Rhopalosiphum tulipae</i> Thomas (1879)
<i>Aphis vulgaris</i> Kyber (1815)	<i>Myzus malvae</i> Oestlund (1886)
<i>Aphis furcipes</i> Rafinesque (1817)	<i>Myzus pergandii</i> Sanderson (1901)
<i>Aphis rapae</i> Curtis (1842)	<i>Phorodon cyanoglossi</i> Williams (1910)
<i>Aphis vastator</i> Smee (1846)	<i>Rhopalosiphum solani</i> Theobald (1912)
<i>Aphis cyanoglossi</i> Walker (1848)	<i>Rhopalosiphum betae</i> Theobald (1913)
<i>Aphis egressa</i> Walker (1849)	<i>Rhopalosiphum lactucellum</i> Theobald (1915)
<i>Aphis redundans</i> Walker (1849)	<i>Rhopalosiphum tuberosellae</i> Theobald (1919)
<i>Aphis aucta</i> Walker (1849)	

The green peach aphid is without doubt the most important economic species in the entire family Aphididae. It is not only cosmopolitan in distribution and feeds on more varieties of host plants, but it is also capable of transmitting more kinds of plant viruses than any other insect known at the present time.

Description and Life History. Like most widely distributed aphids, the green peach aphid has a variable life history, not greatly different from that of the cabbage aphid. In the warmer tropical and subtropical areas, it is maintained by continuous generations of viviparous parthenogenetic fe-

¹¹ This aphid is called the tobacco aphid in Southern Rhodesia and other parts of Africa (Brain, 1940, p. 254).

males—both winged and wingless. There may be 30 to 40 generations a year, although the complete life history has not been accurately recorded in all areas. In the northern limits of its range, it is maintained chiefly by migrations from more favorable and warmer areas where it has persisted and multiplied even during the winter. The migrations or dispersals northward begin early in February, March, April, and May, and may continue until winter approaches. The advance northward is regulated by the increasingly favorable seasonal weather conditions. Escapes from greenhouses and even residences may also account for small isolated colonies which may appear in northern regions in advance of the regular migrations.

In quite cold northern climates the green peach aphid may give rise to sexuales, and eggs are produced that survive the winters and give rise to spring generations. The alternate winter hosts are usually fruit trees, including apricots, cherries, nectarines, peaches, and plums.

In California sexual forms are rarely taken. But males and females were collected on sand cherry, *Prunus pumila*, at Riverside by R. C. Dickson on December 20, 1940. They are probably quite common but are not readily discovered.

The various forms are :

Stem mother, a pink form that hatches from the overwintering egg and gives rise to succeeding generations.

Apterous viviparous female (fig. 5, B), a pale yellow or green form born from the stem mother and living on the primary host. She gives birth to winged spring migrants.

Spring migrants, greenish, yellowish, or reddish, black-marked winged viviparous females (fig. 5, A) that migrate from the winter primary hosts and settle on spring and summer hosts of all kinds. These may also migrate great distances, especially if carried by favorable winds. The apterous females are usually greenish and have the apical portions of the antennae and legs, and tips of cornicles dusky or black. The alates are yellowish or greenish, with the head, thorax, most of the antennae, apical portions of leg segments, bases of the cornicles, lateral spots, and a large median dorsal spot on the abdomen black. The swollen cornicles and black dorsal abdominal spot serve to identify this aphid readily.

Summer alate and *apterous viviparous females* are not unlike the spring migrants. They are produced through many generations on the summer hosts and disperse freely over wide areas. According to Profft (1939, p. 14-15) winged adults have been found on islands 36 miles from the North Sea coast of Germany and on Spitzenbergen, hundreds of miles from their normal habitat. The progeny of these may survive the winters in favorable areas.

Fall migrants, usually darker specimens that migrate to the primary host plants, where they mate and give rise to alate males and apterous sexual females. The latter lay the overwintering eggs.

Males, small, very dark, almost wholly black.

Oviparous females, apterous, not greatly different from the apterous viviparous females.

