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## A Systematic Study of the Genus *Acerophagus* E. Smith with Descriptions of New Species (Hymenoptera: Encyrtidae)

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This paper presents a revision of the genus *Acerophagus* E. Smith (Hymenoptera: Encyrtidae). Some morphological characters which may aid in distinguishing between species are discussed, and keys are given for both sexes. Several species are redescribed and illustrated, and the distinguishing characters of all species are presented.

The following species are described as new: *Acerophagus antennalis* Rosen and *A. californicus* Rosen from California; *A. flavus* Rosen from Jamaica; *A. luteolus* Rosen from Trinidad.

All the known species of *Acerophagus* are primary parasites of mealybugs.

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# A Systematic Study of the Genus *Acerophagus* E. Smith with Descriptions of New Species (Hymenoptera: Encyrtidae)<sup>1</sup>

## INTRODUCTION

*Acerophagus* E. Smith, 1880, page 83.

Timberlake, 1916, page 574.

*Rhopoideus* Howard, 1898, page 235.

THE GENUS *Acerophagus* consists of minute, yellow encyrtids with a five-segmented funicle and a three-segmented antennal club; sexual dimorphism is very slight, males differing from females mainly in primary sexual characters and in having a solid antennal club.

*Acerophagus* is closely related to *Timberlakia* Mercet and *Pseudaphycus* Clausen. *Timberlakia* may be distinguished by the reduced segmentation of the antennal club (two-segmented or solid in the female), and by the minute, two-segmented maxillary palpi and one-segmented labial palpi. *Acerophagus* may be separated from *Pseudaphycus* by the following combination of characters: Body more robust; frontovertex wider, usually less than twice as long as wide; ocelli more frequently in a nearly right-angled or obtuse triangle; dominant color yellow, antennae more or less concolorous, pale, the club never contrastingly white. The mandibles of *Acerophagus* are tridentate, with the two upper teeth usually subequal, the lower tooth smaller and more basal (Timberlake, 1916; Gahan, 1946).

The genus *Psilomirinus* Brèthes (type species: *flavidulus* Brèthes) was con-

sidered by Mercet (1921, p. 692-93) as a synonym of *Acerophagus*. This synonymy was accepted by Compere and Annecke (1960) and by Tachikawa (1963). However, De Santis (1963) placed *Psilomirinus* in synonymy with *Pseudaphycus*. *P. flavidulus* was described from the holotype ♀ and one allotype ♂, both of which are mounted under one cover glass, with their heads in a position that does not permit close examination of the frontovertex and ocellar triangle. (Additional specimens, recently reared in Chile, resemble *Acerophagus* in having the frontovertex relatively wide and the ocellar triangle right-angled.) In other characters, including the structure of the mandibles, as well as general and antennal coloration, *flavidulus* is more closely related to *Pseudaphycus*. The species appears to occupy an intermediate position between the two genera; it seems to have been correctly placed by De Santis in *Pseudaphycus*, and for the present should remain in that genus.

As pointed out by Compere and Annecke (1960), *Acerophagus* obviously belongs to the Ectromatini: paratergites, although indistinct, are evident in cleared specimens (figure 26), and the ovipositor is enclosed by the distal abdominal sternites to the apex of the

<sup>1</sup> Submitted for publication August 19, 1968.



abdomen when at rest, and is everted during oviposition (figure 27).

**Morphological characters.** The species of *Acerophagus* present relatively few good diagnostic characters for their separation. Most species are known only from the type material; the ranges of their geographical distribution, host preferences, and morphological variability are virtually unknown.

The relative width of the frontovertex was used as an important diagnostic character by Timberlake (1916, 1918), as well as in the present study. It is an inconvenient character, as the proportions of the frontovertex are often distorted by shrinkage in dry specimens, and are usually concealed in slide mounts. The frontovertex varies from fully as wide as long in *A. citrinus* (Howard) to nearly twice as long as wide in *A. debilis* Timberlake and *A. luteolus* Rosen. In any given species, it is usually wider in males than in females. However, whenever large series of individuals were available for study, this character presented a considerable degree of variation (1.6 times to nearly twice as long as wide in females of *A. notativentris* (Girault), 1.6 to 1.8 times in the males, 1.50 to 1.73 times in females of *A. coccois* E. Smith). Small specimens tend to have a relatively wider frontovertex.

The ocellar triangle varies from clearly less than right-angled in *A. coccois* to distinctly obtuse in *A. citrinus*. The anterior ocellus may be situated at about the center of frontovertex, as in *A. texanus* (Howard), or considerably beyond that point, as in *A. fasciipennis* Timberlake. The posterior ocelli may be situated at about their own diameter from the inner margins of the compound eyes, as in *A. gutierreziae* Timberlake and *A. coccois*, or considerably closer to the eyes, as in *A. texanus*. Some variation in the position of the ocelli is usually evident in large series. Like the proportions of the frontovertex,

those of the ocellar triangle are frequently distorted in dry or slide-mounted specimens. The actual size of the ocelli is not a valid diagnostic character for species determination.

No specific differences were noted in the structure of the mandibles, which in all species are of the "*Acerophagus* type," with the two upper teeth subequal and the lower tooth smaller and more basal (figures 22, 29). The maxillary palpi are four-segmented in most species, three-segmented in *A. coccois* (figure 23); the labial palpi are two-segmented in all species.

The antennae often offer reliable diagnostic characters, although the apparent proportions of the various segments may sometimes be affected to some extent by the mounting procedure and by the position of the antenna on the slide. The antennae vary from relatively slender and elongated in *A. pallidus* Timberlake to strongly compressed and clavate in *A. debilis*. The scape is more or less slender, nearly four to more than five times as long as wide. The pedicel varies from nearly twice as long as wide in *A. citrinus*, to fully three times as long as wide in *A. pallidus*; it is about as long as the first three or four funicular segments combined in most species, nearly as long as the entire funicle in *A. debilis*. All five funicular segments are usually more or less wider than long; the first segment varies from fully as long as wide or longer in *A. pallidus* (figures 19, 20) to more than twice as wide as long in *A. debilis* (figure 12); the fifth segment varies from nearly as long as wide in *A. antennalis* Rosen (figure 9) to more than twice as wide as long in *A. debilis*. The female club is three-segmented in all species, with the segments closely fused as in *A. texanus* (figures 38, 40), or relatively distinct as in *A. californicus* Rosen (figure 47); the male club is always solid.



The scutellum is usually somewhat wider than long, more or less roundly acute at apex; in *A. luteolus*, it is fully as long as wide and more distinctly acute.

Wing venation is similar in all species: marginal vein about as long as wide or slightly longer; postmarginal vein about as long as marginal vein; stigmal vein widened at apex, usually somewhat longer than the marginal and postmarginal veins combined. The speculum of the forewing is more or less gradually widened below in most species (figures 13, 16, 25, 48); it is interrupted by several setae in *A. erii* Timberlake (figure 2). The marginal fringe of the forewing is usually short, not exceeding one-tenth width of disc.

The pattern of the forewing is an additional diagnostic character. Wings vary from distinctly banded, with a dark, heavily pigmented cloud, in *A. fasciipennis* (figures 33, 34), to dusky, with a similar but much paler cloud in *A. texanus* (figure 42), to partly hyaline, with a distinct, triangular infuscated cloud in *A. californicus* (figure 48), to perfectly hyaline in *A. flavus* Rosen (figure 31).

The ovipositor is always exerted, the sheaths varying in length from one-fourth to over one-third length of abdomen. The relative length of the ovipositor and abdomen may be affected by clearing and mounting procedures.

The relative length of male genitalia may also vary with the species (see figures 10, 44).

Coloration may be used as an additional distinguishing character. The dominant color is always yellow, varying from pale yellow in *A. fasciipennis* to deep orange yellow in *A. texanus*. Some species are uniformly yellow, others have various amounts of fuscous on the thorax, propodeum or abdominal tergites of either female or male, best visible in cleared specimens. The antennae are usually concolorous, some-

times faintly dusky; in males of *A. debilis* and *A. antennalis*, several funicular segments and the base of the club are contrastingly dark brown.

The pubescence of the thorax varies from slender, pale, virtually invisible under a stereoscopic microscope (in slide-mounted specimens on a white background as well as in point mounts) in *A. fasciipennis*, to robust, dark, readily visible in *A. flavus* and in the Mexican form of *A. texanus*. The discal setae on the forewing also vary from very slender, invisible in balsam under a stereoscopic microscope (on a white background) in *A. fasciipennis*, to relatively robust, dark and readily visible in *A. texanus*.

**Biology.** All the known species of *Acerophagus* are parasitic in mealybugs. The life history of *A. notativentris*, a primary, gregarious parasite of the grape mealybug, *Pseudococcus maritimus* (Ehrhorn), was reported by Clausen (1924).

**Geographical distribution.** North America (United States, Mexico) and the Caribbean Islands. Moursi (1948) recorded "*Acerophagus* sp." as a parasite of *Nipaecoccus filamentosus* (Cockerell) in Egypt. His species, however, was found to be a *Timberlakia*, and will be treated elsewhere.

*Acerophagus zambezei* Risbec (1955), a large, black African species with three annelli and a small, two-segmented club in the female antenna, obviously does not belong to *Acerophagus* as understood here. Determination of its correct taxonomic position and affinities cannot be made without examination of type material, and is outside the scope of this paper.

In the present paper, two species from California and two species from the Caribbean Islands (Trinidad, Jamaica) are described as new.

**Type of the genus.** *Acerophagus coccois* E. Smith.



Key to the Species of *Acerophagus*<sup>2</sup>

## Females

1. Frontoververtex as wide as long, or nearly so ..... 2
  - Frontoververtex narrower, one and one-half times as long as wide or longer ..... 3
- 2(1). Frontoververtex fully as wide as long, ocelli in an obtuse triangle; antennal pedicel nearly twice as long as wide, fifth funicular segment over one and one-half times as wide as long; speculum of forewing wide, uninterrupted ..... 1. *citrinus* (Howard)
- Frontoververtex slightly longer than wide, ocelli in a right-angled triangle; antennae more slender, pedicel about 2.5 times as long as wide, fifth funicular segment less than one and one-half times as wide as long; speculum of forewing narrow, interrupted by one row of setae below middle ..... 2. *erii* Timberlake
- 3(1). Extensive dark-brown markings on pronotum, metanotum, propodeum and abdominal tergites; funicular segments moderately transverse, one and one-half times as wide as long or slightly wider; wings nearly hyaline, forewing sometimes with a faint triangular cloud ..... 3. *notativentris* (Girault)
- Coloration more uniformly yellow, sometimes with dark markings on propodeum and some abdominal tergites, never on thorax ..... 4
- 4(3). Frontoververtex relatively narrow, twice as long as wide or nearly so ..... 5
  - Frontoververtex wider, one and one-half to one and three-fourths times as long as wide ..... 7
- 5(4). Antennae strongly clavate, funicular segments strongly compressed, wings perfectly hyaline ..... 6
  - Antennae elongated, not strongly clavate, funicular segments not compressed, fifth segment nearly quadrate; forewing with a faint yellowish cloud on basal half ..... 4. *antennalis* Rosen
- 6(5). Antennal scape widened in the middle, less than four times as long as wide; pedicel nearly as long as the entire funicle; all funicular segments very strongly compressed, fully twice as wide as long, or wider; club large, about 1.6 times as long as wide; coloration capucine yellow ..... 5. *debilis* Timberlake
- Antennal scape slender, five times as long as wide; pedicel about as long as the first four funicular segments combined; funicular segments less strongly compressed, first segment about 1.6 times as wide as long; club more elongated, parallel-sided, twice as long as wide; coloration paler, buff yellow ..... 6. *luteolus* Rosen
- 7(4). Wings perfectly hyaline or nearly so, without a distinct cloud ..... 8
  - Forewing with a distinct integumentary cloud ..... 10
- 8(7). Antennae relatively slender, pedicel three times as long as wide or longer, first funicular segment fully as long as wide, subsequent segments only slightly wider than long, fifth segment one and one-third times as wide as long; ocelli in a right-angled triangle ..... 7. *pallidus* Timberlake
- Antennae less slender, pedicel shorter, first funicular segment distinctly wider than long, fifth segment at least one and one-half times as wide as long ..... 9

<sup>2</sup> *A. gutierreziae* Timberlake not included, see page 69.



