

AERIAL FEEDING APHIDS OF CORN IN THE UNITED STATES WITH REFERENCE TO THE ROOT-FEEDING *APHIS MAIDIRADICIS* (HOMOPTERA: APHIDIDAE)

MANYA B. STOETZEL AND GARY L. MILLER

Systematic Entomology Laboratory, Agricultural Research Service
U.S. Department of Agriculture, Beltsville, MD 20705

ABSTRACT

A brief summary of taxonomic characters, usual hosts, and distribution within the United States are given for each species. *Aphis craccivora* Koch, *Aphis fabae* Scopoli, *Aphis gossypii* Glover, *Aphis maidiradicis* Forbes, *Hysteroneura setariae* (Thomas), *Macrosiphum euphorbiae* (Thomas), *Metopolophium dirhodum* (Walker), *Myzus persicae* (Sulzer), *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* (L.), *Sipha flava* (Forbes), *Schizaphis graminum* (Rondani), and *Sitobion avenae* (Fabricius) are included in the present paper. Pictorial and dichotomous keys are included to aid personnel charged with detection, identification, and control of aphids associated with corn in the United States.

Key Words: Taxonomic keys, identification, control, distribution, *Zea mays*

RESUMEN

Un breve resumen de características taxonómicas, hospederos usuales, y distribución dentro de los Estados Unidos son dados para cada especie. *Aphis craccivora* Koch, *Aphis fabae* Scopoli, *Aphis gossypii* Glover, *Aphis maidiradicis* Forbes, *Hysteroneura setariae* (Thomas), *Macrosiphum euphorbiae* (Thomas), *Metopolophium dirhodum* (Walker), *Myzus persicae* (Sulzer), *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* (L.), *Sipha flava* (Forbes), *Schizaphis graminum* (Rondani), y *Sitobion avenae* (Fabricius) son incluidos en este trabajo. Claves pictóricas y dicotómicas son incluidas para apoyar al personal encargado de detectar, identificar, y controlar los áfidos asociados con el maíz algodón en los Estados Unidos.

Corn or maize (*Zea mays* L.) ranks first among the agricultural crops in both area devoted to its cultivation and the value of the annual crop in the United States. For the 1997 production year, over 80 million acres in the United States were planted in corn for grain with Iowa the leading state with over 12 million acres (Anonymous 1999a; Anonymous 1999b). The total value of production of corn for grain was over \$24 billion in 1997 (Anonymous 1999a). Sweet corn and popcorn varieties serve for human consumption while the field corn varieties are live-stock food, and the herbage is used for forage. In addition, corn-based products are used for a wide variety of items.

In 1996, insecticides were used on 32% of the total acreage planted for corn (Anonymous 1999c). Over 200 species of insects, several of which are aphids, have been recorded as injurious to corn during some part of its life cycle or as a stored product (Bailey 1935). When aphid colonies are large, they can greatly diminish a plant's vigor or even kill the plant through mechanical injury by removal of sap during feeding. Besides mechanical injury, some aphids are able to transmit diseases that affect corn (Chan et al. 1991). Aphids also have the capability of transmitting

nonpersistent viruses between plants that would not otherwise be considered hosts. Aphids also produce a sticky substance called honeydew during feeding. This substance may be problematic when it fouls the corn tassel and interferes with pollination and encourages fungal growth.

The aerial aphid fauna includes at least 12 species that commonly colonize corn in the United States. Several other taxa also feed on the roots of corn (e.g., *Anoecia* spp., *Geoica* spp., *Pemphigus* spp.) however, only the most commonly found, the corn root aphid, *Aphis maidiradicis* Forbes, will be addressed in this paper. A brief summary of taxonomic characters, hosts, worldwide distribution, and U.S. distribution is given for each of the 13 included species: *Aphis craccivora* Koch, *Aphis fabae* Scopoli, *Aphis gossypii* Glover, *Aphis maidiradicis* Forbes, *Hysteroneura setariae* (Thomas), *Macrosiphum euphorbiae* (Thomas), *Metopolophium dirhodum* (Walker), *Myzus persicae* (Sulzer), *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* (L.), *Sipha flava* (Forbes), *Schizaphis graminum* (Rondani), and *Sitobion avenae* (Fabricius). Descriptions as well as written and illustrated keys are included as an aid for detection, identification, and control of aphids associated with corn in the United States.

MATERIALS AND METHODS

In the synonymy section, one asterisk (*) represents the name used by Palmer (1952) and two asterisks (**) represent the name appearing in Blackman & Eastop (1984). Common names are those approved by the Entomological Society of America (ESA) (Bosik 1997).

Information on distribution and hosts is taken from labels on slides in the National Collection of Insects, Beltsville, Maryland, and from records in Palmer (1952), Smith & Parron (1978), and Blackman & Eastop (1984).

In the illustrated keys, the species are grouped by morphological differences of the antennae and antennal tubercles, body and antennal setae, pigmentation of the abdomen, coloration of cornicle, size of cauda, number of caudal setae, and wing venation. Characters used in the keys are apparent with a dissecting microscope with a minimum power of 16 \times and are best seen at 50 \times . Relative body size of the aphid species follows the division proposed by Blackman & Eastop (1984): body length <2.00 mm are "small," 2.00-3.00 mm are "medium," and >3.00 mm are "large." Figure 1 includes a figure illustrating general characters of a wingless and a winged adult. Body length is measured dorsally from the center of the frons to the end of the abdomen, excluding the cauda. Length of the antennal "terminal process" is measured as the distance from the large primary sensorium to the tip of the last antennal segment. Length of the "base" of the antenna is measured from the basal portion of the last antennal segment to the apex of the primary sensorium. Caudal length is measured along the midline from the beginning of the sclerotized portion to the apex. The keys are not intended for identification of single, errant aphids but should be used for individuals fully colonizing corn. Ideally winged aphids should develop from nymphs collected from a colony on the plant.

Aphis craccivora Koch 1854
Figs. 1, 4, 6-7

Synonymy:

**Aphis medicaginis* Koch 1854
(misidentification)

***Aphis craccivora* Koch

ESA approved common name: cowpea aphid.

Other common names: black legume aphid, groundnut aphid.

Taxonomic characters: Wingless adult female.—In life, body shiny black with large black patch on dorsum of abdomen; legs strikingly white with black area near apex of femur and tibia; immatures often covered with grayish wax. Small sized, body length 1.2-1.9 mm, rounded. Antenna 6 segmented; tubercles not well developed; terminal process approximately 1 $\frac{2}{3}$ -2 $\frac{1}{3}$ times length of base of antennal segment VI; antennal segments III-V without secondary sensoria; longest setae

on antennal segment III shorter than diameter of segment. Cornicle black, cylindrical; approximately 3 $\frac{1}{3}$ -4 $\frac{3}{4}$ times as long as wide, longer than length of cauda. Cauda black, with 2-4 (usually 3) pairs of lateral setae and 0-1 dorsal preapical seta.

Winged adult female.—In life body shiny black with black lateral areas and variable bands on dorsum of abdomen, legs similar to wingless adult female; forewing with media twice branched, hind wing with 2 oblique veins; small to medium sized, body length 1.4-2.0 mm. Antenna 6 segmented; tubercles not developed; terminal process approximately 2 times length of base of antennal segment VI; antennal segment III with 5-7 secondary sensoria, 1 or 2 noticeably larger than the others, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle black, cylindrical; 4-5 times as long as wide, longer than length of cauda. Cauda black, with 2-3 pairs of lateral setae and 0-1 dorsal preapical seta.

Hosts: Polyphagous with a preference for the Leguminosae.

Distribution in the United States: Throughout the United States.

Distribution in the world: Virtually worldwide.

Comments: *Aphis craccivora* transmits 51 plant viruses but is not listed as a vector of a corn virus (Chan et al. 1991).