Host Plants. It will probably never be possible to secure an all-inclusive list of the host plants of this aphid. Its feeding habits are so varied that its

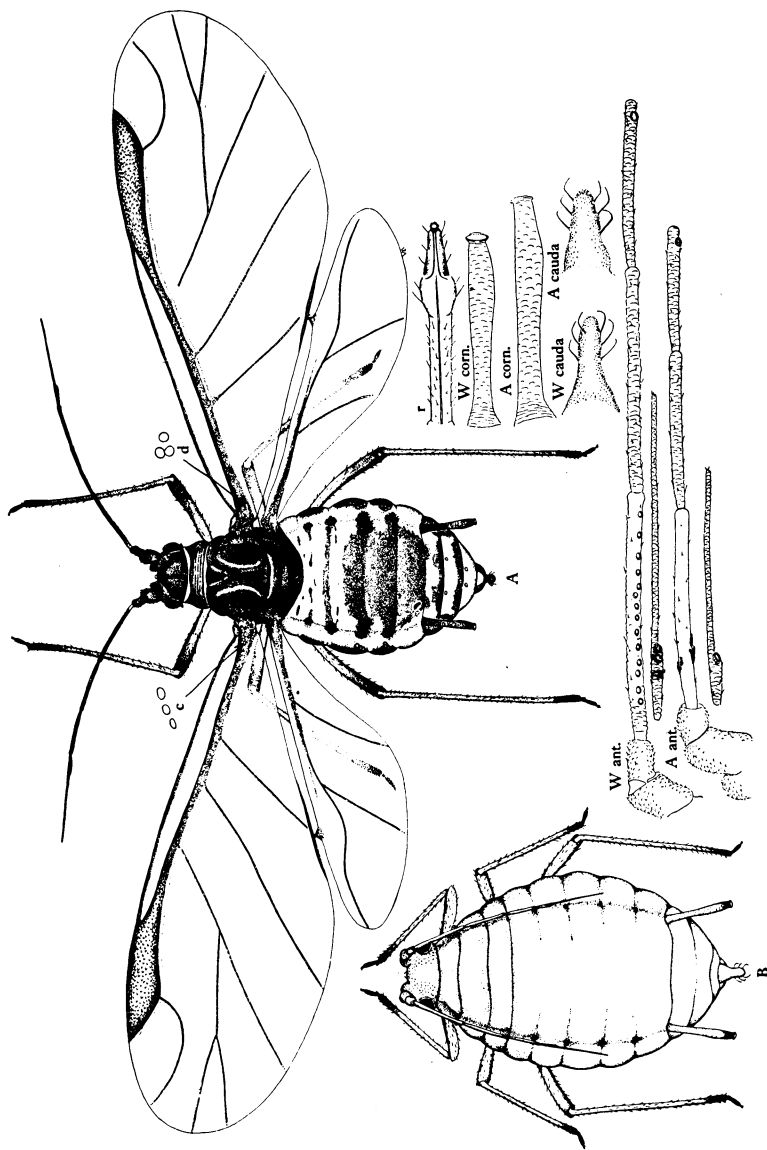


Fig. 5.—The green peach aphid, *Myzus persicae* (Sulzer): A, Adult alate viviparous female: c and d, fenestras or small transparent pores at the bases of the forewings; r, rostrum; W ant., antenna; W corn., cornicle; W cauda, cauda. B, Adult apterous viviparous female: A ant., antennae; A corn., cornicle; A cauda, cauda. All greatly enlarged.

capacity for acquiring new hosts seems to be unlimited. The following list is as complete as facilities at hand permit:

<i>Abutilon</i> sp.	<i>Capsicum dulce</i>	<i>Cyclamen europaeum</i>
<i>Acalypha boemerioides</i>	<i>Capsicum frutescens</i>	<i>Cyclamen indicum</i>
<i>Acanthus spinosus</i>	(<i>C. annuum</i>)	<i>Cynara cardunculus</i>
<i>Acer negundo</i>	<i>Carduus</i> sp.	<i>Cynoglossum grande</i>
<i>Acer nuttali</i> [sic]	<i>Carica papaya</i>	<i>Cyrtanthus</i> sp.
<i>Achyranthes</i> sp.	<i>Carthamus tinctorius</i>	<i>Cytisus</i> sp.
<i>Acnida cannabina</i> (<i>A.</i>	<i>Catalpa speciosa</i>	<i>Dalbergia sissoo</i>
<i>cuspidata</i>)	<i>Centaurea</i> sp.	<i>Daphne</i> sp.
<i>Ageratum conyzoides</i>	<i>Centranthus ruber</i>	<i>Datura stramonium</i>
<i>Alternanthera</i> sp.	<i>Cerastium semidecan-</i>	(<i>D. tatula</i>)
<i>Althaea rosea</i>	<i>drum</i>	<i>Daucus carota</i>
<i>Amaranthus</i> spp.	<i>Cestrum fasciculatum</i> var.	<i>Dianthus caryophyllus</i>
<i>Ammannia</i> sp.	<i>newellii</i>	<i>Dianthus chinensis</i>
<i>Amsinckia spectabilis</i>	<i>Cestrum pseudoquina</i>	<i>Digitalis lutea</i>
<i>Anthemis cotula</i>	<i>Chaerophyllum aro-</i>	<i>Digitalis purpurea</i>
<i>Antirrhinum majus</i>	<i>maticum</i>	<i>Dipsacus fullonum</i>
<i>Apium graveolens</i>	<i>Chaerophyllum hirsutum</i>	<i>Dyssodia</i> sp.
<i>Aquilegia canadensis</i>	<i>Chaerophyllum roseum</i>	<i>Duranta repens</i> (<i>D. plumieri</i>)
<i>Aquilegia vulgaris</i>	<i>Cheiranthus cheiri</i>	<i>Echinops echinatus</i>
<i>Arctium lappa</i>	<i>Chenopodium album</i>	<i>Emilia sonchifolia</i>
<i>Arctium majus</i>	<i>Chenopodium murale</i>	(<i>Senecio sonchifolius</i>)
<i>Asclepias speciosa</i>	<i>Chenopodium viride</i> [sic]	<i>Erigeron canadensis</i>
<i>Asparagus officinalis</i>	<i>Chrysanthemum balsamita</i>	<i>Erodium botrys</i>
<i>Asparagus plumosus</i>	<i>Chrysanthemum coccineum</i>	<i>Erodium cicutarium</i>
<i>Asparagus sprengeri</i>	<i>Chrysanthemum frutescens</i>	<i>Eruca sativa</i>
<i>Astragalus</i> sp.	<i>Chrysanthemum indicum</i>	<i>Erythronium dens-canis</i>
<i>Atriplex</i> sp.	<i>Cichorium endivia</i>	<i>Escallonia pulverulenta</i>
<i>Atropa belladonna</i>	<i>Citrullus vulgaris</i>	<i>Euonymus communis</i>
<i>Aubrieta</i> sp.	<i>Citrus aurantium</i>	<i>Euphorbia helioscopia</i>
<i>Barbarea vulgaris</i>	<i>Citrus limonia</i>	<i>Euphorbia pulcherrima</i>
<i>Bauhinia variegata</i>	<i>Citrus maxima</i>	<i>Ficus pumila</i>
<i>Bellis perennis</i>	<i>Citrus medica</i>	<i>Foeniculum vulgare</i>
<i>Bellis silvestris</i>	<i>Clarkia elegans</i>	<i>Fragaria chiloensis</i>
<i>Beloperone</i> sp.	<i>Clarkia pulchella</i>	<i>Freesia</i> sp.
<i>Beta vulgaris</i> (<i>B.</i>	<i>Cnicus</i> sp.	<i>Fuchsia coccinea</i>
<i>bengalensis</i>)	<i>Cochlearia armoracia</i> (<i>Nas-</i>	<i>Fuchsia macrantha</i>
<i>Bougainvillea campestris</i>	<i>turtium armoracia</i>)	<i>Fuchsia magellanica</i> var.
<i>Bougainvillea juncea</i>	<i>Codiaeum</i> sp. (<i>Croton</i> sp.)	<i>globosa</i>
<i>Bougainvillea spectabilis</i>	<i>Colocasia</i> sp.	<i>Galactites tomentosa</i>
<i>Brassica kaber</i> (<i>B.</i>	<i>Convolvulus arvensis</i>	<i>Galium mollugo</i>
<i>arvensis</i>)	<i>Convolvulus crispus</i>	<i>Geranium molle</i>
<i>Brassica napus</i>	(<i>Ipomoea crispa</i>)	<i>Geranium robertianum</i>
<i>Brassica nigra</i>	<i>Coprosma baueri</i>	<i>Gladiolus</i> sp.
<i>Brassica oleracea</i>	<i>Cordyline</i> sp.	<i>Gloxinia digitaliflora</i>
<i>Brassica pekinensis</i>	<i>Coronopus didymus</i>	<i>Glycine</i> sp.
<i>Brassica rapa</i>	<i>Crataegus</i> sp.	<i>Gnaphalium spathulatum</i>
<i>Buddleia madagascari-</i>	<i>Crepis tectorum</i>	<i>Godetia amoena</i>
<i>ensis</i>	<i>Crocus</i> sp.	<i>Gossypium herbaceum</i>
<i>Buddleia orientalis</i> [sic]	<i>Crotalaria laburnifolia</i>	<i>Grindelia robusta</i>
<i>Calceolaria</i> sp.	<i>Crotalaria mucronata</i>	<i>Hedera helix</i>
<i>Calendula arvensis</i>	<i>Cryptostemma calendulaceum</i>	<i>Helianthus annuus</i>
<i>Calendula officinalis</i>	<i>Cucumis melo</i>	<i>Helichrysum bracteatum</i>
<i>Camellia japonica</i>	<i>Cucurbita maxima</i>	<i>Heliotropium arborescens</i>
<i>Canna indica</i>	<i>Cucurbita moschata</i>	(<i>H. peruviana</i>)
<i>Capsella bursa-pastoris</i>	<i>Cucurbita pepo</i>	<i>Hemerocallis</i> sp.