- 9(8). Ocelli in an acute triangle; maxillary palpi three-segmented; funicular segments moderately transverse, fifth segment one and one-half times as wide as long ..... 8. *coccois* E. Smith
- Ocelli in a right-angled triangle; maxillary palpi four-segmented; funicular segments more strongly transverse, fifth segment twice as wide as long ..... 9. *flavus* Rosen
- 10(7). Abdomen uniformly yellow; cloud on forewing large, starting proximad of speculum ..... 11
- Abdomen with two dark cross-bands; cloud on forewing smaller, triangular, starting distad of speculum ..... 12
- 11(10). Frontovortex relatively wide, one and one-half times as long as wide; funicular segments only moderately transverse, fifth segment clearly less than one and one-half times as wide as long; coloration pale yellow; cloud on forewing distinct, dark, heavily pigmented; discal setae slender, pale ..... 10. *fasciipennis* Timberlake
- Frontovortex narrower, one and three-fourths times as long as wide; funicular segments more strongly transverse, fifth segment one and three-fourths times as wide as long; coloration deep orange yellow; cloud on forewing less distinct, uniform, not heavily pigmented; discal setae coarse, dark ..... 11. *texanus* (Howard)
- 12(10). Funicular segments only slightly transverse, fifth segment only one and one-fourth times as wide as long; delta-shaped area basad of speculum of forewing sparsely ciliated, especially towards base; cloud on forewing large, triangular, starting at the posterior margin of the wing, interrupted by a narrow hyaline streak parallel to the posterior margin; cross-bands on abdomen broad, conspicuous ..... 12. *nubilipennis* Dozier
- All funicular segments more strongly transverse, about one and one-half times as wide as long; forewing evenly ciliated to the base, with a smaller triangular cloud, corresponding to the part of the cloud of *nubilipennis* above the hyaline streak, separated by a broad hyaline band from a narrow, less distinct cloud along the posterior margin of the wing; cross bands on abdomen narrow, inconspicuous ..... 13. *californicus* Rosen

### Males

1. Wings without a conspicuous, dark cross-band ..... 2
- Forewing with a conspicuous, smoky band across the disc ..... 10. *fasciipennis* Timberlake
- 2(1). Frontovortex as wide as long or nearly so ..... 3
- Frontovortex narrower, at least one and one-half times as long as wide .. 4
- 3(2). Frontovortex fully as wide as long; speculum of forewing wide, uninterrupted ..... 1. *citrinus* (Howard)
- Frontovortex slightly longer than wide (11:10); speculum of forewing narrow, sometimes slightly interrupted below middle ... 2. *erii* Timberlake
- 4(2). Apical funicular segments and base of club contrastingly dark brown .. 5
- Antennae yellow, sometimes dusky, without contrastingly dark brown segments ..... 6
- 5(4). All funicular segments strongly compressed, about twice as wide as long ..... 5. *debilis* Timberlake
- Funicular segments not compressed, first and second segments about one and one-third times as wide as long, third and fourth segments one and one-half times, fifth segment one and three-fourths times as wide as long ..... 4. *antennalis* Rosen



- 6(4). Coloration uniformly yellow, without any dark markings ..... 7  
 - Abdominal tergites with dark markings ..... 8  
 7(6). Frontovortex about one and one-half times as long as wide, ocelli in an acute triangle; maxillary palpi three-segmented; funicular segments moderately transverse, fifth segment about one and one-half times as wide as long ..... 8. *coccois* E. Smith  
 - Frontovortex narrower, one and three-fourths times as long as wide, ocelli in a right-angled triangle; maxillary palpi four-segmented; funicular segments rather strongly compressed, fifth segment about twice as wide as long ..... 6. *luteolus* Rosen  
 8(6). Extensive dark markings on pronotum, metanotum, propodeum and abdominal tergites, often on mesoscutum; a distinct, continuous dark blotch on apical half of abdomen ..... 3. *notativentris* (Girault)  
 - Thorax uniformly yellow or orange-yellow; posterior abdominal tergites with dark markings ..... 9  
 9(8). Antennae slender, pedicel fully three times as long as wide, first funicular segment slightly longer than wide, fifth segment only one and one-third times as wide as long ..... 7. *pallidus* Timberlake  
 - Antennae not slender, pedicel shorter, first funicular segment wider than long, fifth segment nearly twice as wide as long ..... 10  
 10(9). General coloration deep orange-yellow; forewing with a faint trace of dusky cloud below the marginal vein ..... 11. *texanus* (Howard)  
 - General coloration light cadmium yellow; forewing perfectly hyaline ..... 9. *flavus* Rosen

### 1. *Acerophagus citrinus* (Howard)

*Rhopoideus citrinus* Howard, 1898, page 235.

*Acerophagus citrinus*: Timberlake, 1916, page 578.

Type host: Unknown.

Distribution: California.

Type: U.S.N.M., Cat. No. 5027.

*A. citrinus* may be readily distinguished from all other known species of *Acerophagus* by the relatively wide frontovortex—fully as wide as long in both sexes.

**Distinguishing characters. Female:** Frontovortex as wide as long; ocelli in an obtuse triangle, anterior ocellus slightly below center of frontovortex, the posterior pair about their own diameter from eye margins, twice their diameter from the occipital rim. Antennal scape slender, nearly six times as long as wide (100:17); pedicel nearly twice as long as wide (40:21), somewhat longer than the first three funicular segments combined; all funicular segments considerably wider than long, increasing successively in length and width; fourth and fifth segments about one and two-thirds times as wide as long (10:14; 11:15; 13:16; 12:20; 15:24); club three-segmented, nearly twice as long as wide (76:40), much wider than the fifth funicular segment. Speculum of forewing relatively wide, widening below, separated by one row of setae from the hairless streak along the posterior margin of the wing. Ovipositor exerted to about one-fourth length of abdomen. Head, thorax and abdomen uniformly pale orange yellow, tips of ovipositor sheaths blackish; wings hyaline; pubescence of thorax slender, pale.

**Male:** Essentially similar to the female. Frontovortex as wide as long; ocelli in a right-angled or slightly obtuse triangle, anterior ocellus at center

of frontovertex. Speculum of forewing relatively wide. Coloration orange-yellow, without any dark markings, abdomen of point-mounted specimens deep orange; wings hyaline.

**Material examined.** The type series includes 5 ♀♀ and 2 ♂♂, all mounted on points; one antenna, one forewing and one hind wing of a female cotype are mounted in balsam.

## 2. *Acerophagus erii* Timberlake

(Figures 1-2)

*Acerophagus erii* Timberlake, 1916, page 577.

Type host: *Amonostherium lichtenoides* (Cockerell).

Distribution: Utah.

Type: U.S.N.M., Cat. No. 19120.

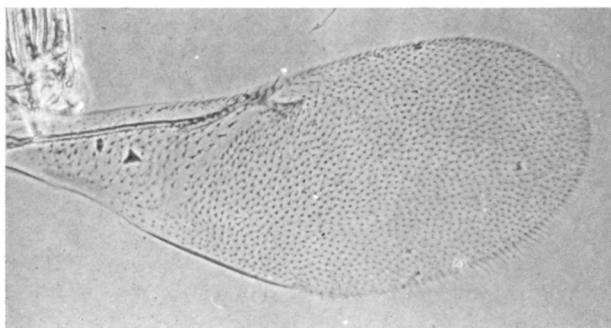
This species may be recognized by the relatively wide frontovertex, the narrow, slightly interrupted speculum, the uniform yellow coloration and hyaline wings. It is closely related to *A. citrinus*, differing from the latter species mainly in the slightly narrower frontovertex, the more slender antennae, and the slight interruption on the speculum of the forewing.

**Distinguishing characters. Female:** Frontovertex about one and one-fourth times as long as wide (26:21), inner orbits parallel; ocelli in a right-angled triangle, anterior ocellus somewhat below center of frontovertex, the posterior pair about their own diameter from eye margins, one and one-half their diameter from the occipital rim. Antennal scape (figure 1) slender, about five times as long as wide (53:10), radicle excluded; pedicel relatively slender, more than

two and one-half times as long as wide (24:9), somewhat longer than the first four funicular segments combined; all funicular segments moderately transverse, the first four segments subequal in length, widening successively, the first segment trapezoidal, slightly wider than long, the fourth about one and one-half times as wide as long; fifth segment larger, only slightly more than one and one-fourth times as wide as long (5:7; 5:7.5; 5:8; 6:9; 8.5:11); club three-segmented, more than twice as long as wide (39:17), about as long as the funicle and one-third of the pedicel combined,



1



2

Figs. 1 and 2: *Acerophagus erii*.

1. Female antenna (paratype specimen).
2. Female forewing (paratype specimen).



about one and one-half times as wide as the fifth funicular segment. Speculum of forewing (figure 2) relatively narrow, interrupted by one row of setae below middle, widening again below the interruption, and separated by one to two rows of setae from the hairless streak along the posterior margin of the wing; marginal fringe short, not exceeding one-twelfth width of disc. Ovipositor exerted to about one-fourth length of abdomen. Coloration uniformly orange-yellow, without any dark markings; ovipositor sheaths blackish; wings hyaline. Pubescence of thorax slender, pale.

**Male:** Essentially similar to the female. Frontoververtex only slightly longer than wide (11:10); ocelli in a right-angled triangle, anterior ocellus at center of frontoververtex, the posterior pair about their own diameter from eye margins. Speculum of forewing narrow, sometimes slightly interrupted. Head and thorax yellow, abdomen deep orange; wings hyaline.

**Material examined.** *A. erii* is known from the type series only (6 ♀♀, 2 ♂♂ on points at the U.S.N.M., 3 ♀♀ on slides in the collection of P. H. Timberlake, Riverside, California; all reared from the typical host, Salt Lake City, Utah, July 14–16, 1913).

### 3. *Acerophagus notativentris* (Girault)

(Figures 3–6)

*Pseudaphycus notativentris* Girault, 1917, page 10.

*Acerophagus notativentris*: Timberlake, 1918, page 349.

Type host: *Pseudococcus* sp. on grape.

Distribution: California, Missouri, Vermont, Connecticut, Virginia, Mexico (Baja California).

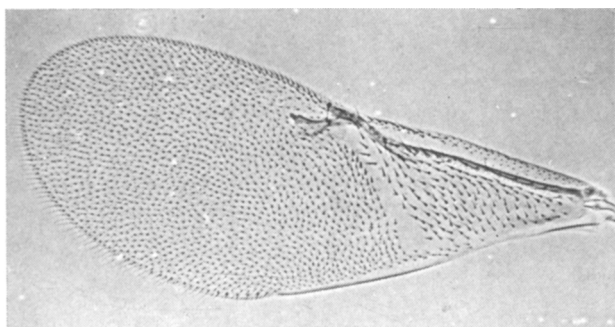
Type: U.S.N.M., Cat. No. 20019.