Aphis fabae Scopoli 1763
Figs. 1, 4-7

Synonymy:

* & ***Aphis fabae* Scopoli

ESA approved common name: bean aphid.

Other common name: black bean aphid.

Taxonomic characters: Wingless adult female.—In life body black, but may appear dull black due to waxy covering; immatures often covered with wax. Small to medium sized, body length 1.1-2.5 mm, rounded. Antenna 6 segmented; tubercles not well developed; terminal process approximately 2 $\frac{2}{3}$ -3 $\frac{2}{3}$ times length of base of antennal segment VI; antennal segments III-IV without secondary sensoria; longest setae on antennal segment III longer than diameter of segment. Cornicle dark, cylindrical; 2-4 times as long as wide, longer than length of cauda. Cauda dark, elongate with 4-7 pairs of lateral setae and 0-1 dorsolateral setae.

Winged adult female.—In life body dull black, usually with dark lateral areas and bands on dorsum of abdomen; forewing with media twice branched, hind wing with 2 oblique veins; small to medium sized, body length 1.7-2.2 mm. Antenna 6 segmented; tubercles not well developed; terminal process approximately 2 $\frac{1}{3}$ -4 times length of base of antennal segment VI; 9-20 secondary sensoria on antennal segment III; 0-6 secondary sensoria on antennal segment IV; longest setae on antennal segment III longer than diameter of segment.

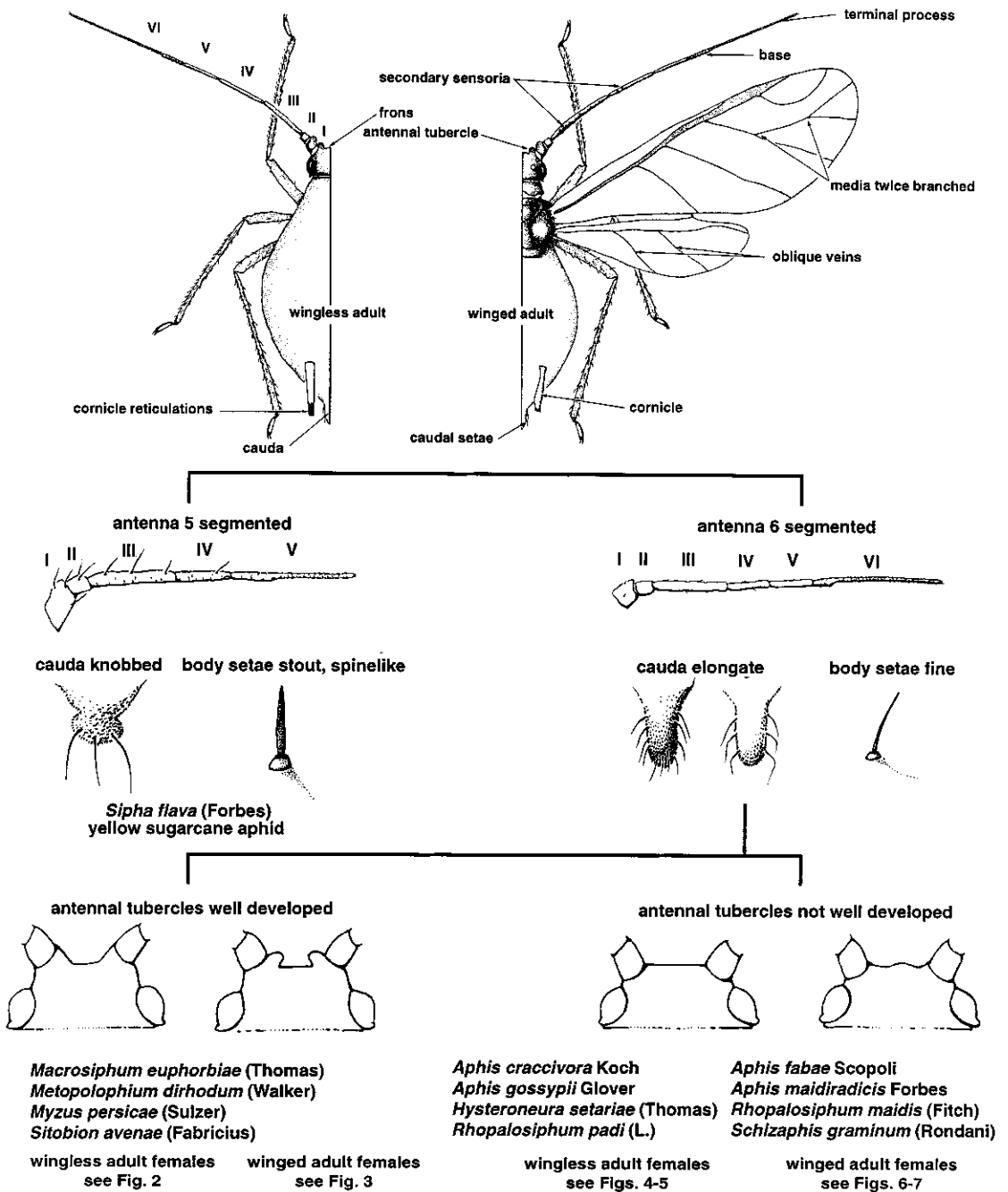


Fig. 1. Pictorial key to 13 aphid species that commonly colonize corn in the United States.

Cornicle dark, cylindrical; approximately 2½-4 times as long as wide, longer than length of cauda. Cauda dark, elongate with 5-8 pairs of lateral setae and 0-2 dorsolateral setae.

Hosts: Polyphagous and damaging to many plants of economic importance.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Aphis fabae* transmits 42 plant viruses but is not listed as a vector of a virus of corn (Chan et al. 1991). Several subspecies have been described in the *A. fabae* complex.

Aphis gossypii Glover 1877

Figs. 1, 4-7

Synonymy:

* & ***Aphis gossypii* Glover

ESA approved common name: cotton or melon aphid.

Other common names: none.

Taxonomic characters: Wingless adult female.—In life, body color varying from dark green to pale yellow or nearly white. Small sized, body length 1.0-1.4 mm, body rounded. Antenna 5-6 segmented; tubercles not well developed, terminal process approximately 2¼-3 times length of base of antennal segment VI; antennal segment III without secondary sensoria; longest setae on antennal segment III shorter than diameter of segment. Cornicle dark, cylindrical with slight tapering; approximately 2½-5 times as long as wide, longer than length of cauda. Cauda pale to dusky, with 2-3 pairs of lateral setae.

Winged adult female.—In life, body shape and coloration similar to wingless adult female; forewing with media twice branched, hind wing with 2 oblique veins; small sized, body length 1.2-1.8 mm, rounded. Antenna 6 segmented; tubercles not well developed; terminal process approximately 2¾-3½ times length of base of antennal segment VI; antennal segment III with 3-8 secondary sensoria in a row, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle dark, cylindrical with slight tapering; approximately 2½-3¾ times as long as wide, longer than length of cauda. Cauda pale to dusky, elongate with 2-3 pairs of lateral setae.

Hosts: Polyphagous and very damaging to many plants of economic importance.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Aphis gossypii* transmits 76 plant viruses including sugarcane mosaic virus which is listed as a virus of corn (Chan et al. 1991).*Aphis maidiradicis* Forbes 1891

Figs. 1, 4, 6

Synonymy:

Aphis maidi-radicis* Forbes*Aphis maidiradicis* Forbes

ESA approved common name: corn root aphid.

Other common names: none.

Taxonomic characters: Wingless adult female.—In life body bluish green with dark head and dusky transverse thoracic and abdominal bands. Small to medium sized, body length 1.5-2.0 mm long, body rounded. Antenna 6 segmented; tubercles not well developed, terminal process approximately 1½-2 times length of base of antennal segment VI; antennal segment III without secondary sensoria; longest setae on antennal segment III shorter than diameter of segment.