- Hibiscus abelmoschus* (H. moschatus, *Abelmoschus moschatus*)
Hibiscus esculentus
Hibiscus roseus
Hordeum sp.
Humulus lupulus
Hyacinthus orientalis
Hydrangea sp.
Ilex sp.
Ionidium concolor
Ipomoea batatas
Ipomoea maxima [sic]
Ipomoea purpurea (Convolvulus major)
Iresine lindenii
Iris sp.
Justicia alba [sic]
Kalanchoë sp. (*Bryophyllum* sp.)
Kleinia neriifolia
Lactuca oldhamii
Lactuca sativa
Lactuca scariola
Lactuca spicata
Lamium sp.
Lantana sp.
Lathyrus odoratus (*Pisum odorata*)
Lavatera assurgentiflora
Lepidium draba
Ligustrum vulgare
Lilium candidum
Lilium longiflorum
Linaria sp.
Liriodendron tulipifera
Lupinus termis
Lycopersicon esculentum (*Solanum lycopersicum*)
Malus communis (*Pyrus malus*)
Malva parviflora
Malva rotundifolia
Malvastrum coccineum
Markhamia platycalyx
Marsilea quadrifolia
Marsilea vestita
Matricaria inodora
Mathiola sp.
Maurandia hendersonii [sic]
Mazus sp.
Melanthus major
Melilotus indica
Mentha aquatica (*M. hirsuta*)
Mercurialis annua
Mesembryanthemum sp.
Mimulus sp.
Montia perfoliata
- Moraea iridioides*
Myosotis scorpioides
Myrtus sp.
Narcissus sp.
Nasturtium armoracea
Nasturtium indicum
Nasturtium officinale (*Radicula nasturtium-aquaticum*, *Roripa nasturtium*)
Nemesia strumosa
Nemophila heterophylla
Nerium indicum (*N. odorum*)
Nerium oleander
Nicotiana rustica
Nicotiana tabacum
Onopordum acanthium
Opuntia sp.
Orobanche sp.
Orthocarpus erianthus
Oxalis cernua
Oxalis corniculata
Oxalis rosea
Panax lancasteri [sic]
Papaver somniferum
Parthenium argentatum
Pastinaca sativa
Paulownia sp.
Penstemon spectabilis
Requeria trinervia [sic]
Petasites tricholobus
Petunia hybrida
Pharbitis nil
Phaseolus vulgaris
Philadelphus coronarius
Physalis virginiana
Picris echioides
Pimelea sp.
Pimenta officinalis
Pisum sativum
Pisum sativum var. *arvense*
Pittosporum eugenioides
Pittosporum tobira
Pittosporum undulatum
Plantago sp.
Poa sp.
Polygonum hydropiper
Polygonum multiflorum
Polygonum persicaria
Portulaca oleracea
Primula forbesii
Primula polyantha
Primula vulgaris
Prunella vulgaris
Prunus americana
Prunus amygdalus (*P. communis*)
Prunus armeniaca
Prunus avium
- Prunus besseyi*
Prunus cerasus
Prunus domestica
Prunus domestica var. *insititia*
Prunus mume
Prunus persica
Prunus serotina
Prunus virginiana
Prunus virginiana var. *melanocarpa*
Psidium guajava
Pulicaria dysenterica (*Inula dysenterica*)
Quamoclit lobata
Radicula curvisiliqua
Ranunculus asiaticus
Ranunculus bulbosus
Raphanus raphanistrum
Raphanus sativus
Rapistrum rugosum
Rheum raphanticum
Ribes odoratum
Richardia africana
Ricinus communis
Rosa sp.
Rudbeckia laciniata
Rumex dentatus
Sagina subulata
Salix sp.
Salsola kali (*S. tragus*)
Salvia leucantha
Salvia mellifera
Sambucus canadensis
Sanguisorba officinalis
Sanicula menziesii
Saxifraga splendens [sic]
Secale cereale
Sedum artissimum
Senebiera pinnatifida
Senecio alpestris (*S. crassifolius*)
Senecio cruentus
Senecio elegans
Senecio jacobaea
Senecio mikanioides
Senecio renifolius (*Cineraria renifolia*)
Senecio vulgaris
Sesamum orientale
Setaria viridis
Silene sp.
Sisymbrium canescens
Sisymbrium irio
Solandra grandiflora
Solanum carolinense
Solanum dulcamara
Solanum melongena