Clausen (1924) reared this species in large numbers from the grape mealybug, *Pseudococcus maritimus* (Ehrhorn), on grape in the San Joaquin Valley, California.

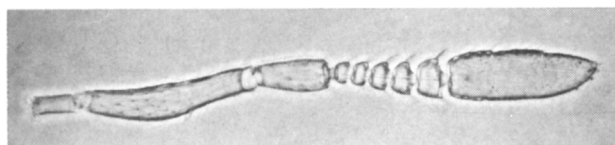
**Distinguishing characters.** *A. notativentris* may be readily recognized by the extensive brownish markings on the pronotum, metanotum, propodeum and abdominal tergites of both sexes. Typical females have five transverse dark bands on the dorsum of the abdomen. Males often have also the anterior margin of the mesoscutum and the mesonotal sutures suffused with brownish, and a distinct, continuous brown blotch on the apical half of the abdomen. The wings are usually nearly hyaline in both sexes (figure 3). In the female, the fronto-

vertex is usually a trifle narrower than in species of the *texanus* group. This character, however, is rather variable. The frontoververtex ranged from about 1.6 times to nearly twice as long as wide in the female specimens studied; length-width relationship of the frontoververtex is also difficult to determine accurately, depending to a large extent on the exact position of the head and the amount of shrinkage, and should not be regarded as a reliable character for the separation of *A. notativentris*. In the male, the frontoververtex is about 1.6 to 1.8 times as long as wide. The maxillary palpi are four-segmented and the labial palpi are two-segmented in both sexes.

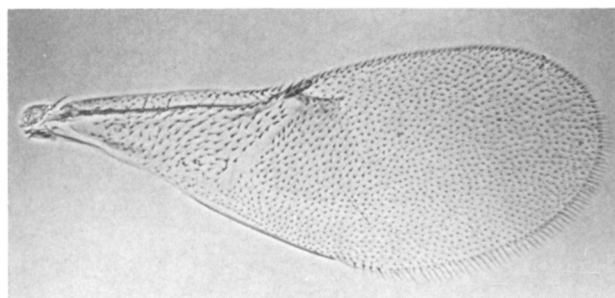
Antennal characters may serve as additional recognition characters for *A. notativentris*. In the female (figure 4), the pedicel is about as long as the first three funicular segments and half the fourth segment combined; all funicular segments are moderately transverse, about one and one-half times as wide as long, sometimes slightly wider (in one of Girault's type specimens: 10:15; 11:17; 12:19; 14:21; 17:26). In the male, the pedicel is about as long as the



3



4



5



6

Figs. 3 to 6: *Acerophagus notativentris*.

3. Female forewing (from a slide prepared by P. H. Timberlake for his 1918 redescription of the species).

4. Female antenna (California material).

5. Female forewing (Mexican material, "series VII").

6. Male antenna (California material, "series II"; note elongated club).

**Material examined.** In addition to Girault's type series (10 ♀♀, 6 ♂♂, on slides in the U.S.N.M.) and the material recorded by Timberlake (1918), the following series of *A. notativentris* have been examined in the present study:

I. 6 ♀♀, 1 ♂, reared by A. H. Hollinger from *Eurycoccus jessica* (Hollinger), Columbia, Missouri, September 29, 1917 (mounted on points in P. H. Timberlake's collection, Riverside).

II. 2 ♀♀, 2 ♂♂, reared by J. D. Maple from *Dysmicoccus ryani* (Coquillett), Monrovia, California, February 1935 and July 1936; 1 ♂ from an undetermined host, Montebello, California, August 1935 (mounted in balsam in H. Compere's collection, Riverside). The males of this series have the funicular segments apparently more strongly compressed than in the type series, and

first four funicular segments combined; the funicular segments are somewhat more strongly transverse, sometimes nearly twice as wide as long (in a paratype specimen: 11:15; 10:16; 12:19; 12:22; 15:28), and the club is relatively elongated, nearly three times as long as wide (103:35), sometimes fully twice as long as the entire funicle.



the club appears to be exceptionally elongated, bearing relatively long, coarse setae (figure 6). Otherwise indistinguishable from typical *notativentris*.

III. 2 ♀ ♀, 1 ♂, reared by D. W. Clancy from *Ferrisia virgata* (Cockerell), Covesville, Virginia, June 9, 1944 (on points, U.S.N.M.).

IV. 2 ♀ ♀, 1 ♂, reared from *Pseudococcus comstocki* (Kuwana), Wilton, Connecticut, July 15, 1946 (on points, U.S.N.M.).

V. 1 ♀, 2 ♂ ♂, reared by R. L. Doutt from *Pseudococcus maritimus* (Ehrhorn) on pear, Santa Clara, California, July 1950 (mounted in balsam in H. Compere's collection, Riverside).

VI. 1 ♀, 2 ♂ ♂, reared from a mealybug by B. Puttler, Cornwall, Vermont, July 11, 1961 (♀ on point, ♂ ♂ in balsam, U.S.N.M.).

VII. 12 ♀ ♀, 15 ♂ ♂, reared by P. DeBach from a mealybug on *Hibiscus*,

La Paz, Baja California, Mexico, January 15, 1967 (5 ♀ ♀ on points, the rest in Hoyer). The specimens in this series differ from typical *notativentris* in having a very faint triangular cloud on the forewing (figure 5), similar to the wing pattern of *A. californicus*. This cloud, however, is almost indistinguishable in smaller female specimens and in some males. The females also have the abdomen relatively lightly colored, yellow, with only three distinct dark cross bands (straight transverse stripes on fifth and sixth abdominal tergites,<sup>a</sup> a semi-circular transverse stripe on seventh tergite). Both sexes have the antennae more decidedly dusky; pubescence of thorax dark, robust.

*A. notativentris* thus appears to be quite widespread in North America, and rather polyphagous. It is, however, possible that it will eventually prove to be a complex of several closely related species.

#### 4. *Acerophagus antennalis* Rosen, n.sp.

(Figures 7–11)

Type host: *Dysmicoccus ryani* (Coquillett).

Distribution: California.

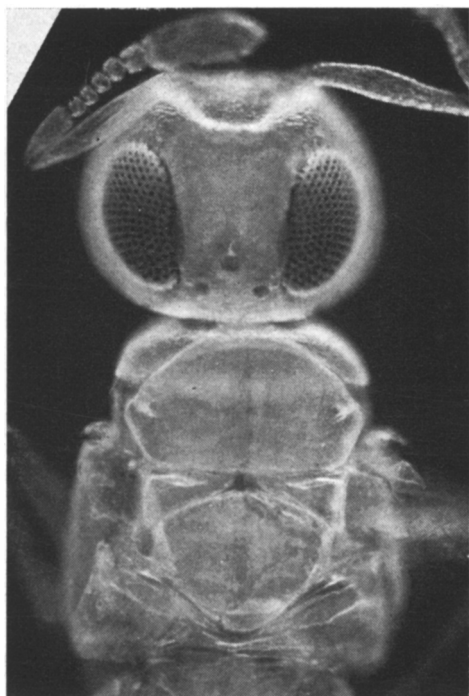
Type: U.S.N.M., Cat. No. 69975.

This species may be readily recognized by the relatively elongated frontovertex, by the nearly quadrate fifth funicular segment of the female, and by the striking, *Pseudaphycus*-like coloration of male antennae. It is probably most closely related to *A. debilis*, from which it may be separated mainly by the much less strongly transverse funicular segments of both sexes. Only slide-mounted specimens were available for study.

*Female*: Frontovertex (figure 7) elongated, widening in front of the

eyes, about twice as long as wide where narrowest (i.e. on the level of anterior ocellus); inner orbits diverging anteriorly; ocelli in a right-angled or somewhat obtuse triangle, anterior ocellus apparently on posterior one-third of frontovertex, the posterior pair about their own diameter from eye margins, about one and one-half their diameter from the occipital rim. Antennal scape (figures 7, 8) slender, about five times as long as wide (radicle excluded); pedicel slender, about two and one-half times as long as wide, slightly shorter than the first four funicular segments combined; all funicular segments more or less rectangular, first four segments subequal in length, slightly widening

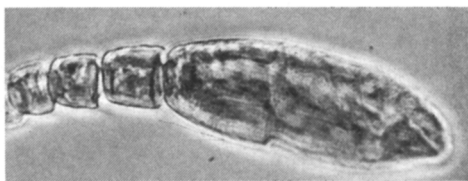
<sup>a</sup> Propodeum counted as first abdominal segment; the reduced ring-like petiole as second (see Richards, 1956).



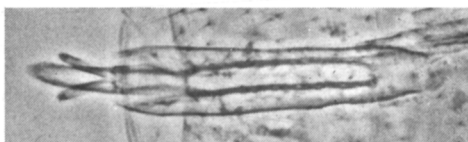
7



8



9



10

Figs. 7 to 11: *Acerophagus antennalis*.

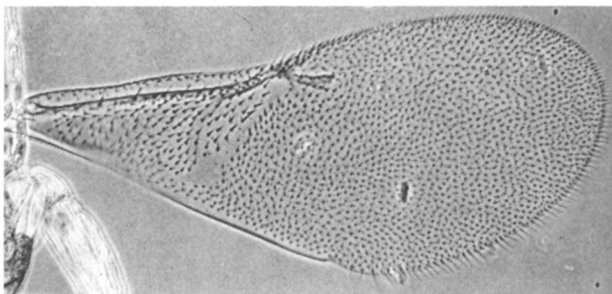
7. Female head and thorax (holotype specimen; photograph by E. B. White).

8. Female antenna (holotype specimen).

9. Female antenna, apical funicular segments and club (paratype specimen).

10. Male genitalia (paratype specimen).

11. Male forewing (paratype specimen).



11

successively, less than one and one-half times as wide as long; fifth funicular segment (figure 9) fully quadrate or nearly so, about one and one-half times longer and one and one-third times wider than the first segment (6:7.5; 6:8; 6:8.5; 7:9; 9:10); club three-segmented, nearly two and one-half times as long as wide, about one and one-third times longer than the funicle, nearly twice as wide as the fifth funicular segment. Scutellum rounded at apex, about one and one-fourth times as wide as long. Wings uniformly ciliated; speculum of

forewing slightly narrowing below middle, widening below, separated by three to four rows of setae from the hairless streak on the posterior margin of the wing. Abdomen relatively long and narrow, longer than the thorax (7:6); ovipositor exerted to about one-third length of abdomen. Setae on head pale, slender; those on the thorax somewhat coarser, dusky. Body elongated; length with the head horizontal 1.1–1.3 mm, ovipositor included.

Head, thorax and abdomen, as seen in balsam-mounted specimens, uni-



formly pale yellow, without any dark markings; legs paler yellow; antennal scape concolorous with the head, flagellum somewhat deeper yellow; apical half of ovipositor sheaths fuscous. Wings nearly hyaline, forewing with a faint yellowish cloud on basal half; venation light brownish, marginal vein darker brown.

**Male:** Essentially similar to the female in structure, coloration and pubescence of head and body. Frontoververtex about twice as long as wide, inner orbits parallel. Funicular segments more strongly transverse than in the female, the first and second segments about one and one-third times, the third and fourth segments about one and one-half times, the fifth segment about one and three-fourths times as wide as long, the fifth segment about one and one-

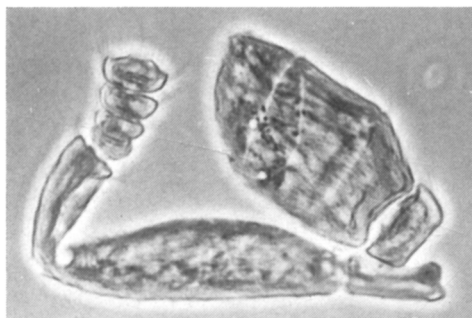
third times longer, about one and three-fourths times wider than the first segment. Abdomen shorter than the thorax; genitalia elongated as shown in figure 10. Length 0.9–1.0 mm.