Cornicle dusky, cylindrical; approximately 1½-2½ times as long as wide, subequal to length of cauda. Cauda dusky, with 7-8 pairs of lateral setae and 1-2 preapical setae.

Winged adult female.—In life head and thorax black, abdomen light green with dusky markings; forewing with media twice branched, hind wing with 2 oblique veins; body length 1.4-1.9 mm body, rounded. Antenna 6 segmented; tubercles not well developed; terminal process approximately 1½-2¼ times length of base of antennal segment VI, antennal segment III with 4-11 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segment IV with 0-2 secondary sensoria, antennal segment IV without secondary sensoria. Cornicle dusky, cylindrical; 2-3 times as long as wide, subequal to length of cauda. Cauda dusky, with 5-8 pairs of lateral setae and 1-2 preapical setae.

Hosts: *Aphis maidiradicis* is principally known as a pest of corn in the U.S. but has been collected on the roots of a wide range of hosts (Blackman & Eastop 1984).

Distribution in the United States: Widespread.

Distribution in the world: Brazil, Jamaica, U.S.A.

Comments: *Aphis maidiradicis* is not recorded as transmitting plant viruses (Chan et al. 1991). This species is found on roots and is often tended by ants. The taxonomic status of *A. maidiradicis*, *A. middletonii*, *A. armoraciae*, and others are unclear and require detailed taxonomic and biological research.

Hysteroneura setariae (Thomas 1878)

Figs. 1, 4-6

Synonymy:

Siphonophora setariae Thomas**Aphis setariae* (Thomas)***Hysteroneura setariae* (Thomas)

ESA approved common name: rusty plum aphid.

Other common names: none.

Taxonomic characters: Wingless adult female.—In life body dark reddish brown, apical area of tibiae dark, cornicles dark to almost black, cauda pale to nearly white. Small to medium sized, 1.2-2.2 mm, body rounded. Antenna 6 segmented; tubercles not well developed, terminal process approximately 4½-5¾ times length of base of antennal segment VI; antennal segments III-V without secondary sensoria; longest setae on antennal segment III shorter than diameter of segment. Cornicle dark to nearly black, tapered apically; approximately 3½-4½ times as long as wide, longer than length of cauda. Cauda pale to nearly white, elongate, with 2-3 (usually 2) pairs of lateral setae.

Winged adult female.—In life coloration similar to wingless adult female; forewing with media twice branched, hind wing with one oblique vein;

small sized, body length 1.2-1.8 mm. Antenna 6 segmented; tubercles not well developed, terminal process approximately 6-7½ times length of base of antennal segment VI; antennal segment III with 12-17 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segment IV with 0-6 secondary sensoria; antennal segment V without secondary sensoria. Cornicle dark to nearly black, tapered apically, approximately 4½-6½ times as long as wide, longer than length of cauda. Cauda pale to nearly white, with 2 pairs of lateral setae.

Hosts: Primary hosts include *Prunus* spp. (Blackman & Eastop 1984) however, secondary hosts include numerous species of Gramineae including corn.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Hysteroneura setariae* transmits six plant viruses including guinea grass mosaic virus and sugarcane mosaic virus which are listed as viruses affecting corn (Chan et al. 1991).

Macrosiphum euphorbiae (Thomas 1878)

Figs. 1-3

Synonymy:

Siphonophora euphorbiae Thomas

**Macrosiphum solanifolii* (Ashmead 1882)

***Macrosiphum euphorbiae* (Thomas)

ESA approved common name: potato aphid.

Other common names: none.

Taxonomic characters: Wingless adult female.—

In life, body color varies between shades of green or pink. Medium to large sized, body length 2.2-3.3 mm, pear shaped. Antenna 6 segmented; tubercles well developed with inner faces divergent; terminal process approximately 4½-6 times length of base of antennal segment VI; antennal segment III with 1-6 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle pale or becoming increasingly dusky towards apex, approximately 6½-9 times as long as wide, longer than length of cauda, with slight apical constriction and several rows of polygonal reticulations in constricted area. Cauda pale, with 3-4 pairs of lateral setae and 1-3 dorsal preapical setae.

Winged adult female.—In life, body usually of varying shades of green or pink; forewing with media twice branched, hind wing with 2 oblique veins; medium to large sized, body length 2.2-3.0 mm, pear shaped. Antenna 6 segmented; frontal tubercles well developed with inner faces divergent; terminal process approximately 5½-7 times length of base of antennal segment VI; antennal segment III with 11-20 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle sometimes pale but

usually progressively darker towards apex, with slight apical constriction and several rows of polygonal reticulations in constricted area, approximately 7½-10½ times as long as wide, longer than length of cauda. Cauda pale, with 4-5 pairs of lateral setae and 1-2 dorsal preapical setae.

Hosts: *Macrosiphum euphorbiae* is polyphagous and damaging to many plants of economic importance.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Macrosiphum euphorbiae* transmits 67 plant viruses but is not listed as vector of a corn virus (Chan et al. 1991).

Metopolophium dirhodum (Walker 1849)

Figs. 1-3

Synonymy:

Aphis dirhodum Walker

**Macrosiphum dirhodum* (Walker)

***Metopolophium dirhodum* (Walker)

ESA approved common name: none.

Other common names: rose-grass aphid, rose-grain aphid.

Taxonomic characters: Wingless adult female.—In life, body green to yellow green with dark green longitudinal stripe along the middle of the dorsum. Small to medium sized, body length 1.7-2.7 mm, elongate. Antenna 6 segmented with dark bands on apices of antennal segments III-V, the base of VI dark near the primary sensoria, and the terminal process dark; tubercles well developed with inner faces divergent; terminal process approximately 3¼-4 times length of base of antennal segment VI; antennal segment III with 1-2 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle pale with darker apices, cylindrical with slight tapering to apical flange; approximately 3¾-5½ times as long as wide, longer than length of cauda. Cauda pale, with 2-4 pair of lateral setae and 2-3 dorsal preapical setae.

Winged adult female.—In life, abdomen green without markings; forewing with media twice branched, hind wing with 2 oblique veins; small to medium sized, body length 1.9-2.6 mm, elongate. Antenna 6 segmented; frontal tubercles well developed with inner faces divergent; terminal process approximately 3¼-4 times length of base of antennal segment VI; antennal segment III with 14-21 secondary sensoria over most of the length, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle pale with darker apices, cylindrical with slight tapering to apical flange, approximately 4-6½ times as long as wide, longer than length of cauda. Cauda pale, with 3-4 pairs of lateral setae and 2-4 dorsal preapical setae.