<i>Solanum nigrum</i>	<i>Tragopogon</i> sp.	<i>Valerianella olitoria</i>
<i>Solanum pseudo-capsicum</i>	<i>Tribulus terrestris</i>	(<i>Valeriana olitoria</i>)
<i>Solanum tuberosum</i>	<i>Trifolium pratense</i>	<i>Verbena chamaedryfolia</i>
<i>Sonchus asper</i>	<i>Trifolium repens</i>	<i>Viburnum opulus</i>
<i>Sonchus oleraceus</i>	<i>Triticum aestivum</i> (<i>T. sativum</i> , <i>T. vulgare</i>)	<i>Vicia</i> sp.
<i>Spinacia oleracea</i>	<i>Tropaeolum majus</i>	<i>Vinca major</i>
<i>Stellaria aquatica</i>	<i>Tulipa</i> spp.	<i>Vinca minor</i>
<i>Stellaria media</i>	<i>Typha</i> sp.	<i>Viola odorata</i>
<i>Stizolobium deeringianum</i>	<i>Ulmus procera</i> (<i>U. campestris</i>)	<i>Viola tricolor</i>
<i>Syringa vulgaris</i>	<i>Umbellularia californica</i>	<i>Vitis</i> sp.
<i>Tamarix</i> sp.	<i>Ursinia</i> sp. (<i>Sphenogyne</i> sp.)	<i>Withania somnifera</i>
<i>Taraxacum officinale</i>	<i>Urtica pilulifera</i>	<i>Zea mays</i>
<i>Thalictrum minus</i>	<i>Urtica urens</i>	<i>Zelkova formosana</i> [sic]
<i>Tilia americana</i>	<i>Valeriana pyrenaica</i>	
<i>Townsendia exscapa</i> (<i>T. sericæ</i>)		

Distribution. The green peach aphid appears to be present throughout the entire world wherever agricultural crops are grown. It does not occur in the extreme cold areas of the Arctic Region nor in certain of the very hot desert oases. Whether this wide distribution is natural or aided by man cannot now be determined. Nevertheless man has indeed had a great influence in extending both its distribution and diet by the extensive development of agriculture in areas which were previously certainly not adapted to the requirements of this aphid.