Antennal scape and pedicel yellow, somewhat paler than the head, sometimes faintly dusky; first funicular segment pale yellow, second and third segments suffused with light brownish; fourth and fifth segments and basal half of club dark brown, apical half of club whitish yellow. Wings (figure 11) more nearly hyaline, yellowish cloud on forewing even paler than in the female.

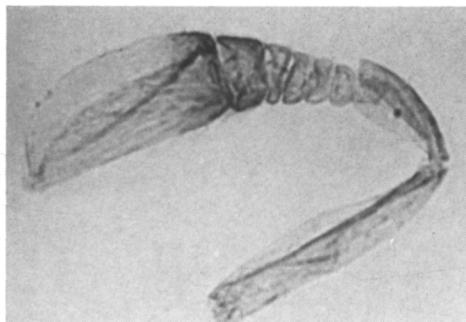
**Material examined.** Described from 3 ♀♀ and 7 ♂♂ (holotype ♀, allotype ♂ and paratypes), reared from *Dysmicoccus ryani* (Coquillett), Monrovia, California, February 1935 (J. D. Maple), all mounted in balsam.

### 5. *Acerophagus debilis* Timberlake

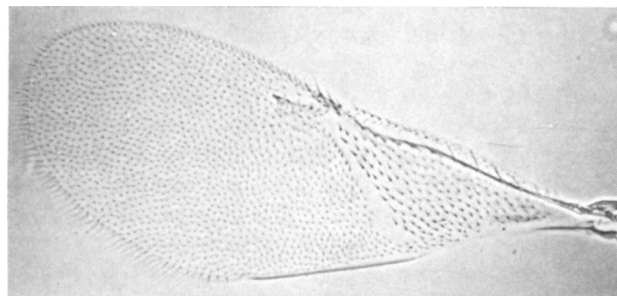
(Figures 12–14)



12



14



13

Figs. 12 to 14: *Acerophagus debilis*.

12. Female antenna (paratype specimen).

13. Female forewing (paratype specimen).

14. Male antenna (paratype specimen).

*Acerophagus debilis* Timberlake, 1924, page 395.

Type host: *Dysmicoccus brevipes* (Cockerell).

Distribution: Mexico.

Type: Bernice P. Bishop Museum, Honolulu, Hawaii, Cat. No. 5619A.

**Distinguishing characters.** *Female:* Frontovertex narrow, nearly twice as long as wide (19:10); antennae very strongly clavate (figure 12); scape widened, less than four times as long as wide; pedicel nearly as long as the entire funicle; all funicular segments very strongly compressed, fully twice as wide

as long or wider; club very large, less than twice as long as wide; coloration entirely capucine yellow; wings perfectly hyaline (figure 13).

*Male:* Very similar to the female; frontovertex narrow, over one and three-fourths times as long as wide (18:10); antennae strongly clavate (figure 14); pedicel nearly as long as the entire funicle; all funicular segments strongly compressed, twice as wide as long or nearly so; fourth and fifth funicular segments and base of club dark brown, rest of antenna pale yellow; general coloration capucine yellow; wings hyaline.

## 6. *Acerophagus luteolus* Rosen, n. sp.

(Figures 15–17)

Type host: *Ferrisia virgata* (Cockerell).

Distribution: Trinidad.

Type: U.S.N.M., Cat. No. 69977.

This species is very closely related to *A. debilis*, from which it differs mainly in the less strongly clavate antennae of both sexes, in the unicolorous male antennae, and in the paler general coloration. It may be separated from *A. flavus* by the narrower frontovertex, the more strongly clavate antennae, and the absence of dark margins on male abdominal tergites.

*Female:* Frontovertex nearly twice as long as wide, inner orbits parallel, imperceptibly converging anteriorly; ocelli in a somewhat less than right-angled triangle, the front ocellus at about the posterior one-third of frontovertex, the posterior pair less than their own diameter from eye margins, about one diameter from the occipital rim. Mandibles of the *Acerophagus* type; maxillary palpi four-segmented, labial palpi two-segmented. Antennal scape (figure 15) slender, about five times as long as wide (radicle excluded); pedicel about twice as long as wide, about as

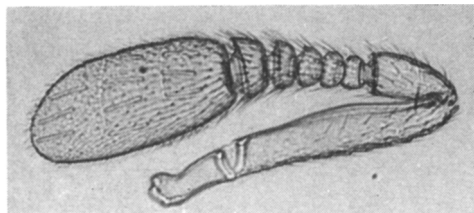
long as the first four funicular segments combined, nearly as wide at apex as the scape; all funicular segments transverse, the first four segments subequal in length, widening successively, the fifth about one and three-fifths times longer and twice wider than the first; first segment about one and three-fifths times as wide as long, second and third segments nearly twice, fourth segment nearly two and one-half times, fifth segment twice as wide as long (5:8; 4.5:8.5; 5:9.5; 5:12; 8:16); club large, three-segmented, nearly parallel-sided, obtuse at apex, about twice as long as wide (50:26), somewhat shorter than the scape (10:11), over one and one-half times as long as the funicle (50:32), about one and three-fifths times as wide as the fifth funicular segment. Scutellum acute at apex, fully as long as wide. Forewing (figure 16) uniformly ciliated, speculum gradually widening below, separated by two rows of setae from the hairless streak along posterior margin of wing; marginal fringe very short, not exceeding one-twelfth width of disc. Abdomen (ovipositor excluded) about as long as the thorax; ovipositor exerted to about one-third length

of abdomen. Pubescence of head dusky, slender; setae on thorax coarser, dark, conspicuous, evenly distributed on the mesoscutum, axillae and scutellum. Length with the head vertical 0.9–1.1 mm, ovipositor included.

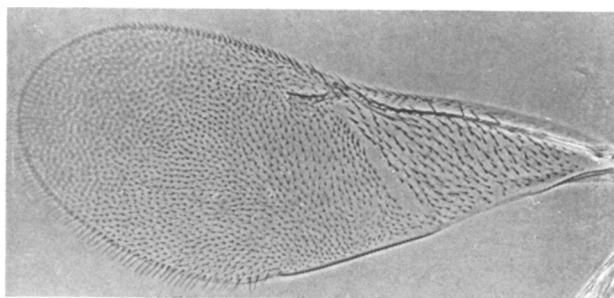
Head, thorax and abdomen uniformly pale yellow (about buff yellow), antennae and legs concolorous, tips of ovipositor sheaths suffused with fuscous. Wings entirely hyaline, venation pale brownish.

*Male*: Essentially similar to the female. Frontoververtex wider, about one

and three-fourths times as long as wide, ocelli in a right angle. Antennal scape (figure 17) slender, about four and one-half times as long as wide; pedicel nearly twice as long as wide, about as long as the first four funicular segments combined, as wide at apex as the scape; all funicular segments transverse, the first four segments subequal in length, widening successively, the fifth about one and two-fifths times longer, somewhat less than twice wider than the first segment; first and second segments less than one and one-half times as wide as long, subsequent segments about twice as wide as long; club about twice as long as wide, somewhat shorter than the scape, about one and one-fourth times as long as the funicle, about one and one-half times as wide as the fifth funicular segment. Abdomen somewhat shorter than the thorax. Length with the head vertical 0.65–0.90 mm.



15



16



17

Figs. 15 to 17: *Acerophagus luteolus*.

- 15. Female antenna (holotype specimen).
- 16. Female forewing (holotype specimen).
- 17. Male antenna (paratype specimen).



**Summary of differences between *A. luteolus* and *A. debilis****Acerophagus debilis* Timberlake

♀ Antennal scape widened in the middle, less than four times as long as wide.

Pedicel nearly as long as the entire funicle.

All funicular segments very strongly compressed, fully twice as wide as long, or wider.

Fifth funicular segment fully twice as long as the first segment. Club about 1.6 times as long as wide.

Ovipositor exerted to about one-fourth length of abdomen.

♂ Pedicel nearly as long as the entire funicle.

All funicular segments very strongly compressed, twice as wide as long or nearly so.

Fifth funicular segment fully twice as long as the first segment. Fourth and fifth funicular segments and base of club dark brown, rest of antenna pale yellow.

♀ ♂ Coloration capucine yellow.

*Acerophagus luteolus* Rosen

Antennal scape slender, about five times as long as wide.

Pedicel about as long as the first four funicular segments combined. Funicular segments less strongly compressed, first segment 1.6 times, second and third segments less than twice as wide as long.

Fifth funicular segment about 1.6 times as long as the first segment. Club longer, about twice as long as wide.

Ovipositor exerted to about one-third length of abdomen.

Pedicel about as long as the first four funicular segments combined. Funicular segments appearing less strongly compressed; first and second segments less than one and one-half times as wide as long.

Fifth funicular segment about 1.4 times as long as the first segment. Antennae unicolorous, pale yellow, without contrastingly dark segments.

Coloration paler, about buff yellow.

**Material examined.** Described from 3 ♀♀ and 6 ♂♂ (holotype ♀, allotype ♂ and paratypes), reared from the striped mealybug, *Ferrisia virgata* (Cockerell), on cocoa, Imperial College of Tropical Agriculture, Trinidad, B.W.I., by F. D. Bennett, 1952–1953 (No. 7 on Bennett's list dated June 9,

1953). All female specimens and three male paratypes are mounted on slides, as is the head of the allotype male; the trophi of the allotype male and two male paratypes are mounted on points; one antenna of the holotype female and one of the allotype male have been mounted separately on slides.

**7. *Acerophagus pallidus* Timberlake**

(Figures 18–21)

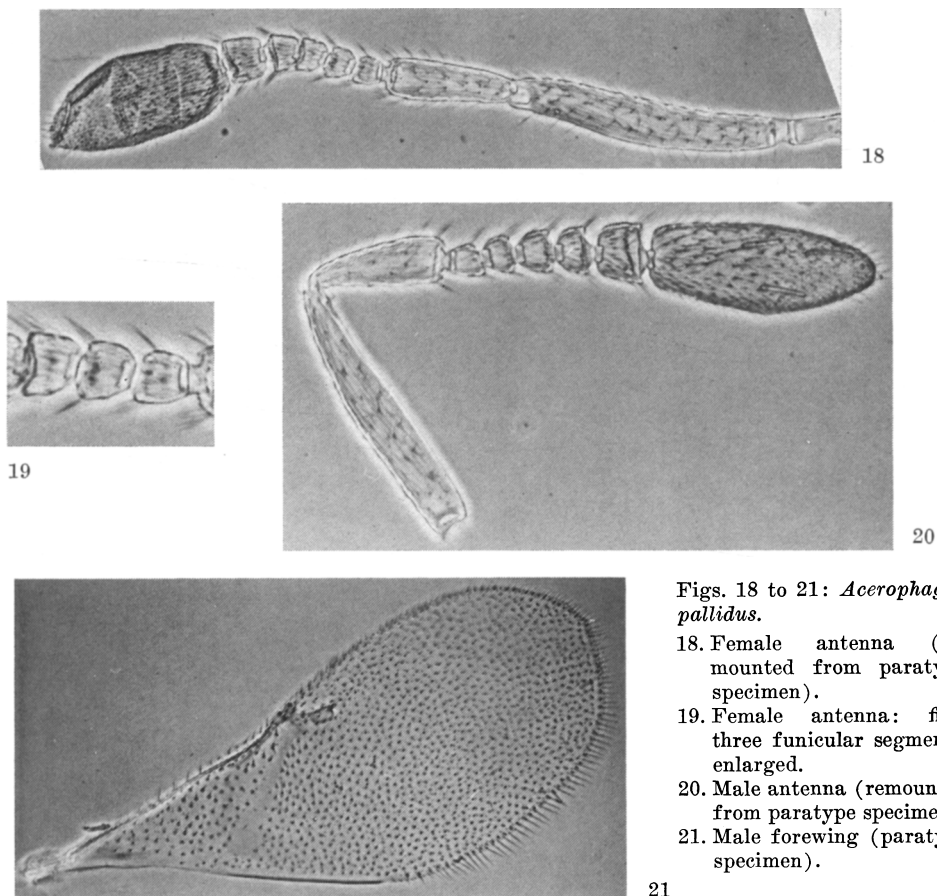
*Acerophagus pallidus* Timberlake, 1918, page 350.