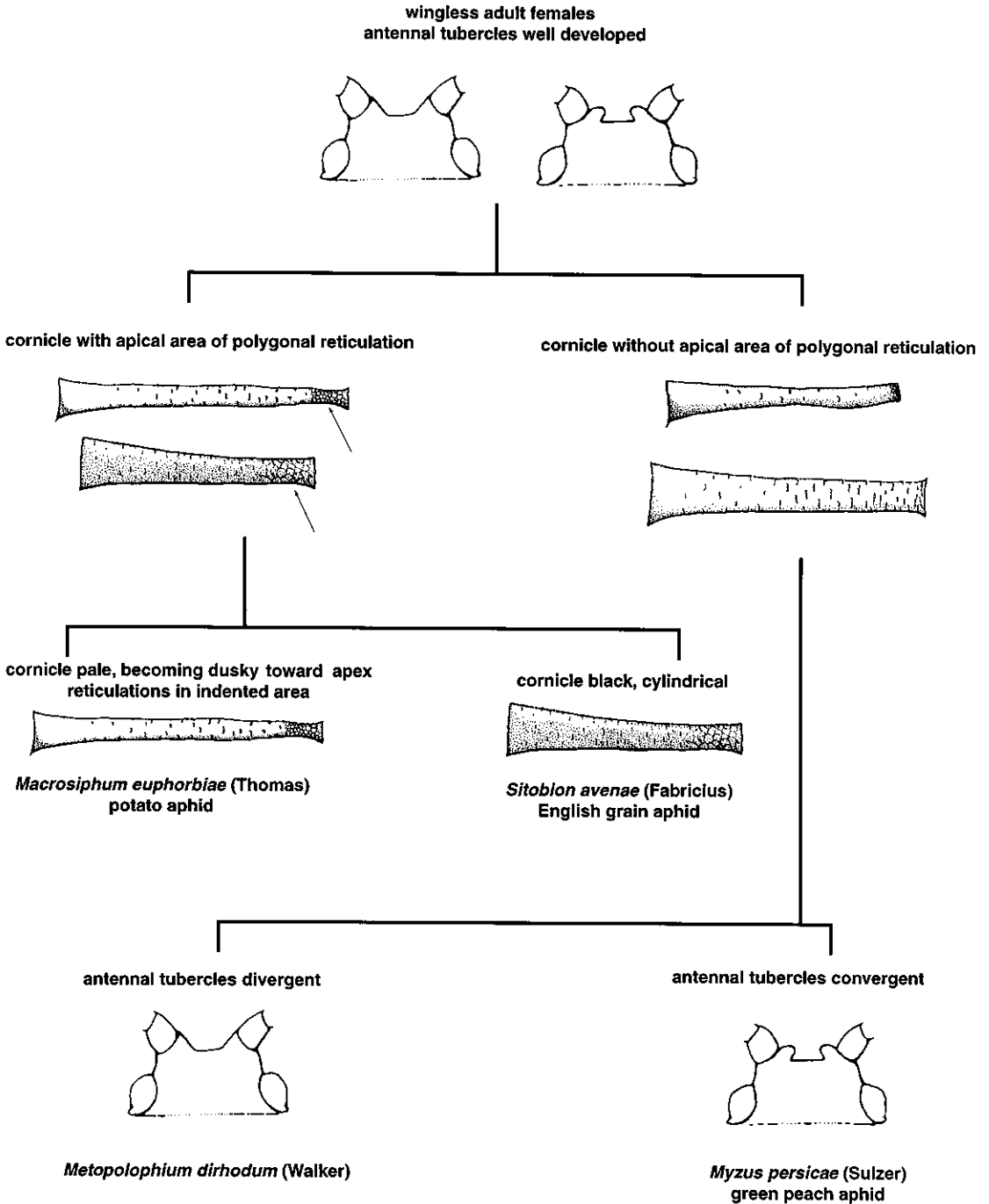


Fig. 2. Pictorial key to wingless adult females of four aphid species that commonly colonize corn in the United States and have well developed antennal tubercles.

Hosts: Primary hosts of *M. dirhodum* include wild and cultivated species of *Rosa*, however, secondary hosts include several species of Gramineae including corn.

U.S. distribution: Widespread except in tropics.
Distribution in the world: Africa, Central Asia, Europe, the Middle East, New Zealand, North America, and South America.

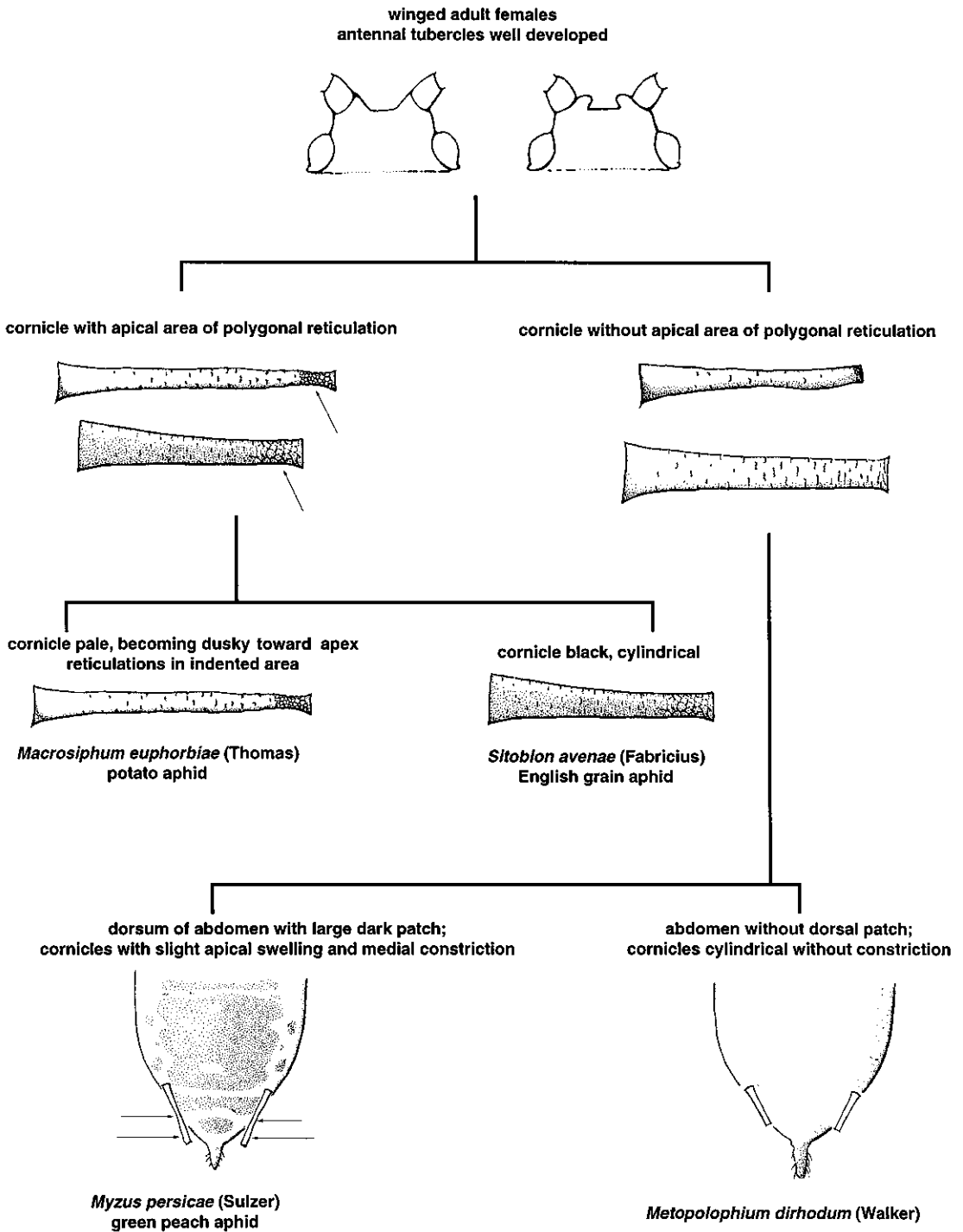


Fig. 3. Pictorial key to winged adult females of four aphid species that commonly colonize corn in the United States and have well developed antennal tubercles.

Comments: *Metopolophium dirhodum* transmits three plant viruses including barley yellow

dwarf virus which is listed as a virus affecting corn (Chan et al. 1991).