In California it occurs in every county and is a pest on plants in houses, greenhouses, lathhouses, and out doors throughout the year in most localities.

LITERATURE CONSULTED

- ALLEN, N., and P. K. HARRISON.
1941. The turnip aphid in the southern states and methods for its control. U.S. Dept. Agr. Farmers' Bul. 1863:1-9. 8 figs.
- BOISDUVAL, J. A.
1867. Essai sur l'Entomologie Horticole 1867:235-99.
- BRAIN, C. K.
1940. Host plants of the tobacco aphid (*Myzus persicae*). Rhodesia Agr. Jour. 37(5): 254-55.
- BRITTON, W. E.
1917. A destructive aphid on turnips. Connecticut Agr. Exp. Sta. Rept. 1916:98-104.
1918. The potato aphid. In: Insects attacking potatoes. Connecticut Agr. Exp. Sta. Bul. 208:115-18.
- BRITTON, W. E., and Q. S. LOWRY.
1918. Outbreak of the pink and green potato aphid. In: Sixteenth Rept. of the State Entomologist. Connecticut Agr. Exp. Sta. Bul. 203:290-302.
- CAMPBELL, R. E.
1926. The pea aphid in California. Jour. Agr. Res. 32:861-81.
- CLAUSEN, C. P.
1931. Insects injurious to agriculture in Japan. U. S. Dept. Agr. Cir. 168:1-115. 1 map.
- CURTIS, JOHN.
1842. Observations on the natural history and economy of various insects affecting the turnip. Roy. Agr. Soc. England Jour. 3:49-77.
1860. Farm insects. 528 p. Gurney & Jackson, London. Reissued 1883, John Van Voorst, London.
- DAVIDSON, J.
1925. A list of British aphides. ix + 176 p. Longmans, Green & Co., London.
- DAVIS, J. J.
1914. New or little known species of Aphididae. Canad. Ent. 46:41-51, 77-87, 121-34, 165-73, 226-36.
1915. The pea aphid with relation to forage crops. U. S. Dept. Agr. Bul. 276:1-67, 17 figs.
- ESAKI, T., et al.
1932. Nippon Konchu Zukan. Iconographia Insectorum Japonicorum. 2241 + 97 + 123 p. Hokuryukah, Tokyo.
- ESSIG, E. O.
1911. Aphididae of southern California VIII. Plant lice affecting the citrus trees. Pomona College Jour. Ent. 3:586-603. figs. 191-96.
- FLETCHER, T. B.
1921. Annotated list of Indian crop-pests. Pusa Agr. Res. Inst. (Imp. Agr. Res. Inst., New Delhi) Bul. 100:1-246. (Aphididae, p. 211-18.)
- FLUKE, C. L.
1929. The known predacious and parasitic enemies of the pea aphid in North America. Wisconsin Agr. Exp. Sta. Res. Bul. 93:1-47.
- FOLSOM, J. W.
1909. The insect pests of clover and alfalfa. Illinois State Ent. Rept. 25:41-124.
- FONSCOLOMBE, BOYER DE.
1841. Des pucerons qui se trouvent aux environs d'Aix. Soc. Ent. France Ann. 10:157-98.
- FRISCH, JOH. LEONHARD.
1734. Beschreibung von allerley Insecten in Deutschland 11. Theil, 9:10-12. III Platte, Tab. XV, 1-4. Christoph G. Nicolai, Berlin.
- GILLETTE, C. P., and M. A. PALMER.
1931-34. The Aphididae of Colorado. Ent. Soc. Amer. Ann. 24:827-934; 25:369-496; 27:133-255. Host index, general index.
- GLOVER, TOWNEND.
1854. The cotton louse. In: Insects injurious and beneficial to vegetation. U. S. Patent Office Ann. Rept. 1854:62-63. Reprinted in: U. S. Patent Office Rept. 1876:36.