Type host: *Spilococcus atriplicis* (Cockerell) (= *Pseudococcus yerbae-santae* Essig).

Distribution: California.

Type: U.S.N.M., Cat. No. 23090.

*A. pallidus* is very closely related to *A. coccois*, from which it may be separated mainly by the relatively slender



Figs. 18 to 21: *Acerophagus pallidus*.

- 18. Female antenna (remounted from paratype specimen).
- 19. Female antenna: first three funicular segments, enlarged.
- 20. Male antenna (remounted from paratype specimen).
- 21. Male forewing (paratype specimen).

21

antennae of both sexes (figures 18, 20), by the right-angled ocellar triangle, and by the dark transverse stripes on the abdomen of the male.

**Distinguishing characters. Female:** Frontovertex relatively narrow, about one and three-fourths times as long as wide; ocelli in a right-angled triangle, anterior ocellus considerably beyond center of frontovertex, the posterior pair less than their own diameter from eye margins, more than one diameter from the occipital rim. Antennal scape (figure 18) slender, about five times as long as wide; pedicel very slender, fully three times as long as wide (three and one-half times in one paratype specimen), clearly longer than the first four

funicular segments combined (in all other species the pedicel is less than three times as long as wide); first funicular segment fully as long as wide (this segment is clearly wider than long in all other species), subsequent segments somewhat wider than long, the fifth segment only about one and one-third times as wide as long (6.5:6.5; 6:8; 7:9; 7:11; 9:12); club three-segmented, slightly more than twice as long as wide, less than one and one-half times as long as the funicle. Wings nearly hyaline. Coloration uniformly pale yellow.

**Male:** Very similar to the female; frontovertex slightly wider; antennae (figure 20) even more slender, pedicel fully three times as long as wide, first

funicular segment slightly longer than wide; posterior abdominal tergites with dark margins, wings nearly hyaline (figure 21).

**Notes.** Maple (1947) recorded *A. palidus* as a frequent parasite of *Phena-*

*coccus gossypii* Townsend and Cockerell in California. At hand are several series of specimens, reared from that host in California by J. D. Maple and H. Compere. They are all referred here to *A. coccois*.

## 8. *Acerophagus coccois* E. Smith

(Figures 22–28)

*Acerophagus coccois* E. Smith, 1880, page 84. Timberlake, 1916, page 576.

*Rhopus coccois*: Howard, 1881, page 361.

*Metallon coccois*: Ashmead, 1900, page 407.

Type host: *Phenacoccus acericola* King.

Distribution: Illinois, Massachusetts, California.

Type: U.S.N.M., Cat. No. 1470.

Timberlake (1916) was apparently unable to locate the type. His redescription of the species, based on a shriveled, poorly preserved female specimen, is rather misleading. *A. coccois* may be recognized by the acute ocellar triangle, the three-segmented maxillary palpi, the moderately elongated antennae, the strongly exerted ovipositor, the hyaline wings, and the uniform orange-yellow coloration of both sexes.

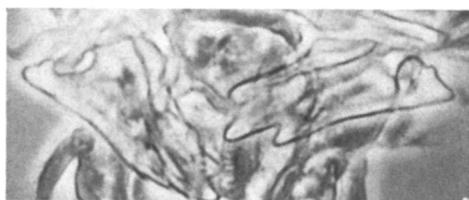
**Female:** Frontoververtex variable, one and one-half to nearly one and three-fourths times as long as wide, inner orbits parallel; ocelli in a clearly less than right-angled triangle, anterior ocellus usually only slightly below center of frontoververtex, the posterior pair about their own diameter from eye margins, about twice their diameter from the occipital rim. Mandibles (figure 22) of the *Acerophagus* type; maxillary palpi (figure 23) three-segmented, labial palpi two-segmented. Antennal scape (figure 24) slender, about six times as long as wide (radicle excluded); pedicel relatively slender, over twice as long as wide, about as long as the first three

funicular segments and half the fourth segment combined; all funicular segments wider than long, the first four segments subequal in length, widening successively, the first segment only somewhat wider than long, the fourth sometimes fully twice as wide as long; fifth funicular segment about one and one-half times longer and nearly twice wider than the first segment, about one and one-half times as wide as long (in the type specimen: 14:17; 15:18; 15:20; 16:24; 20:30); club three-segmented, more than twice as long as wide, nearly one and one-half times as long as the entire funicle (58:42), considerably shorter than the scape (58:72). Scutellum somewhat wider than long (11:10), roundly acute at apex. Wings uniformly ciliated; speculum of forewing (figure 25) gradually widening below, separated by two or three rows of setae from the hairless streak along the posterior margin of the wing; stigmal vein long and slender, over twice as long as the marginal and postmarginal veins combined; marginal fringe short, not exceeding one-eleventh width of disc. Abdomen about as long as the thorax, ovipositor exerted to about one-third length of abdomen. Pubescence of thorax slender, rather pale. Length with the head vertical 0.8–1.2 mm, ovipositor included.

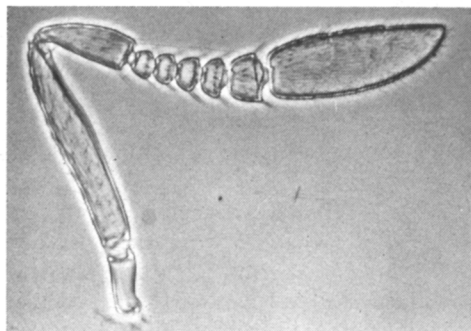
Thorax and abdomen uniformly pale cadmium yellow, sometimes more nearly capucine yellow or orange yellow, head lighter yellow, appendages concolorous; tips of ovipositor sheaths suffused



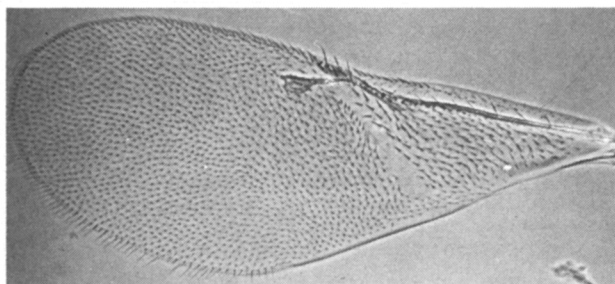
22



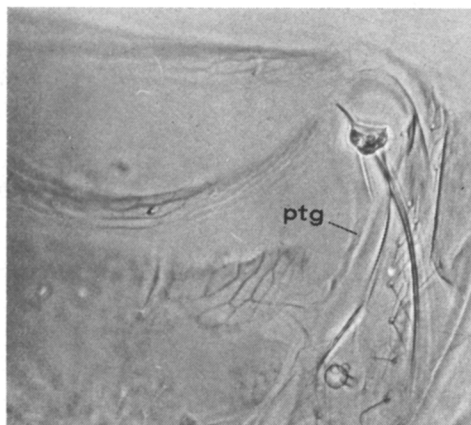
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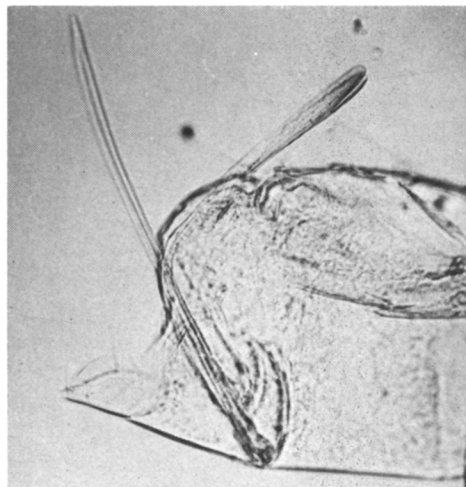
24



25



26



27

Figs. 22 to 28: *Acerophagus coccois* (California material).

22. Female mandibles.

23. Female maxillary palpus.

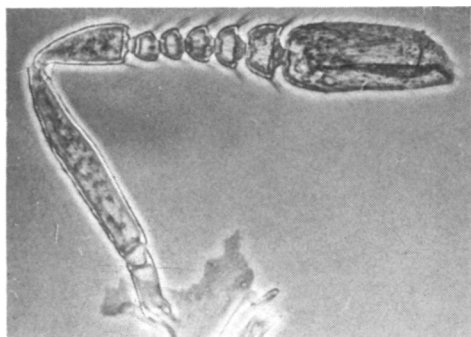
24. Female antenna.

25. Female forewing.

26. Female abdomen; *ptg* = paratergite.

27. Female abdomen, lateral view; ovipositor partly everted.

28. Male antenna.



28

with blackish. Wings hyaline, venation colorless to pale brownish.

**Male:** Essentially similar to the female in structure, coloration and pubescence. Frontovertex about one and one-half times as long as wide; ocelli in a less-than-right angle, anterior ocellus somewhat below center of frontovertex. Antennal segments (figure 28) of about the same proportions as in the female. Length with the head vertical 0.50–0.85 mm.

**Material examined.** Redescribed from a cotype specimen (1 ♀, reared from *Phenacoccus acericola* King, on maple, Sept. 1897, E. A. Smith, Peoria, Ill., mounted on a slide), four additional specimens reared from the typical host

(2 ♂♂, Springfield, Mass., Aug. 5, 1895, on one slide; 1 ♀, Nov. 7, 1895, on a slide; 1 ♀, reared by R. A. Cooley, Springfield, Mass., July 20, 1898, on a point), and many specimens, reared by J. D. Maple from *Phenacoccus gossypii* Townsend & Cockerell, Whittier and Riverside, California, 1935–36, and by H. Compere from the same host on potato sprouts in insectary cages, Riverside, 1936 and 1940.

**Notes.** The maxillary and labial palpi could be examined in detail only in the California material, which is presumably correctly identified as *A. coccois*. Some California specimens have the pedicel fully two and one-half times as long as wide, or somewhat longer than the first four funicular segments combined. In cleared specimens, a faint brownish coloration is sometimes evident on the apical half of the pedicel and on all segments of the flagellum except the first funicular segment. All the photographs were taken from the California material.

*A. gutierreziae* Timberlake may prove to be a synonym of *A. coccois* (see p. 69).

Like other species in the genus, *A. coccois* is a gregarious, primary endoparasite; 6–12 eggs may be laid in a single host (Smith, 1880).

## 9. *Acerophagus flavus* Rosen, n.sp.

(Figures 29–32)

Type host: Undetermined mealybug.

Distribution: Jamaica.

Type: U.S.N.M., Cat. No. 69976.