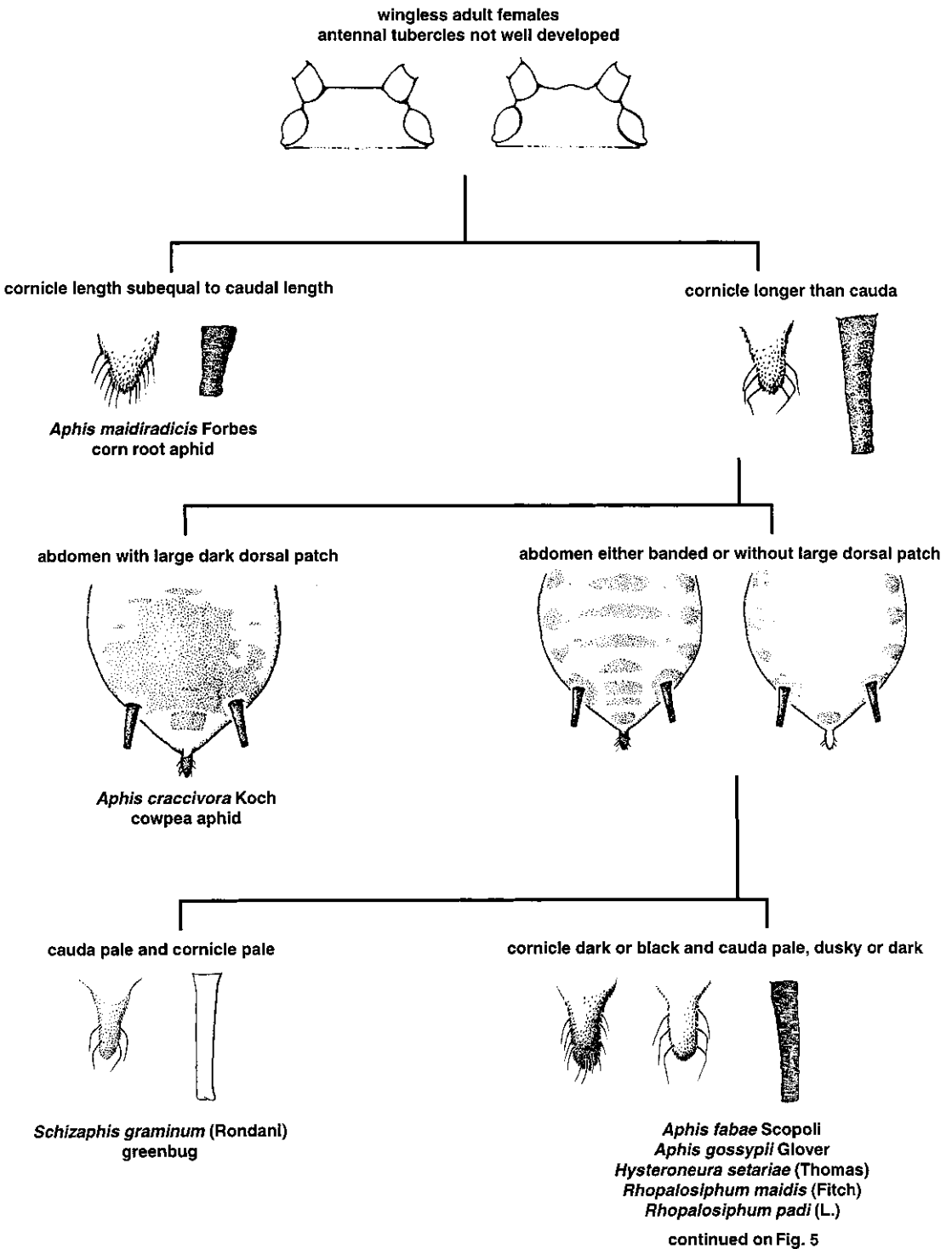


Fig. 4. Pictorial key to wingless adult females of eight aphid species that commonly colonize corn in the United States and have antennal tubercles not developed.

Myzus persicae (Sulzer 1776)

Figs. 1-3

Synonymy:

Aphis persicae Sulzer* & ***Myzus persicae* (Sulzer)

ESA approved common name: green peach aphid.

Other common name: peach-potato aphid.

Taxonomic characters: Wingless adult female.—In life, body color varies from green to pale yellow. Small to medium sized, body length 1.5-2.1 mm, pear shaped. Antenna 6 segmented; tubercles well developed with inner faces convergent; terminal process approximately $3\frac{1}{4}$ - $4\frac{1}{2}$ times length of base of antennal segment VI; antennal segments III-V without secondary sensoria, longest setae on antennal segment III shorter than diameter of III. Cornicle pale but apex may be dark, slight apical swelling and slight medial constriction; approximately $4\frac{2}{3}$ - $7\frac{3}{4}$ times as long as wide, longer than length of cauda. Cauda pale to dusky, with 3 pairs of lateral setae.

Winged adult female.—In life, body varies from green to pale yellow with a large dark patch on dorsum of abdomen; forewing with media twice branched, hind wing with 2 oblique veins; small to medium sized, body length 1.4-2.2 mm, pear shaped. Antenna 6 segmented; tubercles well developed with inner faces convergent; terminal process approximately $2\frac{3}{4}$ - $4\frac{2}{3}$ times length of base of antennal segment VI; antennal segment III with 6-16 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle dusky to dark but apex sometimes darker, slight apical swelling and slight medial constriction; approximately $4\frac{1}{3}$ -9 times as long as wide, longer than length of cauda. Cauda pale to dusky, with 3 pairs of lateral setae.

Hosts: Primary hosts include several species of *Prunus*, however *M. persicae* is polyphagous and damaging to many other plants of economic importance.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Myzus persicae* transmits more than 182 plant viruses including barley yellow dwarf virus and sugarcane mosaic virus which are listed as viruses affecting corn (Chan et al. 1991).

Rhopalosiphum maidis (Fitch 1856)

Figs. 1, 4-7

Synonymy:

Aphis maidis Fitch* & ***Rhopalosiphum maidis* (Fitch)

ESA approved common name: corn leaf aphid.

Other common names: none.

Taxonomic characters: Wingless adult female.—In life, body color blue green to olive green with

reddish-purple areas around cornicle bases, occasionally wax covered. Small sized, body length 1.7-2.6 mm, pair shaped. Antenna 6 segmented; tubercles not well developed, terminal process approximately 2-2 $\frac{1}{2}$ times length of base antennal segment VI; antennal segments III-V without secondary sensoria, longest setae on antennal segment III longer than diameter of segment. Cornicle dark, slightly constricted apically, $2\frac{1}{2}$ - $3\frac{1}{3}$ times as long as wide, longer than length of cauda. Cauda dark, with 2 pairs of lateral setae.

Winged adult female.—In life, abdominal color yellow green to dark green; forewing with media twice branched; hind wing with 2 oblique veins; small sized, body length 1.6-2.0 mm. Antenna 6 segmented, terminal process approximately $1\frac{2}{3}$ - $2\frac{1}{3}$ times length of base antennal segment VI; antennal segment III with 11-20 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segment IV with 1-6 secondary sensoria; antennal segment V with 0-4 secondary sensoria. Cornicle dark, slightly constricted apically, $2\frac{1}{2}$ - $3\frac{1}{2}$ times as long as wide, longer than length of cauda. Cauda dark, with 2 pairs of lateral setae.

Hosts: *Rhopalosiphum maidis* feeds on numerous species of Gramineae including many that are economically important.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Rhopalosiphum maidis* transmits more than 15 plant viruses, including barley yellow dwarf virus, guinea grass mosaic virus, and sugarcane mosaic virus which are listed as affecting corn (Chan et al. 1991).

Rhopalosiphum padi (Linnaeus 1758)

Figs. 1, 4-7

Synonymy:

Aphis padi Linnaeus* & ***Rhopalosiphum padi* (Linnaeus)

ESA approved common name: bird cherry-oat aphid.

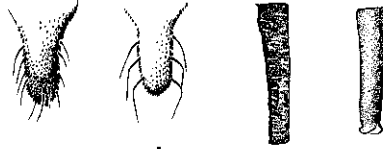
Other common names: oat bird-cherry aphid.