- GORHAM, R. P.
1946. The use of flight traps in the study of aphid movement. *Arcadian Nat.* 2:106-11.
- GOWDEY, C. C.
1926. *Catalogus insectorum Jamaicensis*. Jamaica Dept. Agr. Ent. Bul. 4(1):1-114; (2):1-11.
- GRISWOLD, GRACE H.
1927. Observations on the biology of a new geranium aphid (*Macrosiphum cornelli* Patch). *Jour. Econ. Ent.* 20:91-94.
- HALL, W. J.
1926. Notes on the Aphididae of Egypt. *Egypt. Min. Agr. Tech. and Sci. Serv. Bul.* 68:1-62.
1932. Some Aphidae of Southern Rhodesia with descriptions of five apparently new species. *Stylops* 1(3):49-61.
- HOFFMANN, W. E.
1937. Kwangtung Aphididae including hostplants and distribution. *Lingnan Sci. Jour.* 16(2):267-302.
- HORSFALL, J. L.
1924. Life history studies of *Myzus persicae* Sulzer. *Pennsylvania Agr. Exp. Sta. Bul.* 185:1-16.
1925. The life history and bionomics of *Aphis rumicis*. *Iowa Univ. Studies Nat. Hist.* 11(2):1-57, 9 pls.
- HOUSER, J. S., T. L. GUYTON, and P. R. LOWRY.
1917. The pink and green aphid of potato. *Ohio Agr. Exp. Sta. Bul.* 317:61-88.
- KYBER, J. F.
1915. Einige Erfahrungen und Bemerkungen über Blattläuse. *German's Mag. Ent.* 1(pt. 2):1-39.
- LINNAEUS, C.
1746. *Fauna Svecica*. 411 + 26 p. 2 pls. L. Salvii.
1758. *Systema naturae*. 10th ed. vol. 1, iii + 824 p. L. Salvii.
- MATSUMURA, S.
1917. A list of the Aphididae of Japan, with descriptions of new species and genera. *Tôhoku Imp. Univ. Coll. Agr. Jour.* 7(6):351-414. pls. XVI-XVII.
- MONELL, J. T.
1879. Notes on Aphidinae, with descriptions on new species. *U. S. Geol. and Geogr. Survey of the Territories Bul.* 5:18-32.
- MORDVILKO, A.
1928. In: Filip'ev, *Insect key*. Moscow. p. 200.
- OESTLUND, O. W.
1886. List of the Aphididae of Minnesota with descriptions of some species. *Minnesota Geol. and Nat. Hist. Survey Ann. Rept.* 14:17-56.
- PADDOCK, F. B.
1915. The turnip louse. *Texas Agr. Exp. Sta. Bul.* 180:1-77. 10 figs. 5 pls.
- PATCH, E. M.
1938. Food-plant catalogue of the aphids of the world including the Phylloxeridae. *Maine Agr. Exp. Sta. Bul.* 393:1-431.
- PRETHERBRIDGE, F. R., and J. E. M. MELLOR.
1936. Observations on the life history and control of the cabbage aphid, *Brevicoryne brassicae* L. *Ann. Appl. Biol.* 23(2):329-41. Pl. XII, figs. 1-4.
- PRETHERBRIDGE, F. R., and D. W. WRIGHT.
1938. The cabbage aphid (*Brevicoryne brassicae* L.). [Gt. Brit.] *Min. Agr. and Fisheries Jour.* 1938:140-48.
- PROFFT, J.
1939. The migrations and flights of *Myzus persicae*. The possibilities of spread of potato virus disease. *Deut. Pflanzenschutzdienst Nachrichtenbl.* 19(2):14-15. 8 refs.
- RAFINESQUE, C. S.
1817. Specimens of several new American species of the genus *Aphis*. *Amer. Mo. Mag.* 1817:360-61.
- SANDERSON, E. D.
1901. Some plant-lice affecting peas, clover, and lettuce. *Canad. Ent.* 33:31-39, 69-74.