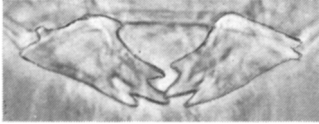
This species is closely related to *A. pallidus* and *A. coccois*. It differs from *pallidus* mainly in the considerably less slender antennae (pedicel much shorter, funicular segments more strongly transverse). It is almost indistinguishable from *coccois* in the female sex, but may be separated by the four-segmented maxillary palpi, the right-angled ocellar triangle, and the somewhat more

strongly transverse funicular segments; the males may be separated from *coccois* by the dark transverse bands on the abdomen.

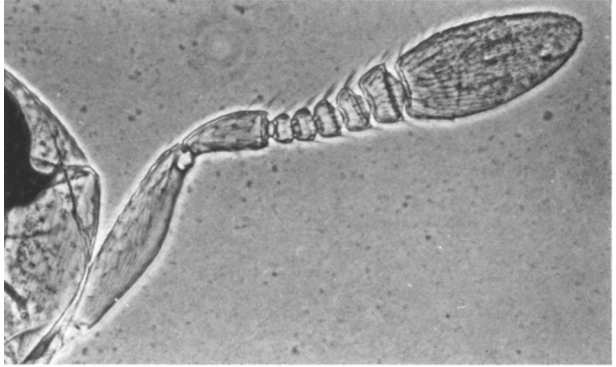
**Female:** Frontovertex about one and three-fourths times as long as wide, inner orbits parallel; ocelli in a right-angled triangle, anterior ocellus considerably beyond center of frontovertex, the posterior pair somewhat less than their own diameter from eye margins, about one diameter from the occipital rim. Mandibles (figure 29) of the

*Acerophagus* type. Maxillary palpi four-segmented, labial palpi two-segmented. Antennal scape (figure 30) slightly widened in the middle, four times as long as wide (radicle excluded); pedicel about twice as long as wide (21:10), about as long as the first three funicular segments and half the fourth combined; all funicular segments wider than long, the first four segments subequal in length, widening successively, the first segment one and one-

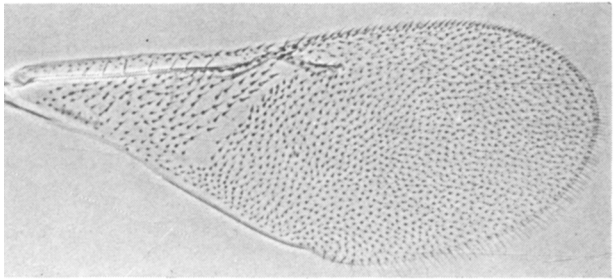
fourth times as wide as long, the fourth segment fully twice as wide as long; fifth funicular segment about twice as wide as long, one and one-fourth times longer and twice wider than the first segment (6:7.5; 6:8.5; 5.5:10; 6:12; 7.5:15.5); club three-segmented, tapering, slightly more than twice as long as wide (49.5:23), considerably longer than the funicle (49.5:35), about one and one-half times as wide as the fifth funicular segment, somewhat shorter



29



30



31

Figs. 29 to 32: *Acerophagus flavus*.

29. Female mandibles (specimen failed to emerge, was taken out of host).

30. Female antenna (holotype specimen).

31. Female forewing (paratype specimen).

32. Male antenna (paratype specimen).



32

than the scape (10:11). Scutellum somewhat wider than long, moderately acute at apex. Wings uniformly ciliated; speculum of forewing (figure 31) narrowing below middle, ending in a somewhat wider, rounded portion; marginal fringe short, not exceeding one-tenth width of disc. Abdomen about as long as the thorax; ovipositor relatively short, exerted to about one-fifth or one-fourth length of abdomen. Pubescence of thorax moderately robust and dark, readily visible. Length with the head vertical 1.2 mm, ovipositor included.

Coloration entirely about cadmium yellow, appendages concolorous; tips of ovipositor sheaths suffused with fuscous. Wings entirely hyaline, venation yellowish brown.

**Male:** Essentially similar to the female. Frontoververtex about one and one-half to one and two-thirds times as long as wide, slightly narrowing anteriorly; ocelli in a right-angled triangle, anterior ocellus only slightly beyond center of frontoververtex, the posterior pair less than their own diameter from eye margins, about twice their diameter from the occipital rim. Antennal scape (figure 32) slender, somewhat over five times as long as wide (42:8); pedicel about twice as long as wide (17:8), about as long as the first four funicular segments combined; all funicular segments wider than long, the first four segments subequal in length and widening successively, the first segment only slightly wider than long (6:5), the fourth and fifth segments about twice

as wide as long, the fifth slightly longer and about twice wider than the first segment; club nearly two and one-half times as long as wide (37:15), longer than the funicle (37:28), somewhat shorter than the scape (37:42), about one and one-fourth times as wide as the fifth funicular segment. Abdomen, including the slightly protruding genitalia, somewhat shorter than the thorax in dry specimens, as long as the thorax or even longer in cleared slide mounts. Length with the head vertical 0.9–1.1 mm.

Thorax about cadmium yellow, head and abdomen lighter yellow, head sometimes with a distinct pale greenish tinge; brown, semi-circular transverse bands on seventh and eighth abdominal tergites; propodeum brownish. Wings perfectly hyaline.

**Material examined.** Described from 4 ♀♀ and 6 ♂♂ (holotype ♀, allotype ♂ and paratypes), reared from an undetermined mealybug on *Acalypha*, Jamaica, June 6, 1951. The female holotype, 1 ♀ and 2 ♂♂ paratypes are mounted in balsam; 1 ♀ paratype is mounted in Hoyer, with one fore and one hind wing mounted separately in balsam; the male allotype, 1 ♀ paratype (headless), and 3 ♂♂ paratypes (damaged) are mounted on points. An unemerged female, one female pupa and one male pupa were dissected from one point-mounted, mummified mealybug from the same stock; they were cleared and mounted in balsam, but are not included in the type series.

## 10. *Acerophagus fasciipennis* Timberlake

(Figures 33–37)

*Acerophagus fasciipennis* Timberlake, 1918, page 348.

Type host: *Anisococcus crawii* (Coquillett).

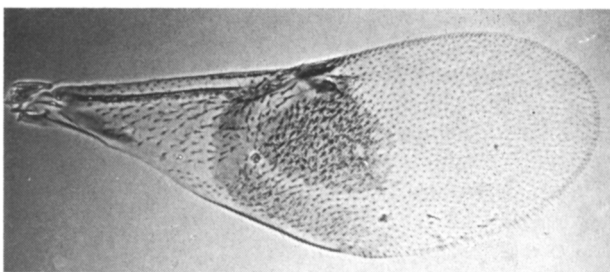
Distribution: California.

Type: U.S.N.M., Cat. No. 23089.

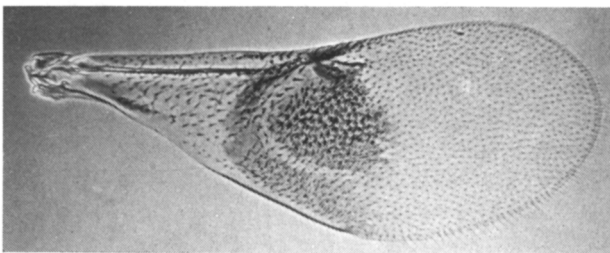
This species may be easily recognized in both sexes by the striking, characteristic wing pattern (figures 33, 34). A conspicuous, well-defined integumentary dark band crosses the disc of the forewing, starting proximad of the



33



34



Figs. 33 to 37: *Acerophagus fasciipennis*.

33. Female forewing.

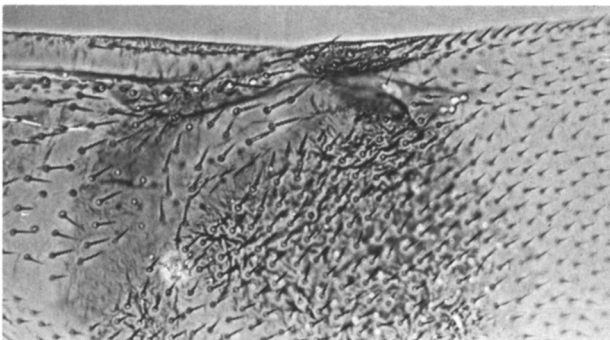
34. Male forewing.

35. Female forewing, showing venation and part of cloud.

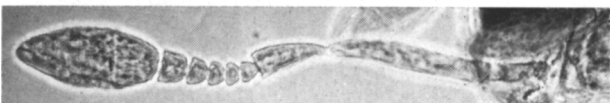
36. Female antenna.

37. Male antenna.

35



36



37



speculum and extending to the apex of venation and from anterior to posterior margin of the wing. The most heavily pigmented part of this band is a large triangular cloud below the stigmal vein and distad of the speculum. It is separated from the rest of the band by a narrow, transverse hyaline streak, parallel to the posterior margin of the wing, starting low on the distal border of the

band and ending just distad of the speculum, and by a relatively lightly infumated streak along the speculum. In its darkest parts, the integument of the wing has a rippled appearance (figure 35). A smaller, less heavily pigmented cloud is situated near the base of the wing. The discal setae, especially distad of the band, are very slender and pale, virtually invisible in balsam (under a

stereoscopic microscope, on a white background).

**Additional distinguishing characters.** Frontovertex relatively wide, about one and one-half times as long as wide in the female (1.46–1.59 in the specimens studied), about one and one-fourth times as long as wide in the male; ocelli in a right-angled triangle, anterior ocellus considerably beyond center of frontovertex. Antennae (figures 36, 37) relatively slender; pedicel about two and one-half times as long as wide, about as long as the first four funicular segments combined; funicular segments only moderately transverse in both sexes, first segment only slightly wider than long, fifth segment clearly less than one and one-half times as wide as long. Ovipositor elongated, exerted to over one-third length of abdomen. Coloration uniformly pale

yellow, without any dark markings, tips of ovipositor sheaths blackish. Pubescence of head, thorax and abdomen very slender and pale, virtually invisible under a stereoscopic microscope.

**Material examined.** The following series of *A. fasciipennis* stand in the collection of the Department of Biological Control, University of California, Riverside:

I. 1 ♀, 2 ♂♂, of the original stock from which the types were selected (Uplands, California, C. P. Clausen coll., November 1914, mounted on points).

II. Many specimens, reared by J. D. Maple from the typical host, Fillmore, California, February and October 1936 (14 ♀♀, 12 ♂♂ on points; 13 ♀♀, 10 ♂♂ on slides; several specimens unmounted).

## 11. *Acerophagus texanus* (Howard)

(Figures 38–45)

*Aphycus texanus* Howard, 1898, page 245.

*Acerophagus texanus*: Timberlake, 1916, page 576.

Type host: *Ferrisia virgata* (Cockerell).

Distribution: Texas, Mexico (Nuevo León, Durango).

Type: U.S.N.M., Cat. No. 5046.

The large dusky cloud on the forewing of the female, the relatively narrow frontovertex, and the uniform, deep orange-yellow coloration may serve as distinguishing characters for this species.