Taxonomic characters: Wingless adult female.—In life, body color varies from light yellow green mottling to dark green, often with orange patches around base of cornicles. Small to medium sized, body length 1.5-2.1 mm, pear shaped. Antenna 6 segmented; tubercles not well developed, terminal process approximately 4-5 $\frac{1}{2}$ times length of base antennal segment VI; antennal segments III-V without secondary sensoria, longest setae on antennal segment III shorter than diameter of segment. Cornicle dark, cylindrical, slightly constricted apically; approximately $2\frac{1}{3}$ -4 times as long as wide, longer than length of cauda. Cauda dark, with 2-3 (usually 2) pairs of lateral setae.

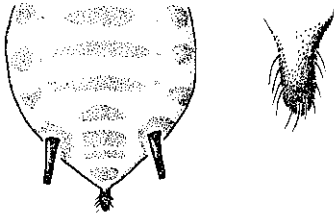
Winged adult female.—In life, abdominal color light green to dark green; forewing with media twice branched, hind wing with 2 oblique veins;

continued from Fig. 4

cornicle dark or black and cauda pale, dusky or dark

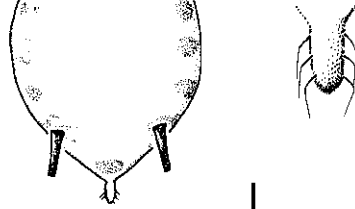


abdomen with dorsal dark bands;
cauda with 4-7 pairs of lateral setae



Aphis fabae Scopoli
bean aphid

abdomen without dorsal dark bands;
cauda with 3 or fewer pairs of lateral setae



cauda pale or dusky

cauda dark or black

apex of femur dark or black

apex of femur without dark or black coloration



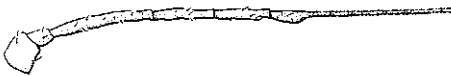
Hysteroneura setariae (Thomas)
rusty plum aphid



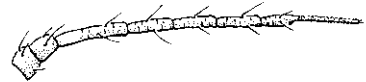
Aphis gossypii Glover
cotton or melon aphid

terminal process >3 times length of base;
antennal setae shorter than width of segment

terminal process < 3 times length of base;
antennal setae longer than width of segment



Rhopalosiphum padi (L.)
bird cherry-oat aphid



Rhopalosiphum maidis (Fitch)
corn leaf aphid

Fig. 5. Continued pictorial key to wingless adult females of eight aphid species that commonly colonize corn in the United States and have antennal tubercles not developed.

small to medium sized, body length 1.6-2.0 mm. Antenna 6 segmented, terminal process approximately 4 1/3-5 1/3 times length of base antennal segment VI; antennal segment III with 11-21 secondary senso-

ria, longest setae on antennal segment III shorter than diameter of segment; antennal segment IV with 3-9 secondary sensoria; antennal segment V with 0-1 secondary sensoria. Cornicle dark, cylin-

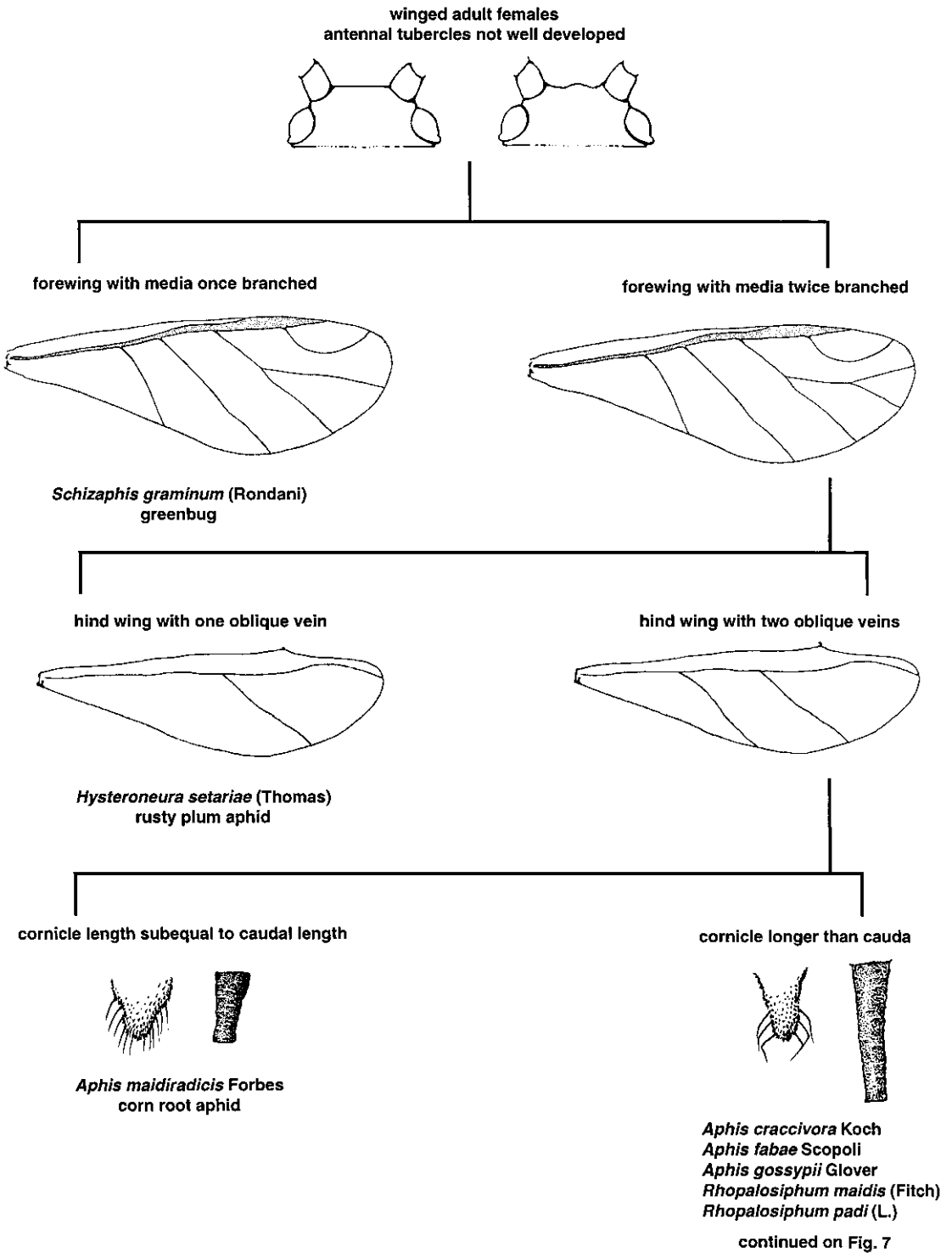


Fig. 6. Pictorial key to winged adult females of eight aphid species that commonly colonize corn in the United States and have antennal tubercles not developed.