SCHRANK, F. VON PAVLA.

1801. Blattlaus. *In*: Geschichte der Baiern einheimischen und zahmen Thiere. Fauna Boica. vol. 2, p. 102-27.

SHEN TSENG, and CHIA-CHU TAO.

1936. A list of the Aphididae of China with descriptions of four new species. Entom. Lab. Coll. Agr. Nat. Univ. Szechuen, Contrib. No. 1. Entom. & Phytopath. Bur. Ent. Hanchow, China 4 (7-9):120-176.

SILVESTRI, F.

1939. Fam. Aphididae. *In*: Compendio di entomologia applicata. vol. 1, p. 412-618. figs. 381-588.

SMEE, A.

1846. The potato plant. p. 63. [*sic.*]

SULZER, J. H.

1776. Abgekürzte Geschichte der Insecten nach dem Linnéischen System. H. Steiner u. Co. Winterthun 4. 2 Teile 1:27-274; 2:1-71. 32 col. Taf.

SWEETMAN, H. L.

1928. Notes on insects inhabiting the roots of weeds. Ent. Soc. Amer. Ann. 21:594-600.

TAKAHASHI, R.

1928. A list of the Aphididae of China. Fukien Christian Univ. Nat. Hist. Soc. Proc. Vol. 1. [No pagination in reprint consulted.]

1939. Some Aphididae from Loochoo. Formosa Nat. Hist. Soc. Trans. 20(111):317-27. 2 figs.

THEOBALD, F. V.

1912. Aphididae of the Hastings district. Hastings and E. Sussex Naturalist 2:9-20.

1913. The aphides on mangolds and related plants. [Gt. Brit.] Bd. Agr. Jour. 19(11): 914-22. 3 figs. 1 pl.

- 1915a. African Aphididae, pt. II. Bul. Ent. Res. 6:103-53.

- 1915b. Notes on new and little known British aphides. I. Entomologist 48:274-75.

1918. African Aphididae, pt. III. Bul. Ent. Res. 8:273-94.

1919. New and little known British aphides. V. Entomologist 52:157-61.

THOMAS, CYRUS.

1879. Noxious and beneficial insects of the State of Illinois. Illinois State Ent. Rept. 8:1-212 + I-X.

VAN DER GOOT, P.

1915. Beiträge zu Kenntnis der Holländischen Blattläuse. 3 + 600 p. 8 pls. Tjeenk Wilink & Zoon, Haarlem, Holland.

1918. Introduction and notes to: Das, B. Aphididae of Lahore. Indian Mus. Mem. 6:135-274. (See esp. p. 158-62.)

WALKER, F.

1848. Descriptions of aphides. Zoologist 6:2217-21.

1849. Descriptions of new British aphides. Zoologist 7: Appendix xxxi-xl.

WILLIAMS, T. A.

1910. The Aphididae of Nebraska. Nebraska Univ. Studies 10:85-175 (1-91). [Dated 1910 published 1911.]

WU, CHENFU F.

1935. Family Aphididae. *In*: Catalogus insectorum sinensium. vol. 2, p. 131-66. Fan Memorial Institute of Biology, Peiping, China.

ZECK, E. H.

1928. The green peach aphid, *Myzus persicae* (Sulzer). Agr. Gaz. N. S. Wales 39:147-54. 11 figs.

The journal *Hilgardia* is published at irregular intervals, in volumes of about 600 pages. The number of issues per volume varies.

Subscriptions are not sold. The periodical is sent as published only to libraries, or to institutions in foreign countries having publications to offer in exchange.

You may obtain a single copy of any issue free, as long as the supply lasts; please request by volume and issue number from:

Publications Office
College of Agriculture
Berkeley 4, California

The limit to nonresidents of California is 10 separate issues on a single order. A list of the issues still available will be sent on request.