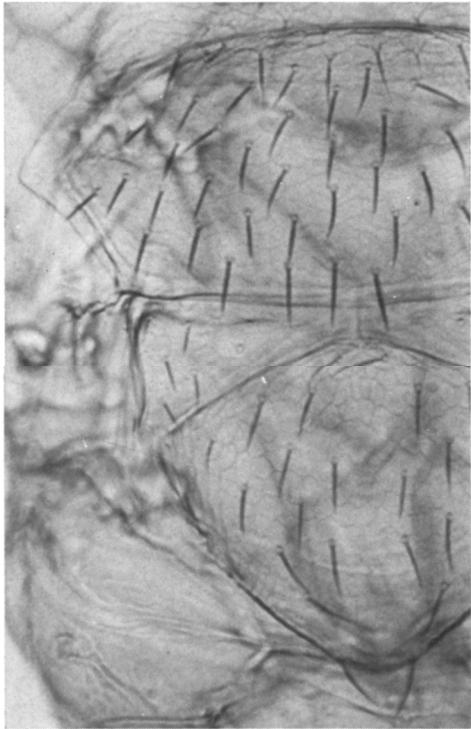
The type series includes 8 ♀♀, reared by C. H. T. Townsend from the striped mealybug, Brownsville, Texas, July 3, 1895, designated by L. O. Howard as cotypes, and a single male specimen of the same stock. Following the suggestion of B. D. Burks, one of the female specimens is designated as lectotype (specimen mounted on a point,

one antenna mounted in balsam on slide No. 503, U.S.N.M.). A redescription of the type series follows.

**Female:** Frontovertex nearly one and three-fourths times as long as wide (1.67–1.75), inner orbits parallel; ocelli in a clearly less than right angle, anterior ocellus at about center of frontovertex, the posterior pair considerably less than their own diameter from eye margins, about twice their diameter from the occipital rim. Mandibles of the *Acerophagus* type. Antennal scape (figure 38) slender, slightly widened in the middle, about four and one-half times as long as wide; pedicel over twice as long as wide, about as long as the first three funicular segments and half the fourth segment combined; all funicular segments transverse, successively increasing in width; first three segments subequal in length, the fourth somewhat longer, first two segments somewhat less than one and one-half



38



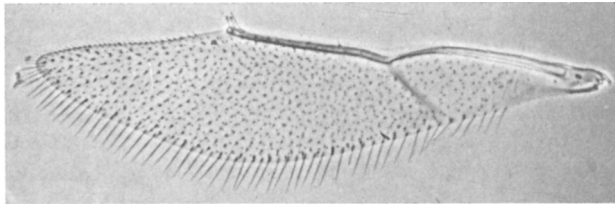
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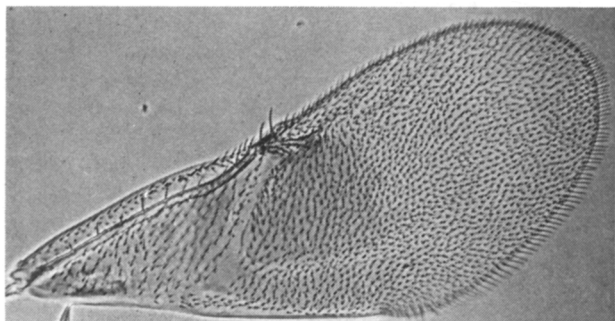
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Figs. 38 to 45: *Acerophagus texanus*.

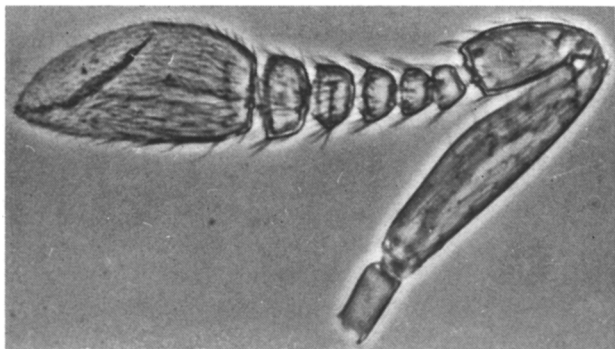
- 38. Female antenna (lectotype specimen, L. O. Howard's slide).
- 39. Female thorax, showing pubescence (Mexican material).
- 40. Female antenna (Mexican material).
- 41. Female hind wing (Mexican material).
- 42. Female forewing (Mexican material).
- 43. Male antenna (Mexican material).
- 44. Male genitalia (Mexican material).
- 45. Male forewing (Mexican material).



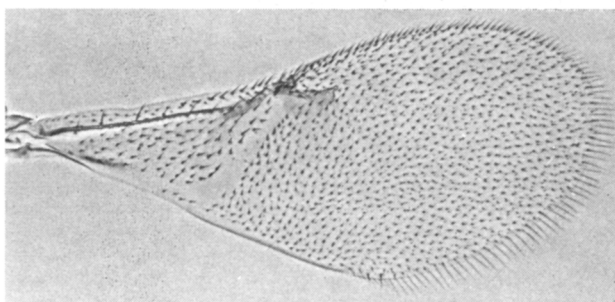
41



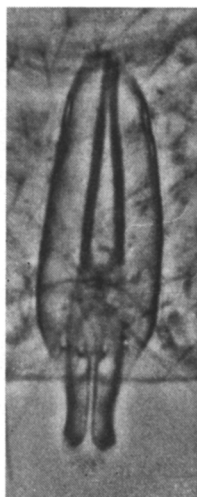
42



43



45



44

times as wide as long, third and fourth segments nearly one and two-thirds times as wide as long; fifth funicular segment larger, about one and three-fourths times as wide as long, less than one and one-half times longer and about one and three-fourths times wider than the first segment; club tapering to a somewhat truncate apex, three-segmented with the segments very closely fused, somewhat over twice as long as wide, somewhat less than one and one-half times as long as the funicle, some-

what over one and one-half times as wide as the fifth funicular segment. Scutellum acute at apex, slightly wider than long. Wings uniformly ciliated, speculum of forewing gradually widening below, separated by two rows of setae from the hairless streak along the posterior margin of the wing; marginal fringe short, not exceeding one-twelfth width of disc. Ovipositor exerted to about one-fourth length of abdomen. Pubescence of thorax abundant, relatively slender and pale, rather incon-



spicuous in point-mounted specimens; discal setae of wings relatively coarse and dark, readily visible in balsam. Length with the head vertical 1.0 mm, ovipositor included.

Head, thorax and abdomen uniformly deep orange yellow; legs, antennal scape and pedicel concolorous, funicle somewhat dusky except first segment, club somewhat paler; ovipositor sheaths blackish at apex. Forewing with a large, dusky integumentary cloud, of the same basic pattern and proportions as in *A. fasciipennis* but less clearly defined and much less heavily pigmented. In point-mounted specimens, the wing does not appear banded as in *fasciipennis*, but is obviously dusky on the basal half; the cloud is readily visible in slide mounts.

**Male:** Very similar to the female. Frontovertex wider, one and one-half times as long as wide; ocelli in a slightly less than right-angled triangle, anterior ocellus at about center of frontovertex. Antennae of single male broken. General coloration deep orange yellow, head lighter yellow, abdomen somewhat darker on center; wings nearly perfectly hyaline. Length with the head vertical 0.7 mm.

**Additional material.** *A. texanus* was reared by P. DeBach from the striped mealybug, on Virginia creeper and mixed ornamentals, Monterrey (Nuevo León) and Ciudad Lerdo (Durango), Mexico, during October and November 1966. The species was reared in the Quarantine Laboratory, Department of

Biological Control, Riverside, for colonization against the striped mealybug in Imperial County, California (DeBach and Warner, 1969). The Mexican material (figures 39–45) agrees with the type series of *texanus* in almost every respect, differing mainly in having the pubescence of the thorax (figure 39) considerably darker, apparently coarser, readily visible in point-mounted specimens. In view of the proximity of collection sites, the common host species, and the similarity in all other morphological characters, these forms are considered conspecific.

In the Mexican series, the maxillary palpi are four-segmented, labial palpi two-segmented in both sexes. Female antennae (figure 40) seem to have the funicular segments somewhat more symmetrical than in the type series. Male antennae (figure 43) are essentially similar to those of the female, but the third and fifth funicular segments are nearly twice as wide as long. Male genitalia are shown in figure 44. Cleared male specimens show some amount of brownish on posterior abdominal tergites: usually a semi-circular transverse stripe on the seventh tergite, followed by a continuous fuscous blotch reaching the tip of the abdomen. Male forewings (figure 45) are nearly hyaline, slightly infuscated on basal half, with a small cloud below the stigmal vein.

*A. texanus* is a gregarious primary parasite of the striped mealybug *ferrisia virgata* (Cockerell).

## 12. *Acerophagus nubilipennis* Dozier

(Figure 46)

*Acerophagus nubilipennis* Dozier, 1926, page 101.

Type host: *Planococcus citri* (Risso).

Distribution: Puerto Rico.

Type: U.S.N.M., Cat. No. 29071.

*A. nubilipennis* is rather closely related to *A. fasciipennis*, from which it differs mainly in the shape of the cloud on the forewing, and in the presence of two conspicuous, dark transverse bands on the abdomen.

**Female:** Frontovortex about one and one-half times as long as wide, inner orbits parallel; ocelli apparently in a less-than-right-angled triangle, anterior ocellus considerably below center of frontovortex, the posterior pair somewhat less than their own diameter from eye margins. Antennal scape slender, about six times as long as wide; funicular segments only slightly transverse; fourth segment about one and one-third times, fifth segment about one and one-fourth times as wide as long (20:15; 23:18); club three-segmented, tapering. Forewing (figure 46) uniformly ciliated distad of speculum; the delta-shaped area basad of the speculum is sparsely ciliated, especially towards the base (this area is uniformly ciliated in *A. fasciipennis*); speculum widening posteriorly, separated by a single row of setae from the hairless streak along posterior margin of wing; marginal fringe very short, not exceed-

ing one-eighteenth width of disc. Ovipositor shortly exerted to somewhat less than one-fifth length of abdomen. Pubescence of thorax very slender, pale, except for a row of more robust, darker setae along posterior margin of mesoscutum. Length of slide-mounted specimen 1.2 mm (head horizontal, ovipositor included).

General coloration pale orange yellow; dorsum of abdomen with two conspicuous, dark brown cross bands, especially strong on the sides; ovipositor sheaths lightly infuscated; antennae dusky yellow. Wings hyaline, forewing with a large triangular dark cloud distad of speculum, starting at the posterior margin of the wing, narrowing towards the anterior margin, considerably paler than in *A. fasciipennis*; the cloud is interrupted by a narrow hyaline streak, parallel to the posterior margin; submarginal vein pale brownish, marginal and stigmal vein more strongly infuscated.

**Male:** Unknown.

**Material examined.** Redescribed from the holotype female, reared from *Planococcus citri* material, Rio Piedras, Puerto Rico, May 26, 1925, by H. L. Dozier, mounted on a slide. A paratype female, reared at the same locality from *Pseudococcus adonidum* (Linnaeus), has apparently been lost.

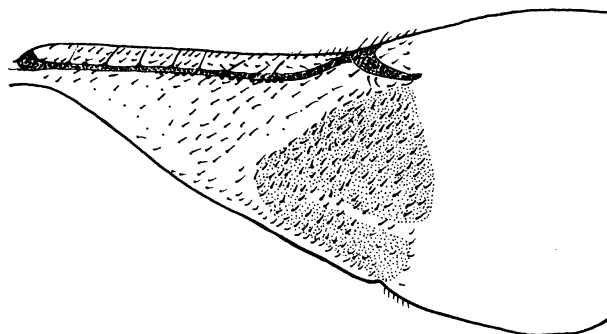


Fig. 46. *Acerophagus nubilipennis*. Female forewing (holotype specimen).

### 13. *Acerophagus californicus* Rosen, n.sp.

(Figures 47-48)

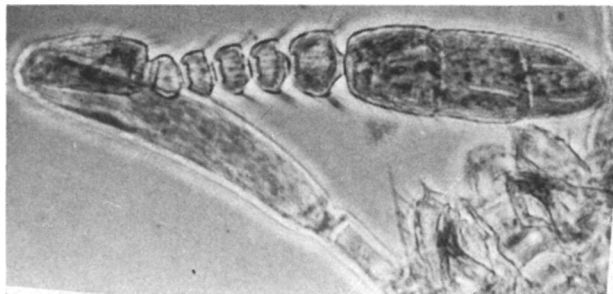
Type host: *Spilococcus pressus* Ferris.