continued from Fig. 6

cornicle longer than cauda

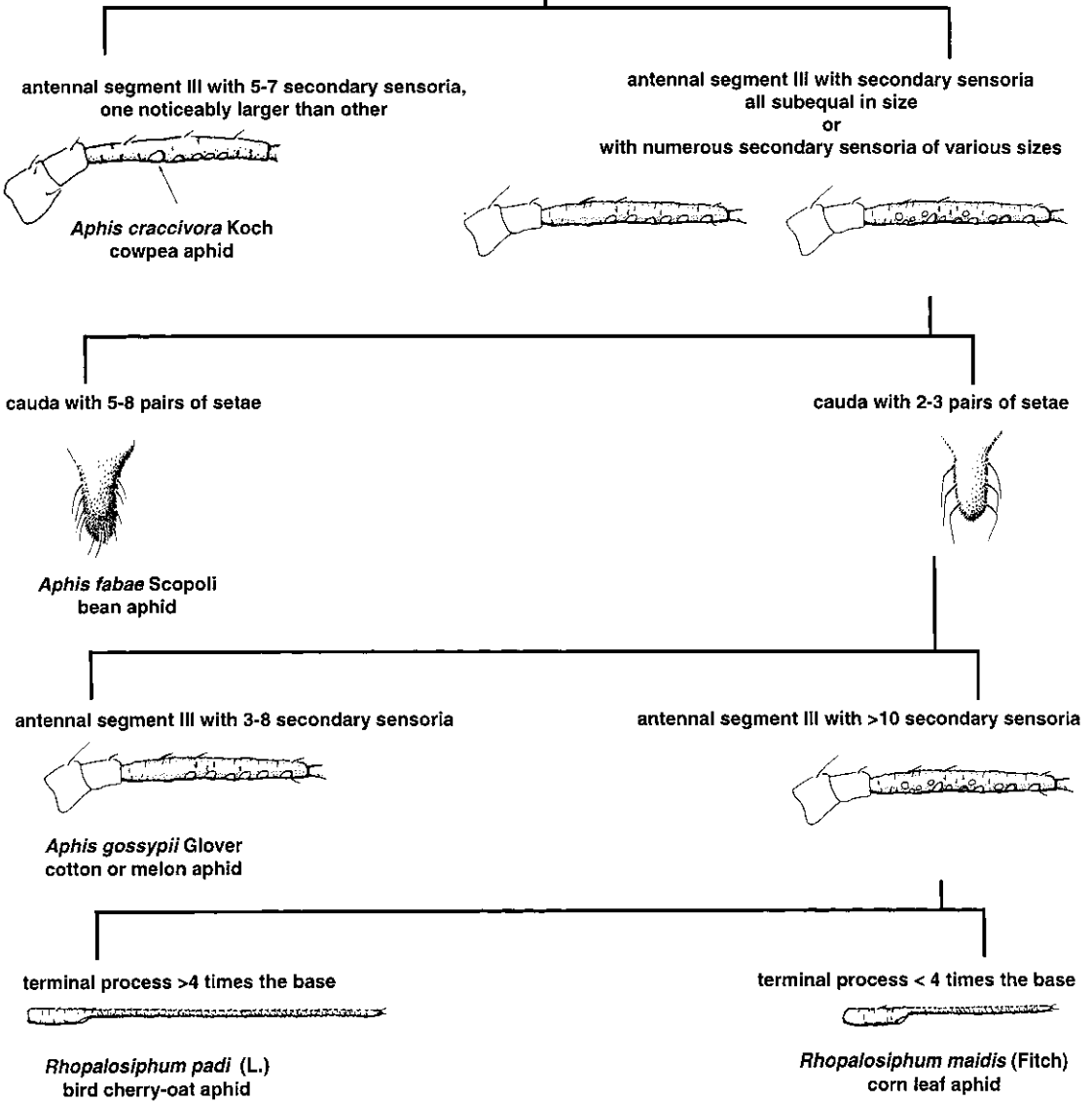
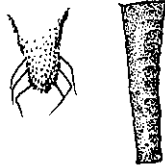


Fig. 7. Continued pictorial key to winged adult females of eight aphid species that commonly colonize corn in the United States and have antennal tubercles not developed.

drical, slightly constricted apically; approximately 4-6½ times as long as wide, longer than length of cauda. Cauda dark, with 2 pairs of lateral setae.

Hosts: Primary host of *R. padi* in North America is *Prunus virginiana*, however it also feeds on numerous species of Gramineae including corn.

U.S. distribution: Widespread.

Distribution in the world: Virtually worldwide.

Comments: *Rhopalosiphum padi* transmits more than 15 plant viruses, including barley yellow dwarf virus, maize leaf fleck virus, and sugarcane mosaic virus which are listed as affecting corn (Chan et al. 1991).

Schizaphis graminum (Rondani 1852)

Figs. 1, 4, 6

Synonymy:

Aphis graminum Rondani

**Toxoptera graminum* (Rondani)

***Schizaphis graminum* (Rondani)

ESA approved common name: greenbug.

Other common names: none.

Taxonomic characters: Wingless adult female.—

In life, body green to yellow green, dorsum often with median longitudinal stripe. Small to medium sized, body length 1.6-2.2 mm, elongate; body setae fine, inconspicuous. Antenna 6 segmented; tubercles not well developed; terminal process approximately $3\frac{3}{4}$ - $4\frac{3}{4}$ times length of base of antennal segment VI; antennal segments III-V without secondary sensoria; longest setae on antennal segment III shorter than diameter of segment. Cornicle pale, sometimes apically dusky, approximately $4\frac{1}{2}$ - $5\frac{3}{4}$ times as long as wide, longer than length of cauda. Cauda pale with 2-3 pairs of lateral setae.

Winged adult female.—In life, head and prothorax yellow brown, abdomen green to yellow green; forewing with media once branched, hind wing with 2 oblique veins; small to medium sized, body length 2.6-3.0 mm, body setae fine, inconspicuous. Antenna 6 segmented; tubercles not well developed; terminal process approximately $3\frac{2}{3}$ - $4\frac{2}{3}$ times length of base of antennal segment VI; antennal segment III with 5-9 secondary sensoria, longest setae on antennal segment III shorter than diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle pale, sometimes apically dusky, approximately $3\frac{1}{2}$ -5 times as long as wide, longer than length of cauda. Cauda pale, with 2-3 pairs of lateral setae.

Hosts: Hosts are several species of Gramineae.

U.S. distribution: Widespread.

Distribution in the world: Africa, Central Asia, Central America, Japan, Korea, Middle East, Nepal, North America, Pakistan, South America, Taiwan, and Thailand.

Comments: *Schizaphis graminum* transmits 3 plant viruses, including barley yellow dwarf virus and sugarcane mosaic virus which are listed as affecting corn (Chan et al. 1991).

Sipha flava (Forbes 1884)

Fig. 1

Synonymy:

Chaitophorus flava Forbes

**Sipha flava* (Forbes), in key

***Sipha flava* (Forbes)

ESA approved common name: yellow sugarcane aphid.

Other common names: yellow sugar cane aphid.

Taxonomic characters: Wingless adult female.—In life, body yellow to green, often with paired intersegmental marking on dorsum. Small sized, body length 1.6-2.1mm, oval shaped, covered with stout, spinelike setae. Antennae 5 segmented; tubercles not well developed; terminal process approximately $4\frac{1}{4}$ - $6\frac{1}{4}$ times length of base of antennal segment V; antennal segments III-IV without secondary sensoria; longest setae on antennal segment II longer than diameter of segment. Cornicle dusky, stout, approximately half as long as wide, shorter than length of cauda. Cauda pale, knobbed, with 3 pairs of lateral setae and 0-1 preapical setae.

Winged adult female.—In life, abdomen yellow with variable dorsal dark markings; forewing with media twice branched, hind wing with 2 oblique veins; small to medium sized, body length 1.5-2.0 mm, covered with stout, spine-like setae. Antennae 5 segmented; tubercles not well developed; terminal process approximately $1\frac{3}{4}$ - $2\frac{3}{4}$ times length of base of antennal segment V; antennal segment III with 3-6 secondary sensoria, longest setae on antennal segment III longer than diameter of segment; antennal segment IV without secondary sensoria. Cornicle dusky, stout, approximately half as long as wide, shorter than length of cauda. Cauda pale, knobbed, with 3-4 pairs of lateral setae and 0-1 preapical setae.

Hosts: Hosts are several species of Gramineae.

U.S. distribution: Widespread.

Distribution in the world: Caribbean, Central America, North America, South America.

Comments: *Sipha flava* transmits sugarcane mosaic virus which is listed as affecting corn (Chan et al. 1991).