Distribution: California.

Type: Dept. of Biological Control, U.C.R.

This species appears to be closely related to *A. nubilipennis* and *A. texanus*. It differs from *nubilipennis* mainly in having the forewing evenly ciliated to the base, in the smaller triangular cloud on the forewing, in the more strongly transverse funicular segments, and in the less conspicuous, narrower transverse bands on the abdomen; from *texanus* mainly in the shape of the cloud on the forewing, in the very slender pubescence of the thorax, in the presence of faint fuscous markings on the propodeum and abdomen of the female, and in the apparent absence of males. Only slide-mounted specimens were available for study, and certain characters of the head could not be accurately determined.

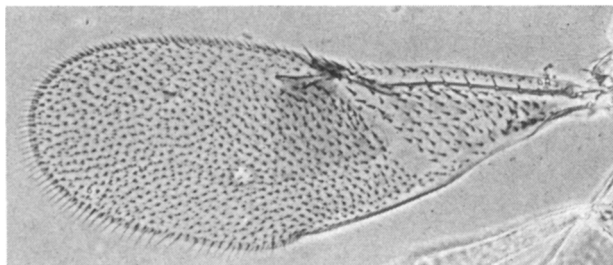
*Female*: Frontoververtex variable in the slide-mounted material, apparently one and one-half to nearly one and three-fourths times as long as wide; inner orbits parallel; ocelli in a little less than right-angled triangle, anterior ocellus apparently considerably beyond center of frontoververtex, the posterior pair about two-thirds their own diameter from eye margins, apparently one diameter from the occipital rim. Mandibles of the *Acerophagus* type; maxillary palpi four-segmented, labial palpi two-segmented. Antennal scape (figure 47) slender, five times as long as wide (radicle excluded); pedicel more than twice as long as wide (18:8), about as long as the first four funicular segments combined; all funicular segments, including the fifth, about one and one-half times as wide as long, the first four segments subequal in length, slightly widening successively, the fifth segment about one and one-half times longer and wider than the first; club three-



Figs. 47 and 48: *Acerophagus californicus*.

47. Female antenna (syntype specimen).

48. Female forewing (syntype specimen).



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segmented, about three times as long as wide, considerably longer than the funicle (35:26), about one and one-half times as wide as the fifth funicular segment. Scutellum roundly acute at apex, slightly wider than long (12:11). Wings uniformly ciliated, including the delta-shaped area basad of the speculum in the forewing (figure 48); speculum gradually widening below, separated by two or three rows of setae from the hairless streak along posterior margin of wing; marginal fringe not exceeding one-tenth width of disc. Ovipositor exerted to about one-fourth length of abdomen. Pubescence of head and thorax slender, pale, virtually invisible under a stereoscopic microscope even at higher magnifications. Length with the head horizontal 0.8–1.2 mm, ovipositor included.

Head, thorax and abdomen uniformly orange yellow; tegulae and propodeum faintly dusky; a transverse, narrow, rather faint fuscous band on sixth abdominal tergite, a semicircular band on seventh tergite; legs and antennal scape concolorous with body, flagellum slightly infuscated, tips of tarsi and apical half of ovipositor sheaths black-

ish. Forewing (figure 48) hyaline, with a distinct triangular, integumentary dark cloud distad of the speculum and below the stigmal vein (corresponding to the triangular part of the band in *A. fasciipennis*, or to the part of the cloud of *A. nubilipennis* above the hyaline streak), less heavily pigmented than in *A. fasciipennis*, separated by a broad transverse hyaline band from a narrow, less distinct cloud along the posterior margin of the wing (this hyaline band is considerably broader than the hyaline streak of *fasciipennis* or *nubilipennis*); a dark spot near base of forewing; hind wing hyaline; venation of wings brown, marginal vein and base of stigmal vein of forewing strongly infuscated.

*Male*: Unknown.

**Material examined.** Described from 26 ♀♀ (syntypes), reared by P. DeBach and S. C. Warner from *Spilococcus pressus* Ferris on oleander, El Centro, southern California, April 22, 1966, all mounted in Hoyer's medium on two slides.

Syntypes in the collection of the Department of Biological Control, U.C., Riverside, and in the author's collection.

## Unplaced Species:

### 14. *Acerophagus gutierreziae* Timberlake

*Acerophagus gutierreziae* Timberlake, 1916, page 577.

Type host: *Spilococcus gutierreziae* (Cockerell).

Distribution: New Mexico.

Type: U.S.N.M., Cat. No. 19119.

*A. gutierreziae* is known from 3 ♀♀ and 1 ♂, all in poor condition. The male and 1 ♀ are headless, and none of the other specimens has an intact antenna. As far as can be determined, the species is very closely related to *A. coccois*, and may eventually prove to be a synonym of the latter. The frontovertex of the female is about

one and one-half times as long as wide; the ocellar triangle is fully right-angled in the holotype, somewhat less than right-angled in a paratype; the anterior ocellus is situated considerably below center of frontovertex. The wings are hyaline, with a very faint trace of yellowish cloud on the basal half of the forewing of the female. Such traces may be seen also in some California specimens determined here as *A. coccois*. The coloration is entirely yellow in both sexes.

Additional material from the typical host and type locality is required in

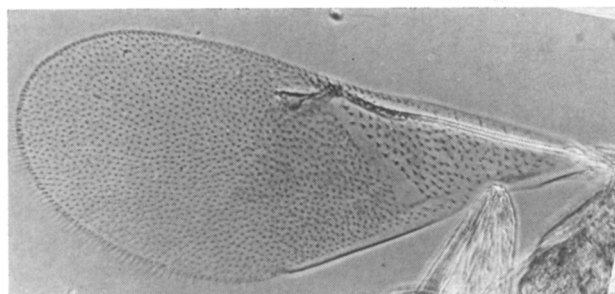




Figs. 49 and 50: *Acerophagus* ?*gutierreziae*.

49. Female antenna (California material).

50. Female forewing (California material).



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order to clarify the status of *A. gutierreziae*.

A series of 30 ♀♀, reared by J. D. Maple from an undetermined host ("Ex 71"), 6 miles west of Perris, California, April 22, 1936, is here provisionally referred to *A. gutierreziae*. These specimens (figures 49-50), mounted in balsam on four slides, have the frontovertex about one and one-half times as long as wide, and the forewing

with a pale yellowish cloud, somewhat more distinct than in *gutierreziae*; they are uniformly yellow, without any dark markings. However, in antennal and other structural characters, including wing pattern, these specimens are very similar to *A. fasciipennis*, and may eventually prove to be a light-winged, possibly uniparental, form of the latter species.

## ACKNOWLEDGMENTS

The author is indebted to Paul DeBach for providing laboratory space and facilities, for making specimens of *Acerophagus* from California and Mexico available for study, as well as for his friendly encouragement and critical reading of the manuscript.

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*rophagus debilis* Timberlake; to Manuel J. Viana, Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, for lending the types of *Psilomirinus flavidulus* Brèthes; and to Luis De Santis, Universidad Nacional de La Plata, Argentina, for making additional specimens of the latter species available to the author.

This study could not have been completed without examination of the types of *Acerophagus* preserved in the U. S. National Museum, Washington, D.C. The Smithsonian Institution made this possible by offering the author a grant for a stay of several weeks in Washington. The author is especially grateful to Bernard D. Burks for his invaluable help during that period, and for critical reading of the manuscript.

## LITERATURE CITED

- ASHMEAD, WILLIAM H.  
1900. On the genera of the chalcid-flies belonging to the subfamily Encyrtinae. Proc. U. S. Natl. Mus. 22:323-412.
- CLAUSEN, CURTIS P.  
1924. The parasites of *Pseudococcus maritimus* (Ehrhorn) in California (Hymenoptera, Chalcidoidea). Part II. Biological studies and life histories. Univ. Calif. Publ. Entomol. 3:253-88.
- COMPÈRE, HAROLD, AND D. P. ANNECKE  
1960. A reappraisal of *Aphycus* Mayr, *Metaphycus* Mercet, and allied genera (Hymenopt: Encyrtidae). J. Entomol. Soc. S. Africa 23:375-89.
- DE BACH, PAUL, and S. C. WARNER  
1969. Importation and colonization of natural enemies of the striped mealybug, *Ferrisia virgata*, in California. Ann. Entomol. Soc. Amer. 62:1117-19.
- DE SANTIS, LUIS  
1963. Encirtidos de la Republica Argentina (Hymenoptera: Chalcidoidea). Anal. Com. Invest. Cient. Prov. Bs. As. 4:9-422.
- DOZIER, H. L.  
1926. Some new Porto Rican scale parasites (Hymenoptera: Encyrtidae). Proc. Entomol. Soc. Wash. 28:97-102.
- GAHAN, A. B.  
1946. Eight new species of chalcid-flies of the genus *Pseudaphycus* Clausen, with a key to the species. Proc. U. S. Natl. Mus. 96:311-27.
- GIRAULT, A. A.  
1917. Descriptiones hymenopterorum chalcidoidicarum variorum cum observationibus III. Private publication, Glenndale, Md., 10 pp.
- HOWARD, L. O.  
1881. Report on the parasites of the Coccidae in the collection of this Department. U. S. Dept. Agr. Rept. of the Entomologist for 1880:350-71.  
1898. On some new parasitic insects of the subfamily Encyrtinae. Proc. U. S. Natl. Mus. 21:231-48.
- MAPLE, JOHN D.  
1947. The eggs and first instar larvae of Encyrtidae and their morphological adaptations for respiration. Univ. Calif. Publ. Entomol. 8:25-122.
- MERCET, RICARDO GARCIA  
1921. Fauna Iberica. Himenópteros, Fam. Encirtidos. Madrid, 732 pp.
- MOURSİ, A. A.  
1948. Contributions to the knowledge of the natural enemies of mealybugs. 3. *Anagyrus aegyptiacus* Moursi, a parasite of the Lebbek mealybug, *Pseudococcus filamentosus* Ckll. (Hymenoptera: Encyrtidae). Bul. Soc. Fouad 1<sup>er</sup> Entomol. 32:17-32.
- RICHARDS, O. W.  
1956. Hymenoptera: Introduction and key to families. Handbooks for the Identification of British Insects, Roy. Entomol. Soc., London 6(1):1-94.
- RISBEC, JEAN  
1955. Chalcidoïdes et Proctotrupides Africains. Bul. Inst. Franc. Afr. Noire, Ser. A, 17: 533-80.
- SMITH, EMILY A.  
1880. Biological and other notes on *Pseudococcus aceris*. N. Amer. Entomol. 1:73-87.
- TACHIKAWA, TETSUSABURO  
1963. Revisional studies on the Encyrtidae of Japan (Hymenoptera: Chalcidoidea). Mem. Ehime Univ. Sect. VI (Agr.) 9(1):1-264.
- TIMBERLAKE, P. H.  
1916. Revision of the parasitic hymenopterous insects of the genus *Aphycus* Mayr, with notice of some related genera. Proc. U. S. Natl. Mus. 50:561-640.  
1918. New genera and species of Encyrtidae from California parasitic in mealybugs (Hymenoptera). Univ. Calif. Publ. Entomol. 1:347-67.  
1924. Descriptions of new chalcid-flies from Hawaii and Mexico (Hymenoptera). Proc. Hawaii. Entomol. Soc. 5:395-417.







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