Sitobion avenae (Fabricius 1775)

Figs. 1-3

Synonymy:

Aphis avenae Fabricius

**Macrosiphum granarium* (Kirby 1798)

***Sitobion avenae* (Fabricius)

ESA approved common name: English grain aphid.

Other common names: grain aphid.

Taxonomic characters: Wingless adult female.—In life, body yellow green to red brown, dorsum often with faint intersegmental markings. Small to medium sized, body length 2.2-3.8 mm, elongate; body setae fine, inconspicuous. Antenna 6 segmented; tubercles well developed, inner faces divergent; terminal process approximately $4\frac{1}{2}$ - $6\frac{1}{2}$ times length of base of antennal segment VI; antennal segments III-V without secondary sensoria; longest setae on antennal segment III shorter

than diameter of segment. Cornicle black, cylindrical and apically reticulated, approximately 4¼-5 times as long as wide, subequal to length of cauda. Cauda pale, with 2-5 pairs of lateral setae and 0-1 preapical setae.

Winged adult female.—In life, coloration similar to wingless adult female but intersegmental markings are more distinct; forewing with media twice branched, hind wing with 2 oblique veins; small to medium sized, body length 1.8-2.8 mm; body setae fine, inconspicuous. Antenna 6 segmented; tubercles well developed, inner faces divergent; terminal process approximately 5½-6½ times length of base of antennal segment VI; antennal segment III with 5-13 secondary sensoria, longest setae on antennal segment III shorter than

diameter of segment; antennal segments IV-V without secondary sensoria. Cornicle black, cylindrical and apically reticulated, approximately 4½-6½ times as long as wide, subequal to length of cauda. Cauda pale, with 3-5 pairs of lateral setae and 1-2 preapical setae.

Hosts: Several species of Gramineae, including all major cereals and pasture grasses.

U.S. distribution: Widespread.

Distribution in the world: Africa (in part), Central Asia, Central America, India, the Mediterranean, Middle East, Nepal, North America, Pakistan, and South America

Comments: *Sitobion avenae* transmits 4 plant viruses, including barley yellow dwarf virus which is listed as affecting corn (Chan et al. 1991).

KEY TO THE AERIAL FEEDING WINGLESS ADULT FEMALE APHIDS OF CORN IN THE UNITED STATES

With Reference to the Root-feeding, *Aphis maidiradicis* Forbes

- 1. Antenna 5-segmented; body setae stout, spine like; cornicle short, its length approximately half of its width yellow sugarcane aphid, *Sipha flava* (Forbes)
- Antenna 6-segmented; body setae fine, inconspicuous; cornicle elongate, its length greater than half its width 2
- 2(1) Antennal tubercles not well developed, not extending beyond frons or approximately even with frons (Fig. 1) 3
- Antennal tubercles well developed, extending beyond frons (Fig. 1) 10
- 3(2) Longest setae on antennal segment III longer than the diameter of the segment 4
- Longest setae on antennal segment III shorter than the diameter of the segment 5
- 4(3) Cornicle with apical constriction; cauda with 2 pairs of lateral setae corn leaf aphid, *Rhopalosiphum maidis* (Fitch)
- Cornicle cylindrical, without apical constriction; cauda with 4-7 pairs of lateral setae bean aphid, *Aphis fabae* Scopoli
- 5(3) Cornicle pale, sometimes apically dusky greenbug, *Schizaphis graminum* (Rondani)
- Cornicle dark 6
- 6(5) Cornicle length subequal to caudal length corn root aphid, *Aphis maidiradicis* Forbes
- Cornicle longer than cauda 7
- 7(6) Abdomen with large dark dorsal patch cowpea aphid, *Aphis craccivora* Koch
- Abdomen without large dark dorsal patch, abdomen may have small dorsal marking or no markings 8
- 8(7) Cornicle cylindrical with apical constriction; cauda dark bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus)
- Cornicle cylindrical or tapered without apical constriction; cauda pale or dusky 9
- 9(8) Terminal process >4 times length of base; cauda pale to white rusty plum aphid, *Hysteroneura setariae* (Thomas)
- Terminal process < 4 times length of base; cauda dusky to pale cotton or melon aphid, *Aphis gossypii* Glover
- 10(2) Cornicle with polygonal reticulation 11
- Cornicle without polygonal reticulation 12
- 11(10) Cornicle black, 5 times as long as wide, subequal to length of cauda English grain aphid, *Sitobion avenae* (Fabricius)
- Cornicle sometimes pale or becoming increasing dusky toward apex, 6½ times as long as wide, longer than the length of cauda potato aphid, *Macrosiphum euphorbiae* (Thomas)

- 12(10) Antennal tubercles with inner faces convergent; cornicle with slight apical swelling and slight medial constriction green peach aphid, *Myzus persicae* (Sulzer)
 Antennal tubercle with inner face divergent; cornicle cylindrical with slight tapering to an apical flange rose-grass aphid, *Metopolophium dirhodum* (Walker)

KEY TO THE AERIAL FEEDING WINGED ADULT FEMALE APHIDS OF CORN IN THE UNITED STATES

With Reference to the Root-feeding, *Aphis maidiradicis* Forbes

1. Antenna 5-segmented; body setae stout, spine like; cornicle short, its length approximately half of its width yellow sugarcane aphid, *Sipha flava* (Forbes)
 Antenna 6-segmented; body setae fine, inconspicuous; cornicle elongate, its length greater than half its width 2
- 2(1). Antennal tubercles not well developed, not extending beyond frons or approximately even with frons (Fig. 1) 3
 Antennal tubercles well developed, extending beyond frons (Fig. 1) 10
- 3(2) Hind wing with one oblique vein; terminal process 6 times the length of the base of antennal segment VI. rusty plum aphid, *Hysterononeura setariae* (Thomas)
 Hind wing with two oblique veins; terminal process < 6 times the length of the base of antennal segment VI. 4
- 4(3) Forewing with media once branched; cornicle pale sometimes dusky apically greenbug, *Schizaphis graminum* (Rondani)
 Forewing with media twice branched; cornicle black or dusky 5
- 5(4) Cornicle length subequal to caudal length corn root aphid, *Aphis maidiradicis* Forbes
 Cornicle longer than cauda. 6
- 6(5) Longest setae on antennal segment III longer than diameter of segment; cauda with 5-8 pairs of lateral setae and 0-2 preapical setae bean aphid, *Aphis fabae* Scopoli
 Longest setae on antennal segment III shorter than diameter of segment; cauda with <5 pairs of lateral setae 7
- 7(6) Antennal segment III with < 11 secondary sensoria and antennal segment IV without secondary sensoria 8
 Antennal segment III with 11 secondary sensoria and antennal segment IV with secondary sensoria 9
- 8(7) Cornicle and cauda black cowpea aphid, *Aphis craccivora* Koch
 Cornicle dark and cauda pale to dusky cotton or melon aphid, *Aphis gossypii* Glover
- 9(7) Terminal process < 3 times the length of the base corn leaf aphid, *Rhopalosiphum maidis* (Fitch)
 Terminal process > 4 times the length of the base bird cherry-oat aphid, *Rhopalosiphum padi* (Linnaeus)
- 10(2) Cornicle with polygonal reticulation 11
 Cornicle without polygonal reticulation 12
- 11(10) Cornicle black, 7 times as long as wide, subequal to length of cauda English grain aphid, *Sitobion avenae* (Fabricius)
 Cornicle sometimes pale or becoming increasing dusky toward apex, >7 times as long as wide, longer than length of cauda potato aphid, *Macrosiphum euphorbiae* (Thomas)
- 12(10) Abdomen with large dark dorsal patch; cornicle with slight apical swelling and slight medial constriction green peach aphid, *Myzus persicae* (Sulzer)
 Abdomen without large dark dorsal patch; cornicle cylindrical with slight tapering to an apical flange rose-grass aphid, *Metopolophium dirhodum* (Walker)

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